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**ABSTRACT BOOK**

**42nd World Conference  
on Lung Health of the  
International Union Against  
Tuberculosis and Lung Disease (The Union)**

**LILLE • FRANCE  
26-30 OCTOBER 2011**

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# The International Journal of Tuberculosis and Lung Disease

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# 42nd World Conference on Lung Health of the International Union Against Tuberculosis and Lung Disease (The Union) Lille, France, 26–30 October 2011

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## PLENARY SESSION

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SUNDAY, 30 OCTOBER 2011

### **Sir John Crofton Lecture: Use of clinical trials to find new and shorter treatment regimens**

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For how long do patients with pulmonary tuberculosis need to be treated? The programme of clinical trials initiated in the 1970s demonstrated that treatment duration could be reduced to 6 months for patients with fully susceptible disease or isoniazid monoresistance, but little progress has been made since then. There have been a number of unsuccessful attempts to reduce the duration of treatment still further for all patients or selected sub-groups. While there is good reason to suppose that many patients could be successfully treated for much shorter durations with existing drugs, the lack of strong predictors means it has not been possible to accurately identify who these patients are.

Many challenges face the researcher conducting clinical trials to improve treatment. These include the most appropriate trial design, HIV coinfection, the

endpoint definition (particularly the classification of unassessables) and the difficulties associated with achieving high levels of follow-up. One of the biggest challenges is designing and conducting late stage trials to yield results that can readily be generalised to routine practice, which is often far removed from the highly controlled conditions under which most research is conducted. Very little has been done to investigate the appropriate treatment duration for patients with MDR or XDR tuberculosis who represent a substantial challenge to control and treatment within many of the national tuberculosis programmes.

New designs in early-stage phase 2 trials offer the possibility of exploring multiple regimens simultaneously. However, while these designs are likely to assist in reducing the number of large phase 3 trials, they are unlikely to eliminate the need for them completely.

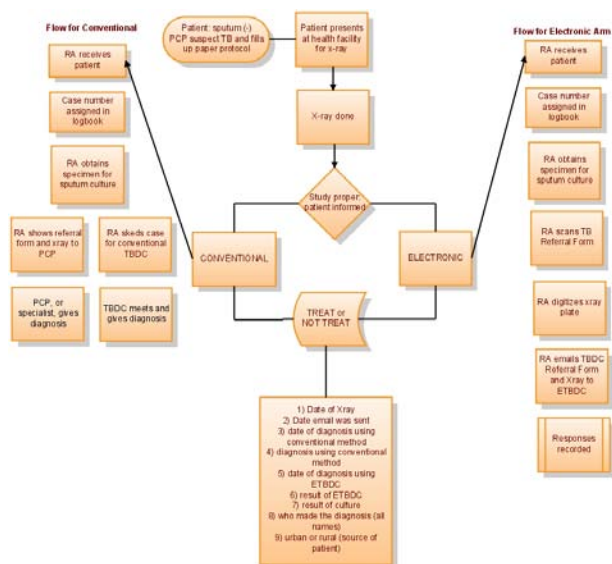
## SYMPOSIA: FRIDAY 28 OCTOBER 2011

### EHEALTH FOR TUBERCULOSIS: INTEGRATING INFORMATION AND COMMUNICATIONS TECHNOLOGY INTO TUBERCULOSIS CARE

#### Electronic Tuberculosis Diagnostic Committees in the Philippines and Pakistan

A B Marcelo,<sup>1,2,3</sup> Z Fatmi,<sup>3,4</sup> R E Scott,<sup>3,5</sup> A J Ganesh,<sup>1</sup>  
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Manila, Manila, <sup>2</sup>International Open Source Network  
ASEAN+3, Manila, Philippines; <sup>3</sup>PANACeA, Karachi, <sup>4</sup>Aga  
Khan University, Karachi, Pakistan; <sup>5</sup>University of Calgary,  
Calgary, Alberta, Canada

Limited human, technical and financial resources are major concerns for tuberculosis (TB) control in developing nations. Difficult tuberculosis cases which require specialist opinion rarely have access to such resources especially in low-to-middle income countries. This study used electronic means to bridge the gap between community doctors and the specialists. Using a free and open source software called iPath, the Philippines studied 76 cases while Pakistan used electronic mail for 88 cases. Conventional methods (face-to-face meetings of specialists) were used as controls while sputum cultures were used as gold standard. In summary, electronic methods for diagnosing difficult TB cases are feasible; their results are comparable to controls; but they require adequate training of all stakeholders in order for the national TB programme to benefit from its full potential.



#### Cost and financing tool (TB COSFIT): a software for estimating cost of TB programme in the Philippines

D Batangan. Linking Initiatives for Networking and Control of TB (TB LINC) Project, Philippine Business for Social Progress, Manila, Philippines

A tool to estimate the cost of providing TB program services at the provincial level, TB COSFIT was developed by the TB LINC project and the Department of Health (DOH) in the Philippines. The United States Agency for International Development (USAID) supported the project that facilitated the development of the TB COSFIT. The tool was developed to support the DOH Province-Wide Investment Planning for Health (PIPH) and the 2010–2016 Philippine Plan of Action to Control TB (PhiPACT) of the National TB Control Program (NTP). The TB COSFIT generates estimates at the provincial level of the total financial resources required to achieve the TB program case detection (CDR) and cure rate (CR) targets.

Population, health system and TB program assumptions at the provincial level were used to project cost requirements over a five-year period. These estimates guide local government units (LGUs) on the annual budget requirements of their TB programs. The DOH, NTP also uses TB COSFIT as a planning tool to estimate aggregate resource requirements of LGU-managed TB program services, a key strategy of the PhilPACT.

The development of the tool was done from 2009–2010 through a series of technical discussions and validation workshops in Manila and Dumaguete City, Negros Oriental Province. Data collection was done in selected municipalities and cities in the province, Provincial Health Office (PHO), DOH and Philippine Health Insurance Corporation regional and national offices. An excel-based template was developed to estimate the costs of implementing TB program services. The resulting software was reviewed and revised by the DOH, NTP and the Bureau of Local Health Development (DOH, BLHD) and is currently being integrated into the PIPH and PhilPACT planning modules.

#### Touchscreen systems for tuberculosis care: experiences in Malawi

S Mumba,<sup>1</sup> H Tweya,<sup>2,3</sup> C Feldecker,<sup>2</sup> D G Phiri,<sup>1</sup>  
L Kamvazina,<sup>1</sup> H Kanyerere,<sup>4</sup> M Egger,<sup>5</sup> S Phiri.<sup>2</sup> <sup>1</sup>Baobab  
Health Trust, Lilongwe, <sup>2</sup>Lighthouse Trust, Lilongwe, Malawi;  
<sup>3</sup>The International Union Against Tuberculosis and Lung  
Disease, Paris, France; <sup>4</sup>Malawi National Tuberculosis  
Programme, Lilongwe, Malawi; <sup>5</sup>University of Bern,  
Bern, Switzerland

**Setting:** The Martin Preuss Center (MPC), an HIV-TB integrated clinic in Lilongwe, Malawi. MPC is the largest TB registration centre in Malawi and has around 4500 HIV clinic visits a month.



**Objective:** To describe the development of an electronic medical record system for TB services to enable a critical examination of the effectiveness of MPC's integrated TB-HIV-services and, ultimately, improve patient care and outcomes.

**Description:** Born through a collaboration between Baobab Health Trust and the Lighthouse Trust, an electronic medical record (EMR) system for the management of HIV/AIDS patients was created. The EMR is optimized for usability, running on touchscreen clinical workstation appliances deployed for use by clinicians at the point-of-care. The EMR has been endorsed by Ministry of Health as the national system for monitoring and evaluation of the national HIV programme, and is in use at 16 high-burden ART sites across Malawi, supporting the care and treatment of more than 65 000 patients. Each patient is given a bar-coded unique ID; facilitating continuity of care. Given that there is a 65% TB-HIV co-infection in Malawi, and challenges of co-management, the EMR has been expanded to include alerts and reminders such as: sputum collection time, HIV status ascertainment and drug interactions. We believe that these synergies built into the EMR will ease TB-HIV co-management and improve data quality. The pilot system will be deployed at Martin Preuss Center in September 2011. Results of the first 4 weeks of the pilot will be presented.

**Next steps:** Based on a successful pilot we plan to recommend a roll out of the system to other TB-HIV integrated clinics in the country.

### Use of OpenMRS to support tuberculosis, MDR-TB and HIV management in resource-poor environments

H S Fraser. Division of Global Health Equity, Brigham and Women's Hospital, Boston, MA, USA

OpenMRS is an Open Source Web based Electronic Medical Record (EMR) system platform designed to support projects in developing countries. Founded by the Regenstrief Institute, Partners In Health and the South African Medical research council, it is now a broad international collaboration of organizations creating and implementing EMR systems in more than 25 developing countries. While the largest focus has been on supporting HIV management, Partners In Health has developed a version of OpenMRS to support the clinical and programmatic management of MDR-TB in collaboration with the WHO. This builds on more than ten years of experience in the development of web based EMR systems to support MDR-TB treatment in Peru and the Philippines. OpenMRS supports open standards for the coding and transmission of medical data which has allowed interoperability with other medical software such as laboratory information systems. It has a modular architecture which simplifies the addition of new func-

tionality, and the software can be downloaded from [www.openmrs.org](http://www.openmrs.org). OpenMRS TB can also support the care of a wide range of diseases including HIV. In this talk I will describe the 'OpenMRS-TB' system and its use in Haiti, Rwanda and Pakistan, as well as plans for wider adoption.

### ROLE OF PARTNERSHIPS IN ADDRESSING TUBERCULOSIS CONTROL IN PRISONS

#### Challenges in forging partnerships for controlling TB in prisons: Indonesia experience

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<sup>1</sup>Department of Correction Institution, Ministry of Law and Human Rights, Jakarta, DKI, <sup>2</sup>FHI360, Jakarta, DKI, Indonesia

**Background:** Department of Correction Institutions (DCI) has a strong commitment to provide TB and HIV services to inmates to reduce mortality. In response to overcrowded prisons and high prevalence of TB in narcotic prisons, DCI worked in collaboration with NTP and partners to address the challenges on TB control in prisons.

**Interventions:** DCI, with NTP, NAP and partners, formulated policy and strategy to control TB-HIV in prisons, and pilot sites have been implementing. The funding and technical support was provided by GFATM R 5, USAID's TBCAP and TBCARE, and AUSAID. Networking with NTP's DOTS has been established, pre-post-release follow-up with NGOs piloted. DCI plans to scale up activities using selected prisons as learning sites. Consultative meetings with the DCI at all level were organized to secure commitment; training, mentoring sessions were conducted. Networking with health facilities and NGOs was established.

**Results:** DCI and NTP placed TB control in prisons as program priorities, NTP included prisons in its five-year strategy and PPM action plan, national strategy for TB control in prisons has been updated. Narcotics prisons have been prioritized by the DCI for TB control. The GF R 10 supports scaling up TB services in prisons. Technical assistance provided by NTP and FHI, and selected NGOs participate in pre- and post-release networking. Early results will be presented in the session.

**Conclusion:** Indonesian DCI has strong political commitment to implement TB-HIV control among inmates. Pilot activities have shown that TB control in prisons is feasible. Activities have been implemented in pilot sites, weaknesses identified, approaches were improved. However, strong partnerships with NTP, NAP and Stop TB partners have to be built and maintained, together with securing ongoing funding and technical support. Scaling up should be continued together with advocacy for maintaining political commitment and leadership.

### Experience of Azerbaijan with TB control in penitentiary institutions through successful partnerships

E Gurbanova, R Mehdiyev, F Huseynov. Main Medical Department of the Ministry of Justice, Baku, Azerbaijan

**Setting:** Azerbaijan; Specialized TB Treatment Institution of the Ministry of Justice.

**Objective:** To present the successful partnership in sustainable TB Control Program in penitentiary system establishment and its impact to epidemiological situation in prison settings.

**Design:** Progress of International and Inter-institutional collaboration in sustainable TB Control Program in prison establishment. Treatment with FLD and SLD in accordance to DOTS strategy for the first time in Azerbaijan has been started in penitentiary sector. The Program was launched by MoJ in 1995 with ICRC technical assistance and government consistent comprehensive support. Specialized Treatment TB Institution where centralized treatment of all prisoners sick with TB is performed was established in 1998 and further reconstructed according to existing infection control requirements. Along with ICRC various national and international partners such as MoH, NGO, GF, WHO, KfW, SNRL, UNITAID, FIND, MSH have enabled on different periods to TB services in prisons improvement and provision of appropriate social and living conditions through secure political commitment, quality assured laboratory diagnostics including rapid methods, providing standard treatment with supervision and patients support, ensuring effective drug supply and management, performance and impact M&E.

**Results:** 100% coverage of all prison population by ACF activities and treatment enrollment; by July 1, 2011 overall 10 905 TB patients were enrolled to FLD and 389 DR-TB patients to SLD treatment; treatment success rate of the first 150 DR-TB patients is 72%; since 2006 new TB cases morbidity rate has decreased over 1.2 times; comparing to 1995 in 2010 TB mortality rate in prisons decreased over 34.6 times.

**Conclusions:** Successful TB control rates in prison are assumed to be the consequences of political commitment, effective international and inter-institutional collaboration.

### INNOVATIVE PARTNERSHIPS FOR TB-HIV CARE OF MARGINALISED POPULATIONS

#### Management of HIV and TB in post-earthquake Haiti: challenges and opportunities

J Furin. Case Western Reserve University, TB Research Unit, Cleveland, OH, USA

The January 2010 earthquake that devastated Haiti was an acute disaster that occurred in a setting of chronic health problems in the country. Chief among these chronic problems are HIV and TB. While much attention was given to responding to immediate health care needs (such as crush injuries, fractures, and acute infectious illnesses), there was limited systematic response to the ongoing medical problems faced by the Haitian population. This presentation will focus on the NGO/government partnerships that were effective in providing care for TB and HIV in post-earthquake Haiti using GHESKIO as a model of success. It will also point out the areas in which TB and HIV experts are needed in such a massive disaster, with a focus on infection control, monitoring patients and providers, and advocacy.

#### Innovative partnerships for equitable access to TB care in Peru

M M Iberico,<sup>1,2,3</sup> M Maritz,<sup>1,3</sup> K Zevallos,<sup>1,2,3</sup> R Montoya,<sup>1,2,3</sup> C Rocha,<sup>1,2,3</sup> A Curatola,<sup>1,2,3</sup> D Boccia,<sup>1,2,4</sup> C A Evans.<sup>1,2,5</sup>

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<sup>4</sup>Faculty of Epidemiology and Population Health, London School of Hygiene & Tropical Medicine, London, UK;

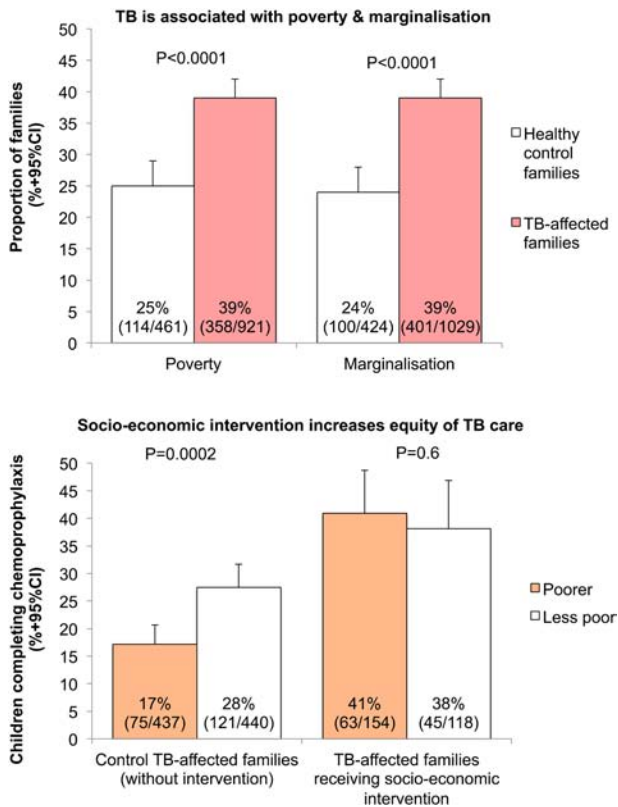
<sup>5</sup>Wellcome Centre for Clinical Tropical Medicine and Department of Infectious Diseases and Immunity, Imperial College London Hammersmith Hospital Campus, London, UK

**Background:** TB and lack of access to care are linked with poverty and marginalization. We characterised these associations and assessed the impact of a multi-disciplinary partnership intervention on the equity of access to TB care.

**Methods and findings, baseline:** We interviewed TB patients and randomly selected healthy controls. TB patients had significantly higher prevalences of poverty ( $P < 0.0001$ , figure upper-left, assessed by a multi-dimensional score) and marginalization ( $P < 0.0001$ , figure upper-right, assessed by a social capital score). Only 22% of children in TB-affected families completed taking TB chemoprophylaxis that was offered to them free and uptake was significantly lower in poorer than less-poor families ( $P = 0.0002$ , figure lower-left).

**Methods and findings, intervention:** The Innovative Socio-economic Intervention Against TB (ISIAT) project offered TB-affected families in randomly selected





shantytowns multi-disciplinary support constituting partnership between health promoters, nurses, psychologists and poverty-reduction specialists. There was 100% recruitment and 97% of TB-affected households participated in regular visits, 71% in community groups, 78% in psychosocial support and 77% in poverty-reduction activities. The intervention was associated with increases in household contact TB screening (from 82% to 96%); successful TB treatment completion (from 91% to 97%); and patient HIV testing (from 31% to 97%; all  $P < 0.0001$ ). Completion of TB chemoprophylaxis by children living with TB patients increased from 22% to 40% ( $P < 0.0001$ ) and became significantly more equitable, such that chemoprophylaxis was completed by more children in poorer than less poor families (figure lower-right).

**Conclusions:** In these vulnerable communities, poorer families who were most in need of free TB care were least likely to access it. A multi-disciplinary partnership intervention overcame these inequalities, improving access and increasing the equity of access to TB care.

### Walking the walk: partnerships for TB-HIV care of native and nomadic populations

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**Background:** Nomadic societies are marginalized and vulnerable to infections. Their relative illiteracy, culture, pastoral lifestyle and living conditions may predispose them to human immunodeficiency virus (HIV) and tuberculosis (TB), including bovine TB especially among cattle herders. Community mobility limits opportunities for HIV counselling, testing and diagnosis, as well as access to TB care.

**Methods:** Lessons from cases and case studies on TB-HIV among the nomadic Fulani in Nigeria and the Manyatta TB project in Kenya will be discussed. Clinical and socio-cultural factors among Fulani patients attending our HIV clinic, currently managing over 7000 patients, will be presented. Comparison will be made to native populations in other parts of the world.

**Recommendations:** Existing programmes for nomads afford opportunities for absorption and integration of TB-HIV services. In Nigeria, the National Commission for Nomadic Education has established an HIV/AIDS desk that focuses on mobilisation and awareness campaigns, and TB-HIV services could be provided along their migration routes. Nomadic communities should be provided with basic TB-HIV services, including education on risk-reduction methods, counselling and screening, medication, adherence counselling, access to laboratory tests and monitoring. These services should be taken to nomadic communities using novel outreach approaches such as mobile units, extension services, case management, directly observed care, and treatment supporters linked to neighbouring facilities in a hub-and-spoke model. Stronger collaborations are recommended between programmes for nomads and TB-HIV services and also between veterinary and public health services. Community participation and leadership should be encouraged to ensure the sustainability of TB-HIV care delivery.

**Conclusion:** There is inequality, inadequacy and inaccessibility of TB-HIV services among nomadic populations and concerted efforts should be made to improve care.

### Peer-to-peer TB health services: reaching populations engaged in commercial sex work and drug abuse

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**Background:** Bangladesh ranks 7th in the 22 high TB burden countries with 109 cases/100 000 population/yr and a reported case detection rate of 72%. Uptake of health services, including TB services, is

low among sex workers, transgenders (TG), injecting drug users (IDU), men who have sex with men (MSM), people living with HIV (PLHIV) and clients of sex workers (CSW). Access and uptake of HIV and STI services among these groups have been increased through the USAID-supported Modhumita network of branded Drop-in-Centers (DIC) in urban centres in Bangladesh.

**Intervention:** In 2010, FHI expanded the Modhumita DIC package of services to include TB screening, diagnosis and treatment by training peer sputum collectors to collect sputum and support directly observed therapy (DOT). At the same time, linkages were established with TB diagnosis and treatment centers of the National TB Control Program (NTP). The sputum collectors do a simple symptoms screen and collect samples from potential TB suspects. They then take the samples to a diagnosis center and return the results to the client. Treatment is provided through government and NGO DOTS centers near by and sputum collectors play a vital role in follow-up of patients and maintaining adherence. The Modhumita centers also provide routine TB awareness sessions.

**Results:** 50 sputum collectors were trained by the NTP; all 40 Modhumita centers in Bangladesh now have sputum collectors. Between January 2010 and March 2011, 8328 persons were screened for suspected TB, 6172 were smear tested and 526 were smear-positive for TB. Of 526 smear-positive cases 474 received DOTS and are being followed up by the centers. See Table for details.

Data by target group							
Population Group	No. reached through DIC services	No. presenting with chronic cough and screened	No. smear-tested	No. with smear positive TB	Smear-positive TB per 1,000 individuals accessing DIC services	No. enrolled DOTS	No. peer sputum collectors
FSW	7,394	2,978	1,907	158	20.8	133	10
MSM	5,689	1,089	791	69	12.1	66	9
TG	3,346	360	439	17	4.8	17	6
IDU	1,395	784	581	47	29.5	42	9
PLHIV	595	466	412	35	38.8	25	4
CSW, migrants and general population	451,597	2,451	2,022	200	na	171	12
<b>TOTAL</b>	<b>470,616</b>	<b>8,328</b>	<b>6,172</b>	<b>526</b>		<b>474</b>	<b>50</b>

**Conclusions:** Expanding TB services to sex workers, IDU, TG, MSM, PLHIV and CSW through integration with branded HIV drop-in-centers and peer sputum collectors has been cost effective and will contribute to improving the case detection rate in underserved populations in Bangladesh.

### Innovative partnerships for TB-HIV care of gay, lesbian and transgender in India

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**Background:** The National AIDS Control Programme (NACP III) has placed highest priority on reaching high-risk groups including men who have sex with men, with targeted interventions. The biggest challenge facing India in dealing with MSM and

TG is that they are a hidden population with higher HIV prevalence (MSM 6.4% and TG 12.8%) than the general population (0.3%). There is no reliable TB prevalence data in these groups. This paper presents some of the challenges in HIV and TB care in this marginalized group, experiences of interventions with MSM and suggestions for innovative strategies.

**Methodology:** This paper is a review of existing literature available on HIV and TB care of MSM and TGs in India. The review is based on publications of various authors across India and reports from National and International organizations. We will also share the work done on HIV prevention in MSM under Indo-US collaborative studies.

**Results:** There are major gaps in HIV and TB surveillance and interventions among LGBT, even though HIV epidemics are concentrated among these groups. This is because of the complexities of their identities, the stigma that they face, their mobility and socio-cultural norms that prevent them from accessing HIV-TB prevention and intervention services. Our study from Chennai has revealed that only 26% of MSM had availed of HIV prevention interventions. While HIV prevalence in this group is high referral for TB services remains a challenge.

**Conclusions:** Innovative strategies are required if this marginalized group have to be reached in TB and HIV care services. This includes combination prevention strategies addressing mental health issues as well as catering to HIV/STI and TB care. The need for integration of these services is crucial as the HIV epidemic presents a massive challenge to global control of TB.

## BIOMARKERS FOR LUNG DISEASES

### Biomarkers in tuberculosis

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Biomarkers can provide insights into host resistance against tuberculosis (TB). A tailored biosignature composed of carefully selected essential markers will be required. Globally more than 2 billion individuals are infected with *Mycobacterium tuberculosis*. Of these, 10% will remain latently infected without clinical signs and 10% will develop active TB. Hence, comparison between these two groups can provide insights into the mechanisms that discriminate between active TB and latent infection. Moreover, biosignatures:

- will help to better understand biology of infection, immunity and pathogenesis;
- will allow to monitor of vaccine and drug trials;
- can predict risk of disease reactivation in latently infected individuals.

We have studied gene expression profiles in latently infected and non-infected individuals and compared them with patients with active TB. We found that a handful of biomarkers suffices for robust distinction between the three groups. These include Fcγ receptor, guanylate-binding protein, granzyme A and defensin-α. In a more sophisticated approach, we defined biosignatures in selected T cells. Members of the JAK/STAT pathway involved in T-cell regulation provided robust biomarkers for discrimination of patients with active TB, individuals with latent infection and non-infected healthy controls. Additional analysis focused on metabolomics. Of around 400 different metabolites, less than 20 were sufficient for robust discrimination between latent infection and active TB. Hence, biosignatures 1) provide deeper insights into mechanisms underlying host resistance and 2) serve as a platform for the development of novel intervention measures against TB.

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### Potential markers for a point of care test for tuberculosis disease

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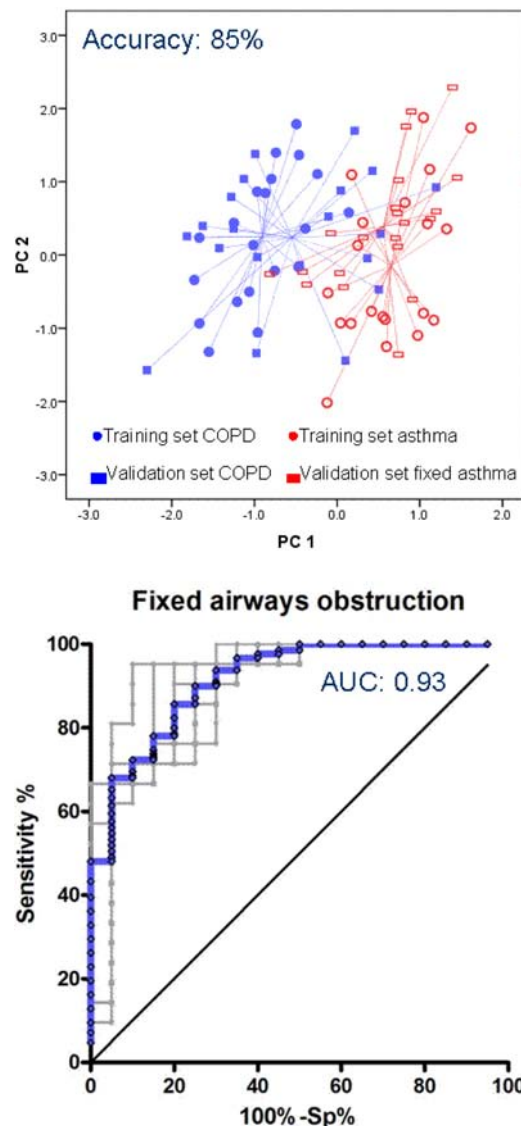
To improve access to treatment we need diagnostic tests that can be used at the location at which care is initiated. The tests should be affordable, give immediate results without referral to a laboratory and be able to differentiate active disease from latent infection. We also need simple, low cost screening tools to identify individuals in a community with a high probability of active disease. Several technologies are available that might be applied at point of care but all are dependent on reliable markers to indicate the disease state. Markers can be derived from the bacteria themselves, or arise from their interaction with the host. They may be macromolecules (proteins, nucleic acids, lipids) or smaller molecules, including volatile compounds and gases. Some nucleic acid and lipid-based molecules, are highly specific for *Mycobacterium tuberculosis* but most markers need to be used in combination with others to increase the predictive value of the test. Molecular tests are moving closer to the patient with the development of new technologies, but detection of specific lipids has so far remained a laboratory based test. Serological tests have proved disappointing but new technology may permit screening for multiple targets. Some progress is being made in deciphering the protein ‘fingerprint’ of TB patients by applying proteomic techniques but further work is needed. Detection of volatile compounds either from breath, or the headspace above specimens is an attrac-

tive proposition as sample handling is reduced and the test can be ‘reagent free’ minimising running costs. However, the discovery and validation of volatile biomarkers is challenging due to the inherent instability of volatile compounds, and ease with environmental gases can contaminate samples. Current knowledge of markers for active TB will be reviewed, and their potential value at point of care discussed.

### Breath biomarkers for asthma

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Asthma and chronic obstructive pulmonary disease (COPD) are chronic inflammatory airways diseases, which are traditionally diagnosed by using symptoms and lung function. There is considerable overlap between these diseases, which is complicating treatment



**Figure** Training and validation sets by eNose: asthma versus COPD. Fens et al. *Clin Exp Allergy* 2011; in press.

decisions. We hypothesized that molecular fingerprints of volatile organic compounds (VOCs) in exhaled air (breathprints) allows accurate discrimination and identification of patients with asthma or COPD. To that end we performed studies for internal and external validation of diagnostic accuracy by electronic nose (eNose) and explored the discriminative signals by using GC-MS. First, we observed that the breathprints in asthma were not affected by acute bronchoconstriction or bronchodilation. Second, it appeared that breathprints from asthmatics could be well discriminated from patients with COPD (accuracy in internal and external validation 96% and 83%, respectively) (Figure). These results were not influenced by smoking, steroid therapy or the presence of fixed airways obstruction. Third, breathprints in patients with COPD were associated with inflammatory markers in sputum (eosinophil and neutrophil counts, eosinophilic cationic protein, major basic protein). The predominant VOCs were reflective of oxidative stress. We conclude that breathomics in exhaled air allows identification of asthma and COPD. This suggests that monitoring of patients by eNose will facilitate asthma and COPD management, which is currently assessed in a pan-European IMI-project.

### Biomarkers in sputum, serum and breath of tuberculous patients

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We investigated the potential of biomarkers for the diagnosis of tuberculosis (TB). We have studied two different electronic noses (e-nose) to differentiate between sputum headspace samples from TB patients and non-TB patients (1). We used only samples from Ziehl-Neelsen stain-(ZN) and *M. tuberculosis* culture-positive sputum samples (TBPOS) and ZN- and culture-negative TBNEG samples (TBNEG) samples. We used 80 TBPOS and 243 TBNEG samples. Best results were obtained linear discriminant function analysis, resulting in a sensitivity of 75%, a specificity of 67% and an accuracy of 69%.

Next we tested the potential of breath analysis by gas chromatography-mass spectrometry (GC-MS). A training set of breath samples from 50 sputum culture-proven TB patients and 50 culture negative non-TB patients was analyzed by GC-MS. A classification model with 7 compounds resulted in the training set with a sensitivity of 72%, specificity of 86% and accuracy of 79% compared with culture. The model was validated with an independent set of breath samples from 21 TB and 50 non-TB patients. A sensitivity of 57%, specificity of 84% and accuracy of 76% was found. As a third method we used an automated GC-MS procedure based on the injection of sputum samples which are then methylated inside the GC injector

using thermally assisted hydrolysis and methylation (THM-GC-MS). The THM-GC-MS procedure was optimized for sputum analysis and identification of mycobacteria after culture (2). Tuberculostearic acid and hexacosanoic acid were used as markers. The method was validated using stored sputum samples. All microscopy positive samples were found positive with THM-GC-MS. No false positives were found. Further research is required before these three methods can be used in routine laboratories. The advantages and limitations of the methods will be discussed.

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## DECENTRALISATION AND SCALE-UP OF ART THROUGH TUBERCULOSIS CLINICS AND OTHER MODELS OF TB-HIV INTEGRATION

### Decentralisation of ART through TB clinics in Kenya

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Comprehensive care for TB patients infected with HIV calls for a full package of patient centered care that leads to improved quality of life, convenience and reduced complications. Kenya initiated TB HIV collaborative activities in 2005 which has led to increased access to TB care. Kenya adopted WHO and UNAIDS policy recommendations on collaborative activities by establishing a national TB HIV steering committee to spearhead a national strategic response. A stepwise approach was adopted by developing policy documents, capacity building, community involvement and ensuring commodity security. Concerns on patients' convenience and issues of TB infection prevention in ART clinics led to the introduction of ART into TB clinics. Identification of Pilot sites in each region for this exercise was based on infrastructure, trained personnel and ease of monitoring and evaluation. Lessons learnt were applied in further decentralization. There has been an increase of HIV testing among TB patients from 14% in 2005 to 91% in 2010 with an inverse reduction of HIV sero prevalence among these patients from 57% to 41%. Consequently, there has been an increase of CPT uptake from 81% to 99% respectively. In addition, uptake of ART increased from 32% to 48%. Provision of HIV services including ART in TB clinics improves HIV testing, uptake of CPT and ART, leading to improved adherence, treatment outcomes and convenience to patients. Successful decentralization of TB HIV service requires strong commitment from TB and HIV programs including uninterrupted supply of commodities.



### Experiences of integration of TB and HIV services, including for pregnant women, in Lusaka, Zambia

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**Aims:** Despite recommendations on early initiation of combination antiretroviral therapy (cART) in TB patients, this has not been achieved in many settings. We describe a TB and HIV integration program that provides HIV care, including cART, within TB clinics in primary care settings in Lusaka, Zambia.

**Methods:** We integrated TB and HIV services in 22 clinics from 2007 to 2010 by providing Provider Initiated Testing and Counseling (PITC) and linkages to HIV care. In 2011, we designed a model of integration with HIV care provided within the TB clinic which includes HIV care enrollment, provision of cART and co-trimoxazole preventive therapy, and referral to regular HIV care at completion of TB treatment. Working with district health management, we trained TB staff in ART care and stationed a physician assistant at the TB clinic once weekly to provide integrated clinical care.

**Results:** Integration of HIV care into TB clinics was challenging for several reasons; lack of space, staff shortages, and resistance to change from clinic staff. We overcame these by re-designing the patient flow to optimize space, mobilizing staff from other clinic departments, and ensuring that the initiative was led by district staff to promote ownership. Baseline and implementation data will be presented including; time to ART enrollment and cART initiation, complications of co-treatment, challenges and recommendations for further scale up.

**Conclusions:** Despite limitations in space and staffing and resistance to a new program, integration of HIV care and treatment into routine TB care is feasible in primary health care settings.

### Integrating TB and HIV services at community level: experience from South Africa

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**Setting:** O.R. Tambo Qaukeni Health Sub District, this is a poverty stricken community that is a labour-sending area to gold mines. Gold mines have above national average TB rates and ill miners are repatriated to their homes with minimum support and protection for the family. At UThukela District there are two sites which are poor and have high unem-

ployment rates and below national average TB case identification.

**Objectives:** This intervention harnessed resources for community based intensive TB and HIV case finding, improved TB and or HIV treatment initiation and adherence; leveraging ARV defaulter tracing campaigns and HIV counselling and testing (HCT) campaigns; and improving disease knowledge competence for involved community based organisation and their outreach officers.

**Design:** A three site prospective intervention study to establish community-based support to improve early identification of TB and HIV cases, improve their entry into care, improve adherence to treatment and completion of TB treatment.

**Results:** At OR Tambo we observed positive trends with TB treatment initiation, adherence and successful completion. Referral for HIV testing also improved during the intervention. UThukela Site 1 which focused on leveraging HCT tested 679 people and referred 118+ve people to care. They collected 550 sputa of which 24 were AFB positive. UThukela Site 2 leveraged its ARV defaulter tracing for the local hospital and combined that with outreach activities to conduct TB screening.

**Conclusion:** There is value in harnessing community based organizations and activities that are either TB or HIV focused to integrate. This however must be supported by disease training for the organisations concerned as well as good collaboration with government health services such as local clinics, laboratory, and TB and HIV control programs. Supportive monitoring is also important.

### PARTNERING INITIATIVES TO 'STOP TB' AT COUNTRY LEVEL: HOW A PARTNERING APPROACH CAN HELP SCALE UP CARE

#### Swaziland: a holistic approach to service delivery

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Swaziland has a population of 1.1 m inhabitants, 70% of which is rural with 63% of the population living below poverty line. Although classified as a lower-middle income country, is ranked low in key development indicators, e.g., a human development index 0.498 and human poverty index of 53.9%. In 2007, the country's high TB and HIV burden evidenced by TB incidence of 1198 per 100 000 population, 81% HIV rate among incident TB cases, emergence of M(X)DR-TB; coupled with inadequate and uncoordinated partner's approaches to TB management, poor TB control outcomes; e.g., 42% treatment success rate in 2006 cohorts with 47% defaulted or

not evaluated; inadequate programme funding, low access to quality DOTS in rural areas posed serious concerns. This prompted a partnering initiative involving government, NGOs, FBOs and CBOs with the aim of addressing the programmatic gaps and pursue the ultimate goal of scaling up interventions towards attainment of the MDG targets for TB control. This paper describes how the Swaziland Partnership's humanistic and holistic approach to TB prevention, diagnosis, treatment and care resulted in rapid improvement in country's TB control outcomes as evidenced by increase in TB treatment success rate from 42% in 2006 to 69% in 2009; and increased uptake of TB-HIV collaborative services resulting 80% TB patients tested for HIV, 95% on CPT and 39% on ART. It further illustrates innovations employed in the removal of barriers to accessing TB, TB-HIV and MDR-TB diagnostic and treatment services; and involvement of patients, families, Civil Society, and communities beyond the clinical setting. The key milestones and experiences in the partnering process from exploration, Partner's services and resource mapping, Partnership launch, to the current maintenance phase have been highlighted and described in a chronological manner. Finally, it describes how the partnership provided the platform for coordination of stakeholders and resource mobilization.

### India: civil society and partnerships for tuberculosis control

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The Partnership for TB Care and Control (PTCC) in India brings together and synergizes civil society contribution to the National TB Program. PTCC evolved from a meeting involving civil society organisations held in 2008, with the agenda of working closely to support the government's efforts in controlling TB. The Partnership has added value in many ways. 1) Unity—PTCC provides a voice of a unified civil society in engaging with the government in TB care and control through efforts like providing recommendations into the program planning (RNTCP) phase III. PTCC is recognized by the program, has a representation in the working group for RNTCP III planning and in the National Coordination committee for Global Fund Round 9. 2) Service—PTCC has been successful in getting the Global Fund Round 9 for ACSM covering 740 million population which strengthens community mobilisation in the fight against TB. 3) Trust—PTCC is building trust and collaboration between multiple sectors involved in TB care and control initiatives, through national and regional consultations, with equal participation from all sectors to brainstorm on collaborative efforts and

have various channels for communication and sharing of experiences among partners. 4) Capacity building—PTCC sought the expertise from among the partners to train others, i.e., ACSM (through PATH) and engaging with media (through media partners and funded by Eli Lilly). With the shift to universal access of TB care, partnership forums are the way forward in achieving a unified a sustainable action against tuberculosis.

### Ugandan civil society organizations support NTP in the implementation of a shared plan

H J Kawuma. Uganda Stop TB Partnership, Kampala, Uganda

The Uganda Stop TB Partnership (USTP), launched in 2004 was registered as a legal entity in 2010. The first mandate of USTP was to mobilise additional human resources to utilise a funding opportunity presented by the Global Fund (Round 1) and Uganda's inclusion among the Intensified Support and Action Countries (ISAC). Progress towards achieving the National TB Programme (NTP) targets for case detection and treatment success was unsatisfactory. The USTP engaged in mobilising Civil Society Organizations (CSOs) was to address this need. Activities agreed on by the NTP and CSOs are today part of the National Strategic Plan (NTP plan) and the Global Fund Round 10 application. Based on their core competences, USTP partners have been committed to take up the responsibility to jointly implement a shared NTP Plan. For example, CUAMM provided additional human resources to support district level supervision of TB control activities using untapped funds that were available in the supported districts. AISPO continues to provide technical support to facilitate the setting up and managing a system for external quality assurance of Sputum smear microscopy services. Thanks to skilled human resources and close relations with targeted communities, CSOs can contribute to the implementation of the NTP plan, when they are involved in the planning process and kept informed about the overall progress in TB control. The USTP can facilitate the mapping of partners highlighting the opportunities to participate in implementation of activities already included in Global Fund application and the NTP plan, and be supported for that.

### Philippines: government works in tandem with the civil society and the private sector

A Sarmiento, T Rodrigo. Philippine Coalition Against Tuberculosis, Quezon City, Philippines

The Philippine Coalition Against Tuberculosis (Phil-CAT) was founded in 1994 amidst the realization that collaboration and partnership between the public and private sectors was vitally needed to succeed in the country's fight against tuberculosis (TB). At



that time, the Philippines already had one of the highest levels of TB in the world. Many obstacles were faced by those who work for TB in the country. The general public awareness of TB and its public health importance was low. Many thought that this disease has already been eradicated; when in fact it was killing 62 Filipinos every day. It affected mainly the poor who had no political voice to cry for help. Moreover, TB carried then, as it does now, the fallacious belief that contracting the disease was a shame. The TB control efforts in the Philippines at that time were in disarray. The government had its National Tuberculosis Program (NTP) that had standardized policies but was viewed with condescension by private medical practitioners. From 12 founding members, PhilCAT has grown to 58 member organizations from the government and non-government, professional and corporate sector. It is governed by an 11-member board elected by all member organizations. It is vice-chaired by the highest Department of Health (DOH) official in charge of the NTP. The coalition has become a forum for interaction between private medical groups and the government. PhilCAT through the various consensus statements had been instrumental in galvanizing private medical practitioners towards a unified standard management of TB. It has also been the springboard for initiatives applying the DOTS strategy in the private sector. As the government's partner in the implementation of the public-private mix (PPM) strategy, PhilCAT has engaged around 5000 care providers increasing case detection rate by 6% in 2008.

## EPIDEMIOLOGY OF DRUG-RESISTANT TUBERCULOSIS: INSIGHTS FROM PARTNERSHIPS

### Distribution of *M. tuberculosis* genotypes and implications for treatment

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**Background:** Genotype diversity of *M. tuberculosis* has recently gained attention as a possible virulence factor.

**Objectives:** To describe and discuss the global distribution of genotypes and possible implications for treatment.

**Results:** Associations of *M. tuberculosis* genotypes with tuberculosis treatment outcomes have mainly been reported for the Beijing/W genotype. These associations primarily reflect associations of this genotype with (multi-)drug resistance, possibly due to increased

mutation rate or impaired gene repair. The Beijing/W genotype is among the predominant genotypes in East and Southeast Asia and the former Soviet Union. It is strongly associated with multidrug resistance in most former Soviet Union countries, elsewhere in Europe, parts of Southeast Asia and South Africa. The association with multidrug resistance is less clear in other parts of the world. The causes of this geographic variation are unknown; data from Vietnam suggest an association with resistance to streptomycin resistance. While animal studies suggest that Beijing strain bacilli have increased clinical virulence. This has not been convincingly shown in humans. Also data on effects of genotype on treatment outcomes in humans, independently of drug resistance, are inconclusive. Some studies suggest higher failure rates; there is growing evidence of increased relapse rate.

**Conclusions:** While *M. tuberculosis* genotypes vary in their association with drug resistance, there are no clear indications that the genotype as such has implications for tuberculosis treatment.

### Identification of high-risk subgroups: application of novel methods to existing surveillance data

T Cohen. Global Health Equity, Brigham and Women's Hospital, Boston, MA, and Epidemiology, Harvard School of Public Health, Boston, MA, USA

Current standard survey methods for assessing the burden of drug resistant TB aim to estimate the proportion of disease that is drug resistant at a national (or occasionally regional) level. Aggregated estimates may mask local variation in the burden of resistance. Alternative sampling methods and/or analytic approaches that can distinguish geographic areas of relatively high burden or risk may be helpful for prioritizing public health responses within a country. We will present examples of 1) Lot Quality Assurance Sampling and 2) spatiotemporal analysis as two approaches that can identify variation in the burden of resistance at the sub-national level.

### Resistant *M. tuberculosis* genotype and HIV: distribution and significance for programme management

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Clinical and molecular epidemiology can provide insights and inform on strategic planning by NTPs in high burden settings in several ways, which include:

- 1 Appropriate resource allocation to support interventions that preferentially target treatment adherence versus interruption of disease transmission.
- 2 Interrupting transmission of drug resistant TB in HIV-infected and non-infected persons in hospitals and congregate community settings.

- 3 Identification of the most infectious patients with drug resistant TB so that appropriate and directed isolation strategies can be rapidly implemented.
- 4 Design and implementation of appropriate treatment regimens in HIV-infected and non-infected persons.

Several of these issues will be discussed within the context of the clinical and molecular epidemiology of drug-resistant TB in South Africa.

## BRIDGING THE GAP BETWEEN PUBLIC HEALTH AND CLINICAL CARE: IMPROVED APPROACHES TO NON-COMMUNICABLE DISEASES

### Adapting the DOTS strategy as a framework to monitor NCDs

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In most low- and middle-income countries, management standards for non-communicable diseases, including diabetes mellitus, in the public health services are poor. The burden of non-communicable diseases, including diabetes, is predicted to grow during the next 20 years, but there is no standardised and structured care and no reliable information on the number of patients presenting with the diseases or data on their morbidity and survival outcomes. The 'DOTS' model has been used as the framework for the control of tuberculosis for over fifteen years, allowing monitored, structured therapy to be successfully delivered to millions of tuberculosis patients in some of the poorest countries in the world. This model has been adapted for the life-long monitoring and evaluation of antiretroviral therapy in HIV-infected eligible patients in Malawi, and has allowed strategic national planning and rational drug forecasting in this low-income country. A similar model has been used for monitoring and reporting on patients with diabetes mellitus in Queen Elizabeth Central Hospital, Blantyre, Malawi. This lecture discusses how the model has been set up, and presents quarterly and cumulative case finding and treatment outcome data for diabetes mellitus patients. If such data were reliably and consistently collected for all non-communicable diseases and reported as part of a programmatic approach, this would enormously strengthen the ability of resource-poor countries to monitor and assess their response to the growing epidemic.

### A global framework for action to improve the primary care response to chronic NCDs

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Decreasing the global burden of chronic NCDs requires a dual approach: firstly, implementation of multisectoral policies to decrease population-level NCD risks, and secondly, delivery of effective and affordable primary care interventions for patients with NCDs. In place of the current primary care response to common NCDs which is often unstructured and inadequate, we propose a programmatic, standardised framework to deliver primary care interventions for patients with NCDs. The initial focus is on hypertension, diabetes mellitus, chronic airflow obstruction, and obesity. This 'public health approach' to primary care is informed by lessons learned from scaling up TB and HIV interventions, including the importance of political commitment, a robust strategy, standardised interventions, and rigorous monitoring and evaluation of progress towards targets. The goal is to reduce NCD morbidity, disability and premature mortality through a three-pronged strategy: 1) identify and address modifiable risk factors, 2) screen for common NCDs and 3) and diagnose, treat and follow-up patients with common NCDs. The framework includes targets, a package of interventions for quality care, key operations for national implementation of these interventions (political commitment, case-finding among people attending primary care services, standardised diagnostic and treatment protocols, regular drug supply, and systematic monitoring and evaluation), and indicators to measure the impact of primary care interventions on chronic NCDs. The framework needs evaluation and adaptation in different settings. Research on the cost, value and feasibility of implementation will pave the way to extend the benefit of this approach to millions of people worldwide with chronic NCDs.

### Country case studies on the implementation of NCD prevention programmes and tobacco

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**Objective:** To assess the status of national non-communicable diseases (NCDs) strategies/programmes and their implementation in a range of low- to high-income countries and how they incorporate tobacco control.

**Method:** WHO and the NCD Alliance are calling for the prevention and control of NCDs to be put on the global agenda. They are recommending that all member states of the United Nations develop national NCD plans which include 'accelerating the

implementation of Framework Convention on Tobacco Control FCTC, committing to regular increases in tobacco taxes, developing national tax strategies, and protecting policies from the tobacco industry'. A Union working group 'Strengthening NCD prevention and control through tobacco control' has therefore conducted a baseline survey of its members of its 13 different countries. A questionnaire was designed to elicit information on the presence of a national NCD strategy if such a strategy existed, and if it incorporated tobacco control. Questions were also asked about the involvement of civil society, partnerships and resources. A follow up survey will be carried out in February 2012.

**Results:** Interim results of the survey have found that despite the recommendations from WHO and the Alliance, not many countries have actually implemented an NCD strategy. Some are in the early stage of developing a strategy, such as Egypt, and those that do have a strategy generally only have links to tobacco control rather than it being an integral component of the strategy. High income countries such as England and New Zealand are addressing NCDs but on an issue by issue basis rather than through a broader NCD strategy or programme approach. The final results of the survey will be presented in this symposium.

**Conclusion:** We will present case studies of three countries and how they are managing NCDs and specifically how tobacco control fits into the prevention and control of NCD programmes.

## PARTNERSHIPS TO DEVELOP ALTERNATIVE LIVELIHOOD AND CROP DIVERSIFICATION FOR TOBACCO CONTROL

### Human rights issues in tobacco farming: Bangladesh experience

A Islam, S Ahmed. WBB Trust, Dhaka, Bangladesh

While many farmers believe that growing tobacco will prove more lucrative than other crops, they are frequently deceived. While a few farmers with large plots of land are able to negotiate a good deal with the tobacco companies, most farmers in Bangladesh have very little land and thus little negotiation power, and fail to gain the prices of the few larger farmers. For small farmers, tobacco cultivation can lead to a cycle of debt, in which they are unable to repay the loans needed to buy the many expensive inputs, and must continue growing tobacco because of their debt obligation to the industry from which they purchased the inputs. Of the many complaints of tobacco farmers are the following: that they must follow precisely the instructions of the industry, so that they serve more as workers than farmers; that the highly labour-intensive nature of the work means that children and



women, even pregnant women, must join in the work, leaving little or no time for education or household work; that for the many farmers without a direct contract with the industry, the pay is extremely low, and even with a contract, the farmer has to accept the industry grading of their leaf, thus often earning far less than they expect. This also leads to pressure and tension about payment. Tobacco farmers suffer particularly during the curing of tobacco, both from the air pollution that results and the almost non-stop work as they need to maintain constant temperature day and night. The combination of low pay, miserable working conditions, lack of independent decision-making, high labour demands, and debt burdens means that for many tobacco farmers, the work violates their basic rights to a decent livelihood. Alternatives to tobacco use would also mean alternative income flows, many of which could result in far better conditions, given that other parts of the economy are not so dominated by a few companies as is tobacco.

### The perverse economics of tobacco cultivation and tendu harvesting: policy examples from India

P Lal. Union South East Asia, New Delhi, New Delhi, India

Traditionally, tobacco crop and the tobacco industry contributed a major proportion of tax revenue to governments in developing countries like India. Since its independence in 1947, given political and economic compulsions, the government of India added welfare dimensions like poverty alleviation and providing employment to support the nascent but growing tobacco industry. Gradually economic incentives, subsidies and tax waivers were offered to the industry to support the welfare arguments. Over the years, as more communities began to depend on tobacco for their livelihood, welfare arguments dominated over economic ones. This has resulted in the tobacco industry to be weakly regulated, with less burden of tax being passed onto tobacco products. As other industries have emerged in India as a source of revenue, there is less reliance on tobacco for tax revenues.



This presentation will compare policies on tobacco cultivation of the major types of tobacco in India, and tendu leaf plucking which is vital component of the bidi industry (bidis are indigenous made leaf-rolled cigarillos and the dominant form of smoking in India). It also compares policy measures and the hidden externalities and distortions that have been created over the years. The aim of the presentation is to present policy evidence that has supported the proliferation of tobacco cultivation and tendu harvesting in India. It concludes that more political fortitude is needed to correct these distortions.

### **At the crossroads of life and livelihoods: health and socio-economic concerns of bidi workers and tendu leaf pluckers in India**

B Mukhopadhyay. Voluntary Health Association of India, New Delhi, India

**Background and challenges to implementation:** India is a major producer of tobacco and tobacco products and millions of people are employed in this industry. To support existing evidence on health hazards of tobacco use, VHAI conducted a primary research study in six states of India—Uttar Pradesh, Bihar, Jharkhand, West Bengal, Gujarat and Madhya Pradesh among bidi rollers and tendu pluckers to identify the key health and development concerns associated with tobacco-related employment.

**Intervention:** Primary research involved field work, data collection, analysis, focus group discussions, interviews, participant, non-participant observations, capacity building, skill training and exploring marketing linkages. Literature review consisted of studies, government documents, media reports and online sources.

**Results and lessons learnt:** Bidi workers and tendu pluckers are paid bare minimum wages, suffer from serious diseases, enjoy no rights and live in poverty. Despite ban, children work long hours for the tobacco industry, losing out on childhood and education. Welfare provisions or policy benefits do not reach tobacco workers, thereby, impeding development. 39 self-help groups of nearly 500 bidi rollers have successfully upgraded their skills and shifted to alternative livelihoods, earning up to 40–50% more, availing benefits from government schemes and sending their children to school. India-focused, occupation-specific evidence on tobacco-poverty link is essential to strengthen policy advocacy efforts.

**Conclusions and key recommendations:** Rehabilitation measures as part of a national initiative on alternative livelihoods for tobacco workers can be successful if they are built around aspirations, skills and needs of tobacco workers. Bidi industry should be regulated and taxes on tobacco products should be increased with part of revenue utilized to enforce welfare provisions.

### **Alternative livelihood for bidi workers in southern districts of Tamil Nadu: best practices**

E Vidhubala. Resource Center for Tobacco Control, Cancer Institute (WIA), Chennai, Tamil Nadu, India

Conservative estimates place bidi workers in India at 5.5 million. The multi core bidi industry takes refuge in the farce that this industry is only for the benefit of bidi workers; who in reality are summarily exploited for the profit maximization of the bidi industry. Recognizing the problems of bidi workers, the government enacted the Bidi Workers Welfare Fund Act, 1976 to provide them with welfare measures. However, most of them have failed to reach the bidi workers and has not changed their socio-economic status. To compile best practices among bidi workers in Tamil Nadu who have adopted alternative livelihoods. Bidi workers ( $n = 212$ ; women 210, men 2) rolling bidis for 1 to 45 years who later adopted alternative livelihoods were identified from 17 villages of Tamil Nadu. Data was collected using a structured proforma in June 2011. Majority of the respondents were illiterate (35.8%) or primary school educated (41.5%) and only 1% went to college. As bidi rollers, 58.6% earned less than 1\$ a day. Majority (71.7%) began this vocation before 18 years (13.7% before 10 years) and 69.8% were inducted by the mother. Reasons attributed for shifting were health (53.8%), dislike (33%) and monetary (12.3%). Irrespective of age, 54.7% adopted alternative jobs (21.2% tailoring). Current family income ranged from Rs.1000 to Rs. 20000. As bidi workers their quality of life was poor (38.7%) or moderate (60.8%), but after quitting it was satisfactory or good (99.6%). A village instituted in the name of bidi workers; only the name remains not the occupation (80% shifted work and moved due to poverty). Bidi rolling is clearly neither remunerative nor healthy, and does not improve the quality and standard of life. Welfare schemes promote the occupation as only bidi rollers can claim benefits and education has not reached even their next generation. Instead allocated resources can be utilized for providing alternative livelihood to change their living standards permanently.

### **Trends in tobacco farming: a case study from Tamil Nadu**

S Cyril Alexander. Mary Anne Charity Trust (MACT), Chennai, Tamil Nadu, India

As a signatory to the Framework Convention on Tobacco Control (FCTC), India has to reduce tobacco farming by 50% in 10–15 years. But the government is improving tobacco production by supporting the industry to maintain its market internationally through its tobacco board.

To explore trends in tobacco farming and possible alternatives in Tamil Nadu. Tobacco cultivators

( $n = 112$ ) were identified in one district (15 villages). A semi-structured interview was conducted by trained investigators at the farm during the harvesting period. The farmers were initially hesitant and responded only after repeated assurances of confidentiality. Majority were aware of the undesirable nature of the crop but were traditionally cultivating for 2–3 decades. Despite knowing the health hazards, farmers cultivated tobacco for monetary gains giving little importance to their health and that of the consumers. Although, they cultivate chilly, drumstick, onion, cereal, beetroot, brinjal, sunflower, potato and ground nut, better marketing system, monetary benefits and its draught resistant nature makes tobacco more attractive. Challenges such as dealing with middlemen, higher commission, low prices and storage remain. Farmers expressed their readiness for crop diversification, but report that the onus is on the Government who are themselves promoting it. Considering the immense health benefits to consumers at large, Government should take active steps to fulfill its commitment to the FCTC. It is difficult to achieve tobacco control with a fully functioning tobacco board, with not a single dedicated staff for tobacco control in the Government. Though various measures have been undertaken in tobacco control, farming is a crucial starting point. Subsidies for farmers producing alternate crops to tobacco should be considered. Government should also consider setting up procurement and storage units for alternate crops to ease the marketing burden on the farmers.

## **TUBERCULOSIS REACH: INNOVATIONS AND PARTNERSHIPS FOR EARLY AND INCREASED TUBERCULOSIS CASE FINDING AMONGST THE POOR AND VULNERABLE**

### **Overview of case finding approaches used by TB REACH Wave-1 projects**

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TB REACH is a funding initiative that supports the development of innovative approaches for early and increased TB case detection for the poor and vulnerable and other people with limited access to TB diagnosis and treatment. TB REACH recognises the importance of learning from these newly developed approaches and to evaluate which approaches work well within the different projects and contexts to allow recommendations to be made on replication and/or scaling up. HLSP&KIT have been assigned the role of external monitoring and evaluation agency for the first 2 Waves of project funding. In this pre-

sentation we will present an overview of the different approaches chosen by the projects in Wave 1 to increase case detection in a variety of target populations and different contextual circumstances. We will share some preliminary lessons on the implementation of the different strategies and highlight a number of challenges faced by the projects. The evaluation of level of success and outcome of the projects constitute special challenges in particular in terms of defining success, measuring increases in numbers of TB cases detected and judging additionality of these cases. We will discuss our experiences in monitoring and evaluation, present the approach taken and provide insight in how the different players work together to address these challenges in estimating effect.

### **Partnership and innovations with a local university to improve detection of childhood TB**

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**Background:** Few children are diagnosed with TB in Yemen due to poor knowledge, access to health and diagnostic paediatric services. Parents are unwilling to attend repeated hospital visits to complete the diagnostic process and children have low (<40%) treatment completion rates.

**Objectives:** To improve access to TB diagnostic services and case detection of TB in children and adherence to treatment.

**Methodology:** Children <15 years old in contact with adults with smear-positive pulmonary TB (SM+PTB) are visited at home and symptomatic children are taken to hospital to collect multiple specimens in a single day (one expectorated/induced sputum and one nasopharyngeal and gastric aspirate or nasopharyngeal swab). Children hospitalised at Al-Thawra and Al-Sabeen hospitals are screened with 3 expectorated/induced sputum, nasopharyngeal and gastric aspirates or 3 nasopharyngeal swabs over 3 days plus chest X-rays. The reference standard is culture. Parents/guardians receive tailored text messages and offered health care through the DOTS centres.

**Results:** 14 (4%) of 385 (37%) contact children and 4 (16%) of 25 hospitalized children had microbiologically-confirmed TB from Jan–June 2011, with an increase in case detection compared to baseline data. Treatment adherence increased to 96%. Further data will be updated at the conference.

**Conclusion:** Home visits increased case detection among children. Single day multi-site specimen collection has the same yield as multi-day approaches and is more acceptable to parents.

## TOWARDS UNIVERSAL ACCESS: SCALING-UP ACCESS TO TB-HIV DIAGNOSIS AND TREATMENT FOR MARGINALISED POPULATIONS

### Best practices for case finding and treatment among the homeless in the US

B Moore,<sup>1</sup> K Powell,<sup>1</sup> S Bamrah,<sup>1</sup> R Yelk-Woodruff,<sup>1</sup> M Haddad,<sup>1</sup> I Sanchez.<sup>2</sup> <sup>1</sup>US Centers for Disease Control and Prevention, Atlanta, GA, <sup>2</sup>Rollins School of Public Health, Emory University, Atlanta, GA, USA

**Objectives:** To compare characteristics of homeless to non-homeless persons with TB and to describe evidence-based approaches for addressing TB in the homeless population.

**Methods:** We completed a descriptive epidemiologic analysis of homeless persons diagnosed with TB during 1994–2009 in the United States. We reviewed published studies to determine what constituted best practices—particularly those shown to improve outcomes in this marginalized population.

**Results:** It is estimated that approximately 1% of the population experience homelessness each year in the United States. Of the 258 003 reported TB cases during 1994–2009 that had housing status ascertained, 15 191 (6%) persons were homeless. These homeless persons with TB were predominantly male (86%); 41% were U.S.-born blacks. Among persons with HIV results reported, 18% of non-homeless patients, versus 33% of homeless patients, had HIV infection. Compared with non-homeless persons, homeless patients had twice the odds of not completing treatment due to refusal or losing contact with the health department. In the review of published studies, best practices included chest radiography screening onsite at homeless services, treatment with directly observed therapy for both active TB disease and latent TB infection, and use of incentives and peer educators to improve treatment adherence.

**Conclusions:** Published articles about TB control in this population recommend targeted chest radiography screening and incentive-based, directly observed therapy. Because homeless persons with TB are particularly vulnerable to TB but less likely to complete TB treatment, identified best practices may provide guidance to programs on addressing TB in this at-risk population.

### Effective and sustainable partnerships for TB-HIV care of people with comorbid alcohol and substance use

T A Mathew. Division of Infectious Diseases, Department of Medicine, University of Connecticut Health Center, Farmington, CT, USA

**Background:** Alcohol use disorders (AUD) and substance use disorders (SUD) are associated with TB and HIV disease transmission and progression. Therefore,

effective partnerships with patients and their providers are critical in TB-HIV disease management. However, there are both provider and patient challenges in developing sustainable partnerships, in context of alcohol and substance use disorders. This discussion will review some of the challenges, and practical approaches to developing sustainable partnerships.

**Interventions:** This presentation will review the clinical aspects of care of TB, HIV and AUD and or SUD comorbidities. The presentation will also elucidate on some of the challenges from patient perspective as well as from provider perspective in addressing and managing these comorbidities. The clinical and social determinants associated with management of comorbid conditions of addiction disorders, HIV, and TB will be addressed. Clinical and programmatic interventions for fostering and sustaining patient-provider partnerships in patients with AUD and or SUD, and TB or HIV, will also be discussed. Effective partnerships between community of patients with HIV or TB and AUD or SUD and community health care providers, nurses, social workers, peer support workers and program managers, will also be explored in this discussion.

**Solutions:** The role of multidisciplinary care model, and patient centered approach for TB, HIV and AUD or SUD will be reviewed. Existing models of care of these co morbidities in different settings and communities will also be discussed, to improve TB and HIV care.

### Barriers to TB-HIV services for injecting drug users and prisoners

J Van der Meer. AIDS Foundation East-West, Amsterdam, Netherlands

**Issue:** Injecting drug users (IDU) and prisoners are among the marginalized populations in Eastern Europe and Central Asia (EECA). Injecting drug use, while a risk factor for HIV, has been associated independently with a higher prevalence of TB. Increased risks for both HIV and TB are amplified in prison settings. Both populations face barriers to adequate prevention, care and treatment for both diseases.

**Challenges:** There are barriers to access the first point of care, barriers to remain in care and/or remain compliant, and more structural barriers linked to the organization of health care in EECA countries. Examples of barriers include discrimination and stigma from health care personnel related to drug use, HIV or both. The issue of continuity of care is an issue especially for prisoners when they are released from prison. The vertical organization of health care with few linkages between different services is also a barrier.

**Interventions:** Experiences and best practices in case management, continuity of care, outreach, and integration of TB, HIV and addiction services in the region will be discussed, as well as barriers to scale-up of successful interventions.



**Conclusion:** Because of the high burden of TB, TB as cause of mortality among people living with HIV, and HIV itself being sharply on the rise in EECA, scale-up of successful interventions and removing barriers to access among populations most at-risk for TB and HIV is crucial for public health and from an individual patient care perspective. Action is needed now, otherwise the TB and HIV community have missed the opportunity.

## INTERNATIONAL STANDARDS FOR TUBERCULOSIS CARE (ISTC): FIVE YEARS IN THE FIELD

### Indonesia: the ISTC as a vehicle for engaging specialist physicians

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**Background:** There are 170 pulmonologists in Jakarta treating tuberculosis (TB) patients daily but their case findings do not notified by the National TB program. Problems faced by these pulmonologists: inconsistent accessibility of sputum examinations, recording and reporting of TB patients to the Health Office, and no linkage between clinics and public health centers.

**Objective:** To ensure all patients are diagnosed and treated according to ISTC, to implement ISTC among pulmonologists as private practitioners, to increase TB case notification to National TB Program.

**Method:** 23 participants were selected based on a survey of PDPI members. Specialists and their nurse/administrative staff received DOTS and ISTC training. Participants were expected to implement ISTC in their practices. Nurse/administrative staff conducted recording and reporting, under supervision of additional personnel supplied by PDPI, who collected and reported data to the appropriate District Health Office. Evaluations were done in the middle and end of project.

**Results:** From October 2010–March 2011, 759 TB patients (643 pulmonary) were enrolled, 211 receiving TB program drugs, 548 using prescribed drugs. 77% (494/643) patients had sputum smear results for diagnosis, with 40% (197/494) AFB-positive and 60% (297/494) AFB-negative. 23% of patients were diagnosed without sputum smear examination. 448 patients have passed week 8 (or week 12 for Category-2 patients) of treatment. Sixty-nine (50%) of 138 of

these patients with positive diagnostic smears converted to smear-negative. 17% (129/759) of patients had missed appointments; only 4% (29/759) of patients have dropped out from TB treatment.

**Discussion:** Several issues: lack of recording and reporting infrastructure in half of the hospitals where participants practice, high percentage of smear-negative result, some labs have not been accredited, high numbers of missing appointments.

### India: using ISTC to develop a national coalition of professional societies to collaborate with RNTCP

R V Asokan. Indian Medical Association, Punalur, Kerala, India

The Revised National Tuberculosis control programme (RNTCP) of India is the largest national TB control programme in the world. It aims to serve through linked public and private efforts, a full 20% of the global TB case burden.<sup>1</sup> The Indian private healthcare delivery system is large and diverse. 90% of the 1.3 million private healthcare establishments are run by stand alone medical practitioners. Roughly half of the establishments are run by modern medicine practitioners.<sup>2</sup> Together they provide 47% of the India's TB care.<sup>3</sup> It has been shown that they follow multiple regimens and rarely follow internationally accepted level of care.<sup>4</sup> In an effort to promote self regulation by professionals, Indian Medical Association joined hands with RNTCP to sensitise and train private doctors. ISTC was incorporated into the official training programme. IMA has founded a professional coalition to fight TB knitting together various professional associations (IMPACT: Indian Medical Professional Association Coalition against Tuberculosis). ISTC is the key tool to reach out to the private doctors especially the physicians and chest physicians. This effort is in conformity with the Stop TB strategy to engage all care providers and provides a way to contain the fast emerging MDR-TB situation in the country.

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## PARTNERSHIPS TO ACCELERATE TUBERCULOSIS VACCINE DEVELOPMENT

### Expanding the TB vaccine pipeline

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With 14.4 million prevalent cases and 1.7 million annual deaths tuberculosis (TB) remains one of the most serious infectious diseases to date. An estimated 2 billion people are believed to be infected with *Mycobacterium tuberculosis* and at risk of developing disease. HIV-TB co-infection and the appearance of multi- and extensively drug resistant strains challenge current control measures for TB. More effective vaccines are urgently required to control TB more effectively and to reach the eventual target of eliminating TB in 2050. In the recent decade tremendous progress has been made and a rich global TB vaccine pipeline has emerged with 14 new vaccine candidates that have entered clinical development. Eleven of these are currently undergoing clinical testing. An overview of the current TB vaccine pipeline will be presented highlighting some of its promises and challenges. Specific focus will be on the challenge of filling the pipeline with new innovative approaches aiming to prevent disease in target profiles currently not addressed.

### New tuberculosis vaccines in clinical development

J Connolly. Aeras, Rockville, MD, USA

**Background:** The current TB vaccine, bacille Calmette-Guérin (BCG), is largely ineffective in preventing adult pulmonary TB disease, and has had no discernible impact on the growing TB epidemic. Efforts are currently underway to develop new, more effective TB vaccines.

**Methods:** TB vaccines under development could work by preventing infection, primary disease, latent infection or reactivation. Vaccines are also being developed that could shorten the course of chemotherapy. The current TB vaccine development strategy for preventive vaccines includes the development of recombinant BCG (rBCG) or live attenuated vaccines to use as a prime in a heterologous prime-boost strategy, and the development of several novel vaccine candidates that could be used as a booster vaccine in infants, adolescents and adults previously primed with BCG or as a boost to an improved prime vaccine. The goals for new TB vaccines include increased efficacy and increased safety in people latently infected with Mtb and/or infected with HIV as compared to the current BCG.

**Results:** As of mid 2011, 14 vaccine candidates have entered clinical trials and 11 are currently undergoing clinical testing. The two most advanced preventive vaccines, MVA85A and AERAS-402/Crucell

Ad35, are in Phase IIb proof-of-concept trials. Three Phase IIb trials of these candidates are currently underway at several trial sites in Africa in two distinct populations—healthy infants and adults with HIV. Combined, the trials are expected to enroll over 8000 volunteers and will provide much needed data on vaccine efficacy in humans.

**Conclusions:** New TB vaccines are essential to reach the global target of eliminating TB. Much progress has been made, but TB vaccine development is a scientifically complex and expensive process. With sufficient resources and positive results from current or near-term clinical candidates, a new TB vaccine could be available by the end of this decade.

### Global partnerships: a key factor in the successful clinical development of vaccine candidate MVA85A

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An effective vaccination strategy is essential to control the TB epidemic. The protection conferred by BCG against pulmonary disease is highly variable, although efficacy against systemic disease in childhood is more consistent. Including BCG in any new vaccination strategy has merit for the non-HIV-infected population. MVA85A is a recombinant poxvirus expressing the immunodominant antigen 85A from *Mycobacterium tuberculosis*. MVA85A was developed by the University of Oxford and since 2002, has been evaluated in a series of Phase IIIa clinical trials. These trials, which include latently infected subjects and HIV-infected people, have demonstrated MVA85A to be safe and highly immunogenic. The lack of an immunological correlate of protection means the new generation vaccines can only be evaluated in large efficacy trials. Such efficacy trials require the formation of global partnerships for success. Oxford University have formed a Joint Venture with Emergent Biosolutions, called the Oxford Emergent Tuberculosis Consortium (OETC), and OETC have established collaborations with Aeras and with the South African TB Vaccine Initiative, the Clinical Infectious Diseases Research Initiative (South Africa) and Le Dantec (Senegal) in order to test the efficacy of this vaccine. There are now 2 ongoing efficacy trials with MVA85A: one in South African BCG vaccinated infants and the second in HIV-infected adults in South Africa and Senegal.

## MEETING THE NEEDS OF THE MOST NEGLECTED PATIENTS: THE RISING CASELOAD OF PAEDIATRIC DRUG-RESISTANT TUBERCULOSIS

### The global burden of paediatric DR-TB

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There is limited data on the epidemiology of childhood TB. Compared to adults, we know that children share a disproportionate burden of TB as they are more likely to progress to disease once infected. They constitute up to one third of cases in some programs. In communities with a high prevalence of HIV infection, there has been an exponential increase in the incidence of TB, including drug-resistant (DR) TB. In children in Johannesburg (South Africa) in 2008, the prevalence of MDR-TB was 8.8%, and of INH-resistant TB was 14.2%, associated with a 48.5% rate of HIV co-infection. There are various reasons why this data is limited. Firstly, in poor settings, many children do not even have access to health professionals, and limited diagnostic aids make the diagnosis that much more difficult. Furthermore, bacteriological confirmation is intrinsically difficult to attain in children. Secondly, data on drug resistance is even more limited as it requires drug-susceptibility testing which tends to be least available in those communities where DR-TB is most prevalent. Thirdly, surveillance data on DR-TB in children is limited by the fact that it has mostly been gained from retrospective analyses. Lastly, healthcare has undergone a competitive market reform in many countries, sometimes including the transfer of TB control to managed-care organizations (MCOs) in the setting of weak regulation by the government. This has led to fragmentation and discontinuity of healthcare delivery, and to the disintegration of the public health information system. There has been a lack of political will by some governments to uphold the 'International Standards of TB Care' (ISTC) and to regulate MCOs to do the same. Through the implementation of the ISTC (which includes the notification of all cases to public health authorities, Standard 21), the true burden of DR-TB in children can be elucidated, and the control of TB in them can be improved.

## Challenges to diagnosing and treating children with DR-TB in resource-limited settings: programme experience from Médecins Sans Frontières (MSF)

M Gale. Médecins Sans Frontières (MSF), Sydney, NSW, Australia

Médecins Sans Frontières (MSF) is a medical humanitarian organization working in over 60 countries across the world. In 2010, 70 MSF projects across 43 countries provided tuberculosis care. Despite more than 10 years of diagnosing and treating drug resistant (DR) forms of tuberculosis, MSF clinicians still struggle to provide appropriate diagnosis and treatment for children with DR-TB. Globally, the diagnosis of DR-TB in children is hampered by a variety of factors, most critically, lack of awareness of children being a potential high risk group, and the lack of appropriate methods to confirm tuberculosis disease and obtain drug sensitivity testing results. The majority of child TB cases, including in MSF programs, can only be diagnosed on clinical and radiological grounds which often makes clinicians hesitant to treat even presumed drug sensitive TB, and sets an even higher treatment threshold in cases where DR-TB is suspected. The result of this lack of 'definitive proof' of DR-TB disease is that many children are treated with inappropriate drugs, initiated on treatment too late, or die untreated. The available literature, and MSF's own program experience show that children who initiate treatment for DR-TB in a timely manner generally do well despite limited evidence on the safety of second-line drugs in children, the complex manipulation of formulations required, and the lack of evidence supporting current recommendations for dosing, regimen construction and duration of treatment. There is a need for program implementers, researchers and donors to start seriously addressing the specific needs of children in the context of the emerging epidemic of drug resistant tuberculosis.

### Review of challenges to treatment: from trials to formulations

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The treatment of children with multidrug-resistant tuberculosis (MDR-TB) is poorly studied and guidance is lacking. The World Health Organization and most national health departments generally extrapolate recommendations from adult guidelines and suggest referral to a specialist. It is advised that treatment be tailored to the drug susceptibility test (DST) pattern of the child's isolate but where this is unavailable note should be made of the DST of the index

case. Treatment with at least four drugs known to be effective is recommended and duration should be for at least 12 months. Children, however, are not a homogeneous group, with differences in age, nutrition, immunocompetence and a wide spectrum of disease presentations requiring different regimens and durations of therapy. Pharmacokinetics of the second-line drugs are poorly studied, formulations are inaccessible for young children and adverse effects rarely described. In many cases response to therapy cannot be assessed primarily on microbiology, as it is for adults. This talk will review the available data regarding the pharmacokinetics of second-line drugs and their adverse effects as well as discussing ongoing and proposed studies and trials regarding paediatric MDR-TB treatment. It will discuss barriers and challenges to the investigation of drugs, appropriate formulations, response to treatment and classification of outcome together with the regulation and licensing of medications. Possible solutions will be proposed.

## ONE HEALTH APPROACH: COORDINATING DIAGNOSIS, SURVEILLANCE AND EDUCATION PROGRAMMES IN ZONOTIC TUBERCULOSIS

### Isolation and differentiation of *Mycobacterium tuberculosis* complex species from human TB patients in contact with cattle and wildlife infected with *Mycobacterium* spp in Namwala, Zambia, Africa

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**Background:** *Mycobacterium tuberculosis* accounts for the majority of human tuberculosis (TB) cases throughout the world. *M. bovis*, another member of the *M. tuberculosis* complex, is primarily a pathogen of cattle but has a wide host range and causes progressive bovine tuberculosis in domestic and wild animals, as well in humans. The incidence and importance of *M. bovis* infections in human TB patients who live in close contact with infected cattle and wildlife is generally not investigated.

**Objectives:** The objectives of this study are 1) to iso-

late and differentiate the specific *M. tuberculosis* complex species found among humans in a high-risk area in which *Mycobacterium* spp has been reported in cattle, wildlife, humans and the environment; 2) to investigate routes of transmission between cattle, wildlife and humans; and 3) to investigate *M. tuberculosis* complex species and TB treatment outcomes in humans.

**Approach/methods:** Lymph node aspirates and sputum samples will be collected from human TB patients in Namwala, Zambia and *M. tuberculosis* complex isolates subjected to standard laboratory microbiological testing including genotyping. Through the collecting of epidemiological, pathological and environmental data, we will investigate the routes of transmission between cattle, wildlife and humans as well as the association between the specific isolates and treatment outcomes in human TB patients.

**Expected outcomes:** This study will differentiate the causative agent of TB in humans in areas in which cattle and wildlife are infected with *Mycobacterium* spp., thus establishing the importance of *M. bovis* (and other *Mycobacterium* spp) in human TB patients. We will establish the role of exposure to domestic stock and wildlife with TB plays in the transmission to humans. Finally, this study will provide new information with regards associations between different *Mycobacterium* spp. and drug susceptibility and TB treatment outcomes in humans.

### New species of *Mycobacterium* associated with death of cows and monkeys in Bangladesh

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**Background:** Bovine TB (BTB) is important of its zoonotic implication. It is one of the neglected animal health problems in many developing countries including Bangladesh. This disease is mostly diagnosed by tuberculin skin test. As a result, isolation and characterization of the causative agent are rarely done. Therefore, there is a gap of knowledge of the diversity of the agents causing BTB.

**Objectives:** a) To isolate mycobacteria (TB bacilli) from vital organs of dead cows and monkeys, and b) to characterize the isolates.

**Methods:** Dead animals (15 cows and 2 monkeys) were included in this study. Postmortem was performed by a veterinarian. Vital organs (lung and liver) were processed for histopathology and isolation of TB bacilli on Löwenstein-Jensen slant. To characterize TB bacilli, isolated strains were screened for acid fast staining (AFB), sensitivity to P-nitro benzoic (PNB) acid, and TCH. For molecular characterization, RD



analysis was performed for *cfp32*, RD1, RD4, RD9, and RD12; single nucleotide polymorphism for the *gyrB*, *mmlp6*, *TbD1* and *PPE55* genes. Spoligotyping was performed following standard technique.

**Results:** Fifteen cows and two monkeys were included in this study. Prominent nodulation was detected on the lung tissue at the time of postmortem. TB of these dead animals was confirmed with the presence of giant cell, macrophage and calcification in the histopathological examination. Prominent AFB staining, sensitivity to PNB indicated that the strains were members of *M. tuberculosis* complex. However, in depth molecular characterization indicated that these strains are different and belongs to new species.

**Conclusion:** Strains isolated from cows and monkeys were similar but differ from the existing species. Therefore, we propose for new species designation for these isolates. Further study needs to be conducted to confirm origin of this new species in Bangladesh.

## MANAGEMENT OF ASTHMA IN LOW- AND MIDDLE-INCOME COUNTRIES AND THE ASTHMA DRUG FACILITY

### Asthma in low- and middle-income countries: burden and challenges

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Asthma is a common chronic disease affecting people of all ages. The burden of illness includes death, disability, costs for health care delivery and impaired quality of life. In low and middle income countries there are particular problems in both diagnosis and disease management. A range of common respiratory conditions that share common features including bronchiolitis, pneumonia, other acute respiratory infections, tuberculosis, and heart failure may all be confused with asthma both at the first level of care and at higher levels of care. The Practical Approach to Lung Health is intended to address these problems. Diagnosis is a necessary prelude to treatment but even when the correct diagnosis has been made, there are barriers to the implementation of effective treatment. Lack of availability and cost of inhaled corticosteroids is one limitation. However, other barriers include lack of knowledge among health care providers and the absence of patient education about how these inhalers are used. The consequences are low rates of use of effective therapies. In the absence of any effective primary prevention interventions for asthma, this disease will be around for a long time. We need to come up with new ways of managing the disease that are suitable for implementation in low and middle income countries.

### Integración de la estrategia PAL (Practical Approach to Lung Health) con el proyecto de asma de la Unión en El Salvador

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El Salvador como país en desarrollo, continúa presentando en la población muchos problemas de salud debido a sus condiciones de vida, el hacinamiento, la pobreza y la contaminación ambiental entre otros. Con la implementación de la estrategia PAL (Practical Approach to Lung Health) en el año 2005, se realizó el primer protocolo de atención de enfermedades respiratorias crónicas incluyendo el asma. Para ello el ministerio de salud de el salvador apoyo la iniciativa y se realizaron elaboración de Guías, protocolos, flujogramas, espirometría, medicamentos gratuitos, etc. Cada año se reciben un promedio de 25 000 consultas de emergencia por asma y otras enfermedades respiratorias crónicas como neumonías adquiridas en la comunidad, enfermedad pulmonar obstructiva crónica y demás infecciones respiratorias crónicas y agudas. Los protocolos de atención de asma de La Unión han venido a darle una mejor apoyo y fortaleza a la atención que se estaba dando al asma por la estrategia PAL, ya que en el primero se realizaba control de la crisis de asma y control del mismo y el segundo da una mejor herramienta al trabajador de salud en darle un diagnóstico más correcto, clasificando el asma en intermitente, persistente leve, persistente moderado y persistente severo; y así dar el tratamiento correcto y seguimiento adecuado. La integración de PAL con el protocolo de atención de asma de La Unión, está en la elaboración de un solo documento regulatorio (Guía técnica) la cual fortalece el diagnóstico, clasificación y tratamiento del asma. Con el apoyo político por parte de las autoridades de salud se compra medicamento antiastmático, insumos como medidor de picoflujo y espirómetros para el trabajador de salud que atiende los pacientes asmáticos. La integración no ha sido dificultad para el país, ya que PAL da atención a la crisis y hacia algunos aspectos de como clasificar el asma y dar el tratamiento correcto, algo que vino a complementar la estrategia nacional para atención de asma. Con la experiencia de tres establecimientos de salud en aplicación de la guía de asma de La Unión, se han podido elaborar grupos de expertos en entrenar a demás personal de salud para aplicación de la guía de asma para el país. Esta integración de ambos programas ha ayudado a la población de El Salvador a que conozca más sobre la enfermedad del asma, así como identificar sus signos y síntomas, consultar tempranamente y acceder a una consulta médica de mejor calidad y atención, con medicamentos y exámenes o pruebas gratuitas, así disminuye la crisis y reduce los costos para la institución.

### Revolving drug fund mechanism and asthma control in Benin

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<sup>1</sup>Programme National contre la Tuberculose, Cotonou, Bénin,

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**Contexte :** Le Programme National contre la Tuberculose (PNT) du Bénin, en partenariat avec L'Union, a initié depuis 2008 dans des sites pilotes la prise en charge de l'asthme. Les principaux objectifs de ce projet sont de faciliter l'accès aux médicaments essentiels et d'améliorer la qualité de vie des asthmes persistants.

**Méthode :** Pour améliorer l'accès aux médicaments essentiels, un fonds de roulement a été mis en place en 2008 par la Banque Mondiale qui a financé un premier stock de médicaments qui a ensuite été vendu aux malades pour reconstituer ce fonds. Ce fonds a ensuite été complété en 2009 par une nouvelle commande de médicaments financée par L'Union et achetée à travers l'Asthma Drug Facility (ADF). Cette deuxième commande a ainsi également permis de réduire le coût du traitement d'environ 50%.

**Résultats :** La reconstitution régulière du fonds de roulement par la vente des médicaments aux patients a ainsi permis au PNT de placer deux nouvelles commandes auprès de l'ADF en 2010 et de garantir la continuité de l'approvisionnement pour les malades asthmatiques.

**Conclusion :** La gestion de ce fonds, incluant la fixation de la marge ajoutée au prix d'achat, demande toutefois de la part du PNT une vigilance importante pour éviter d'importantes pertes par péremption dues à la difficulté d'anticiper les besoins et à la non utilisation des stocks au niveau de certains sites peu fréquentés. Une prise en compte des besoins des indigents sans mettre en péril le fonds de roulement s'avère nécessaire.

### Beyond the asthma pilot project: prospects of a national asthma strategy in Sudan

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First Sudan Asthma Guidelines were developed in 2002, based on The Union's. A study about asthma management, conducted at Khartoum State ER on 2003, showed that 29% were severe cases, 95% paid the full cost for asthma drugs and only 2% gets regular treatment for asthma from a single facility. The feasibility of launching a successful national asthma control programme, was confirmed via a successful pilot project, using standardized care for 1000 adult asthmatics with positive treatment outcomes. With the idea that high quality TB services will have an impact on improving health systems by sharing lessons learnt, the comprehensive lung approach/asthma project was implemented in 2006. Epi-Lab's knowledge of the health system, assisted in identifying the

correct in-country partners to support the project. Initially were namely the state ministries of health (Khartoum and Gezira), national society and the central medical stores. There was a 94.19%, 97.15% reduction in ER visits among patients involved in the project in year 1 and 2 respectively. It is now consolidating in 19 district hospitals with a plan of step wise expansion to cover nationwide. The project takes on board all partners to advocate for SCM. ADF/RDF pilot project is there to put right the sustainability of affordable essential asthma drugs. This innovation has promoted for endorsement of a national strategic plan for NCDs. A joint PAL/CLHS strategy is on the phase to be endorsed, to provide standardized management at primary level. This innovative project will inspire other developing countries to adopt the model.

### Asthma Drug Facility: progress and challenges ahead

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**Background:** The Union established the Asthma Drug Facility (ADF) to provide affordable access to quality assured, essential asthma medicines for low- and middle-income countries and to promote a quality improvement package for the diagnosis, treatment and management of asthma.

**Response:** The ADF has now been fully operational since 2009 and has performed two rounds of qualification followed by restricted tenders to establish contracts with manufacturers. Countries, organisations and programmes can now use the ADF services to implement asthma programmes or integrated approaches to respiratory health.

**Results:** The ADF has already supplied essential asthma medicines to Benin, El Salvador, Kenya, Sudan and Burundi. New orders are also in progress for Viet Nam and Guinea Conakry, and new contacts have also started with other countries. Through the ADF, these countries have seen the cost of inhalers fall by as much as 50%, making one year of treatment with Beclometasone and Salbutamol for a patient with severe asthma cost less than 40 USD. However, the ADF services have only been used by a very limited number of countries. Millions of people with asthma in low- and middle-income countries currently have no treatment, or are inappropriately treated.

**Conclusion:** Having a procurement system in place for asthma medicines at global level is only part of the solution to improve asthma management in low- and middle-income countries. To change the situation countries need also political will to invest in asthma management and funds to support their activities. The financing options used by the first ADF clients can be an incentive for other countries to move



forward to implement asthma management. It is also hoped that the UN Summit on Non-Communicable Diseases in September 2011 will recognise and promote practical solutions such as the ADF.

## **SMOKEFREE HEALTH CARE AS AN ENTRY POINT FOR SCALING UP TOBACCO CONTROL IN HIGH-BURDEN COUNTRIES**

### **An overview of innovative smokefree health care practice internationally**

T Fraser. The Union, Glenorchy, New Zealand

**Objective:** To present some innovative tobacco-free healthcare practices in a range of countries.

**Method:** A scan of literature, websites and resources has been conducted to identify countries that have shown leadership at a political level to implement broad reaching tobacco-free healthcare policies and processes, and similarly at a local level (provincial and district) and/or individual healthcare facilities whose administrators have gone beyond meeting the usual minimum requirements of smokefree health care buildings and grounds and the provision of advice and support to patients to quit smoking.

**Results:** Despite tobacco-free healthcare now being the expected 'norm' in most countries. The reality is many healthcare organisations are still struggling even to maintain a 100% smokefree environment (in the buildings and grounds) and to provide routine smoking cessation support to all patients who smoke. High income countries are now generally moving towards trying to implement 100% tobacco-free policies in mental health services, which is proving very challenging. High burden countries are, in the main, still focused on creating tobacco-free general health services. A number of health care organisations are implementing creative policies and expanding tobacco-free beyond their organisational boundaries.

**Conclusion:** Countries such as, the UK, New Zealand, Russia and China will be very briefly showcased as examples of countries that have implemented a country-wide (or regional) tobacco-free healthcare strategy, as well as examples of innovative practice implemented in healthcare organisations including mental health services. Finally best practice models for tobacco-free healthcare from a country perspective and that of a healthcare organisation will be presented from the information gathered as part of the scan.

## **Progress on China's 'Decision on banning smoking in medical and health systems by 2011'**

N Dong. NOTC, China CDC, Beijing, China

**Objective:** To present some progress of implementing 'Decision' and its limitations in China.

**Method:** A scan of media coverage, websites and resources has been conducted to present the process and progress of implementing broad reaching tobacco-free healthcare policies in China, including MOH 'Decision', smokefree healthcare buildings and grounds, provision of cessation advice and support to patients to quit smoking, and some results of unannounced monitoring.

**Results:** Despite tobacco-free healthcare now being the expected 'norm' in China, the reality is many healthcare organisations are still struggling even to maintain a 100% smokefree environment (in the buildings and grounds) and to provide routine smoking cessation support to all patients who smoke. Typically, a variety of activities have been conducted in a hospital, for instance, smokefree policy was issued, publicity activities were conducted, and non-smoking signage was displayed. However, it is hard to maintain a smokefree environment. It is not a compulsory policy, but voluntary. There is no enforcement and penalty. Some senior leaders have exemption, who can smoke in his office.

**Conclusion:** It is crucial to include smokefree policy into examination system of healthcare facilities, or any other systems which influence hospital rating or performance management of hospital president.

## **Smokefree health care and cessation support in Russia: from local to the national level**

A Kotov, I Berezhnova, F Godfrey. International Union Against Tuberculosis and Lung Disease, Moscow, Russian Federation

**Background:** According to current law in the Russian Federation, smoking is still allowed in specially designated indoors and outdoors areas in medical facilities. Unfortunately, this law has very low enforcement and compliance, leading to 10.2% of the Russian population being exposed to secondhand smoke in healthcare facilities. There are no official guidelines on smokefree healthcare implementation in the Russian Federation, and according to the existing standards of general medical practice, general practitioners are not obliged to ask patients about smoking status. Only 45.4% smokers were asked about their smoking status and 31.8% were advised to quit smoking (GATS, 2009).

**Approaches:** In 2010 Krasnoyarsk region (Siberia), under a Union grant, was the first region in Russia to develop and approve legislation for 100% smokefree medical facilities. Several other Russian regions have

followed: Samara, Chuvashia, Krasnodar and others. Taken together, these regions cover more than 15% of total Russia population. These regional initiatives were influential in encouraging the national Ministry of Health to develop national guidelines on smokefree healthcare implementation. This, in turn, has promising political implications for creating a successful model to extend 100% smokefree to other public areas.

**Result:** Recent work on smoke-free at the national level has contributed to comprehensive tobacco control policy drafted by Ministry of Health of Russia in 2011. This policy includes a goal of comprehensive smokefree public places, including all medical facilities, planned to be implemented by 2015. Development of these national guidelines will occur through 2011 and will be based on regional and international experience. An additional outcome of increased activity and interest in tobacco control on a national level is the creation of a Ministry-sponsored tobacco control postgraduate courses for general practitioners, family doctors, pulmonologists and other specialists.

tions are implementing creative policies and practices and expanding support for cessation beyond their immediate organisational boundaries.

**Conclusion:** New Zealand is well on the way to sector-wide coverage of smokefree environments and systems that promote cessation support for smokers who engage with the sector. While much innovation has been supported, the challenge is to evaluate the effectiveness of such novel approaches, and their generalisability and reach within and even beyond the health sector.

### **Smoking cessation support in healthcare systems: innovation from down under**

C Bullen. Clinical Trials Research Unit, The University of Auckland, Auckland, New Zealand

**Objective:** To present an overview and analysis of innovative cessation support practices from New Zealand.

**Method:** Review of New Zealand literature, Ministry of Health and Health authority websites and resources, and interviews with key informants were undertaken to identify examples of innovative practice in regard to smokefree health care facilities, in particular the provision of advice and support to patients to quit smoking in community and primary health care, in secondary care and in other allied health settings (such as drug and alcohol services).

**Results:** Since the advent of a major national smoking cessation initiative supported by national guidelines and a simplified framework (ABC) together with wide-ranging tobacco control legislation and a national commitment to be a smokefree nation by 2025, many examples of innovative practice have emerged in New Zealand. All hospitals are 100% smokefree and thousands of healthcare staff have trained as quit providers through online training. Smoking cessation support is available in all hospitals. In July 2009 the government introduced a health target of 'Better Help for Smokers to Quit' that requires public hospitals to ensure that 90% of hospitalised smokers will be provided with advice and help to quit by July 2011 and 95% by July 2012. Data will be presented showing the extent to which these targets have been achieved. A number of other health care organisa-

## SYMPOSIA: SATURDAY 29 OCTOBER 2011

### SCALING-UP INTERVENTIONS FOR CHILD LUNG HEALTH

#### Improving evidence-based case management and implementation at district hospitals

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**Background:** Pneumonia is a leading cause of admissions and mortality in low income countries (LIC). The gaps in LIC are; poor documentation, failure to classify disease severity, inappropriate antibiotic and oxygen use. These show a disconnect between research/guideline development at international/national level, pre-service and workplace practice.

**Efforts to improve care:** In Kenya, 2005 and 2010, efforts were made to develop/disseminate evidence-based case management guidelines for pneumonia, and other illnesses for LIC. For implementation, a training named Emergency Triage Assessment and Treatment plus admission care (ETAT+) was developed covering: triage, resuscitation, diagnosis, guidelines on antibiotics, oxygen, fluids. Training has few lectures but mostly skills and simulations. This targets health care workers (HCWs), doctors, nurses, medical and nursing students from a single district to create a critical mass. Trainees also conduct surveys/audits then make action plans in meetings with administrators to improve care. The best are trained as instructors.

**Results and lessons learnt:** Engagement with government/partners has seen by 2011 May, 12 000 guidelines distributed, ETAT+ delivered to: 1615 HCWs, 926 undergraduates in Kenya; 120 HCWs and 88 undergraduates in Rwanda; 32 HCWs in Uganda; Somaliland is using ETAT+ in HCW training. This has improved diagnosis, documentation, use of antibiotics and oxygen. Mentors hasten implementation. Challenges remain running integrated intervention in settings dominated by disease specific programs.

**Conclusion:** The integrated approach, with diverse HCW and pre-service training, has improved adherence to guidelines on management of pneumonia. The skilled instructors sustain quality trainings and champion improvement in care for children. Challenges are: access to simple technologies—oxygen delivery, oximetry, and garnering support for integrated programs.

### FINANCING NATIONAL MDR-TB SCALE-UP PROGRAMMES

#### The collaboration with the health insurance schemes services: the example of China

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**Example:** Supported by Bill & Melinda Gates Foundation, the MOH-Gates Foundation TB Program was initiated in 2009. One of objectives of Study on the Model of Hospital-CDC Cooperation for TB Management is to improve the affordability of MDR-TB diagnosis and treatment to MDR-TB patients by elevating the reimbursement of patient expenses from medical insurance system. Basic MDR-TB service packages have been developed in this program based on literature review and expert opinions. Standardized MDR-TB packages include the package for MDR-TB patients at designated health facilities, package for MDR-TB patients in public health system, and package for MDR-TB management, according to the service providers and the clients. The overall expense for standardized MDR-TB packages is RMB 33 140 yuan per patient, and shared by insurance, program fund and patients, with ratio of payment by insurance, program fund and patient being 5:4:1. That is, the proportion of reimbursement for not less than 50% of expenses is from medical insurance agencies, and the factual expense by patients is no more than RMB 3000 yuan. Based on the preliminary observation from this ongoing project, the percentage of diagnosed MDR-TB patients without starting treatment is about 27%, and only 17% of patients failed to starting treatment due to unaffordable service, showing the practicability and feasibility of this fundraising model.

**Implication:** We propose a fundraising model combined with insurance for MDR-TB treatment, including: 1) The expense of MDR-TB treatment is mainly paid by insurance in eastern region, and by insurance plus health reform on system construction in west-middle region in China. 2) Necessary second-line drugs needed for MDR-TB treatment will be incorporated into the new rural cooperative medical scheme and medical insurance for urban employees and residents. 3) The proportion of reimbursement for expense for MDR-TB treatment should be further elevated.

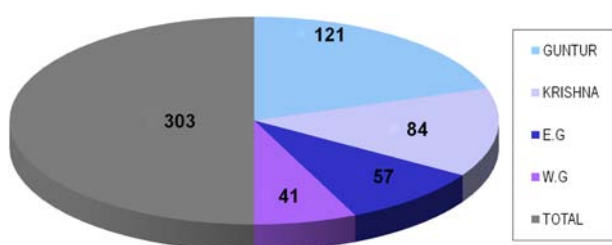
## TACKLING HIV AND TUBERCULOSIS THROUGH PARTNERSHIPS

### Strengthening the response to MDR-TB through public-private partnerships

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**Background:** LEPRA India an NGO based in India has field and clinic based activities for TB control in partnership with Revised National TB Control Programme (RNTCP). In response to revised NGO schemes, further expanded the partnership to offer laboratory services of MDR-TB, through the accreditation of its Blue Peter Public Health and Research Center (BPHRC). The laboratory has undergone a formal accreditation process between 2007 and 2009 and has entered in to a MoU with the State TB control programme of the Govt. of Andhra Pradesh, India and caters to about 17 million populations in four districts (Guntur, Krishna, East Godavari (EG) and West Godavari (WG)) of the state. Present report aims to look at the contribution of the NGO to the diagnosis and treatment services for MDR-TB in the Krishna district with a population of about 4.6 million.

**Observations:** Between June 2009 and June 2011, 764 MDR suspects from TB and TB-HIV patients were tested. 303 out of 764 were diagnosed to be MDR (district wise break up shown in Figure), out of which, 196 were put on treatment, 68 died before initiating treatment, 18 died during treatment and 21 defaulted. LEPRA through its microscopy centers has detected 20 (includes 8 PLHIV) out of the total 84 MDR-TB cases of Krishna district, which are under treatment and followed up for adherence.



**Figure** Number of MDR-TB cases: district wise break up, Andhra Pradesh State, India (during June 2009–June 2011).

**Conclusion:** Supporting MDR-TB diagnostic and treatment services as demonstrated, is a successful NGO-RNTCP partnership model. This PPM model has a promising potential to be replicated in other resource constraint settings in reducing the morbidity and mortality related to TB, TB-HIV and MDR-TB.

## USE OF NEW MOLECULAR TECHNIQUES FOR TRACKING TRANSMISSION OF *M. TUBERCULOSIS* AND DETECTING DRUG RESISTANCE

### Industrialised country perspective on the use of rapid molecular methods to detect drug resistance

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**Background:** Because of the substantially increased morbidity and mortality, cost, and public health consequences, rapid and accurate identification of drug-resistant tuberculosis, including infection with multidrug-resistant and extensively drug-resistant strains, is essential.

**Methods:** The Molecular Detection of Drug Resistance service is a laboratory-developed DNA sequence-based assay that detects mutations among nine genetic loci associated with resistance to the following first-line and second-line drugs: isoniazid, rifampin, pyrazinamide, ethambutol, amikacin, capreomycin, kanamycin, and the fluoroquinolones. The service includes parallel convention phenotypic testing. It is available nationally without charge to patients and their providers in the United States.

**Results:** The service delivers interim results to submitters with an average turnaround time of two days as compared to the average turnaround of 28 days for traditional culture-based methods, required for the final results. Evaluation of the service at 18 months demonstrates that it has been well received by the public health community with CDC reporting results for 50% of multidrug-resistant isolates within the United States.

**Conclusions:** Results provided by this clinical service affect not only decisions about individual patient management, but those related to infection control and public health interventions designed to limit additional morbidity and mortality among those exposed to a person with tuberculosis. Rapid confirmation of drug resistant tuberculosis and guidance on selection of an effective drug regimen will reduce the delay in the adequate treatment of tuberculosis and will translate into decreased transmission of tuberculosis, which is necessary to accelerate the elimination of tuberculosis in the United States.



### Application of rapid molecular tests to detect drug resistance in a high-burden country

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**Introduction:** South Africa has the 2nd largest reported number of MDR-TB. In 2008 rapid molecular diagnosis of MDR-TB through line probe assays (LPA) was introduced. The conventional method for diagnosis of drug-resistant tuberculosis requires culture-based drug-sensitivity testing (DST), which delays diagnosis up to 12 weeks. Diagnostic delay contributes to increase in mortality, secondary drug resistance and ongoing transmission of disease. Reported here is the programmatic application of the GenoType MTBDRplus® MTBDRplus assay (Hain Lifescience, Germany) LPA for rapid diagnosis of MDR-TB.

**Methods:** High risk MDR-TB suspects were consecutively enrolled in a prospective cohort across two provinces in SA. Sputa of smear positive suspects were investigated for MDR-TB using the LPA and culturing on MGIT for first-line drug-sensitivity testing. Gain in case finding by LPA was calculated, and time-to-diagnosis and time-to-treatment start. The MDR-TB patients were followed-up from diagnosis to completion of MDR-TB treatment to determine impact of rapid diagnosis on treatment outcomes.

**Results:** Over the 12 month study period 139 MDR-TB cases were diagnosed, 25 by only the conventional procedures and the remaining 59% by LPA. The gain in case finding by LPA was 10%, and 26% of diagnosed cases were early defaulters. After receipt of sputa in the laboratory, the time-to-LPA diagnosis was less than 7 working days, but long delays for initiation of MDR-TB treatment were observed.

**Discussion:** Molecular diagnosis of MDR-TB yields in an increase in case finding. In comparison with conventional diagnosis of MDR-TB, diagnostic delay was brought down significantly, but this was not translated in lower rates of early defaulters. The referral period for MDR-TB patients to be started on appropriate (i.e., second-line) treatment was also not decreased, which may have impacted on the limited improvement in successful treatment outcomes observed.

### Clinical management using molecular tests to detect drug resistance

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New rapid molecular diagnose technologies have the potential to create the biggest advance in TB practice in the latest 40 years. Our clinical approach is starting to change in those countries using them, initially in MDR-TB management but in a near future it will

affect to susceptible TB and TB-HIV practice as well. New molecular diagnoses have proved efficacy, however how they will modify our clinical performance is still unknown. Not many countries have been using this kind of diagnose for more than 2 years, hence clinical and practical experiences are much reduced. In the absence of strong evidence, personal observations and difficulties found in different settings are relevant given the dramatically growing application of new diagnose methods. Along the talk, experiences from different countries are going to be presented focused on clinical management changes due to new rapid diagnose technologies. As well, new challenges like what to do in case of discordant results between molecular and conventional drug susceptibility results are going to be drawn. Clinical guidelines and attitudes are surely going to be changed in the near future.

### Incorporating genotyping in a high-burden TB control setting: the programme perspective

R M G J Houben,<sup>1,2</sup> J Mpunga,<sup>3</sup> A C Crampin.<sup>1,2</sup> <sup>1</sup>Infectious Disease Epidemiology, London, UK; <sup>2</sup>Karonga Prevention Study, Chilumba, <sup>3</sup>National Tuberculosis Programme, Lilongwe, Malawi

**Background:** In 2009 the World Health Organization (WHO) endorsed the first rapid automated test for the detection of *M. tuberculosis* in sputum samples. Encouraged by studies reporting consistent good performance under various conditions, WHO has since actively driven the expansion of its use in many countries.

**Objective:** To give a current perspective on the potential and remaining issues with the implementation of rapid molecular based diagnostics as well as the wider range of molecular epidemiological techniques currently available, in the context of National Tuberculosis Programmes in high-burden countries.

**Perspective:** The prospect of a test that greatly outperforms sputum microscopy yet does not require expensive time consuming and skill-intensive culturing facilities is tempting for any TB control programme in a high-burden country. Better and earlier detection of active TB disease will reduce *M. tuberculosis* transmission in the population and is key to strengthening struggling DOTS programmes—provided that they can handle the additional caseload. However, rapid molecular testing does not replace existing infrastructure. Sputum microscopy will still be required for patient care, so the high initial and operational costs of the currently available device would increase the burden on often limited budgets. Improved TB control now may reduce costs in the long-term, but where the money will come from now is unclear. Other issues, such as the long-term robustness or logistical challenges should be addressed as our experience with the device grows.

**Conclusion:** Current developments are heralding a

much-needed new era for TB diagnostics, but costs are likely to remain an obstacle for widespread implementation in resource limited settings. Cost reduction, cheaper and more robust platforms are needed, and should allow resource-limited high-burden countries to take advantage of new molecular techniques to tackle the ongoing burden of tuberculosis.

## INCREASING ACCESS TO QUALITY, PATIENT-CENTRED CARE THROUGH PARTNERSHIPS

### Global to local: ICN's patient-centred approach to training for the transformation of patient care

G Williams. International Council of Nurses, Geneva, Switzerland

International Council of Nurses has developed a new and exciting approach to training which leads to real changes on the ground. The Training for Transformation (TFT) approach allows flexibility and creativity in training and has emerged from the ICN's TB Project which has been supported since 2005 as part of the Lilly MDR-TB Partnership. Over 1100 nurses in 16 different countries with a high burden of TB and MDR-TB who have attended an ICN training of trainers (TOT) course, have in turn been involved in training over 28 000 additional nurses and allied health workers. Countries so far involved in the project include China, Colombia, Ethiopia, India, Indonesia, Kenya, Lesotho, Malawi, Mozambique, Philippines, Russian Federation, Senegal, South Africa, Swaziland, Uganda, and Zambia. The courses are most often run at a country level by the National Nurses Association whose focal point also co-ordinates evaluation and reporting to ICN following the training. Feedback from those who have received training so far highlights a much greater impact than the passing on of information including improved attitudes to patients, lower default rates, better case finding and safer work environments. This has prompted ICN to rename the approach as Training For Transformation (TFT). This presentation will present a variety of examples of the impact that the training has made at local, national and international levels. It will describe the different aspects of the methodology and discuss how it might be more broadly used to bring about more effective and lasting changes at ground level and strengthen programmes from the bottom up.

### Providing comprehensive primary care support from community to clinic in rural South Africa

J McLoughlin,<sup>1</sup> H Hausler,<sup>1</sup> C Newton.<sup>2</sup> <sup>1</sup>TB HIV Care Association, Cape Town, Western Cape, <sup>2</sup>Edzinkulu, Underberg, KwaZulu-Natal, South Africa

**Background:** Access to patient centred TB-HIV care in rural communities in South Africa has been problematic. Some reasons for this are: the health system is not an integral part of the community, recruitment is not from local communities, inadequate training and supervision, poor linkages between clinic and community, lack of transport and a poor monitoring and evaluation system.

**Methods:** Training was conducted for the Community Care Givers on: basic home based care, HIV counselling and testing (HCT), adherence support, directly observed treatment support, infection control, integrated management of childhood illnesses (IMCI), growth monitoring, gender based training and infant feeding. A structured supportive supervision was implemented with a simple monitoring and evaluation system which generated quality data which was used for management. Data was collected monthly and quarterly and was analyzed from January 2005 to April 2011.

**Results:** During this period the following results were found: HCT coverage in this catchment area is 67%. Among HIV positive pregnant women, 91% are enrolled in care. The antiretroviral treatment retention rate is 78%. Of children less than 2 years, 83% are enrolled into the IMCI program. Among HIV-exposed infants 95% tested for PCR-positive for HIV with a vertical transmission rate of 6%. 95% of HIV positive children are retained in care.

**Conclusion:** This patient centred provision of TB-HIV services has demonstrated effective case finding, treatment and retention in TB-HIV care through an integrated community/facility model.

### Collaboration to deliver effective patient-centred care in Tomsk, Russia

T Fedotkina,<sup>1</sup> S Mishustin,<sup>1</sup> V Berezina,<sup>1</sup> D Taran,<sup>2</sup> O Ponomarenko.<sup>2</sup> <sup>1</sup>Tomsk Oblast TB Dispensary, Tomsk, Russian Federation; <sup>2</sup>PIH, Boston, MA, USA

The TB Control Program in Tomsk Oblast has been successfully collaborating with various NGOs: 1994, MERLIN, UK; 1998, PHRI (NY), PIH (MA), USA; 1998, Tomsk branch of the Russian Red Cross; 2001, GLC WHO; 2002, Eli Lilly (training initiatives). In 2004 the Global Fund to fight AIDS, TB and Malaria awarded Tomsk Oblast a five-year grant to fight MDR-TB, the project enjoying full support of Tomsk Oblast Governor. In 2009, after its results had been thoroughly analyzed by the WHO experts, the funding of the project was extended for the next 6 years. The project's priorities include: early TB detection in primary health care services; infection control;



uninterrupted supply of TB drugs and medications needed to fight the side-effects of TB drugs; high quality laboratory diagnostics; effective system of information monitoring. Patient-centered TB care is one of the most important parts of Tomsk TB Program. It embraces clinical monitoring (identifying and promptly alleviating side-effects); psychological and social support; continuity of care linking the civil and prison TB services; measures to reduce the harmful effects of alcohol abuse; introduction of community-based home care (house visits and outpatient clinics), Sputnik Program (enhanced medical and social support to outpatients, tracing defaulters), individual approach to those at risk of default, health education.

The project outcomes in the period between 2004 and 2010 per 100 000:

- Default rates decreased from 28.7% to 9.8%
- TB death rates decreased by half, from 17.8 to 8.8 (15.1 in the RF)
- TB prevalence fell by 1.8, from 205.2 to 116.5 (185.1 in the RF)
- TB incidence rate in 2009–2010 decreased by 23%, from 105.6 to 80.4 (77.4 in the RF).

**Conclusions:** Thanks to our collaboration with various partners to deliver patient-centered care in Tomsk Oblast.

- Treatment adherence and efficacy rates have significantly improved.
- TB death, prevalence and incidence rates are steadily decreasing.

### **Caring for carers: creating a Wellness Centre in Swaziland for health workers and their families**

P Mamba. Swaziland Nurses Association, Manzini, Swaziland

**Swaziland at a glance:** Swaziland is a land-locked country bordered by South Africa in the north, south and west and by Mozambique in the east. The population stands at  $\pm 1.2$  million people with a life expectancy of 31.99 years. 26% prevalence rate in ages 15–49 years and 31.1% Women aged 25–49 are infected with HIV. 80% of TB patients are HIV positive. There are  $\pm 9000$  health workers with about 4000 nurses in 223 health facilities mainly manned by nurses.

#### **Key points on health workers and HIV:**

- In high HIV prevalence countries, HIV may account for 60% of health care workers (HCW) vacancies compared to 23% for outmigration
- HCW annual mortality in Swaziland—5% in 2004
- Little data on how best to deliver HIV care to HCWs—some authors report integrated HCW clinics within hospital ART clinics in South Africa—versus private vouchers—versus stand-alone HCW clinics

- *NO DATA* on what HCW themselves think about HIV services.

**The need for a Wellness Centre:** Swaziland has a high HIV prevalence among the pregnant women tested is at 42%. The nurses in the country were overburdened in the facilities and most nurses were migrating to Europe not because of money but for care and support. Therefore Wellness Centre was to:

- Show HCWs they are valued—access to health is a human right
- Break down barriers to care including stigma, professional embarrassment, ‘othering’ element
- Accelerate comprehensive care interventions/services
- Close the knowledge gap within the health workforce
- Contribute to the reduction of professional migration.

**Impact of the Wellness Centre:** Since being established in 2006 the Wellness Centre has seen around 10 000 HCWs and their immediate family members. There is now a mobile clinic to provide services to HCWs in all regions of Swaziland and the staff team has grown with the support of the Swaziland Ministry of Health. Numerous impacts have been seen including:

- Reduced stigma and discrimination in the workplace
- Reduced staff turnover
- Reduced absenteeism
- Improved health worker motivation
- Increased accessibility to HIV testing and counselling and tuberculosis services including up-take of Antiretroviral Therapy
- Prompt and appropriate prevention, treatment, care and support for HCWs
- Unity amongst health workforce through joint activities.

### **EXTERNAL AGENCIES AND FUNDERS: ARE THEY REALLY PARTNERS IN INTERNATIONAL TUBERCULOSIS CONTROL AND DEVELOPMENT?**

#### **Previous country programme manager**

A El Sony. The Epidemiological Laboratory, Khartoum, Sudan

Compounding the societal burden that TB levies by its sheer prevalence and lethality is the fact that the disease disproportionately afflicts the poor, and specifically those in their most economically productive years. The gap between wealthier and poorer has started to widen. Are donations to the development strategy tackling the real need of poor populations? Not contacting countries at the first beginning would not mirror the reality; the challenges, the capacities, and the priorities. Bombarding the landscape of

developing countries with donations will confuse them, which will sequentially deprive them of resources. Are the donors' agenda similar to the development agenda of poor countries, or it is a give and take relation? Saving resources is a mutual relation; all of us need to be alert. Development partners could help through tackling poverty and encouraging ownership. Maybe the solution lies in the improvement and encouragement of appropriate FDI in the poorest nations, i.e., foreign investment that promotes sustainable economic development, tailored to a country's needs.

### Researcher

**N Beyers.** Desmond Tutu TB Centre, Stellenbosch University, Tygerberg, South Africa

Various challenges that researchers face daily with funding organizations, e.g., whose agenda is being promoted by research agencies, who decides on priorities, sustainability of funding, constant changes to budgets, etc. will be discussed and examined and tested against the 11 principles of the Swiss Commission for Research Partnership in their Guidelines for Research in Partnership with Developing Countries (<http://www.int.uzh.ch/northsouth/KFPEGuidelines.pdf>). In addition, research activities and funding mechanisms will be examined using the Singapore Statement on Research Integrity (<http://www.singaporestatement.org/>) as a norm and case studies will be examined and discussed. The challenge of the responsibility of external agencies and funders towards creating an environment conducive of capacity building, responsible communication of results and the effect of research on the TB and other programmes will be explored.

### Charitable fund

**R Bedell.** Dignitas International, Toronto, ON, Canada

The proposed minimal definition, for the purpose of this discussion, of a partner is 'one who contributes something essential towards the collaborative attainment of a mutually desired effect'. The adjective 'real' signifies that there are qualities that distinguish real partners from apparent partners. Sorting out the what kind of partnership we have (or want) depends on how we address a conceptual tension between goals defined in relation to TB control—with its vertical disease control inference, its population-health perspective, and its utilitarian pedigree—on one hand, versus, goals defined in relation to development on the other hand—which implies a holistic perspective on humanity, refers to a plurality of ethical sources, and isn't usually confined to TB alone. From the TB control perspective we can define metrics and quantify goals; partnership could be seen as instrumental to the attainment of those goals. From the develop-

ment perspective, in contrast, partnership is the basis for making decisions—and sorting out who makes them—about what the goals are, how they should be attained and how to define success or failure. Partnership, so understood, is constitutive of the entire process of development. We will look at some contemporary examples of partnership from the perspective of an international NGO (INGO) working on TB control and development. The qualities of partnership in these examples will be considered in relation to insights gained from 'The Listening Project' (CDA Collaborative Learning Projects, Cambridge MA) and the MSF 'Perception Project' (MSF Switzerland, Geneva).

### Technical advisor

**C Macé.** The Union Headquarters, Paris, France

**Background:** The Union is involved in technical assistance to NTPs and in procurement activities for its projects. Through these activities, The Union is a witness/an actor of the quality assurance and procurement requirements of donors and to the support given by some international initiatives such as the Global Drug Facility (GDF).

**Objectives:** This presentation will analyse the current quality assurance and procurement requirements of the main donors such as The Global Fund, USAID and UNITAID and the procurement support given by the GDF and their impact on the availability of medicines/medical items in low- and middle-income countries.

**Results:** The main objectives of current requirements from most of the donors and international initiatives are to improve the quality of medical items available in recipient countries, to improve fair competition and transparency in procurement practices and to facilitate the work of recipient countries/organisations. However, in practice, these requirements or the use of international initiatives is often increasing the complexity of the procurement for recipient countries/organisations and the number of actors involved with lack of coordination, is generating delays in the procurement cycle which put these countries at risk of stock-out situations and demobilising the national actors. Each donor may also have different requirements which mean countries or organisations have often to adapt their own procurement system for each donor.

**Conclusion:** If the initial objectives of the donor policies and international initiatives are positive, their impact at country level should be further analysed and discussed to really bring support to recipient countries/organisations and not to add complexity to countries facing already many challenges and should consider much more the reinforcement of local actors. Donors should also seek for harmonisation of their requirements for quality assurance and procurement.

## FORGING NEW ALLIANCES FOR A RIGHTS-BASED APPROACH TO TUBERCULOSIS PREVENTION, CARE AND CONTROL

### New policy guidance on a rights-based approach to tuberculosis from Stop TB, WHO and UNAIDS

A Wlodarski,<sup>1</sup> Stop TB Task Force on TB and Human Rights.<sup>2</sup> <sup>1</sup>SECTION27, Johannesburg, South Africa; <sup>2</sup>Stop TB Task Force on TB and Human Rights, Geneva, Switzerland

The Stop TB Partnership established the Task Force on TB and Human Rights in 2010. The aim of the task force is to advance the protection and promotion of human rights in pursuit of universal access to TB prevention, diagnosis, treatment, care and support so as to advance health, development and an effective response to TB, including for the most at risk or vulnerable groups, through the implementation of rights-enhancing policies, strategies and programing. The Task Force is developing a policy framework on a rights-based approach to TB care and control as well as pursuing a strategic agenda among partners for promoting action in 2011–2012 on critical concerns.

The Task Force comprises members from the following constituencies: health and human rights experts; health and human rights advocates; patient advocates; national TB programme managers; migrant population advocates; people who use drugs and alcohol; prisoners' advocates; health workers; community task force (CTF) of the Stop TB Partnership; TB and Poverty Subgroup of the Stop TB Partnership; WHO Ethics Task Force; Steering Group of the Global Indigenous Stop TB Initiatives; access to new tools advocates/public-private partnerships for new TB tools development. It also includes institutional members: WHO, UNAIDS, Global Fund, UNDP, IOM, UNOHCHR, Human Rights Watch and Open Society Institute.

The following components of the policy framework will be introduced in this session:

I. What is a rights-based approach? Overlap between public health law, ethics and human rights; II. Preventing vulnerability to TB including the socio-economic and behavioural determinants; III. Increasing access to quality TB diagnosis, treatment and care: Financial, geographical and systemic barriers to access to quality care, stigma and discrimination, liberty restricting measures, and access to new and effective diagnostics and treatment; IV. Strategies for dissemination and use of the policy and monitoring and evaluation.

## Reforms to protect health and rights in East African prisons

J J Amon. Human Rights Watch, New York, NY, USA

**Objective:** To analyze the health and justice reforms needed to address high tuberculosis (TB) rates in east and southern African prisons.

**Background:** While largely unmeasured, TB prevalence in African prisons has been estimated at 6 to 30 times rates in the general population. Overcrowding is widespread, and prison health services are under-resourced. Referral to community-based care, even for emergency services, is frequently controlled by prison staff with no medical training.

**Methods:** A literature review was conducted of prison conditions, health resources, and pre-trial detention rates in east and southern African countries. A survey with similar variables was sent to prison medical directors in 48 sub-Saharan African countries. Case studies were conducted, including in-depth interviews with 246 prisoners and 30 prison officers at 6 prisons in Zambia and 164 prisoners and 30 prison officers at 16 prisons in Uganda. Legislation and policy governing prisons and the criminal justice system in both countries were reviewed.

**Results:** In east and southern African countries, prisons are frequently overcrowded, with Kenya, Uganda, and Zambia over 200% of capacity. Minimal ventilation, poor isolation practices, and a significant immune-compromised population increase TB infection risk. Overcrowding is a direct result of extended pre-trial detention, with 25% or more of the prison population incarcerated pre-trial in at least 14 of 20 countries in the region.

**Table** Approximate prison populations, capacity, and percentage of remanded prisoners in select east and southern African countries

Country	Prison population (year)	Official capacity (year)	Remand prisoners, % of total prison population (year)
Angola	16 183 (2009)	6 000 (2002)	59 (2003)
Botswana	5 216 (2009)	3 967 (2009)	17 (2009)
Ethiopia	85 450 (2010)	N/A	N/A
Kenya	49 757 (2010)	22 000 (2000)	43 (2009)
Lesotho	2 498 (2010)	2 910 (2010)	18 (2010)
Madagascar	18 647 (2010)	10 199 (2009)	43 (2010)
Malawi	11 672 (2010)	6 070 (2009)	19 (2009)
Mauritius	2 354 (2009)	2 194 (2008)	30 (2008)
Mozambique	16 000 (2011)	8 346 (2009)	27 (2009)
Namibia	4 251 (2010)	4 475 (2010)	8 (2007)
Rwanda	62 000 (2010)	43 400 (2010)	27 (2008)
South Africa	159 265 (2011)	118 154 (2011)	30 (2011)
Swaziland	2 628 (2009)	2 838 (2009)	28 (2009)
Uganda	30 649 (2011)	14 334 (2011)	54 (2011)
United Republic of Tanzania*	37 811 (2011)	27 653 (2009)	52 (2011)
Zambia	16 666 (2010)	5 500 (2009)	28 (2010)
Zimbabwe	15 000 (2010)	17 000 (2010)	30 (2010)

Sources: World Prison Brief and Human Rights Watch interviews with prison authorities in Zambia and Uganda.

\* Excluding Zanzibar.

**Conclusions:** Addressing fundamental justice issues including arbitrary and extended pretrial detention is integral to public health efforts in prisons. Alleviating overcrowding by increasing the availability of non-custodial alternatives including bail and community service, and improving access to legal representation, are essential to TB prevention and control.

## PILOT PROJECTS TO ADDRESS TUBERCULOSIS BURDEN IN INDIGENOUS COMMUNITIES

### Progress in engaging indigenous communities in tuberculosis control

K Barker. Public Health and Preventative Medicine, University of Toronto, Toronto, ON, Canada

Globally, there are an estimated 370 million indigenous peoples, in over 70 countries. In many countries they are among the poorest and most marginalized. Where data are available, as in industrialized countries, the burden of tuberculosis is significantly higher among indigenous peoples. It is likely that where data are not routinely collected, the burden is greater still. This presentation will summarize the efforts that have been undertaken to better understand the burden of tuberculosis in indigenous communities globally as well as proposed next steps. In particular, the symposium will highlight the recognition by the UNPFII at 3 annual meetings making it one of the first public health issues debated by the forum and one which is being tracked at their annual deliberations. The response by global TB expertise must be equally committed and vigorous in response. It must address the need for disaggregated data, for pilot projects to garner experience and evidence of the value of community based participatory partnerships in local TB control.

### TB control and the nomads' population displacement in the horn of Africa

A El Sony. The Epidemiological Laboratory, Khartoum, Sudan

The health and safety of those living in border and turbulence areas are widely neglected. The remoteness and prevalent pastoral lifestyle of many communities living in the borders of Africa makes it difficult to provide them with services. The regional office for EMRO of the WHO, in close collaboration with the regional office of AFRO of the WHO and the Ministry of Public Health of Kenya, convened a 4th meeting on the TB control initiative in the countries of the Horn of Africa (HOA). HOA has its exceptional state, facing continuous turbulence, poverty and failing health system. The meeting recognized the need to strengthen the collaboration at inter-country and national levels, provision of financial support for cross-

border activities, and facilitation of regular information exchange. Further strengthening of TB control in line with DOTS was also an important recommendation. A situation analysis targeting nomads of the HOA envisaged that they are marginalized, lack political representation, disputed and neglected from TB control. In Djibouti, according to NTBP data, the number of TB cases among nomads were 6 in 2008, which were much less than expected. In Somalia; 40% of the population is nomadic, yet no standardized TB services exist for them. More exploration is needed to visualize the gap and nomads need real priorities. TB control needs to re-programme to fit in nomads. Efficient TB control for nomads could have a spillover for other health and development issues of HOA.

### Initiatives among the tribal peoples of India

A Sreenivas, S Chadha, S Satyanarayana, S Yadav, N Wilson. Tuberculosis, International Union Against Tuberculosis and Lung Disease (The Union) South-East Asia, New Delhi, Delhi, India

India with one sixth of the world population and one fifth of the global burden of tuberculosis has more than 400 groups of tribal which constitutes about 8% of the population of the country. Tuberculosis is an important cause of morbidity and mortality among the tribal population of India. Prevalence of tuberculosis among various tribal groups are not different from that of other communities in India except for a specific group of tribals in Madhya Pradesh 'Saharia tribes' where the prevalence of tuberculosis and annual risk of tuberculosis infection is more than 5 times (1515/100 000 population and 3% respectively). Inaccessibility to diagnostic facilities and lack of knowledge regarding symptoms of tuberculosis leads to late diagnosis of TB and poor treatment outcomes including high default and death rates among tribal TB patients. A large TB-ACSM focused intervention, 'Project Axshya' (GF R-9 India TB) being implemented in 240 districts of India with The Union SEA as PR, has special focus on this marginalized section. In the study period from Oct 2010 to June 2011, the project has conducted 6829 focused meetings with vibrant community groups in the villages reaching directly to a population of 135 530 in order to sensitize them about tuberculosis and facilities for diagnosis and treatment. 8% of these meetings were conducted in 26 tribal districts. Traditional healers are important health care providers among tribal and rural population in the country. Under the project in the same period 3727 traditional healers and rural health care providers were trained in TB care, of which 574 were from tribal districts (15%). Other initiatives under the project include establishing sputum collection and transport facilities, decentralized DOT provision using local trained community volunteers and helping patients adhere to treatment with social support systems using local self-help groups. Impact of these interventions will be studied after one year of implementation.



## TOBACCO CONTROL FROM POLICY TO IMPLEMENTATION

### Tobacco control in Egypt: successes, challenges and lessons learnt

S Labib, E Attia. MOHP, Cairo, Egypt

Tobacco use is a leading cause of preventable deaths throughout the world. Prevalence rate of tobacco use are throughout North Africa and in Egypt around 38% of men use some of tobacco product (nearly 32% smoke cigarettes, about 6% smoke shisha and almost 5% use smokeless (chewed) tobacco). In addition to cigarette consumption, Egypt is experiencing an upsurge in the prevalence of water pipe (shisha) smoking, particularly among youth and women. Egypt was an early signatory to the FCTC, having ratified it in February 2005. In 2007, the adoption of new tobacco control laws paved the way for Egypt to meet its obligations under the FCTC. Implementation is now gaining significant attention from the government and a visible momentum is evident in Egypt. In 2008 Egypt adopted pictorial health warnings on tobacco packs which cover 50% of the main display areas. In 2010 and 2011, Egypt has professed a rise in taxes on all tobacco products to reach 74% of the retail price and restructured its tax system for tobacco products to reduce tax avoidance, generate more tax revenues and improve public health. Furthermore, a plan of action to free Egypt from tobacco in 5 years was adopted by MOHP with primary focus on primary health care facilities. Enhanced collaboration with both national and international partners is a key to the success in national tobacco control efforts however more efforts are underway to adopt a comprehensive approach in tobacco control and develop coordination mechanisms with other concerned ministries and civil society to advance effective implementation and enforcement efforts.

### From policy to implementation in Russia

F Godfrey, A Kotov, I Berezhnova. Tobacco Control, The Union, Moscow, Russian Federation

**Background:** Russia has one of the highest smoking prevalence rates in the world. It is estimated that there are between 300 000 and 400 000 premature deaths attributable to smoking in the Russian Federation each year. The economic losses attributable to smoking are calculated to be approximately 1–2% of national GDP. Until recently the Russian government had been slow to act on this demographic time bomb: legislation was limited and weakly enforced and public awareness of the harm caused by tobacco was low. However, in 2008 Russia ratified the WHO Framework Convention on Tobacco Control and has played an increasingly active role in subsequent FCTC negotiating fora.

**Approaches:** The Union has been working in Russia on tobacco control since 2007 as part of the Bloomberg Initiative (BI). The Initiative Partners have deployed a wide range of health, economic and other arguments to raise awareness of tobacco harms in the Russian Federation. Using key studies from Russia as well as internationally, and using other key tools such as mass media campaigns, working with the earned media, and training a new generation of advocates, BI partners have worked to help create a new coalition of support for effective, evidence-based tobacco control policies.

**Result:** There is now much greater awareness amongst the public, policy makers and the media of the extent of the tobacco epidemic in Russia. This awareness has resulted in concrete policy responses. In October 2010 the government adopted a wide-ranging national tobacco control concept with the ambitious goal of a 10 to 15% reduction in smoking prevalence by 2015. In July 2011 the Ministry of Health unveiled comprehensive draft legislation, including tax rises and smokefree laws. The next 12 months will be crucial in the development of Russian tobacco control and a key test as to whether policy in Russia can indeed move to successful implementation.

### Impact of media campaign on support for smokefree policy: the case of Lebanon

J Khalife, A Semaan, N Kazzouh, A Haddad, G Saade. National Tobacco Control Program, Ministry of Public Health, Beirut, Lebanon

**Background:** The purpose was to evaluate the impact of a month-long national media campaign in June 2010 on the knowledge, behavior and attitudes of the public, in particular support for smoke-free policy. Various media were used, including a two-week long television advertisement, adapted from another national campaign, focusing on second-hand smoke (SHS) harm in a restaurant setting.

**Methods:** A questionnaire was developed and piloted; cross-sectional design was used on a randomly selected sample of 770 household landline telephone numbers (5% approximation, CI 95%). The questionnaire was administered by telephone to willing adult participants.

**Results:** A total of 437 individuals participated (56.8% response rate). Thirty-day smoking prevalence was higher among males than females (45.8%, 33.8%;  $P = 0.014$ ), with 5% of smokers reporting use of both cigarette and arguileh (waterpipe). A majority of 58.4% were exposed to the campaign through one or more of the media used (road billboards, 30.5%; television, 29.0%; mall posters, 17.0%; radio, 16.7%; newspapers, 15.1%; magazines, 10.5%). The majority (93.8%) considered SHS harmful, with no difference between smokers and non-smokers ( $P > 0.05$ ). Among those exposed through television,

two-thirds of smokers reported the advertisement motivated them to decrease or quit smoking. Individuals exposed through television were more likely to be bothered by SHS in restaurants (80.2%, 65.8%;  $P = 0.001$ ) and bars/nightclubs (81.0%, 66.4%;  $P = 0.005$ ) but not in other locations, and were also more supportive of banning smoking in all indoor public places (96.8%, 89.6%;  $P = 0.013$ ).

**Conclusion and recommendations:** The campaign was able to reach the majority of the population, strengthen support for tobacco control, in particular smoke-free policy, and motivate reduction/cessation. The use of a relatively modest number of televised media spots for a short period in a developing country has considerable impact to support tobacco control.

### Powering up political will to implement tobacco control policy at the sub-national level: China experience

Y Lin, Q Gan, N Dong, H Liu, J Ma. The Union China Office, Beijing, Beijing, China

**Background:** China ratified the FCTC in 2005, but there has been no comprehensive tobacco control law or regulation at the national level. With passing a national law considered to be difficult by many, it has become important to promote legislations at the sub-national level. To protect nonsmokers' exposure to SHS, the BI, through the Union, has supported 9 major cities (Shanghai, Guangzhou, Harbin, Shenyang, Lanzhou, Shenzhen, Tianjin, Nanchang and Chongqing) in China to promote smokefree legislation since 2008. Total population of the 9 cities is 124 million. The focus of the legislation is creating 100% smokefree indoor public places and work places that meet the requirements of the FCTC.

**Methods:** Initiative begins from enhanced political commitment by strengthening leadership development and empowerment at the Mayor's level. Multi-sector involvement was encouraged and various forms of tobacco control coalitions were formed. Messages on the health effects of cigarette smoking and passive smoking were promoted on mass media in the cities. Legal consultation and various seminars were organized. Best practices were shared through trainings, education materials and study tours. The Union technical input contributed to confidence of the political leaders in the success of the legislation.

**Results:** Among the nine cities, two cities have had the legislation approved and implemented since 2010; three of the cities have had the draft legislations approved by the Mayors and reviewed by the People's Congress. Four cities are preparing for the legislation drafts with the input from legislation stakeholders. Smoking ban in major public places has been achieved or partially achieved via improved responsibility of government departments.

**Conclusions:** Leadership development and empowerment is crucial in the success of smokefree legislation in the sub-national level to achieve the protection of nonsmokers from the exposure of secondhand smoke.

## TUBERCULOSIS IN HEALTH CARE WORKERS: THE RESPONSE

### Monitoring tuberculosis incidence among health care workers: the way forward

D Chemtob. Stop TB Department, World Health Organization, Geneva, Switzerland

**Background:** Systematic reviews of tuberculosis (TB) among health care workers (HCWs) have demonstrated a higher occupational risk of developing TB and therefore, a specific TB surveillance system for HCWs may improve early TB detection and treatment among HCWs. However, most countries have no such system. In addition, surveillance should also enable assessment of changes resulting from the implementation of TB infection control (TB-IC) measures in health care facilities.

**Objective:** To describe the development of a guide for monitoring TB incidence among HCWs and the required steps of implementation at country level.

**Results:** As part of a USAID/TB CARE funded project, WHO is leading the development of a guide to support countries in establishing TB surveillance system for HCWs. First, WHO included TB among HCWs as a major indicator to monitor country TB-IC implementation, which was adopted by the Global Fund (GFATM). To prepare the guide, WHO reviewed the literature, and an inventory of tools available for such surveillance has been performed. A global meeting, with institutional partners and country representatives, ensured expert consensus on the method to be used by countries. Following GFATM's recommendations for funding, many countries will soon seek guidance on ways to establish a TB surveillance system among HCWs. The way forward includes: 1) testing feasibility of the guide in a few countries; 2) publishing the guide; 3) helping countries to include the surveillance system in donor proposals (e.g., GFATM, USAID, PEPFAR); 4) advocating its implementation at country level; 5) monitoring country implementation at global level.

**Conclusions:** Progress has been made in preparing a guide for monitoring TB among HCWs. Yet, further steps are needed for enabling a larger number of countries to establish such a system. This should ultimately improve early detection and treatment of TB among HCWs and monitor TB-IC implementation measures.

## THE CORPORATE SECTOR: KEY PARTNERS IN THE FIGHT AGAINST TUBERCULOSIS AND HIV

### Engaging the corporate sector beyond the workplace

D Mohaupt. Stop TB Partnership, WHO, Geneva, Switzerland

Companies rely on the communities they operate in, both as a place to recruit staff and as a market for their products and services. It seems clear therefore that businesses need healthy communities in order to thrive. In turn, it is also evident that public health threats such as TB put a burden on communities and inhibit business opportunities. While many companies already recognize the need to invest in the health of their own employees, the potential of the corporate sector to protect public health and to utilize their resources for the benefit of the wider community remains widely untapped. Why is this? This presentation looks at how we can better harness the skills, competencies, and resources of companies in the fight against TB, not just in the workplace, but in the wider communities that they operate in.

## A PARTNERSHIP APPROACH TO INTRODUCING NEW LABORATORY TOOLS FOR TUBERCULOSIS DIAGNOSIS

### The Supranational Laboratory Network: a partnership to ensure quality and provide assistance

A Van Deun. Mycobacteriology Unit, Institute of Tropical Medicine, Antwerpen, Belgium; and Tuberculosis Department, The Union, Paris, France

For many years, the TB reference Supranational Laboratory Network (SRLN) did not change much in members or scope of activities since its inception in 1993. The network was composed of about 20 laboratories, all but a few located in industrialized countries in the north, and mainly in Europe. Although a few individual SRL were active in low- and middle-income countries, the activities of the network were not well organized except for the conduct of an annual round of proficiency testing for drug susceptibility tests (DST). However, with the fast developments in TB laboratory issues of recent years, also the SRLN have become more involved. More new and candidate SRL were admitted to the network: the number is now going towards 30, with new SRL predominantly located in low- and middle-income countries. A global SRLN consultation led to the adoption of revised and far broader terms of reference, and better defined eligibility criteria. These are now being used to admit new members to the network, but also to

decide on continued certification of established SRL. The aim is to arrive at a truly active network, giving guidance and assistance where needed, as the most important tool of the Global Laboratory Initiative. Examples include the permanent links established between a SRL and specific countries with their NRL to support the complete laboratory network, and not just rounds of DST proficiency; and the investigation into DST problems with some drugs or methods.

### Advocacy, communication and social mobilisation (ACSM) to incorporate new laboratory testing into national tuberculosis control programmes and policies

N Otwoma. Network of People Living with HIV in Kenya (NEPHAK), Nairobi, Kenya

**Issues:** Care of patients with tuberculosis (TB) starts with a quality assured laboratory diagnosis. In Kenya, lack of appropriate diagnostics and vastly inadequate existing laboratory capacity are key barriers to TB control. The challenge is even greater among people living with HIV who are co-infected with active TB disease. If TB diagnosis become reliable and timely, many deaths could be avoided and patients cured. Unfortunately investment in laboratories has been minimal.

**Intervention:** The National Empowerment Network of PLHAs in Kenya (NEPHAK) and partners embarked on advocacy, communication and social mobilization (ACSM) to incorporate new laboratory testing into national TB control programmes and policies. The ACSM initiative included capacity building to community leaders, roundtable discussions with TB and laboratory programme managers and advocacy campaigns, including community and media outreaches.

**Results:** With capacity building, there emerged an informed community and civil society leaders with good understanding of the role of laboratories in TB management. Such leaders, including PLHIV and those who have had TB are becoming Laboratory Champions. ACSM has also broadened partnership needed for continued advocacy for new laboratory testing into national TB control programmes and policies.

**Conclusions:** Increased investment in the laboratories is going to be a sure step towards managing TB. Advocacy, communication and social mobilization (ACSM) provides an opportunity and a framework upon which new laboratory testing can be incorporated into national TB control programmes and policies. Communities, including TB patients should be part of the partnerships aimed at improving access to quality laboratory services.

## ENHANCING PARTNERSHIPS IN THE FIGHT AGAINST TUBERCULOSIS THROUGH TRAINING AND EDUCATION INITIATIVES

### A tuberculosis and diabetes education resource for use by tuberculosis nurses and community DOT workers in the South Pacific

P Banner,<sup>1,2</sup> A Christensen,<sup>1,2</sup> K Shaw,<sup>1</sup> R Brostrom,<sup>3</sup> M Ekiek,<sup>4</sup> K Briand.<sup>5</sup> <sup>1</sup>Australian Respiratory Council, Sydney, NSW, <sup>2</sup>NSW Health, Sydney, NSW, Australia; <sup>3</sup>Centers for Disease Control and Prevention, Honolulu, Hawaii, USA; <sup>4</sup>Department of Health and Social Services, Klononia, Ponhepei, Micronesia; <sup>5</sup>Ministry of Health, Majuro, Marshall Islands

**Objective:** To develop an education tool to promote TB treatment adherence and diabetes self-management which can be delivered during the administration of TB Directly Observed Therapy (DOT) in Pacific Island Countries (PICs).

**Background:** The rate of diabetes in the Pacific region is high. The region tops international obesity and diabetes charts. Pacific TB notification rates range between 0–326 cases per 100 000 population. People with diabetes have a greater risk for developing TB following exposure to the bacterium and for death during TB treatment. TB nurses and DOT workers have a unique opportunity to impact on diabetes self management during the delivery of TB DOT. The Australian Respiratory Council, US Centres for Disease Control and Prevention and National TB and Diabetes Programs of Micronesia (FSM) and Marshall Islands (RMI) collaborated to develop a TB and Diabetes education resource. This project was funded by the Secretariat of the Pacific Community.

**Methodology:** A literature review was undertaken to identify key TB and diabetes messages for incorporation into a 26 week educational period. Input was sought from Pacific TB and diabetes programs and Chronic Disease Coalition regarding format and content of the educational resource. The resources were piloted in FSM, RMI and Hawaii.

**Results:** A pictorial flipchart and patient information booklet containing patient and health worker information were developed. The content is structured to support the development of the patient/health worker relationship. Educational topics were organised according to standard TB and diabetes management plans to support patient monitoring and adherence to TB and diabetes control activities.

**Conclusion:** A structured tool for the combined delivery of TB and diabetes education has been developed for use in the 22 PICs. Future activities include the development of a training package to aid implementation of these resources and a study to measure their impact on health outcomes.

## The development and use of a public-private mix toolkit in Indonesia

J Voskens. KNCV Tuberculosis Foundation, Den Haag, Netherlands

Indonesia has made strong progress in TB control over the last 10 years, becoming the first country among the high burden countries (HBC) in this region to successfully reach the global TB targets for case detection and treatment success in 2006. Yet uncontrolled and irrational use of first- and second-line drugs in hospitals and private sector is a major threat for further spread of MDR/XDR. One of the priorities of the NTP is improving access to quality DOTS for all TB patients through implementation of ISTC by all care public and private providers. Key interventions consist of scaling up hospital DOTS linkage and promotion of ISTC. Notification of TB cases by hospitals and private providers has increased considerably over the last 5 years as a result of strong efforts of NTP and partners led by KNCV to link these hospitals and providers to the NTP. The National Program Indonesia has been closely involved in the development and piloting of several of the generic tools from the PPM toolbox developed under TBCAP (<http://www.who.int/tb/careproviders/ppm/tools/en/index.html>). This is particularly true for the Guidance Document to Engage Hospitals, the field piloting of ISTC, the ISTC handbook and the Guidance for Engaging Private Practitioners to involve Professional Societies. Furthermore the National Situation Assessment for PPM was intensively used for development of the National Strategic Plan for TB control and the development of Global Fund Applications. These PPM tools have also been included in national guidelines for the various provider groups and have been extensively used in national in-service training activities and advanced training for technical staff and program managers at national and provincial level. Other PPM tools that are relevant for the NTP at this stage are tools for engaging workplaces, guidance for engaging Social Security Organizations, and for engagement of private providers in MDR-TB management.

## Evaluating peer educators working with homeless and substance users affected by TB

J Hall,<sup>1</sup> M Murphy,<sup>2</sup> J Mavromatis,<sup>1</sup> D Olapoju,<sup>1</sup> S Hellenen,<sup>2</sup> A Story.<sup>1</sup> <sup>1</sup>Find and Treat, University College London Hospitals, London, <sup>2</sup>Groundswell, London, UK

**Background:** In London, 1 in 6 tuberculosis (TB) cases are hard-to-reach due to homelessness, drug/alcohol use or imprisonment. These groups are at very high risk of delayed diagnosis, infectious and drug resistant TB and poor treatment outcomes. While initiatives involving hard-to-reach communities in HIV control have proven effective, evidence to support their contribution to TB control activities is lacking.



**Aim:** To improve uptake of screening among hard-to-reach groups by harnessing the authentic voice and experience of former TB patients from these affected communities.

**Method:** Eleven former TB patients with experience of homelessness and drug/alcohol dependence have been recruited, trained and supported to work as peer educators alongside a mobile X-ray screening service. Qualitative and quantitative methods were used to evaluate their impact on service access and screening uptake.

**Results:** Over a 24 month period peers recruited 10 190 clients at 332 screening sessions, resulting in 78 hospital referrals and 20 cases of active TB. A crude comparison of 39 screening sessions supported by a peer compared to sessions without a peer resulted in increased uptake in 60% of venues. 92% of attendees at peer training events strongly agreed that 'hearing from someone who had TB motivated me to tackle TB'.

**Conclusion:** Our evaluation demonstrated that trained peer educators can improve service access and screening uptake and provide an authentic voice of experience that homeless people and drug/alcohol users can relate to. Peer involvement should be integral to tackling metropolitan TB among hard-to-reach groups.

### Using radio to create awareness and educate the community about tuberculosis and HIV in Zambia

J O'Brien. Zambia AIDS Related TB (ZAMBART) Project, Lusaka, Zambia

**Methods:** Working with a group of local health-focused journalists, who attended an intensive three-day media training workshop on TB and HIV organized and facilitated by Zambia AIDS Related TB (ZAMBART) Project, the group designed a comprehensive radio programme series on TB and HIV which was broadcast on both national and community-level radio stations throughout the country. Each programme featured a different ZAMBART researcher discussing topics such as the TB-HIV relationship, the Zambia-South Africa TB and AIDS Reduction (ZAMSTAR) Study's community interventions, TB stigma, the changing role of home-based care, the Three I's and TB and food security. The campaign indirectly touched more than 6 million people and spanned the entire country.

**Results:** One of the more enlightening aspects of this radio programme campaign was the misconceptions that listeners held on TB and HIV (based on the caller contributions and questions) and as such highlighted the fact that more radio programme series are needed to reach the mass population with accurate health promotion messages. To help bridge this gap, ZAMBART edited and standardized the contents of

the radio programme series it created to produce a complete volume of TB-HIV programmes and packaged it for broadcast on community radio stations throughout the country. Using this 'ripple in the pond approach', ZAMBART maximized the voice of the organization and the impact of its initial TB-HIV radio programme series to reach an even more diverse audience.

**Conclusion:** The majority of Zambians remain unaware of the intricate relationship between the two diseases; therefore, the responsibility falls to researchers, NGOs and journalists to improve the current public health environment in the country. These critical groups, though sometimes at odds, can always find common ground on health promotion. Moving forward, these focused radio programme series should continue to occur to increase health knowledge in the country.

### MARKET-BASED APPROACHES IN TUBERCULOSIS TREATMENT SCALE-UP: LESSONS LEARNT, REMAINING ISSUES AND FUTURE OPPORTUNITIES

#### Welcome and introduction to market-based approaches for public health: UNITAID's partnership model

B Waning. UNITAID, Geneva, Switzerland

UNITAID works through market-based approaches to increase access to medicines, diagnostics and preventive items for HIV, tuberculosis (TB), and malaria. Specifically, UNITAID aims to promote 'healthy', dynamic market conditions whereby manufacturers have incentives to invest and innovate, while at the same time supply quality public health products at affordable prices and in acceptable formulations that enable the maximum number of people to access them.

The particular roles UNITAID play depend upon the circumstances in a given market and include: market catalyst (identifying and facilitating adoption and uptake of new and superior public health products); market creator (provide incentives for manufacturers to produce otherwise unattractive products with low demand that yield little profit but substantial public health benefit to those in need); and market fixer (address severe market inefficiencies that contribute to low access to quality-assured public health products).

UNITAID's market framework consists of five phases: identifying and quantifying the public health problem and commodity access issue; identifying market shortcomings and their reasons; design and implementation of innovative market interventions; sustainable market impact; and long-term public health impact.

This session provides an overview of UNITAID's Market Impact Framework and highlights results from UNITAID-funded TB projects, including: Expanding Access to New Diagnostics for TB (EXPAND-TB) Project; WHO Prequalification of Medicines Programme; Strategic Rotating Stockpile; and projects to scale up treatment of multidrug-resistant and paediatric TB.

### **How treatment guidelines shape and react to markets: lessons from WHO and Make Medicines Child Size**

S Hill, L Hedman. Department for Essential Medicines and Products, World Health Organization, Geneva, Switzerland

In order to identify a pathway of critical activities needed to advance the availability of appropriate paediatric formulations of TB medicines, a combined consultation was undertaken across scientific, regulatory, and market experts to identify blocks in producing and making a fixed-dose combination of rifampicin, ethambutol, isoniazid, and pyrazinamide. The consultation highlighted factors contributing to the lack of availability, including misperceptions regarding the status of paediatric dosing guideline; lack of information on an appropriate product specification and on a clear regulatory pathway; and insufficient market information to support investment from industry. In conclusion, achieving access to the recommended paediatric formulations will require a coordinated effort across programmatic implementers, industry, regulatory agencies and universities and other scientific organizations. The necessary activities will include formal requests for advice from regulators on the most advantageous pathway; securing additional market research; reviewing product specifications and issues such as weight banding the final product to be consistent with drug management in HIV/AIDS programmes. Specific communication initiatives must also be undertaken to clarify the purpose of ongoing research and to clarify the status of the guidelines.

### **Interplay of national and global policies and impact on markets: perspectives of national regulators**

A Pillay. National Department of Health, Pretoria, South Africa

Pharmaceutical markets are vast and complex ecosystems consisting of many actors, including: investigators, developers, producers, distributors, donors and financiers, insurers, managed-care organizations, providers, wholesale, retail, and informal outlets, international organizations, governments, regulators, patients, and others. Tuberculosis (TB) markets in low- and middle-income countries are particularly challenging to shape and influence given their relatively small size and dispersion across public, private

and donor-funded segments. While donors have substantial leverage as dominant funders in other diseases, donors have less leverage in TB markets. National governments, however, have considerable leverage to influence national, regional, and global TB markets and create conditions to promote access to affordable, quality-assured medicines and diagnostics for TB. Governments have direct impact on the size and shape of markets through their actions as large-scale suppliers, buyers, and third-party payers; but also have indirect impact through laws, regulations, harmonisation, and other means of influence. Policies at national level, however, must balance goals for health with those for industrial organization, development and politics. Countries with high TB prevalence and the ability to produce TB medicines have particular influence on market dynamics, not only in their own countries but also at regional and global levels. This session describes regulatory mechanisms national governments can adopt to shape markets towards improved public health. The session also highlights the need for Global Health donors and organisations to work more closely with national governments to jointly develop and implement new public-private interventions to improve access to TB diagnostics and medicines.

### **Identifying and overcoming intellectual property issues**

T Amin. Initiative for Medicines, Access and Knowledge (I-MAK, Inc), New York, NY, and Department of Global Health and Social Medicine, Harvard Medical School, Boston, MA, USA

Tuberculosis treatment has become more complex with the emergence of multidrug-resistant strains of *Mycobacterium tuberculosis* (MDR-TB). Approximately 250 000–400 000 new cases of MDR-TB each year globally are added to the 500 000 or more ongoing cases, with the highest prevalence being in the Eastern Europe, Central Asia, China and South Africa. As MDR-TB is resistant to the two most commonly used treatments, isoniazid and rifampicin, newer drugs are needed. One promising new treatment for MDR-TB is the investigational diarylquinoline compound (TMC207), being developed by a partnership between a pharmaceutical company and a non-profit organization. However, as with many new treatments, the role of intellectual property rights can play an important role in shaping access, particularly for lower-middle income and middle-income countries. This case study looks at the global patent coverage for TMC207 and the potential access scenarios. The study also considers possible options to overcome intellectual property barriers to access TMC207 in the design and implementation of access programs.

### **What makes a market attractive to manufacturers? Perspectives from generic pharmaceutical industry**

S Kulkarni. LUPIN Limited, Mumbai, Maharashtra, India

Generic pharmaceutical manufacturers typically consider the following issues before entering a particular niche: market size and growth, risk versus return on investment, barriers to entry, opportunity for product differentiation, demand fluctuation and business viability over the long term. Factors that make the tuberculosis (TB) medicines market less attractive include its small size, low growth and pressures on pricing. Other market characteristics deterring investment include the role of institutional buyers, with expectations of pre-qualification approval and requirement of special products specific to institutional customers. These characteristics present challenges for manufacturers to remain viable in TB markets. It would be useful to consider a range of measures to motivate the industry and individual players to keep actively engaged in the TB market:

- 1 Involvement of manufacturers at the time of deliberation of any new guidelines or programs—treating manufacturers as partners rather than mere suppliers
- 2 Commitment of quantities to the manufacturers based on well developed forecast mechanism
- 3 Discussions between manufacturers and large-scale institutional buyers on changes to quality approval systems that assure quality without posing barriers to entry of manufacturers
- 4 Providing incentives in the form of long term commitment for buying medicines once the manufacturer has invested in developing and producing the desired products.

### **Looking forward to predict and address market issues of the future: new partnerships and approaches**

B Waning, E Hannay, P Duneton. UNITAID, Geneva, Switzerland

Significant technological development has occurred in both medicines and diagnostics for tuberculosis (TB) over recent years. A new and improved pipeline of products is reaching the market with potential for dramatic improvements in access to timely and effective TB diagnosis and treatment. For example, a new automated nucleic acid amplification test, Xpert MTB, reduces diagnosis time to two hours, while two new medicines for multidrug-resistant tuberculosis (MDR-TB) are expected to reach the market over the next year. These are among the first substantial improvements in these markets for decades. There is a risk, however, that these products will not achieve their public health potential if these new, improved TB medicines and diagnostics cannot be easily intro-

duced and diffused through low- and middle-income markets. Mitigating this risk requires identifying and addressing potential challenges before they become entrenched. Additional information, in the form of real-time market intelligence is needed to better define market characteristics and market shortcomings, including the ability to track uptake and diffusion of new products in a timely manner. New partners, including governments, public-private partnerships, non-governmental organisations and others must come together today to predict and plan for the challenges of tomorrow. This session highlights new TB innovations that have entered or will soon enter the market; and describes potential challenges to their rapid scale-up. The session also provides an overview of what UNITAID is doing to proactively identify and address challenges to maximize access to diagnostics and medicines for TB. This includes, among other things a commitment to map and monitor the market and technology landscapes for TB medicines and diagnostics and the identification of new projects and partners to address TB market shortcomings before they become significant barriers to access.

### **IMPLEMENTING SMOKEFREE LEGISLATION THROUGH PARTNERSHIPS: CASE STUDIES OF SCALING UP IN DEVELOPING COUNTRIES**

#### **Smokefree Kottayam: a replicable grassroots smokefree model**

S Itty. Kerala Voluntary Health Services, Kottayam, Kerala, India

Kerala Voluntary Health Services a state chapter of VHAI, New Delhi made a remarkable achievement in the area of tobacco control in the state of Kerala by declared Kottayam district as the first Smoke Free District in India on 27th September 2008. The declaration not only covered Kottayam Town but also to cover enter district which includes 76 villages and 4 municipalities consisting of 20 lakh of population. This we achieved by our effective partnership with government especially with Kottayam District Administration and District Medical Office. Last one year this partnership took lot of initiatives on tobacco control measures in the district. The technical input from 'The Union', WHO, VHAI, TFK and ACS help us to complete the task professionally and effectively. So now we all can proud about this achievement and it proves the strength of civil society to enforce the tobacco control among a large population. The achievement we made through initiating thousands of volunteers from all sessions of population and building up a strong coalition among civil society groups and establish a productive partnership with district and

state administration. The orders and proceedings issued by the district administration for the effective implementation of COTPA defined the legal framework of the declaration. The support from the media and trade union leadership was vital in this achievement. But the tough tasks ahead are monitoring the violations and counter the promotional tactics of tobacco companies. Our coalition is strong and commitment is well defined to face such challenges.

### Experience from promoting smokefree legislation in seven major cities in China

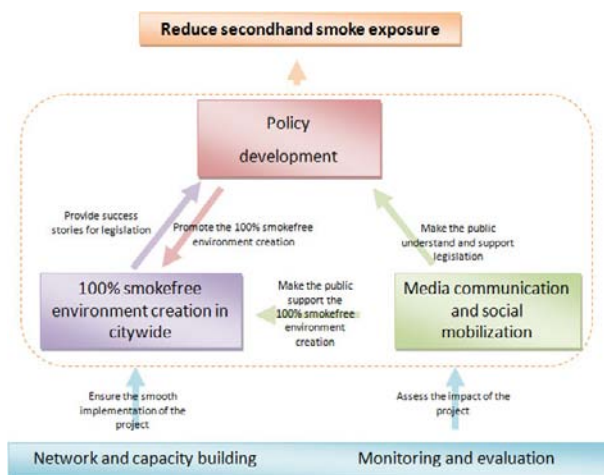
J Yang,<sup>1</sup> L Wu,<sup>1</sup> Y Yang,<sup>1</sup> J Zhang,<sup>1</sup> Z Zhang,<sup>2</sup> G Yang,<sup>1</sup> Q Gan.<sup>3</sup> <sup>1</sup>Chinese Center for Disease Control and Prevention, Beijing, <sup>2</sup>CCTV, Beijing, <sup>3</sup>International Union Against Tuberculosis and Lung Disease, Beijing, China

Overall goal is reducing secondhand smoke exposure in seven major cities in China. For achieving the aim, we establish 5 strategic objectives: establish and strengthen national tobacco control network, and improve the capacity of network members; promulgate new or modify existing laws, regulations and policies on smoking ban in public and work places in selected provincial cities; improve public perception of harm caused by smoking and exposure to secondhand smoke and change the social norm of offering cigarettes as gifts and a social courtesy; promote the creation of 100% smoke-free environments in selected provincial cities; develop and apply best-practice evaluation methods to assess the impact of the tobacco control interventions.

#### Result:

- 1 Network and capacity building  
The tobacco control, legal and media network are working together closely to committed to promoting the implementation of the project.
- 2 100% smoke-free legislation
  - a Draft guidelines on 100% smoke-free legislation and enforcement, and trained the local staff on how to use it. The guideline help to make clear.
  - b Establishing legal expert network to direct smoke-free legislation.
  - c Media communication: drafted the guidelines on media practice of the project on promoting smoke-free environments, and trained the local staff on how to use it. The guideline help to make clear: the stage of the media communication; the key message of the different stage of the media communication; what can we do at the different stage of the media communication.
  - d 100% smokefree environment building. Developed the guidelines on creating 100% smoke-free environment, and trained the local staff on how to use it. The guideline help to make clear: the necessity of creating 100% smokefree environment; the standard of creating 100% smoke-

- free environment; what shall we do to create 100% smokefree environment.
- e Coping with Misconceptions in China's Legislation



### Working towards smokefree implementation with GOV-NGO partnerships

M Arif. Society for Alternative Media and Research (SAMAR), Islamabad, Pakistan

The NGOs in Pakistan led by 'Pakistan Anti-Tobacco Coalition' (PATC), an alliance of 33 NGOs, started lobbying with government authorities and succeeded in developing a framework for restricting the use of tobacco. Withstanding the resistance by tobacco industry, the NGOs continued exerting pressure on the government, and finally the government promulgated tobacco control law, 'Prohibition of Smoking and Protection of Non-Smokers Health Ordinance 2002'. Under the law, all public places and public transports declared smoke free with no designated Smoking Zones anywhere and advertisement of cigarettes was banned. Though the law was promulgated, its implementation was a problem and even the authorized persons did not know about their responsibilities regarding enforcement of the law. No proper structure for monitoring and implementation of the law was there. In 2007, the Coalition for Tobacco Control in Pakistan and other NGOs worked closely with the ministry of health and in the same year the ministry established a separate section for tobacco control with the name of Tobacco Control Cell. A number of NGOs started monitoring of the implementation of law. CTC-Pak developed survey monitoring tools and conducted surveys in more than 20 districts of Pakistan through its coalition members to help the ministry and Tobacco Control Cell. The Cell uses the information from the monitoring surveys to make implementation of tobacco control law more efficient. The Cell has also formed district coordination committees to ensure implementation of the law in



priority areas. As a result of efforts by NGOs and the Cell, the Sindh Provincial Assembly passed a resolution on May 10, 2011 prohibiting the use of Sheesha in public places including restaurants and cafes. The government and the NGOs are constantly trying to implement tobacco control law, but they have to go a long way to achieve a 100 percent smoke free status in order to comply with the FCTC.

## **TUBERCULOSIS, TOBACCO, HIV, COPD AND OTHER LUNG HEALTH ISSUES: SCALING UP PARTNERSHIPS TO DRIVE RESEARCH INTO POLICY AND PRACTICE**

### **Social determinants of tuberculosis, HIV and malaria among the urban poor in high-burden countries**

A David. Tobacco Control, The Union, Tamuning, Guam; Cancer Research Center, University of Guam, Mangilao, Guam; and Cancer Research Center of Hawai'i, University of Hawai'i, Manoa, Hawai'i, USA

With over 1 billion of the world's population living in cities, and accelerated urban expansion, today's urban settings are redefining the field of public health. The complex dynamics of cities, with their concentration of the poorest and most vulnerable (even within the developed world) pose an urgent challenge to the health community. While retaining fidelity to the core principles of disease prevention and control, major adjustments are needed in the systems and approaches to effectively reach those with the greatest health risks (and the least resilience) within today's urban environment. This is particularly relevant to the prevention and control of infectious diseases like tuberculosis and HIV/AIDS, as well as behavioral health risks like tobacco consumption. Slums and informal settlements represent the most vulnerable settings within cities. The challenge for prevention and disease control in slums and informal settlements is not in identifying which interventions work, but rather in ensuring that slum dwellers: (1) are captured in health statistics that define disease burden and (2) are provided opportunities equal to the rest of the population to access proven interventions. Viewed within the framework of the 'social determinants of disease' model, this requires broad and integrated interventions that address the underlying causes of inequity that result in poorer health and worse health outcomes for the urban poor. Global developments, including the Millennium Development Goals, the WHO Framework Convention on Tobacco Control and the considerable resources being mobilized to counter AIDS, TB and tobacco, provide an unprecedented opportunity for countries to seriously address the structural and intermediate determinants of poor health in

these settings. Emerging 'success stories' from around the world provide important insights into the effective, innovative and integrated approaches for prevention and control.

### **Tobacco use and delays in tuberculosis diagnosis and treatment in Nepal**

T S Bam,<sup>1</sup> D A Enarson,<sup>2</sup> N Wilson.<sup>3</sup> <sup>1</sup>International Union Against Tuberculosis and Lung Disease (The Union), Jakarta, Indonesia; <sup>2</sup>The Union, Paris, France; <sup>3</sup>The Union, New Delhi, India

**Setting:** Published literature documented that smoking is a significant risk factor for tuberculosis (TB) infection, increased likelihood of death, increase likelihood of relapse from TB treatment, and increased clinical severity and delayed in TB diagnosis. Longer delay might increase the TB infection rate in the community and increase the health care cost. Thus early identification of TB infection, early bacteriological examination, and directly observed treatment are the basic components of TB programs. The study was conducted to identify the effect of smoking in total delay among new smear positive tuberculosis patients in Kathmandu, Nepal.

**Methods:** A cross-sectional analytical study was carried out in 605 subjects. Direct interviews were conducted using semi-structured questionnaire at the DOTS centres. Delay intervals were calculated.

**Results:** Of the 605 subjects, 271 (44.7%) were current smokers, 33 (5.5%) were ex-smokers and 301 (49.8%) were never smokers. Cough was the first symptom appearing in 90% of current smokers and 76.7% of never smokers. At the point of TB diagnosis, more than half (58.3%) of the current smokers had highest level of bacteriological load (3+) while it was found only in 23.3% of never smokers. The median total delay (the time interval from the onset of symptom to the time of start of TB treatment) was 120 days for current smokers and 90 days for never smokers. Median patient delay (the time from the onset of symptoms to the first contact with any type of health care provider) was 70 days for current smokers and 45 days for never smokers. More than one third (41.1%) of current smokers and only 13.3% of never smokers perceived that coughing is not a serious matter that would recover without treatment.

**Conclusions:** Patient delay and total delay was found longer in current smokers. Anti-smoking interventions are needed within TB control program for early diagnosis and treatment.

### Scaling up partnerships for practical approaches to lung health in the Philippines

M E Limpin. FCTC Alliance, Philippines (FCAP), Quezon City, and Pulmonary Critical Care, Philippine Heart Center, Quezon City, Philippines

Addressing issues such as health promotion and chronic disease prevention requires the inclusion of people from diverse backgrounds and disciplines. Work in partnerships, collaborations and coalitions can be challenging but powerful tool for mobilizing individuals or groups to action, bringing public health issues to prominence and developing policies. This is more true when one is battling against the strong lobbying of the tobacco industry that has enormous resources at their hands. Despite passing its national tobacco control law, The Tobacco Regulation Act, in 2003, implementation and enforcement are poor since these rest on the local government units (LGUs) and the Inter-Agency Committee on Tobacco (IAC-T), where the tobacco industry is a part of. A strategy opted to ensure implementation and enforcement of 100% smoke-free policy is the 'bottoms-up' (sub-national) approach based from best practice of Davao and Makati City. Very crucial in building the partnership is the engagement of the local chief executives (LCEs) and the health department. In addition, local civil society groups (health organizations, academe, religious organizations, youth groups, environmental organizations) must also be mobilized to show to policy-makers the presence of constituency that will make it hard for them to ignore. The result of these partnership is the adoption and very good implementation and enforcement of 100% smoke-free indoor policy in selected regions that included tobacco-growing areas. Forming these partnerships has not been easy. A nurturing relationship has to be continuously cultivated to develop sustainable working partnerships and to gain the trust and confidence of the people. In addition, FCAP has to assume the role of coordinator and provider of technical information when needed. This sub-national approach has provided a good pathway to success. Even in the presence of strong TI lobbying, the TI finds it difficult to thwart 100% smoke-free policy implementation.

### How tobacco use fuels tuberculosis morbidity and mortality

T E Novotny, R A Lindsay, S Shin. Joint Doctoral Program in Global Health, University of California, San Diego, and San Diego State University, CA, USA

**Setting:** Smoking is a true global epidemic, responsible for an enormous and increasing burden of disease, particularly among the poor, where infectious diseases such as tuberculosis (TB) still rage. Smoking increases susceptibility to TB infection and progression to active disease. Among TB patients, smokers

are more likely than non-smokers to relapse and require retreatment after completing treatment. Smoking may also increase risk of drug-resistance, overall TB-attributable mortality, and risk of TB transmission in households where TB cases are smokers. With over 9 million new cases and nearly 2 million deaths worldwide each year, more focused efforts at tobacco control within TB settings are needed.

**Objective:** To respond to the tobacco and health crisis, the World Health Organization (WHO) spearheaded the Framework Convention on Tobacco Control (FCTC), a global treaty for instituting tobacco control across a variety of channels. A key channel is smoking cessation, involving behavior modification and pharmacotherapy in healthcare settings especially. To address the dual threat of TB and smoking, the World Health Organization and the Union have jointly called for the inclusion of smoking cessation in TB treatment programs. However, cessation interventions are based on the theory that quitting smoking is a process, and that smokers are at different stages of behavior change at any particular time. Brief advice by a healthcare provider can help patients progress towards achieving long-term cessation, but given the critical relationship between smoking and TB treatment outcomes, a more focused, disease-control approach to tobacco use is needed in TB settings. This includes monitoring and evaluation, policy approaches, home and community interventions, and truly integrated infectious disease and non-infectious disease professional collaboration.

**Results:** This presentation will summarize current findings from feasibility and pilot studies to integrate tobacco control into TB treatment programs in China, Brazil, and elsewhere.

**Conclusions:** Attention should be paid to improving trans-disciplinary communication and training for both tobacco control and TB providers. Smoking cessation is likely to be a critical element for improving TB treatment outcomes in many LMICs where the epidemics of TB and tobacco use coexist. In addition, such interventions may, in fact, have additional public health value in preventing spread of TB in smoking households. Additional research is needed in a variety of cultural and clinical settings in order to implement effective tobacco control programs for TB patients and their household contacts.

## SYMPOSIA: SUNDAY 30 OCTOBER 2011

### LABORATORY ACCREDITATION: ESSENTIAL FOR QUALITY, BUT HOW TO GET THERE?

#### The Union/GLI roadmap for laboratory accreditation

T Shinnick. US Centers for Disease Control and Prevention, Atlanta, GA, USA

Striving to obtain accreditation strengthens diagnostic services because it promotes implementation and compliance with standards. However, many laboratories are uncertain as how to start a quality improvement process that will lead to accreditation. An IUATLD working group has partnered with the Global Laboratory Initiative of the Stop TB Partnership and representatives of other accreditation groups to develop a roadmap and implementation guide to assist laboratories in implementing a quality improvement process to meet the requirements of the ISO15189 International standard. The Union/GLI roadmap describes requirements for methods, SOPs, equipment, facilities, biosafety, process control, and internal and external controls. The road map includes an electronic implementation guide with links to templates, resources, and checklist questions and which provides step-by-step guidance to address each of the IS15189 elements. The overall process is divided into four phases. Phase 1 is designed to ensure that the primary process operates correctly and safely. Phase 2 is designed to control and assure quality, create traceability. Phase 3 is designed to ensure proper management and organization. Phase 4 is designed to ensure continuous improvement and building up history. At the end of phase 4, the laboratory should be ready to apply for accreditation by an international accrediting agency.

#### How to implement a quality management system—approaches and training packages

T A M Datema, L Oskam, M Engelberts, P R Klatser. Royal Tropical Institute, KIT Biomedical Research, Amsterdam, Netherlands

For implementing a quality management system (QMS) a laboratory can use standards, guidelines and checklists. Standards sum up requirements without providing any guidance; guidelines provide deeper understanding of laboratory processes but do not describe how a QMS should be implemented step-by-step; checklists are useful for assessing progress but generally do not provide guidance either. It should be prevented that every laboratory has to reinvent

the wheel while implementing a QMS. The needs of a laboratory are (besides enough funding and commitment) training and translation of standard requirements into specific prioritized activities. Also provision of tools, templates, background information and example documents are valuable. The WHO–AFRO Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIP-TA) checklist and the Strengthening Laboratory Management Towards Accreditation (SLMTA) training are tailor-made for use by medical laboratories in low/middle income countries (LMIC). However, the SLIP-TA, as a checklist, provides no guidance on implementation. The SLMTA is a training package; suitable for increasing knowledge of quality management but not providing prioritized, step-by-step, guidance on implementing a QMS. For tuberculosis laboratories in LMIC the Global Laboratory Initiative Stepwise Implementation Guide towards TB Laboratory Accreditation provides a solution: this guide contains a translation of the ISO 15189 standard for medical laboratories into specific activities supplemented with descriptions on the why and how of each activity. Links are provided to additional material such as generic documents, software, tools, and background information. All activities are prioritized into four different levels of implementation and within each level a roadmap indicates the ideal sequence of implementing each activity, striving to implement a complete QMS as efficiently as possible. Roll-out of this guide is expected end 2011.

#### Experience with WHO–AFRO accreditation using SLMTA mentoring process in Rwanda

A Umubyeyi Nyaruhirira,<sup>1</sup> S Koblavi Deme,<sup>2</sup> A Murphy,<sup>3</sup> L M Kitty,<sup>3</sup> N Nqobile,<sup>4</sup> D McAlister,<sup>5</sup> K Yao,<sup>6</sup> B Nizeyimana.<sup>7</sup> <sup>1</sup>International Center for AIDS Care and Treatment Programs (ICAP), Global Health Action, Columbia University, Kigali, Rwanda; <sup>2</sup>International Center for AIDS Care and Treatment Programs (ICAP), Global Health Action, Columbia University, Mailman School of Public Health, New York, NY; <sup>3</sup>American Society for Clinical Pathology (ASCP), Chicago, IL, USA; <sup>4</sup>African Field Epidemiology Network (AFENET), Kampala, Uganda; <sup>5</sup>Centers for Disease Control and Prevention, Kigali, Rwanda; <sup>6</sup>Centers for Disease Control and Prevention, International Laboratory Branch, Atlanta, GA, USA; <sup>7</sup>Ministry of Health, Quality Service Delivery, Kigali, Rwanda

**Background:** The WHO–AFRO stepwise scheme that embraces the model of assessment—competency training—implementation of improvement projects, and re-assessment was launched in 2009. It uses a checklist with 12 sections of Quality System Essentials (QSEs) and Strengthening Laboratory Management towards Accreditation (SLMTA), a competency training tool. This past May, Rwanda became the second country to successfully implement and complete the standard SLMTA model: 3 workshops and subsequent supervised improvement projects, which started with 5 central labs in January 2010.

**Aim:** To describe the process, measure achievements,

and discuss lessons learnt from laboratory accreditation activities in 5 laboratories using the WHO–AFRO checklist and the SLMTA mentorship approach.

**Methods:** A baseline assessment was conducted in January 2010 followed by 3 successive workshops and supervised improvement projects. In May 2011 after the completion of the SLMTA process a final scoring assessment was performed.

**Results:** At baseline one lab achieved a compliance level to the checklist above 65% (2 stars). The remaining labs were under 50% (0 star). At the post-SLMTA assessment, 4 labs improved more than 30%, reaching 3 stars for 2 labs (>75%), 2 stars for 2 labs (>65%) and one star for one lab (>55%). Changes have been observed regarding documentation, bio-safety, and stock management. For each lab a gap analysis was done based on partial or non-conformities to reveal facility specific challenges and priorities, and to design sustainable interventions.

**Conclusion:** The stepwise approach recognizes laboratories where they are and tailors a specific support for quality improvement. The SLMTA program has shown team spirit and upper management commitments are crucial to reward progress in the accreditation journey.

## STRATEGIES TO EXPAND AND IMPROVE ACTIVE TUBERCULOSIS CASE FINDING

### Household contact tracing for TB and HIV in South Africa

A E Shapiro,<sup>1,2</sup> M H Rakgokong,<sup>3</sup> R E Chaisson,<sup>1,2</sup> P Modiba,<sup>3</sup> B Luke,<sup>4</sup> J E Golub,<sup>1,2</sup> E Variava,<sup>4,5</sup> N A Martinson.<sup>2,3</sup> <sup>1</sup>Johns Hopkins School of Public Health, Baltimore, MD, <sup>2</sup>Center for TB Research, Johns Hopkins School of Medicine, Baltimore, MD, USA; <sup>3</sup>Perinatal HIV Research Unit, University of the Witwatersrand, Johannesburg, <sup>4</sup>Department of Medicine, Klerksdorp/Tshepong Hospital Complex, North West Department of Health, Klerksdorp, <sup>5</sup>University of the Witwatersrand, Johannesburg, South Africa

**Background:** South Africa has a high prevalence of tuberculosis (TB), HIV, and TB-HIV-coinfected adults in whom TB is often diagnosed late in the course of disease, with resultant high mortality. Improved case-finding approaches for both TB and HIV are needed to reduce mortality and prevent transmission.

**Methods:** Two case-finding studies were conducted in North West Province, South Africa. One enrolled household contacts of 725 newly diagnosed TB patients, the other enrolled 312 randomly-selected control households. Participants were screened for TB using sputum smear and culture and offered voluntary counseling and testing (VCT) for HIV. TB symptom duration prior to enrollment and CD4 T-cell count at the time of HIV diagnosis were assessed. Clinic VCT registers were examined for comparison.

**Results:** Active case-finding detected a prevalence of 6075/100 000 cases of undiagnosed active TB in contacts of known TB cases ( $n = 2843$ ). 19% of contact households had >1 undiagnosed TB case. The prevalence of undetected TB in persons ( $n = 983$ ) from randomly selected control households was 407/100 000, significantly lower ( $P < 0.001$ ). Among TB contacts tested for HIV, 166 (11%) were positive and 76 (14%) of non-contacts tested were positive. The adjusted mean symptom duration prior to TB diagnosis was 4.5 weeks longer in passively-detected TB cases than actively-detected (95% CI 3.1–5.3,  $P < 0.001$ ). Adjusted mean CD4 count at HIV diagnosis was over 200 cells/mm<sup>3</sup> higher among actively-detected compared to passively-detected HIV (95% CI 136–316,  $P < 0.001$ ).

**Conclusions:** Targeted active case-finding in South Africa detects high rates of undiagnosed TB and HIV and is associated with accelerated time to diagnosis. Household contact-based case-finding should be considered to improve case-detection in high-prevalence settings, but sensitive diagnostic tools are necessary.

## TAKING TUBERCULOSIS CONTROL BEYOND THE CLINIC: IMPACT OF HOUSEHOLD AND COMMUNITY INTERVENTIONS IN SOUTHERN AFRICA

### Do we need to go beyond the clinic to control TB?

P Godfrey-Faussett,<sup>1</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup> <sup>1</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>2</sup>ZAMBART Project, Lusaka, Zambia; <sup>3</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa

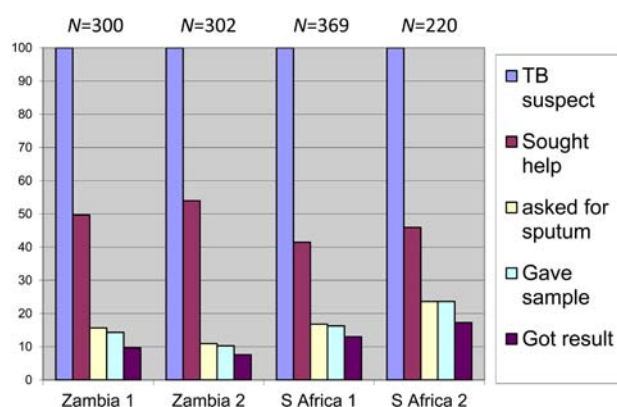
**Background:** We are failing to control the burden of TB in countries with generalised HIV epidemics. The Consortium to Respond Effectively to the AIDS and TB Epidemics (CREATE) was established in 2004 to conduct large scale, community based trials of approaches that used existing tools to reduce this burden.

**Previous studies:** The Zambia and South Africa TB and AIDS reduction (ZAMSTAR) team conducted baseline epidemiological surveys in two communities around Lusaka (see Ayles et al. PLoS One 2009;4(5): e5602) and two around Cape Town. These studies reinforced other studies from the region that demonstrate that there is a large burden of undiagnosed, culture-positive TB in the community.

**Methods:** Adults were randomly selected, based on census enumeration areas. 16481, who consented, were interviewed about health seeking and symptoms and gave a respiratory sample that was cultured in liquid medium for mycobacteria.



**Results:** 41–54% of subjects in the four communities who had been coughing for more than three weeks had sought help at a facility that could request sputum microscopy (see Figure). Those who were subsequently shown to have culture-positive TB or were diagnosed clinically to have TB were more likely to have sought care. At the facility, the majority of TB suspects reported that they had not been asked to provide sputum samples (see Figure).



**Figure** Drop out for TB suspects.

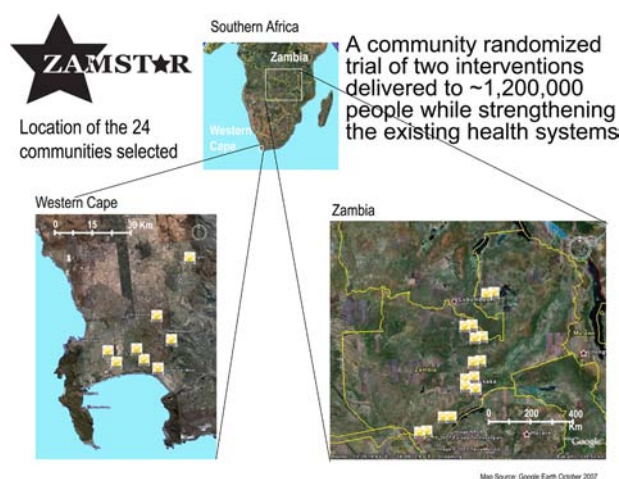
**Conclusions:** Current TB control approaches in these four communities miss many opportunities to interrupt transmission of TB. The ZAMSTAR team developed and tested interventions that could be affordable and acceptable in order to reduce transmission of TB using the then available technologies. The interventions and their impact on TB burden will be described in the following presentations.

### The ZAMSTAR study—community and household interventions to reduce tuberculosis in Zambian and South African communities

H Ayles,<sup>1,2</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup> <sup>1</sup>ZAMBART Project, Lusaka, Zambia; <sup>2</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>3</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa

**Background:** We developed two interventions that take TB control beyond the usual clinic-based approach and tested whether they led to a detectable difference in the epidemiology of TB at community and household level.

**Interventions:** In the Household (HH) intervention, community-based counsellors visited the home of consenting patients newly notified with TB. Over the course of three HH visits, all HH members were encouraged to consider their own risks, to undergo HIV testing and TB symptom screening with referral for microscopy. By encouraging disclosure and support within the HH, we aimed to improve adherence to both TB and HIV treatments and facilitate linkage to existing care services. In the Enhanced Case Finding (ECF) intervention, barriers to sputum submission



were reduced by providing open access services at clinics, as well as sputum collection points in the community. Demand for sputum examination was enhanced by community dramas and engaging with schools, where children acted as agents of change within their own households.

**Outputs:** 9876 households were visited in the HH arm with 33 341 individuals consenting to at least 1 visit. 55% of adult HH members were tested for HIV. 20 630 individuals submitted sputum through the ECF arm (3.5% of the population). 1689/7192 (23%) of all sputum positive cases found in the ECF sites were found via the ECF services.

**Evaluation:** ZAMSTAR used a factorial design and stratified randomisation to allocate 24 communities to either, both or neither intervention arm. Clinics in all 24 communities were supported to implement standard TB-HIV activities more efficiently. The primary endpoint was the difference in the prevalence of culture positive tuberculosis after three years of intervention. Secondary endpoints were measured at the community level (incidence of TB infection) and at the household level (incidence of HIV infection and TB disease and outcomes of TB treatment). These are presented in the following sessions.

### Social context of tuberculosis in the ZAMSTAR communities: large-scale studies in poor countries

M Simwinga,<sup>1,2</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup> <sup>1</sup>ZAMBART Project, Lusaka, Zambia; <sup>2</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>3</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa

**Setting:** The ZAMSTAR study included a population of 1.2 million people across 24 communities in 7 districts in Zambia and 2 in South Africa. These communities were selected as being geographically well defined and served by a particular health centre (or two). Like most communities at high risk from TB and HIV, most people were poor or very poor with major structural impediments and urgent competing



priorities when it came to making decisions about their own or their family's health care.

**Challenge:** Many of the communities had had little exposure to large-scale multi-country research, which raises ethical as well as practical consideration. Many of our large team of research assistants were recruited from the same communities and also had limited research experience.

**Approach:** A social science team conducted an array of broad-brush surveys and more detailed work to understand the social context and the meaning of the ZAMSTAR study for people in the community. We reinforced existing community-based structures to function as community advisory boards (CABs) and arranged a variety of personal development strategies through training and mentoring around research ethics, principles of Good Clinical Practice and salient TB and HIV information for both CAB members and for our staff. The complex trial design, with a restricted, stratified, factorial cluster randomised design was explained to communities through the analogy of the World Cup Football draw (which also includes restriction) at a public ceremony based around a football theme and led by Denis Liwewe, the most famous Zambian sports commentator.

**Outcome:** Despite early fears and misgivings, the communities and the local health system became enthusiastic partners in the process. Misunderstandings of the research process persist, and most were unhappy at the fact that the study was time-limited, as the small local study teams were seen as a major benefit to service provision regardless of the ZAMSTAR interventions.

## Impact of ZAMSTAR interventions on prevalence of culture-positive tuberculosis

M Muyoyeta,<sup>1,2</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup>

<sup>1</sup>ZAMBART Project, Lusaka, Zambia; <sup>2</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>3</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa

**Background:** To measure the impact of the ZAMSTAR interventions on our primary endpoint, we conducted TB prevalence surveys in each of the 24 communities.

**Methods:** Standard enumeration area (SEA)s within the intervention area were listed and sampled in a random order. All adults aged 18 years and over with ability to give informed consent, resident in households within the sampled SEAs were eligible. Households were visited up to three times and data including demographic, socio economic, health seeking for HIV and TB was entered into personal data assistants pre-loaded with questionnaires with built-in range and validity checks. Data was uploaded daily to central servers. All study participants were asked to submit a single respiratory sample for TB culture, which was inoculated into two liquid culture tubes. HIV testing, was also offered to all study participants on an opt out basis.

**Results:** 55 455 households were enumerated. At least one person consented to participate in 48 470 (87%). Of 125 860 eligible individuals in these households, 92 661 (74%) were found at home and consented to participate. After excluding those that leaked, were lost or in which none was submitted, 90 215 respiratory samples were cultured. Men were more likely to be repeatedly absent or not to give consent. 65% of the analysed population were female; the age pyramids were similar to those reported by the censi in both countries; reported HIV status concurred well with that found among those who tested and showed that 12% of men and 19% of women were HIV infected with similar results in both study countries. Mycobacterial identification is ongoing and the prevalence of culture positive *M. tuberculosis*



**Figure** Using Google Earth to define household structures within census SEAs for sampling frame.

and the impact of the ZAMSTAR interventions will be presented.

**Conclusion:** The ZAMSTAR primary outcome involved large population-based surveys of culture positive tuberculosis. A high proportion of the enumerated population who could be found gave consent and a respiratory sample.

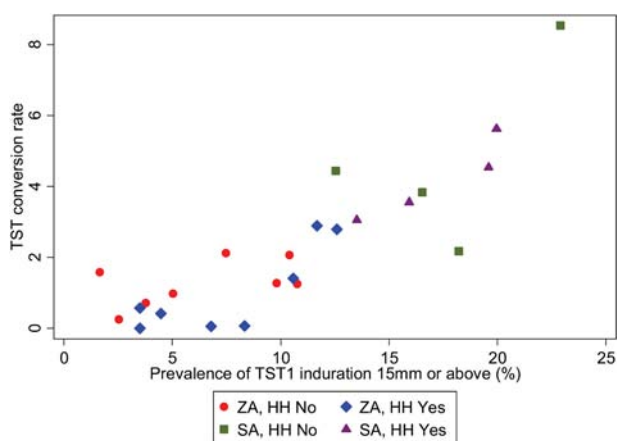
### Impact of ZAMSTAR interventions on transmission of tuberculosis

K Shanaube,<sup>1,2</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup> <sup>1</sup>ZAMBART Project, Lusaka, Zambia; <sup>2</sup>London School of Hygiene & Tropical Medicine, London, UK; <sup>3</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa

**Aim:** To determine whether ZAMSTAR interventions had an impact on transmission of tuberculosis at the community level in 24 ZAMSTAR sites.

**Methods:** With consent from legal guardians and assent from children, tuberculin skin tests (TST) were performed in 21393 school children (grades 1–3; aged 6–11, see Shanaube et al. PlosONE 2009; 4(11): e7749). Four years later, the TST was repeated. Following our analysis plan, we calculated the incidence rate of infection in each community using a strict criterion (0 mm at baseline with a 15 mm or more increase). We compared geometric means of rates between intervention arms and corresponding rate ratios. To calculate adjusted rate ratios, we used Poisson regression to calculate the expected number of children who were newly infected, allowing for age, sex, country and prevalence of infection at baseline. We calculated the ratio of observed to expected infections (O/E) for each community. Geometric means of O/E were compared between arms, with corresponding adjusted rate ratios. Confidence intervals and *P*-values were calculated from an analysis of variance, and *P*-values also from a stratified permutation test.

**Results:** There was considerable variation between communities, (estimated  $k \sim 0.47$ ; see Figure). Incidence of TB infection was strongly correlated with baseline



**Figure** Scatter plot of TST conversion rate (per 100 person-years) against baseline prevalence of TST induration.

prevalence of infection (Spearman rank correlation coefficient 0.85). The geometric means of incidence rates were 0.87 and 1.71 per 100 person-years for communities with and without the household intervention, with an adjusted rate ratio of 0.45 (95%CI 0.20–1.05, *P* = 0.06). Corresponding figures for the Enhanced Case Finding (ECF) intervention were 1.41, 1.05, and 1.36 (95%CI 0.59–3.14, *P* = 0.45).

**Conclusions:** The ZAMSTAR HH intervention is likely to have substantially reduced transmission of TB at the community level, although the variability between communities limits the power of the analysis. The ECF intervention did not show any impact on TB transmission in this study.

### Impact of ZAMSTAR interventions on households

S Sattar,<sup>1</sup> The ZAMSTAR Study Team.<sup>1,2,3</sup> <sup>1</sup>Desmond Tutu Tuberculosis Centre, Stellenbosch University, Tygerberg, South Africa; <sup>2</sup>ZAMBART Project, Lusaka, Zambia; <sup>3</sup>London School of Hygiene & Tropical Medicine, London, UK

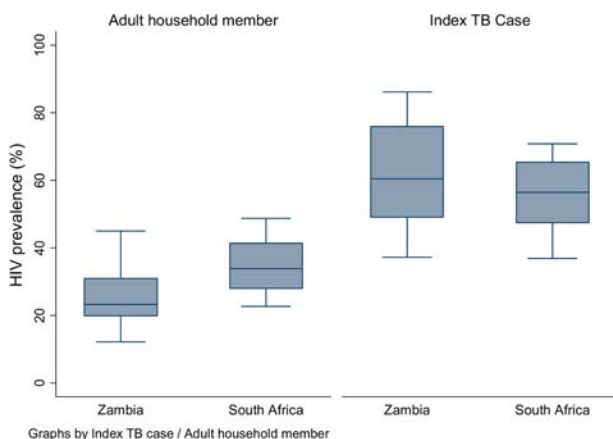
**Background:** The Secondary Outcomes Cohorts (SOCs) were designed to measure the ZAMSTAR interventions' secondary outcomes such as cumulative TB incidence, HIV incidence, and TB treatment outcomes at the household level.

**Methods:** Adult TB cases (pulmonary smear positive, smear negative or extra-pulmonary TB) recorded in the TB register of the community health centre were invited to participate in SOC's along with their household members. All household members were enumerated, however only adults  $\geq 15$  years, and children  $\leq 5$  years were invited to participate. Recruitment occurred in every intervention site, and across all intervention arms, until a cohort of about 350 adults were recruited for participation per community. Consenting participants were visited three times within the 3 year ZAMSTAR intervention time period: initially before the ZAMSTAR interventions occurred, at 18 months into the interventions, and at the end of the 3 year period. Visits involved administration of a questionnaire to all adult participants, blood drawn and sent to central laboratories for HIV testing, and tuberculin skin tests performed on children between 3 months and 5 years old. We compared outcomes in the SOC's in the communities receiving each intervention, with those in communities which did not.

**Results:** 12139 participants were enrolled in SOC's, across all study arms and sites. 6349 of these participants were part of the household intervention arm and 5790 were from the non-household intervention arms. Of participants enrolled 43% were male; 28% were index cases and 80% were adults. The self-reported HIV prevalence in TB index cases was 60%, and 31% in adult household members.

**Conclusions:** Results show a high self-reported





**Figure** Box plot showing distribution of community-level HIV prevalence by country, for index TB cases and their adult household members.

HIV prevalence in index cases, and also their adult household members. HIV prevalence in adult household members was higher than anticipated, which limits the power of the HIV incidence analysis.

## SCALING UP TB-HIV INTEGRATION, TUBERCULOSIS PREVENTION AND CARE FOR PREGNANT WOMEN AND CHILDREN IN HIGH-BURDEN SETTINGS

### TB case finding and diagnosis in HIV-infected pregnant women and children: a review of the evidence

S Modi,<sup>1</sup> M Guevorkian,<sup>1</sup> H Menzies,<sup>2</sup> A Date,<sup>3</sup> E Rivadeneira.<sup>1</sup> <sup>1</sup>Maternal and Child Health Branch, Division of Global HIV/AIDS, Centers for Disease Control and Prevention (CDC), Atlanta, GA, <sup>2</sup>International Research and Programs Branch, Division of Tuberculosis Elimination, CDC, Atlanta, GA, <sup>3</sup>HIV Care and Treatment Branch, Division of Global HIV/AIDS, CDC, Atlanta, GA, USA

**Background:** Early identification and treatment of tuberculosis (TB) disease in HIV-infected pregnant women and children are important to reduce morbidity and mortality among this group. However, data about TB screening among HIV-infected pregnant women and children are lacking.

**Objective:** To assess current approaches and evidence base for TB screening among HIV-infected pregnant women and children.

**Methods:** We conducted a systematic review of published manuscripts and abstracts related to screening for TB among HIV-infected pregnant women, all children, and children with HIV. We reviewed grey literature (including websites of major international conferences and professional societies) and nine electronic databases (including PubMed, Cochrane Library, and Embase) for manuscripts, abstracts, conference proceedings and reports that were published between

January 1, 1980 and May 31, 2011. Search strategies were developed using a combination of subject headings and keywords, including tuberculosis, HIV/AIDS, screening, children, pregnant women. Titles and abstracts were excluded if the subject matter was animal-based research, laboratory-based research, case studies, descriptions of screening for diseases other than tuberculosis, and/or if the language was not English, Spanish or French.

**Results and conclusions:** A total of 26 622 manuscripts and abstracts were identified in the initial database search. After screening titles for relevance, 24 875 (93%) titles were excluded. The remaining 1747 abstracts were reviewed to select full articles for evaluation. Literature review and data abstraction from abstracts and full manuscripts are ongoing. The findings of this systematic review will inform programmatic guidance and future research priorities related to TB screening for HIV-infected pregnant women and children.

### Novel diagnostic modalities for TB diagnosis among children in Cambodia

R Song,<sup>1,2</sup> S Sam,<sup>2</sup> V Cardenas,<sup>3</sup> S Chan,<sup>2</sup> S Khem,<sup>2</sup> B Guillard,<sup>4</sup> S Thim,<sup>2</sup> A Goldfeld.<sup>2,5</sup> <sup>1</sup>Children's Hospital Boston, Boston, MA, USA; <sup>2</sup>Cambodian Health Committee, Phnom Penh, Cambodia; <sup>3</sup>AERAS Global TB Vaccine Foundation, Rockville, MD, USA; <sup>4</sup>Institut Pasteur in Cambodia, Phnom Penh, Cambodia; <sup>5</sup>Harvard Medical School, Boston, MA, USA

**Background:** WHO recommends Xpert MTB/RIF testing for both adults and children, but pediatric data are limited. We sought to determine the utility of Xpert MTB/RIF and the urine lipoarabinomannan (LAM) assay for TB diagnosis among non-hospitalized children in rural Cambodia.

**Methods:** From 07/2010 to 02/2011, children younger than 5 years suspected of having TB were enrolled from 28 outpatient centers and through contact investigation in Svay Rieng Province in Cambodia. Enrolled children underwent physical examination, TST, CXR, and collection of 2 induced sputum (IS), 2 gastric aspirates (GA) and 1 stool for smear microscopy and solid/liquid culture. A child was diagnosed with TB based on microbiological confirmation or standardized clinical case definition. Xpert MTB/RIF testing was performed on all specimens from children diagnosed with TB and from 200 children without TB. Urine LAM was performed on urine from all TB cases and 175 non-TB cases. All TB cases were followed for treatment response and final treatment outcomes were collected.

**Results:** 829 children with a median age of 2.1 years (IQR 1.2–3.4) were enrolled (766 from outpatient centers and 63 through contact investigation). 121 (14.6%) children were diagnosed with TB. Among them, 1 child had two GA positive by both culture and Xpert MTB/RIF; 1 child had positive Xpert MTB/



RIF (GA) with negative cultures. Among TB cases, Xpert MTB/RIF testing on IS and stool was negative. There were no positive Xpert MTB/RIF tests among non-TB cases. Urine LAM was positive in 12/121 children with TB (sensitivity 10%). 147/175 children without TB had negative urine LAM (specificity 84%). All 121 TB cases improved on therapy and completed treatment.

**Conclusion:** TB prevalence among the surveyed children in rural Cambodia was high. Culture yield was low. Xpert MTB/RIF can provide rapid diagnosis using gastric aspirates, but more data from other settings are needed. Urine LAM showed poor test characteristics.

### **HIV-exposed uninfected children: a special risk group needing TB care and intervention**

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Women in their childbearing years have a disproportionately high prevalence of HIV. Vulnerability to co-infection with TB is well known. Improvements in vertical transmission prevention of HIV are eventually leading to reduced numbers of HIV infected infants. The high mortality and morbidity in HIV-infected infants, especially in the first 2 years of life, is increasingly being addressed by early diagnosis and initiation of antiretroviral therapy (ART). Increased mortality and morbidity in HIV-exposed uninfected (HEU) infants is also well recognized. While numbers of HIV-infected infants decrease, the number of HEU infants remains cumulatively large. HIV-infected infants require close monitoring and timely access to ART for their own health and in order to be able to care for their children. There are emerging data on increased susceptibility to severe infections. There is diminished transplacental antibody transfer to young infants for vaccine-preventable diseases. HEU infants are vulnerable to TB due to the mother's HIV status. Both congenital and perinatally acquired TB can occur. There is also probably an increased risk of exposure to TB in the household. In a large recently published INH prevention trial in South Africa, the cumulative prevalence of TB was 7.3% in HEU infants, not that much lower than the 12.6% observed in HIV-infected infants, suggesting a high risk in both groups. Currently, HEU infants that are formula fed are discharged from the PMTCT program from approximately 6 months. Those still receiving breastfeeding and on nevirapine for prevention of vertical transmission are followed for the duration of breastfeeding. Formula fed infants may be more vulnerable to less intensive follow-up.

1 Madhi SA, Nachman S, Violari A, et al. Effect of primary isoniazid prophylaxis against tuberculosis in HIV-exposed children. *N Eng J Med* 2011; 365: 21–31.

## **NATIONAL TUBERCULOSIS PREVALENCE SURVEYS: GLOBAL PROGRESS, RESULTS AND LESSONS LEARNT**

### **National TB prevalence surveys: an overview of global progress, 2008–2011**

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The creation of a WHO Global Task Force on TB Impact Measurement in June 2006 and the Task Force's subsequent definition of nationwide TB prevalence surveys at least 21 global focus countries as one of its three major strategic tracks of work (December 2007) affirmed and reinforced a growing national and international commitment to prevalence surveys. Since December 2007 Prevalence Survey sub-group of the task force has been providing global level coordination of efforts to ensure that necessary guidance, advice and direct technical support are available to countries. As of July 2011, China and Myanmar are finalizing the reports of the survey that completed in 2010; Ethiopia has completed field data collection as the first nation level survey with chest radiogram and culture examinations in Africa since 1960; Laos, Pakistan and Cambodia are on field data collection; Nigeria, Rwanda, and Thailand nearly completed the preparation; Tanzania, Ghana, Kenya, South Africa, Gambia and Malawi are in good shape to go final preparation; and several Asian countries are to prepare repeated surveys by 2015. In this symposium, we will focus recent survey results from China, Myanmar and Ethiopia and discuss what we could learn from their surveys.

### **The first national TB prevalence survey in Ethiopia, 2010–2011: results and lessons learnt**

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**Background:** Ethiopia ranks 7th TB high burden country in the world and third in Africa. The current TB control program performance of the country indicates 36% case detection rate and 84% treatment success rate of smear positive TB. There was no population based TB prevalence study at the national level for the country before this study. The existing estimation of prevalence of TB in the country is based on a number of assumptions even without having a single base line data. This study can give the actual epidemiology of TB in the country.

**Objective:** Estimation of the prevalence of pulmonary TB in Ethiopia in 2010–2011, for evaluation of current performance in case detection and as a baseline measurement for future surveys.

**Methods:** A population based cross-sectional pulmonary tuberculosis prevalence survey was conducted

among adults aged  $\geq 15$  years from October 2010 to June 2011. A multistage stratified cluster sampling was used. In each stage of sampling, we applied probability proportion to size (PPS) sampling. A representative random sample of Kebeles or villages was selected from 85 districts. All eligible individuals were interviewed for symptoms related to tuberculosis and were offered X-ray examination. Sputum samples were collected from all eligible individuals who had abnormal chest X-ray in the lung or mediastinum and or TB symptom. All collected sputum specimens were transported to the central reference laboratory, and examined by FM smear microscopy and solid media culture methods.

**Results:** From the total 85 selected clusters census was done for 19 267 households and a total of 95 084 individuals were registered. Out of the total registered, 51 660 individuals were eligible for screening: male 24 620 (47.7%) and female 27 040 (52.3%). From those eligible for screening 46 733 (90.1%) were screened for symptoms and X-ray examination was performed for 46 474 (90%) individuals. The overall proportion of symptomatic individuals (cough > 14 days) was 6.5%.

### **The national TB prevalence survey in China, 2010: results, evaluation of the impact**

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**Objectives:** To know the prevalence and trends of tuberculosis and assess the impacts of National Tuberculosis Control Programme (2001–2010).

**Method:** The multi-stratified grouping and proportional random sampling method was used for the country as a whole in this survey. Symptom survey and chest X-ray film should be performed for all residents aged 15 years or above to be surveyed. Sputum smear and culture should be performed for all people with suspected pulmonary TB symptoms and/or pulmonary TB lesion or suspected TB lesion as shown by chest X-ray film. All the bacterial strain should be performed DST.

**Result:** The prevalence of active and smear positive were 459/100 000, 66/100 000 respectively. The prevalence of male was much higher than female. The active and smear positive prevalence of pulmonary tuberculosis were 291/100 000 and 44/100 000 respectively in eastern area, 463/100 000 and 60/100 000 respectively in the middle area, 695/100 000 and 105/100 000 respectively in western area. The prevalence of active and smear positive were 569/100 000, 78/100 000 respectively in villages and 307/100 000, 49/100 000 respectively in cities and townships. The MDR-TB rate was 6.8%.

**Conclusion:** As compared with the prevalence in

2010, the prevalence of smear positive pulmonary tuberculosis was declined and as well as in different age group and gender. The prevalence in villages was higher than cities and townships. The prevalence in western area was higher than middle and eastern area. The results of this survey showed that the prevalence of tuberculosis was declined. But the disease burden especially MDR-TB was heavy.

### **COMMUNITY ENGAGEMENT: STRENGTHENING THE EVIDENCE BASE TO SUPPORT PATIENT AND COMMUNITY PERSPECTIVES IN TUBERCULOSIS DRUG RESEARCH**

#### **Research literacy in community engagement programmes**

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**Introduction:** Community engagement (CE) is a critical component of clinical TB drug trials, and education is a priority for ensuring that stakeholders understand, participate in, and ultimately accept clinical research and its outcomes. Low levels of knowledge about TB disease, treatment and research have been identified as challenges to achieving buy-in and trial participation around research sites in Kenya, South Africa and Tanzania. To address this challenge, a research literacy training curriculum was developed and implemented.

**Methods:** The TB Alliance developed a TB Drug Research Literacy Toolkit, aimed at educating community stakeholders about the TB drug research and development process; including the phases of clinical drug trials, criteria for trial participation, ethical conduct and the role of community. The toolkit provides training modules for utilization by CE program staff at the site level. Training-of-Trainer (TOT) workshops were conducted at sites in South Africa, Kenya and Tanzania to familiarize CE staff with the toolkit. Pre- and post-workshop knowledge assessments (KAs) measured the baseline and follow-up knowledge of each trainee group.

**Results:** Trainee groups showed improvement in knowledge when pre- and post-workshop test scores were compared. Scores were higher when individuals attended more than one RL workshop and when they practiced facilitating sessions on their own. TOTs yielded better KA results, and participants retained more knowledge when workshops were held over three days instead of two.

**Conclusion:** Research literacy education can improve community knowledge and therefore increase trust and participation in TB drug trials.

### Strengthening the dialogue between researchers and community stakeholders

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**Introduction:** Phase III clinical trials for the evaluation of novel antituberculosis regimens require a high number of participants willing to complete a 2-year period of drug intake and follow up. Participant recruitment and retention is a major challenge in communities with high TB incidence unfamiliar with the demands of rigorous formal drug evaluation.

**Methods:** In a TB research clinic attached to a community health centre (CHC) in Delft, Cape Town (in 2000 Delft had 92 000 inhabitants) we recently established a community advisory board and set out to investigate how to best engage with key role players to improve participant recruitment. To this end we prospectively observed a consecutive series of 100 adults newly diagnosed with smear positive TB at the CHC.

**Results:** In this pilot series 7% participated, 7% declined, 36% did not qualify, and 50% had either been put on treatment by CHC staff (16%) or not been referred to or contacted by research staff (34%).

**Conclusion:** Between the key role players of community members, health care providers and research staff the most potential for improving trial participation lies in the relationship between researchers and health care providers. This is currently being addressed with presentations at clinics and strengthening of channels of communication. The results of an ongoing follow-up investigation will be presented.

### Working with local and regional NGOs to raise awareness

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**Background:** Tuberculosis (TB) is a relatively new priority to local and regional NGOs in Eastern Africa that have in the past focused on HIV/AIDS, poverty, human rights and other socio-economic issues. This shift is being influenced in part by HIV activists who have personal experience with TB disease, and are encouraging their organizations to lead a community response to TB. Historically, interventions to reduce and treat TB have been centred within public health service facilities, based on a medical model that focused solely on TB as a medical issue, relegating communities as mere consumers of TB services but not key partners in addressing the epidemic.

**Methods:** New partnerships and approaches to curb the TB epidemic in the East Africa region are being forged among TB-HIV activists as individuals, and with local and regional NGOs that are incorporating TB into their missions of reducing disease bur-

den, increasing access to treatment, and encouraging new and innovative scientific responses to disease that affected communities can participate in and benefit from.

**Results:** Though the number of TB activists is still few in the region, commendable strides have been made in converting HIV and human rights activism into TB activism leading to an increased number of HIV/AIDS and human rights focused NGOs adding TB programming to their community-based health and human rights portfolios in response to the needs of local populations.

**Conclusion:** There are working links between national TB programs (NTPs), Ministries of Public Health and Medical Services, international partners/donors, TB and HIV research institutions, academic institutions, affected communities and local and regional NGOs. These groups are collectively exploring policy and programmatic opportunities to address these interlinked problems through an integrated partnership approach in raising awareness about TB.

### Incorporating community feedback into clinical research

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Community engagement is central to the conduct of clinical research. Stakeholder consultation and community advisory groups have an important role to play in providing a community perspective with respect to: developing the protocol, participant information sheet, consent form and recruitment and retention strategies; and managing concerns around serious adverse events; and providing feedback to the community.

The Thibela TB study, which is a cluster randomised trial of community-wide isoniazid preventive therapy (IPT) in controlling TB in a high HIV prevalent setting, is an excellent example of how the community can contribute to clinical research. The Thibela TB study was conducted among 80 000 gold miners in South Africa working in 20 mine shafts in three provinces. Community engagement was central to the successful implementation of this large phase IV trial.

Input from the community was achieved through stakeholder consultation, establishing provincial community advisory groups, shaft advisory groups and participant focus groups. The study community mobilisation team in each province established a strong relationship of trust with each of the advisory groups and maintained constant communication with them.

Community input was essential in developing the protocol, establishing a strong brand for the study, identifying communication strategies and key messages, developing successful recruitment and retention

strategies, responding to rumours and serious adverse events and managing conflict with other national and local stakeholders. As a result of the communities input we were able to enrol 27 861 participants and start 24 221 participants on IPT, the largest number of participants enrolled into a trial of IPT ever.

### Engaging community and stakeholders in the Critical Path to TB Drug Regimens (CPTR) Initiative

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**Introduction:** For the first time, pharmaceutical companies, civil society and regulatory officials are joining forces to address the urgent need to develop new combination drug regimens for TB. The partnership called the Critical Path to TB Drug Regimens (CPTR) will work together to test promising TB drug candidates in combination. CPTR has three arms; Regulatory Science Consortium, Drugs Development Coalition and Research Resources Group. Research resources has 5 working groups that includes stakeholder and community engagement.

**Methods:** Stakeholder and community engagement working group (WG) held an introductory meeting to come up with mission statement, established operational structures and performed a community engagement assessment using a standard questionnaire that was sent via email to document implementation by CPTR partner organizations.

**Results:** Mission is to provide direction on effective community engagement. Inaugural meeting recognized interdependencies with other working groups and arms. An interim chair was selected and WG agreed to use monthly teleconferences for updates. Out of forty (40) partner organizations targeted using existing networks, 18 (18) completed questionnaire, 11 are pending and 10 did not respond. Solid 'emerging themes' and next steps were concretized during the evaluation.

**Conclusion:** Ongoing stakeholder and community engagement is critical for the success of CPTR initiative. Community engagement and stakeholder WG will aid cross-pollination of ideas utilized in partner organizations to strengthen co-dependencies.

### Patient impact of shortened regimens

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**Background:** Shortened (4 month) regimens for TB are currently being tested in Phase 3 clinical trials. Much of the benefit from these shortened regimens would accrue to the patients themselves, but a recent TB Alliance study confirmed that patient voices were rarely heard in the past decision making processes around TB regimen change. The TB Alliance is keen to ensure that a strong evidence base exists to support patient concerns, as this will facilitate the increased input of patients into regimen decision making.

**Aim:** To understand and document the impact of current TB treatment on the lives of patients, and thus assess the potential impact of shorter regimens on patients. Outputs will include patient narratives, patient opinions, data on timing of default and initial guidance on patient costs that will be relevant to subsequent cost-benefit analyses.

**Methods:** The study is being undertaken in Tanzania and Bangladesh. The research tools include focus group discussions, review of treatment registers, in depth patient interviews and a patient cost questionnaire.

**Results:** Interim results to be presented during presentation.

## INHALATION APPROACHES TO TUBERCULOSIS AND OTHER LUNG INFECTIONS

### Inhaled capreomycin for MDR-TB: preclinical results

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**Objective:** The use of a single daily dose of inhaled capreomycin for TB treatment in the guinea pig model of TB was previously reported with modest positive effects on the extent of infection, possibly due to a dosing regimen that resulted in insufficient time of exposure to therapeutic systemic and local levels of drug between doses.

**Methods:** In order to define an appropriate time interval to achieve therapeutic capreomycin levels during the treatment period, the present study investigated



the disposition of capreomycin powders after multiple pulmonary administrations of 20 mg/kg doses.

**Results:** Capreomycin concentrations in animals receiving single, double or triple doses of capreomycin powder for inhalation were significantly higher (50–100-fold) in BAL and lung tissue compared to plasma concentrations, or those observed for animals receiving capreomycin solution by IM injection (10–100-fold higher). Moreover, local capreomycin concentrations were approximately 100-fold higher than those in plasma at the end of each dosing period and several-fold higher than MIC, which suggests that sufficient capreomycin remains in the lungs to kill mycobacteria. Capreomycin did not accumulate in lung or BAL after 3 doses of powder delivered by the pulmonary route.

**Conclusions:** These results suggest that a dose of 20 mg/kg capreomycin powders for inhalation administered three times a day could be an effective and safe dosing regimen for the treatment of MDR-TB.

### Inhaled capreomycin for MDR-TB: clinical results

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**Background:** Multidrug resistant pulmonary tuberculosis (MDR-TB) treatment includes several medications given by intramuscular injection in systemically toxic, high doses to achieve therapeutic levels. Advances in inhaled drug delivery science, however, now allow delivery of high concentrations of medication directly to the lungs, the most common site of TB infection, potentially reducing unwanted systemic exposure and painful injections. A dry powder form of capreomycin for inhalation now exists, with pre-clinical results showing efficacy.

**Aim/methods:** In this phase I clinical study in 20 healthy adult volunteers ( $n = 5$  per group) who self administered a single dose of inhaled capreomycin (25 mg, 75 mg, 150 mg, or 300 mg nominal dose) using a handheld inhaler, we evaluated the drug's safety, tolerability, and systemic pharmacokinetics.

**Results:** Capreomycin was rapidly absorbed after inhalation, with systemic levels detected in each dose group within 20 minutes. Peak and mean plasma concentrations of capreomycin were dose proportional. Serum concentrations exceeded 2  $\mu\text{g}/\text{mL}$  (minimal inhibitory concentration for *M. tuberculosis*) following the highest dose (300 mg), and  $t_{1/2}$  was  $4.8 \pm 1.0$  hours. The most common adverse event was cough, reported in 5 subjects. There were no changes in lung function, hearing, or other clinical laboratory variables, nor any serious or severe adverse events.

**Conclusion:** A novel inhaled dry powder formula-

tion of capreomycin rapidly achieved serum drug concentrations above the MIC for *M. tuberculosis* after a single 300 mg dose and was well tolerated. The results suggest potential for this inhaled drug as part of an MDR-TB treatment regimen.

### SMOKING CESSATION AND SMOKEFREE ENVIRONMENTS FOR TUBERCULOSIS PATIENTS: LESSONS LEARNT FROM THE FIELD

#### The Union's Guide on 'Smoking Cessation and Smokefree Environments for Tuberculosis Patients'

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Smoking increases the risk of tuberculosis infection and tuberculosis disease. This is why helping TB patients to quit smoking or never become a smoker will help to control tuberculosis in the community. This Guide describes how to make TB services 100% tobacco-free, then presents 'ABC for TB' (Ask, give Brief advice, provide Cessation support), an intervention for TB programmes to help patients quit smoking and to promote smokefree homes for patients and families. It advocates keeping smoking cessation simple, expanding it widely through the health services and reaching communities. 'ABC for TB' does not require specialised staff, clinics or medicines. It is delivered systematically within routine TB programme activities and can be done within as little as 2–5 minutes. It includes recording and monitoring processes and outcomes. The Guide thus proposes a way for TB programmes to work in healthier environments, project strong public health messages about tobacco to patients, communities and other health services, and make a significant contribution to the prevention and control of both tuberculosis and tobacco. It is hoped that experience and evidence gained from pilots of the Union Guide will serve TB programmes in other countries, as well as other health programmes, so that progressively all health services will have implemented 100% smoke- and tobacco-free healthcare policies and will have incorporated cessation within routine systems and activities.

#### Overview of implementation of 'Smoking Cessation and Smokefree Environments' for tuberculosis patients

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**Background:** Poverty, HIV infection and tobacco use are the main determinants for tuberculosis. Exposure to tobacco smoke, either active or passive, have

important impact on both epidemiologic and clinic aspects of tuberculosis. Smoking cessation for TB patients is crucial to make effective TB treatment.

The Union Guide 2010 describes how to make TB services 100% tobacco-free, then presents 'ABC for TB' (Ask, give Brief advice, provide Cessation support). The Union Guide provides a wider guidance to create a smoke-free health care, establish tobacco cessations and finally leads to make a smoke-free home of the patients. The broader objective of the guidelines is to build a consolidate efforts for TB and tobacco control by engaging health professionals, policy makers and community at large.

Key steps of the implementation are i) commitment of the organization; ii) create 100% smoke-free health care; iii) establish ABC services (adoption of the guide, training, develop posters, leaflet, record and reports); iv) create smoke-free home and v) monitoring and evaluation.

Working group members from 19 countries of 30 government and non-government organizations have shown willingness and commitment to implement the Union Guide. Countries such as India, China, Bangladesh, Indonesia, Nepal and Brazil are at different stages of implementation. NTP officials from Sudan, Benin, Thailand, Cambodia, and Mongolia have expressed their interest to implement. Preliminary results of the implementation will be presented by the working group members.

**Conclusion:** ABC approach would strengthen TB and Tobacco Control through active engagement of health providers, patients and family members.

### Testing the Guide through a research protocol in India

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**Introduction:** Several studies in India already show high prevalence of tobacco use among TB patients and the WHO and Union monograph (2004) recommends that national TB programmes routinely identify tobacco users among TB patients and provide them support to quit. The Union has additionally developed guidelines for NTPs to integrate tobacco cessation interventions for TB patients within NTPs (2008, 2010). In 2010, the Revised National Tuberculosis Control Programme (RNTCP) and the National Tobacco Control Programme (NTCP) coordinated to discuss the potential to introduce tobacco cessation within the RNTCP.

**Description:** A concept paper on 'Tobacco Cessation Intervention for Tuberculosis Patients' was developed using the Union Guide 2008. Stakeholder consultations were coordinated and two districts which were part of the pilot phase of the NTCP were identified for the implementation as the RNTCP is already implemented across the country. All TB patients regis-

tered in the 4th quarter of 2010 in the districts of Kamrup (Assam) and Vadodara (Gujarat) were routinely asked about their tobacco use at the time of registration for treatment. Patients identified to be tobacco users were offered basic support to quit during the course of their treatment.

**Results:** Enrolled smoking patients between October–December 2010 are being followed up for 12 months and outcome of these TB patients will be evaluated as per the guidelines of RNTCP. The findings will be presented in the conference.

**Conclusions:** Introducing tobacco cessation into TB programmes is feasible and can be coordinated in a simple and cost effective way that is carefully monitored. While the information provided in the guide is simple, there is need to adapt it to local context. It was also felt that information collected by the TB programme could be simplified to include only the most important data—more detailed information on tobacco use could be collected by the NTCP.

### Smoking cessation and smokefree environments for tuberculosis patients in Brazil

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**Introduction:** In Brazil, there are national guidelines from the National Tobacco Control Program (NTCP) and also from the National Tuberculosis Program (NTP) regarding smoking among the tuberculosis (TB) patients. The International Union Against Tuberculosis and Lung Diseases (IUATLD) issued in 2010 a revised version of the Smoking Cessation and Smokefree Environments guide. At the end of 2010, the NTP and the Union agreed in collaborating to adapt and pilot the Union Guide in Brazil.

**Objective:** To adapt the Union Guide for the Brazilian context, to document that health facilities in Brazil are smokefree, as established by law, and to promote smoking cessation among TB patients in selected health units in the state of São Paulo.

**Methods:** The three main guides (NTCP, NTP and IUATLD) were analyzed, compared and an adapted version was produced. Seven municipalities were selected for the activity. We visited the sites to assess their smokefree status and prior training of the staff on smoking cessation. The intervention was started in those where training had taken place (two out of seven). We analyzed the curriculum of the course offered by the State Tobacco Control Program (STCP) and complemented the training accordingly. For the other five municipalities we are going to provide, in

September of 2011, a complete training, developed in partnership with the STCP.

**Results:** The two health facilities deemed eligible for the study were certified as smokefree after the initial evaluation. Both of them started to apply the adapted approach to every TB patient in June of 2011.

**Conclusions:** Studies sites, as well as the TB and tobacco programs, have been receptive to the proposed approach. We believe that expansion of this intervention is feasible and sustainable considering its effectiveness gets proven by the end of this process. The next step will be to scale up this approach to other regions and eventually incorporate it into national guidelines.

### Tobacco cessation and smokefree environments for tuberculosis patients in Bangladesh

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**Background:** In Bangladesh, about 44.7% of men and 1.5% of women currently smoke tobacco. Tobacco smoking is an important risk factor for TB and also contributes to poor treatment outcomes including increased mortality. BRAC is an NGO implementing community based TB control programme in two-thirds of country with the guidance and support of National TB Control Programme.

**Objectives:** To identify current smokers among TB patients and support them to quit smoking and to promote smokefree health care facilities using the guidelines developed by the International Union Against Tuberculosis and Lung Disease (The Union).

**Methodology:** BRAC Dhaka urban TB control programme staff was trained on tobacco control on the harmfulness of smoking, second-hand smoking and its impact on TB, introduce counseling methods and documentations using the Union smoking cessation and smokefree environments for tuberculosis patients guideline. The Union tools were translated in Bangla and shared with staff. Counseling for smoking session is given to patients during the initiation of treatment and subsequent visits to TB centre. The pilot phase started in 17 Dhaka city peri-urban TB centers that covers about 2.8 million population.

**Results:** Since May 8, 2011, a total of 322 patients were enrolled. Out of 322 patients, 170 (52.8%) were male and 152 (47.2%) were female. 50 (29.4%) out of 170 males and 3 (2%) out of 152 females were current smokers. All these 17 health were declared as smokefree and non-smoking signage is placed at the entrance of centre.

**Conclusion:** The study indicates the need to declare facilities as smoke free before initiating smoking cessation counseling. We also need to include smokeless tobacco as 27.9% women use smokeless tobacco in Bangladesh. Detail results will be available after the pilot phase and the intervention will be expanded to other areas.

### Smoking cessation and smokefree environments for tuberculosis patients in China

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**Background:** Association between tobacco smoking and TB has been well documented. Smoking increases susceptibility of TB infection and progression to active TB disease. Among TB patients, smokers are more likely to have prolonged period of smear conversion, relapse and require retreatment after completing their initial course of treatment compared to non-smokers. However, cessation intervention is not on the National TB Program for most countries. To address this problem, the International Union Against Tuberculosis and Lung Disease (The Union) published a guideline, Smoking Cessation and Smokefree Environments for Tuberculosis Patients, in 2008 and updated in 2010. The Union began piloting the guide in Ningdu and Xingguo Counties in Jiangxi Province from March 2010.

**Methods:** The TB doctors received 3 hours training on why smokefree, cessation intervention, recording and reporting. Smoking status was accessed and willingness of quit was asked at the time of confirmed TB diagnosis. TB doctors gave brief advice on harmful health effect of smoking and asked their smoking status at each of patient visit during entire course of treatment.

**Results:** From 1 March to 31 August 2010, 389 and 413 confirmed TB cases were registered in Ningdu and Xingguo respectively. Of the TB cases, number of current smokers was 103 in Ningdu and 141 in Xingguo; of which, 102 in Ningdu and 131 in Xingguo were willing to quit smoking. Among the patients who are willing to quit, the number of quit smoking for at least 3 months were 76 in Ningdu and 98 in Xingguo respectively. There is no significant difference on quitting rate between patients with different clinical presentations. However, the number of patients who quit smoking for at least 3 months was significantly more than that quitting by themselves before the intervention.

**Conclusions:** Brief advice at each patient visit is effective way of cessation intervention for TB patients.

### Smoking cessation and smokefree environments for tuberculosis patients in Indonesia

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**Background:** Tobacco smoke causes cancer, cardiovascular diseases and lung diseases including tuberculosis. Tuberculosis patients who smoke are on greater risk to get severity of disease, to get relapsed and failure from TB treatment. TB and tobacco epidemic kill thousands of people in Indonesia every year. Tobacco cessation would improve tuberculosis treatment.

**Method:** The Union ABC approach (Ask, Brief advice, Cessation support) is being implemented for tuberculosis in 24 health centres in Bogor City. Patients' recruitment was started since April 2011. ABC services are provided in every visit of the patients in the health centre. Patients are advised to make their home smoke-free. Patients detail information is kept on ABC register and card.

**Results:** ABC intervention is being piloted in 24 health centres by creating 100% tobacco free health care. DOT provider and health promotion staff were trained. No smoking signage, poster and leaflet were developed and distributed. About 200 patients were already recruited and they are under TB treatment and ABC intervention.

**Conclusion:** Health staff found ABC is a simple approach to create public awareness on danger of tobacco smoking among health providers, patients and family members.

### FROM SURVEY TO ACTION: COPD IN LOW- AND MIDDLE-INCOME COUNTRIES

#### The treatment gap for 'essential respiratory medications' in low and middle income countries

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**Background:** Inhaled beclomethasone and salbutamol are three to five times as expensive in poor as in rich settings, resulting in less use (Ait-Khaled N, 2006). We describe differences in use of bronchodilators or inhaled corticosteroids ('essential respiratory medicines') and factors associated with their use among 20 BOLD sites.

**Methods:** Reported use of 'essential respiratory medicines' in the last year was assessed among population samples of adults aged 40+ with and without spirometrically defined COPD. Factors associated with their use were examined by univariate analyses

and multiple logistic regression models fitted separately for each site. Results for each factor were subsequently pooled across sites and across high income countries (HIC) and low and middle income countries (LMIC) and meta-analysed.

**Results:** 'Essential medication' use was higher in HIC than in LMIC, in people with COPD than in those without COPD ( $P < 0.0001$ ) and in countries with higher GNP per capita. Differences were not related to COPD prevalence, nor to reported doctor-diagnosed asthma. Use of 'essential medication' was increased with unemployment due to breathing problems (OR 6.00 95%CI 3.57–10.11), BMI  $\geq 25$  (OR 1.36 95%CI 1.08–1.71), COPD stage  $\geq 3$  (OR 24.10 95%CI 12.89–45.05), response to salbutamol (OR 4.23 95%CI 3.10–5.77), co-morbidities (OR 1.27 95%CI 1.05–1.54) and respiratory symptoms (OR 6.14 95%CI 4.44–8.50), and was lower in males (OR 0.72 95%CI 0.60–0.86) and those aged 60–69 (OR 0.69 95%CI 0.53–0.89). Similar trends for these effect estimates were seen in HIC and LMIC. Overall effects did not vary across sites except for the effects of COPD stage  $\geq 3$  ( $I^2 = 61.3\%$ ,  $P = 0.001$ ) and respiratory symptoms ( $I^2 = 55.2\%$ ,  $P = 0.003$ ).

**Conclusion:** The use of 'essential respiratory medication' is higher in HIC than in LMIC. Improving access to care in LMICs is important, as is understanding factors affecting low uptake.

#### Experiences of COPD in the Practical Approach to Lung Health (PAL)

N Ait-Khaled. The Union, Paris, France

The Practical Approach to Lung Health (PAL) is a patient-centred approach to improve the quality of diagnosis and treatment of common respiratory illnesses including COPD in the primary health care (PHC) setting. It seeks to standardize service delivery through development and implementation of clinical guidelines and managerial support within the district health system. Suspected COPD are identified at peripheral level of the district and are referred to first referral level for confirmation by spirometry and treatment prescription. Essential drugs identified are bronchodilators (usually salbutamol and ipratropium bromide) and inhaled steroids. Prevention is based on smoking cessation. Presently, there are more than 50 countries worldwide at different stages of the PAL development process and several of them received financial support by Global Fund. Data from a published feasibility study conducted in 9 countries identified that 80 to 90% of all patients presenting at primary health care settings for respiratory symptoms are diagnosed with acute respiratory infections. When considering chronic respiratory diseases, chronic obstructive pulmonary disease (COPD) and asthma are the top two, with COPD representing an average of 5% of all patients.



These data also suggest that PAL is likely to:

- i improve quality of care of acute and chronic respiratory patients at first level health facilities;
- ii reduce unwarranted drug prescription, particularly antibiotics, systemic bronchodilators and adjuvant drugs;
- iii significantly increase the use of inhaled bronchodilators and inhaled steroids;
- iv reduce the total cost of prescriptions per patient; and
- v significantly increase TB case detection in some situations.

### Indoor air pollution and management of COPD

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IAP, a physical, chemical and biological contamination of indoor air, is a silent, deadly and hidden unreported killer. Primary source of IAP in the developing world is burning of biomass fuel for cooking, heating and lighting. IAP alone and also supplemented by tobacco smoking leads to increased incidence of COPD which kills one person every 10 seconds—1.6 mn every year. 90% of COPD deaths occur in low and middle income countries on account of cumulative effect of fumes from burning biomass with an additive effect from simultaneous smoking in unventilated kitchens. Major target are the females who are responsible for cooking and the children who normally remain clung to their mothers. IAP is a grossly neglected area from both public health and clinical perspectives. Number of people using biomass fuels is likely to increase from 2.4 bn to 2.63 bn by 2030 and presently 2 bn tobacco consumers are also increasing at an alarming pace. Unchecked, COPD may become the 3rd leading cause of global deaths by 2030. Although IAP is more lethal than tobacco smoking, global priority to IAP control is practically negligible even to tobacco control. Focus has largely been on public health impacts of air pollution especially in high income countries. To reduce IAP afflicted morbidity and mortality, focused and sustained advocacy evoking multisectoral response by sharing consequences of IAP is urgently required. Community awareness and lung health promotion relating to IAP needs to be promoted. Empowering community in post hospitalization rehabilitation of COPD patients will be a low cost high gain sustainable intervention. Partnering with NGO's and other market players, social marketing of improved cooking and heating devices to control IAP needs to be taken as a priority area. Programmes targeting families against IAP and adolescents against smoking will arrest COPD. Sharing best practices will accelerate efforts combating IAP and eventually COPD.

## CLINICAL TRIALS OF NEW DRUGS AND REGIMENS FOR MDR- AND XDR-TB

### EBA study of PA-824 with companion drugs

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**Background:** The novel nitroimidazo-oxazine, PA-824 (Pa), in combination with the 8-methoxy fluoroquinolone, moxifloxacin (M), and the first-line TB drug, pyrazinamide (Z), has previously shown substantial efficacy and treatment-shortening potential in a mouse model of TB. Pa, M and Z have each shown early bactericidal activity (EBA) over 14 days in phase 2 trials in TB patients. Z has strong sterilizing antimycobacterial properties. We are reporting preliminary results of a combination EBA study aimed at evaluating the potential of the 3-drug combination, PaMZ, to shorten and simplify treatment of both MDR and drug-sensitive (DS) pulmonary TB.

**Methods:** Patients received either daily dosages of Pa 200 mg, Z 20–30 mg/kg and M 400 mg ( $n = 15$ ) or daily standard TB treatment (HRZE) as positive control ( $n = 8$ ). The primary efficacy endpoint was the change in number of colony forming units (CFU) per day of *M. tuberculosis* incubated on agar plates from serial overnight sputum collections over 14 days, analyzed with bi-linear regression and expressed as decrease in logCFU/d/ml sputum  $\pm$  D (termed EBA0-14). Safety and tolerability were also assessed.

**Results:** 27% and 50% of patients were female, in the PaMZ and HRZE arms, respectively. Mean age was 30 years and 28 years, respectively. The EBA0-14 of HRZE was biphasic and of the expected magnitude relative to previous studies ( $0.161 \pm 0.088$  logCFU/d/ml sputum  $\pm$  SD). The EBA0-14 of PaMZ was similar to that of HRZE. The regimens appeared safe and well-tolerated. Various 2-drug combinations were also evaluated. Final data will be presented.

**Conclusions:** The 3-drug combination, PaMZ, has the potential to treat both MDR (since it contains neither H nor R) and DS TB with efficacy similar to HRZE, and should be compatible with ART. A mouse model accurately predicted the relative activities of PaMZ and HRZE in the first two weeks of TB treatment. This regimen deserves further evaluation in late stage clinical trials.

### Phase 2 open-label trial of TMC207 in an MDR-TB treatment regimen

M Haxaire-Theeuwes and the TMC207 Team,<sup>1</sup> A H Diacon,<sup>2</sup> A Pym,<sup>3</sup> M Grobusch,<sup>4</sup> S Tang,<sup>5</sup> N Chu,<sup>6</sup> V Lemaire,<sup>7</sup> L Qiu.<sup>8</sup> <sup>1</sup>Tibotec, Titusville, NJ, USA; <sup>2</sup>Tiervlei Trial Center, Karl Bremer Hospital, Capetown, <sup>3</sup>Unit for Clinical and Biomedical Research, Medical Research Council, Durban, <sup>4</sup>Sizwe Hospital, Sandringham, South Africa; <sup>5</sup>Shanghai Pulmonary Hospital, Shanghai, <sup>6</sup>Beijing Chest Hospital, Beijing, China; <sup>7</sup>State Agency Infectology Centre of Latvia, Clinic of TB and Lung Disease, Riga District, Latvia; <sup>8</sup>Shandong Provincial Chest Hospital, TB Department, Jinan, China

TMC207 (bedaquiline) is the first investigational drug in a new class (diarylquinoline) of anti-tuberculosis (TB) drugs to inhibit mycobacterial ATP synthase. It has demonstrated activity against both drug-sensitive (DS) and multidrug-resistant (MDR) TB. It has potent late bactericidal and sterilizing properties in the established murine TB model. A Phase II, single arm, multicenter open label trial was undertaken to evaluate the safety, tolerability and efficacy of TMC207 as part of a multi-drug regimen in the treatment of patients with MDR-TB. TMC207 was administered for 24 weeks in addition to an individualized background regimen (BR) of antibacterial drugs used in the treatment of TB according to National TB Program (NTP) treatment guidelines. Upon completion of dosing with TMC207, subjects continued to receive BR according to the NTP guidelines and will be followed up in the trial for 24 months after the last dose of TMC207. The primary outcome variable is time to sputum culture conversion during the first 24 weeks in the mITT population (ITT population excluding DS TB patients and subjects with a negative culture at screening and/or baseline). 294 subjects were screened of which 233 were entered and received at least one dose of TMC207 (ITT). The primary study population (mITT) included 205 subjects of which the majority were males (64%), Asian (41%), had previous exposure to second-line drugs (86%) and a median age of 32 years. The proportions of subjects categorized as MDR-TB, pre-XDR-TB and XDR-TB were 54%, 25% and 21% respectively. The majority of patients had cavitarian disease (66%). In total 13% of the patients discontinued the study for both populations (ITT and mITT), primarily for adverse events/MDR-TB related events or withdrawal of consent. In this symposium we will present preliminary data from a planned 24-week interim analysis of this trial.

### Scale-up of MDR-TB treatment

E Gardiner. Market Access, TB Alliance, New York, NY, USA

New TB regimens offer unprecedented opportunity in TB treatment. The lower cost of the new drugs compared to current MDR treatments along with improved efficacy, reduction in side effects, and ease of use make scale up an imaginable reality. The ability

to treat both MDR- and DS-TB with the same regimen helps to overcome market size limitations faced by drugs that only treat MDR-TB. Nonetheless, challenges with pricing as well as TB diagnosis and drug sensitivity testing remain. Partnerships not only for drug development but also for delivery are needed to make scale up of novel regimens a reality.

## PATIENTS AS PARTNERS

### Empowering patients to become equal partners in care: the experience of community-based organisations

M Banda. Paradiso House, Lilongwe, Malawi

The number of people with TB infection continues to grow in Malawi as in many other African Countries due to the TB-HIV co-infection. Unlike in the HIV/AIDS specific programmes, there is little collaboration between formal health sector and community based organizations in the fight against TB. Paradiso House Community Based Organization is a Malawian registered entity with a goal of empowering people with HIV/AIDS through sharing of experiences on how to manage opportunistic diseases and stigma from the community and later encompassed empowerment of TB patients because of its relationship with HIV/AIDS. Paradiso has also grown to encompass other activities to support empowerment of TB and co-infected patients like implementation of IGAs. Through volunteers most of who were supported during treatment themselves and offer their voluntary services to support TB and HIV/AIDS activities; they mobilize other former TB patients through door-to-door patient visits, conduct community meetings and act as a link with the formal health sector through referrals between hospitals and Paradiso. An active interaction between these players significantly help TB patients to complete their treatment, trace defaulters and bring them back on board and also institute early testing for TB through community outreach meetings. By involving community organizations the formal health sector begin to have social representation (opinion leaders—chiefs and others) that are willing to identify those who are presenting signs and symptoms of TB and bring them forward for treatment. TB is demystified through personal testimonies and patients are encouraged to be open about their disease.

### Empowering patients to become equal partners in care: the experience of community-based organisations

G Mukumbuta Chembo, M Mette Klouman, M Mara Banda. Health: Copperbelt Health Education Project (CHEP), Kitwe, Copperbelt Province, Zambia

**Background:** Copperbelt Health Education Project in collaboration with Zambian Ministry of Health supported by Norwegian Lung and heart Patient Organization has promoted DOTS program through health communication strategy in targeted areas of Copperbelt province to empower TB patients in accessing benefits at individual, community and health care levels.

**Objective:** To help care providers understand importance of empowering TB patients to participate in their own care and management and allow them to discover effective ways to improve TB programmes.

**Methodology:** The program uses a capacity building technique and communication tools to empower TB patients with knowledge and skill to participate in their own TB management and to help improve delivery of good quality care.

**Results:** Program has increased understanding of TB and provides benefits at three levels:

- 1 Patient's level: Patient's wellbeing improves recovery, their coping capabilities increase active participation in management of their treatment contrary to passive way of management and patients now know what to do and what not.
- 2 Community level: Patients' family members benefit by actively participating in patients care. They help in TB prevention hence develop coping skills to deal with challenges. Patients and treatment supporters become good teachers since they are living examples of TB and stigma management therefore giving TB a human face that deals with stigma reduction and improve case detection.
- 3 Health Care System level: Increased case finding, access to health services leading to better treatment outcomes have been evidenced.

**Conclusion:** TB-patient empowerment, reduces burden of TB in communities and prolongs life.

### The use of health communication as a tool to strengthen partnership with patients

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LHL has together with partner countries developed tools for improving communication between health care providers and patients to contribute to better treatment outcomes. The tools are training in basic communications skills for health care workers and treatment supporters, as well as booklets developed together with patients based on their needs for information about tuberculosis. Impact studies shows

remarkable results: patients feel empowered due to increased understanding and knowledge about TB and how to cope with the disease. This in turn benefits the community as the patients are able to give TB a face by being open and sharing information. Increased dialogue about the disease helps to decrease stigma. Knowledgeable patients are a resource as they can help identify new cases, encourage adherence to treatment which leads to better treatment outcomes. The patient booklets 'I will be cured of TB' and training in basic health communication contribute to increased cooperation and respect between the parties (patients, treatment supporters and health care workers). Health care workers and treatment supporters report that the tools in health communication have increased their understanding, knowledge and confidence in the work they do. Health communication is a tool to empower the different stakeholders in TB control Mukikute is a patient organization in Tanzania. They have trained treatment supporters in how to use the booklets 'I will be cured of TB' as a tool for good communication with patients. The director of Mukikute, Joseph Mapunda, will present what effect these booklets have had not only for the patients, but also for the treatment supporters, as well as the health care system and the TB control-programme.

### IMPLEMENTING INTENSIFIED CASE FINDING AND ISONIAZID PREVENTIVE THERAPY: FROM POLICY TO PRACTICE

#### Scale-up of TB intensified case finding in HIV clinics: getting ready for IPT

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**Setting:** Central and Nyanza Provinces in Kenya where intensified TB case finding (ICF) is being implemented in preparation for isoniazid preventive therapy (IPT) roll out.

**Objectives:** To monitor the implementation of ICF and provision of IPT in TB-HIV settings in the two provinces where HIV prevalence is high.

**Design:** Kenya Ministry of Health has developed guidelines and monitoring and evaluation tools for implementation of ICF and IPT for HIV-infected individuals enrolled in HIV care and treatment. The guidelines recommend systematic screening of all HIV-infected patients for TB and linkage of all TB suspects to TB diagnostic evaluation and therapy, and provision of IPT to those without active TB.

**Results:** Since January 2007, the two provinces have implemented ICF in 170 HIV clinics. Of the 93 187 HIV-infected patients attending these clinics between

January 2007 and June 2011, 72 793 (78%) were screened for TB. 6975 (9.6%) of screened patients were identified as TB suspects and 1623 (23%) of TB suspects were diagnosed with active TB. Four facilities began providing IPT in June 2011, with 16 patients receiving IPT to date.

**Conclusions:** ICF can successfully be implemented in HIV clinics and identifies a large number of patients with active TB and equally a large number of PLHIV eligible for IPT. Kenya should expand the ICF and IPT programs nationally.

## **PARTNERSHIP EXPERIENCES WITH ADDRESSING THE CHALLENGES OF SCALING-UP NEW LABORATORY DIAGNOSTICS**

### **Integration of TB and HIV services in Lesotho: a partnership between the MOH, CDC, CHAI and FIND**

A Somoskovi. Foundation for Innovative New Diagnostics, Geneva, Switzerland

Diagnosis and treatment of HIV and TB requires a diverse set of laboratory services. Separate HIV and TB disease control programs often lead to duplication of capacities. Laboratory infrastructure, diagnostic platforms and related commodities should be standardized and integrated to optimize scarce resources. Laboratory integration also supports a more efficient use of skilled laboratory personnel. As of 2006, Lesotho did not have the capacity to carry out culture and drug susceptibility testing (DST) for TB, or to provide early infant diagnosis (EID) for HIV by PCR. All specimens for TB culture and DST, and EID testing had to be referred to laboratories in South Africa. To meet this challenge, FIND and its partners such as the Ministry of Health, Partners in Health, The Clinton Foundation, and CDC collaborated on the renovation of the National TB Reference Laboratory. Progressively, solid and automated liquid DST were implemented. In 2008, line probe assay (LPA) for the direct detection of MDR-TB was established in a pre-fabricated molecular unit and paved the way to introduce HIV molecular testing. Since, sending specimens for EID to South Africa was time consuming and expensive in 2009 molecular EID was established within the TB molecular facility. Common equipment could be used for both assays, and it was relatively straightforward to train the laboratory personnel who were already familiar with molecular diagnostic techniques for TB. Implementing molecular testing capacity for both TB and HIV led to a substantial increase in the number of tests performed while the turn-around-time for reporting was significantly reduced in Lesotho. Since tests were performed

locally using rapid techniques, testing took considerably less time than the months required for reporting when specimens were shipped out of the country. The presentation will summarize our experiences on the integration of TB and HIV molecular diagnostic services in Lesotho.

### **Strengthening laboratory management towards accreditation**

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**Background:** Strengthening Laboratory Management Toward Accreditation (SLMTA) is a training tool developed to facilitate immediate, measurable improvement in laboratories of developing countries. Since its launch in 2009, 242 laboratories from 24 countries have adopted the SLMTA program. Several countries have graduated first cohorts and reported results from those laboratories.

**Aim:** To describe the partnership formed for its development and implementation, report on achievements to date, and discuss lessons learned from multi-country implementation of the program.

**Methods:** The laboratory management framework, a tool that prescribes managerial job tasks, forms the basis of the hands-on, activity-based curriculum. Participants attend a series of workshops and receive regular monitoring and mentoring for the assigned improvement projects. A baseline assessment and an exit assessment are conducted in the beginning and at the end of the process using the evaluation checklist developed for the World Health Organization Regional Office for Africa's Laboratory Improvement Process Toward Accreditation (SLIPTA) initiative.

**Results:** Early results have indicated that laboratories at different levels from resource-limited settings can achieve improvement. Many laboratories in the program have made remarkable progress as measured by the WHO-AFRO's SLIPTA checklist.

**Conclusion:** SLMTA's practical content, innovative implementation model, and structured improvement approach, coupled with its interlocking relationship with SLIPTA's evaluation checklist, make it an excellent tool to build laboratory preparedness toward accreditation.



## NTP/NAP: THE IMPACT OF NEW DIAGNOSTIC TOOLS ON ACCESS TO TB-HIV SERVICES

### How new TB diagnostics have improved access to MDR care in the context of HIV co-infection

H Satti. Partners In Health Lesotho, Maseru, Lesotho; and Harvard Medical School, Department of Global Health and Social Medicine, Boston, MA, USA

**Background:** Since 2006, Partners In Health Lesotho (PIHL) has collaborated with the Ministry of Health and Social Welfare to provide community-based treatment to MDR-TB patients in Lesotho, 72% of whom are co-infected with HIV. HIV co-infection complicates the diagnosis and treatment of MDR-TB.

**Intervention:** From its inception, PIHL implemented an aggressive strategy of intensive case-finding among HIV patients and empiric treatment with second-line TB drugs while awaiting the results of liquid culture-based drug susceptibility testing (DST) for presumed MDR-TB patients. Although the majority of MDR-TB suspects treated at PIHL are smear-positive, a significant number end up with negative or contaminated culture results due to transport and laboratory challenges. In 2009, PIHL began to use molecular line probe assays (LPAs), the Hain test, on smear-positive specimens for rapid testing of resistance to isoniazid and rifampicin among MDR-TB suspects to supplement culture-based DST.

**Results:** Because LPAs have a turnaround time of 1–2 days and can be performed directly on smear-positive sputum without the need to grow cultures, they have helped to guide clinical decisionmaking for MDR-TB and HIV co-infected patients in Lesotho. Of the patients in the 2008 and 2009 cohorts who have completed treatment, outcomes were comparable to those reported in low HIV prevalence settings: 65% achieved favorable outcomes (cure or treatment completed), 32% died, and 2% defaulted or were lost to follow-up.

**Conclusions:** The mortality among MDR-TB and HIV co-infected patients can be reduced by early diagnosis using rapid testing.

### Scale up of Xpert MTB/RIF from the national laboratory perspective: issues and challenges

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**Introduction:** South Africa (SA) is one of the 22 high burden countries that collectively contribute over 80% of global cases of tuberculosis (TB) and ranks second in absolute numbers of multidrug-resistant (MDR)-TB cases reported. High rates of HIV co-infection result in increasing numbers of smear-negative and

extra-pulmonary TB with significant delays in diagnosis. In December 2010, WHO endorsed the use of Xpert MTB/RIF test as the initial test in individuals suspected of multi-drug resistant (MDR) tuberculosis and those with HIV co-infection and a pilot study was initiated.

**Methods and results:** By World TB Day 2011, 30 GeneXpert instruments were placed at 25 laboratories situated in high TB burden districts in each of the nine provinces in SA. These included 1 GX48, 9 GX16 and 20 GX4 instruments. By early August, over 73 000 tests were performed with an invalid rate of 3.3%. MTB was detected in 16.7% sputa referred and a rifampicin resistance rate of 7.5% with some geographical variation noted. Valuable experience was gained including piloting a novel method for instrument verification, interfacing with Laboratory Information Systems to facilitate central collection and monitoring of data and the development of a national costing model.

**Conclusion:** Successful limited implementation of the GeneXpert technology in South Africa has laid the foundation for a phased national roll-out, but many challenges remain. Ongoing data collection and evaluation will assist policy decisions going forward.

## SCALING UP PUBLIC-PRIVATE MIX APPROACHES FOR TUBERCULOSIS CARE AND CONTROL

### Promoting rational use of anti-TB medicines in the private sector

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A number of new compounds and regimens are undergoing the latest stages of TB drug development. There is an urgent need to prepare for the introduction of these new drugs. This means maximizing uptake, but also promoting responsible use. The private sector will be key to both of these goals. TB is widely considered a public health, public-sector disease. But across ten high burden countries representing 60% of the world's TB burden, we found that there is as much TB drug volume in the private sector as in the public sector. This private sector presents many challenges due to its lack of centralized, uniform practices. For example, a total of 111 different first line TB drug dosages and combinations are used across just these 10 countries. There is no single solution to this issue, but the size of the multisectoral response should be commensurate with the size of the problem. To prepare the ground for new TB drug introduction, greater government and international support is needed for

public-private mix (PPM), expanding the reach of public programs, improving regulatory oversight for both marketing approvals, expanding public sector diagnosis and treatment of multidrug-resistant TB (MDR-TB), and improving the quality of care in the private sector. Drug developers must consider carefully the options for roll-out in terms of developing fixed dose combinations, choosing countries for early introduction that have the capacity to manage the new drugs, and considering whether to introduce the new TB drugs into both public and private sectors. Introduction strategy options for the private sector will be explored, ranging from the most to the least restrictive. Not only can the private sector not be ignored in understanding the access equation for TB drugs, but more people and more resources should be directed towards it—with the end goal of rational prescribing that will protect both current and future drugs.

## **PARTNERING BEYOND THE FORMAL HEALTH SECTOR TO PROMOTE ACCESS FOR HARD-TO-REACH POPULATIONS**

### **Romania: working with the Roma to improve TB knowledge and access to services in a disenfranchised population**

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**Background:** Romania is a country that adopted DOTS in 1998 and has 100% DOTS coverage since 2005. The efforts made to tackle TB have started to show positive results, but TB remains a huge public health issue. The TB incidence among vulnerable groups is reported to be high, strongly related to poverty and also more frequently to non-adherence to treatment.

**Setting:** Calarasi and Ilfov Counties, Romania.

**Objective:** To strengthen social mobilization and community involvement in TB prevention and care activities in vulnerable communities of Romania in order to reduce infection.

**Design:** Working directly with poor communities having high incidence of TB and high number of Roma individuals. Identifying and using local resources, like community nurses and Roma mediators. Building bridges between professionals and community leaders for developing sustainable activities at local level whilst ensuring synergy with public TB control interventions.

**Results:** Better response to two Roma communities' needs in Calarasi County—improved access to both information and treatment through setting up

community-based DOTS and counseling centers. Direct work with children and teachers in 13 schools—leading to devising a model of good practice replicated and developed further at an after-school community center. Increased awareness about TB at local level by using journalists as 'vehicles' to fight discrimination, support TB patients, and mobilize political commitment and resources.

**Conclusions:** From the experience of a three-year community-based project it is clear that the lack of awareness about TB, stigma, fear, other socio-cultural and economic barriers that cause poor access to health care and non-adherence to treatment can be overcome if all local actors work together. The local needs shape a local approach, hence the importance to develop and implement tailored activities with a more sustained support at community level, particularly among the vulnerable Roma population.

### **China: changing the face of TB financing for the poor**

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**Objectives:** To assess whether changing the insurance mechanism from a reimbursement scheme to a capitation payment where providers were paid a fixed amount for an agreed package of services to TB patients would increase access to services for all rural residents and reduce OOP payments.

**Methods:** A pilot project with major intervention measures was implemented in two intervention counties in Hunan Province from July 2009 to July 2010; a third county was chosen as control. Questionnaire surveys were carried out in the three counties both before and after the pilot; costs were obtained from NCMS and local CDC in both the intervention and control counties; data were collected from detected TB patients. These data were used to evaluate the impact of the intervention measures.

**Results:** The pilot resulted in a significant reduction in outpatient costs. Cost per new case of the TB department of CDCs reduced in the two intervention counties during the pilot but increased in the control county. Total number of cases notified during the pilot compared with the previous year increased by 29% and 14% respectively, while in Huarong it dropped by 12% in the same period.

**Conclusions:** Improving the health insurance mechanism by making it more equitable and by eliminating out of pocket payments has resulted in increased service coverage. It is crucial that people who cannot afford insurance receive the benefits of risk pooling and equally important that out-of-pocket payments are eliminated if services are to reach the poor.

### Dominican Republic: partnering with CBOs and shopkeepers to improve TB case detection in urban slums

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**Setting:** In the Dominican Republic half of its 4000 annual TB cases are found in the capital of Santo Domingo, mainly in the poorest crowded areas where most vulnerable population live with risk factors of HIV, alcohol and drug abuse. Partnering interventions were initiated in the area with country's worst TB indicators.

**Objective:** To involve systematically organized community groups, public and private health providers, pharmacies and grocery shops to achieve an increase in early referrals of TB suspects among the hardest to reach groups.

#### Methodology:

- 1 Selection of the intervention area based on TB and socio-economic indicators
- 2 Mapping of problems, vulnerable groups and existing organized groups
- 3 Participatory planning session with leaders and health providers
- 4 Implement concrete simple work plans
- 5 Simultaneous intervention with shopkeepers and pharmacy personnel through detailing visits
- 6 Empowering rights based approach was used going beyond giving only TB information
- 7 Continuous coordination with local health providers emphasizing their role towards their community
- 8 Quarterly monitoring through register books.

**Results:** During a 9 month period 236 suspects and 23 smear positive TB cases were referred by the targeted community.

#### Conclusions:

- The applied methodology shows that even in the poorest and hardest to reach urban slums it is feasible to mobilize community groups for TB control most likely because they feel finally taken into account at planning stage and part of the solution.
- Involvement of communities in early case detection can be measured through routine used indicators.
- Community mobilization is a step wise process and should be aiming at action and should always go hand in hand with involvement of the local health providers to be able to respond to increased demand and adjust to more informed and demanding patients.

### REGIONAL LESSONS ON PARTNERSHIPS FOR SCALE-UP OF IPT AND CONTACT INVESTIGATION IN CHILDREN

#### Models for partnership and scale-up for child MDR contacts in South Africa

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**Background:** Childhood multidrug-resistant tuberculosis (MDR-TB) has traditionally been diagnosed and managed in the hospital setting by specialists. Médecins Sans Frontières (MSF) have been working with local health authorities in Khayelitsha, an urban township and health sub-district in Cape Town, South Africa since 2007. MSF is piloting a decentralized model for the identification and treatment of MDR-TB patients and from December 2008 a monthly community-based paediatric outreach MDR clinic has been implemented. It is unclear if this decentralised model of care improves case detection of child contacts and time to assessment.

**Methodology:** All adults with MDR-TB in the Cape Metropole from 1/4/10 to 31/3/11 were identified using routine register data. MDR-TB child contacts were recorded at both the established hospital (centralized) and the new outreach (decentralized) paediatric MDR clinics. The number of children seen and time delays associated with clinic visits were determined for both models of care.

**Results:** 996 adult MDR-TB index cases were registered during the study period. 157 (15.8% of total) patients were registered in Khayelitsha and of these 28 (17.8%) led to the assessment of at least one child contact. This compares to 82 (9.8%) of the 839 cases diagnosed in the other Cape Town sub-districts ( $P = 0.003$ ). Children in Khayelitsha were seen a median 71 days (IQR: 37–121 days) from the date of index case sputum production as compared to 90 days (IQR: 56–132 days) in the other sub-districts ( $P = 0.15$ ).

**Discussion:** Although decentralised care seems to offer some advantages for the identification of MDR-TB child contacts, both models only identify contacts in a small proportion of MDR-TB patients. New approaches are needed for the care of MDR-TB child contacts.

### Strategies for contact tracing and IPT delivery to children in the South-East Asia region

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Children in contact with an adult with smear positive tuberculosis (TB) are at high risk of being infected themselves and progressing to TB disease. The World Health Organisation recommends that such children, if aged under 5 years, should receive preventive treatment, once TB disease has been ruled out. A symptom based strategy is proposed to facilitate this. This policy is rarely implemented and attempts to do so have had disappointing results. I present a new approach using a Health Needs assessment framework, research tools, and a strategy for clinical evaluation. Preliminary results from applying this approach in Indonesia are presented, followed by suggestions for how this approach could be applied and evaluated by national TB control programs.

### Yield of contact investigation in the household for new cases of pediatric tuberculosis in Tanzania

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**Background:** Primarily due to resource limitations, national tuberculosis (TB) programs in high incidence countries rarely implement active contact investigation. To date there has been no documentation that active contact investigation is better than the current approach that relies on index cases advising symptomatic contacts to seek care (passive contact investigation). We aimed to evaluate the feasibility of active household contact investigation and to compare the yield of active versus passive contact investigation, with a focus on the evaluation of children.

**Methods:** All reported sputum smear positive cases of TB from 10 clinics in Kinondoni District of Dar es Salaam were prospectively enrolled during a 4 month pilot study. Index cases were randomized into an intervention group, in which active household contact investigation was conducted, and a control group in which patients received standard care. A cadre of 12 former TB patients and volunteers was trained to perform active contact investigation that included symptom-based screening and referral to local clinics for further evaluation if symptoms were present. Yield was defined as new secondary cases of TB found through contact investigation. At monthly intervals during the study period through a 12 month follow-up, district level TB registries will be reviewed to ascertain whether any household members from either group developed TB.

**Results:** During a 4 month pilot phase 349 index cases have been notified in Kinondoni and 349 (100%) have been interviewed. 985 contacts have been elicited of which 39.8% have been evaluated. 1.2% of contacts were <15 years of age. No cases of TB have been identified in children evaluated to date.

**Conclusions:** This pilot has demonstrated that contact investigation using former patients and volunteers is effective in identifying and screening contacts of infectious cases of TB. It is still too early to determine if the yield of cases is sufficient to justify the efforts.

### PREVENTING TOBACCO INDUSTRY INTERFERENCE IN LUNG HEALTH BY MOVING BEYOND MONITORING TO IMPLEMENTING POLICY SOLUTIONS

#### Preventing tobacco industry interference at the global level: next steps

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**Background:** The International Union Against Tuberculosis and Lung Disease (The Union) has established its Strategic Directions for Tobacco Control for 2010 to 2015 (SDTC2015). One of the five goals of SDTC2015 is to 'Protect policies from interference by Tobacco Industry and other vested interests'. As part of this work stream, the Union asked Allen and Clarke Policy and Regulatory Specialists Limited to develop a draft scoping paper with a recommended action plan for countering the interference of the tobacco industry in tobacco control policy, legislation, programme development and implementation.

**Methods and current status:** The Union established a working group comprising Dr Ehsan Latif, Ms Anne Jones OAM, Professor Bill Bellew (all from the Union) and Mr Matthew Allen (Allen and Clarke) who is principal author of the report. Extensive desk research, consultation with key experts and critical appraisal by the working group led to several iterations and a final draft report by mid-August 2011. It is intended that this working document now be used by the Union as the basis for further discussion with international partners on an agreed way forward for implementation of Article 5.3.

**Discussion:** The presentation will further elucidate the report 'Implementing the FCTC Article 5.3 Guidelines: Scoping Paper and Action Plan on Curbing the Influence of the Tobacco Industry'. This will include elements such as discussion of tobacco industry tactics, the current strategic context, available tools/resources, and key recommendations in the Article 5.3 Guidelines.



## ABSTRACT PRESENTATIONS FRIDAY 28 OCTOBER 2011

### ORAL PRESENTATION SESSIONS

#### KEY OBSERVATIONS ON TUBERCULOSIS CARE IN HIGH-BURDEN COUNTRIES

##### OP-614-28 Fourth serial 2-year tuberculosis drug resistance survey in children, Western Cape, South Africa

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**Aim:** To determine the prevalence of drug resistance and HIV-co-infection among children with TB; to compare results with 3 previous serial surveys and determine frequency of mutations for INH resistance. **Method:** Prospective surveillance was performed from March 2009 to February 2011 at Tygerberg Hospital, Cape Town, South Africa. Drug-susceptibility testing (DST) was done by line probe assay (LPA, GenoTypeMTBDRplus) for INH and rifampicin (RMP) on an isolate from every child < 13 years routinely diagnosed with culture-confirmed TB. HIV status was documented. Mutations conferring resistance to INH were noted.

**Results:** 327 children (median age 29 months) were diagnosed and included. Data from the four surveillance periods are presented in the Table. There was a

Survey period	(1) 2003– 2005	(2) 2005– 2007	(3) 2007– 2009	(4) 2009– 2011
Confirmed TB	323 320	291 285	294 292	327 327
DST completed	(99.1%)	(97.9%)	(99.3%)	(100%)
Any INH/ RMP-resistance	41 (12.8%)	43 (15.1%)	45 (15.4%)	49 (15.0%)
INH resistance	22 (6.9%)	22 (7.7%)	15 (5.1%)	19 (5.8%)
RMP resistance	0	2 (0.7%)	4 (1.4%)	6 (1.8%)
MDR	19 (5.9%)	19 (6.7%)	26 (8.9%)	24 (7.3%)

significant increase in RMP-monoresistance between surveys 1 and 4 ( $P = 0.03$ ). No statistical significant differences were found with INH or MDR resistance. HIV testing increased to 81.7%; 62/268 (23.1%) were

HIV+. There was no difference between HIV prevalence in drug-resistant and drug-susceptible cases. The *inhA* mutation was present in 27/43 (63%) and *katG* mutation in 17 (40%) of INH resistant cases.

**Conclusions:** Rates of drug resistance amongst children are high but stable. Increases in RMP-monoresistance may be due to switching from phenotypic to LPA DST, missing some INH resistance. High rates of *inhA* mutations imply resistance to ethionamide, where high-dose INH may still be clinically beneficial.

##### OP-701-28 First insights into the genetic diversity of *Mycobacterium tuberculosis* in Nepal

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**Aim:** Nepal has a tuberculosis (TB) incidence of 163 per 100 000 populations and proportion of multidrug resistance (MDR) TB is 2.6% in new cases. However, little is known about genetic diversity of *M. tuberculosis* (*M. tuberculosis*) in Nepal. The aim of this study was to define the *M. tuberculosis* lineages circulating in Nepal and to measure the relative frequency of drug resistance.

**Methods:** TB patients from across country, visiting German Nepal Tuberculosis Project; a referral laboratory at Kathmandu, were recruited from August to December 2009. Phylogenetic lineages of *M. tuberculosis* were determined by single nucleotide polymorphism (SNP) genotyping. Spoligotyping data were compared to international spoligotypes database (spolDB4). Drug resistance to isoniazid and rifampicin was determined by sequencing the hot spot regions of the genes.

**Results:** A total of 184 culture positive TB patients were included. The median age was 34 years, and 133 (72.3%) being male. The patients were; 112 (60.9%) new TB cases, 54 (29.3%) relapse cases and the remaining 18 (9.7%) were treatment defaulters and failures. Based on SNP results; the majority of isolates belonged to Lineage 3 (75/184, 40.7%), followed by Lineage 2 (56/184, 30.4%), Lineage 4 (30/184, 16.3%) and Lineage 1 (23/184, 12.5%). Spoligotyping data showed that 82% (161/184) of the isolates comprised 7 different ST types described in spolDB4. The Beijing and Delhi/CAS families together represented 61.4% of all isolates, while Orphan spoligotypes accounted for 17.3%. Mono-resistance to any drug was observed in 8.2% isolates. Fifteen isolates (8.2%) were MDR. Mono-resistance to any drug was more frequent among Lineage 2 isolates (26.8%) compared to the other Lineages (11.71%;  $P < 0.05$ ). Most of the drug resistance mutations

were observed in codon position 531 of *rpoB* gene and 315 of *katG*.

**Conclusion:** The genetic variability among *M. tuberculosis* isolates in Nepal is relevant. Lineage 2, which includes Beijing strains, was associated with drug resistance.

#### OP-992-28 Source of previous treatment for re-treatment TB cases registered under the RNTCP, India, 2010

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**Background:** Retreatment Tuberculosis (TB) cases are 10% of the global tuberculosis notifications and India contributes 46% to the global re-treatment TB notifications. Retreatment TB patients occur in the community as a result of inadequate and improper treatment of the new-TB cases. There is no national level data on the source of previous treatment for re-treatment TB cases in India.

**Objectives:** To assess the source of previous treatment for re-treatment TB patients registered under India's Revised National TB Control Programme (RNTCP).

**Methodology:** A nationally representative cross sectional study from a sample of 36 districts selected by Population proportionate to size sampling methodology. All consecutively registered retreatment TB patients during a defined 15 day period in these 36 districts were contacted and the information on the source of previous treatment sought.

**Results:** Data was collected from 1712 retreatment TB patients. This includes data from 595 'relapses', 105 'failures', 437 'treatment after default (TAD)' and 575 're-treatment others'. The source of most recent previous anti-tuberculosis therapy for 754 [44% (95%CI 38.2–49.9)] of the re-treatment TB patients was from 'non-RNTCP' sources and the remaining 958 [56% (95%CI 50.1–61.8)] was from RNTCP. TAD (64%) and 'retreatment others' (59%) are more likely to have been previously treated from 'non-RNTCP' sources when compared to relapse (22%) and failures (6%).

**Conclusions:** Nearly half of the re-treatment cases were previously treated outside the programmatic setting. Efforts towards enhancing the reach of the programme by advocacy, communication and social mobilisation both with health care providers and community is needed along with strengthening the programmatic processes to reduce the risk of relapse, failure and default among new patients registered under the programme.

#### OP-1013-28 Scale up of isoniazid preventive therapy in PEPFAR-assisted clinical sites in South Africa

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**Background:** In South Africa, approximately 70% of individuals with active tuberculosis (TB) disease are co-infected with HIV. Isoniazid preventive therapy (IPT) reduces the risk of tuberculosis disease in those with HIV infection. In May 2010 the South African National Department of Health recommended IPT for all HIV-infected individuals without symptoms of active tuberculosis; in all public medical services. We report on the uptake of IPT for HIV-infected individuals in the periods before and after guideline implementation.

**Methods:** We analyzed program monitoring data reported by PEPFAR implementing partners from clinical sites in South Africa in 2010. Asymptomatic HIV-infected individuals were considered eligible for IPT. We displayed trends from Quarter (Q) 1 through Quarter (Q) 4 2010 and determined the differences of IPT uptake from Q1 2010 to Q4 2010 and between provinces for the most recent quarter (Q4) using  $\chi^2$  tests for proportions.

**Results:** During 2010 there was a significant increase in IPT use from 3309 (1.0%) out of 317 797 eligible patients in Q1 to 28 316 (7.3%) out of 386 038 eligible in Q4 ( $P < 0.0001$ ) with an average absolute increase of 8336 patients initiated on IPT per quarter. IPT uptake of those eligible per province in Q4 was largest in Eastern Cape where 1964 (21%) patients were initiated on IPT of the 9346 eligible. Northern Cape had the lowest uptake, 145 (1.4%) were put on IPT out of 10 220 eligible patients ( $P < 0.0001$ ). Patients eligible to receive IPT in Eastern Cape were 14.8 times as likely to receive IPT as eligible patients in Northern Cape (95%CI 12.5, 17.5).

**Conclusion:** At PEPFAR-assisted sites in South Africa in 2010, there was a significant increase in the number and proportion of HIV-infected patients initiated on IPT, however, the overall proportion receiving IPT was low. The differences in uptake between provinces should be further explored. Expansion of programs to increase IPT is urgently needed.

### OP-1060-28 Patterns of treatment interruption among multidrug-resistant TB patients

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**Background:** The reasons that MDR-TB patients miss treatment are multi-factorial and complex. Identifying patterns of treatment interruption that are predictive of poor treatment outcomes can be used to target program activities aiming to improve treatment compliance.

**Objective:** To characterize patterns of treatment interruption among MDR-TB patients and determine the association between patterns and final treatment outcomes.

**Methods:** Data were abstracted from medical charts and treatment cards of all MDR-TB patients who initiated treatment between 1999 and 2006, had >1 year of follow-up, and had final treatment outcomes available. Patients were characterized by the number, length and variability of interruptions, per cent of missed doses, and the variability of the gaps between interruptions. Relative risks were calculated to determine the association between characteristics of treatment interruption and treatment outcomes. Default, death, and failure were categorized as a poor treatment outcome and compared to cure or treatment completion, categorized as treatment success.

**Results:** Only 12 (2.5%) of 479 patients eligible for inclusion completed treatment without interruption. Of the remaining 467 patients, median length to the first interruption was just under 3 months (86 days). In multivariate analysis adjusted for age, history of treatment default and cavitary disease, patients that missed greater than 10% of treatment doses (RR = 2.0, 95%CI 1.3–3.0,  $P = 0.002$ ) or had longer, sporadic interruptions (vs. shorter, regular: RR = 2.4, 1.3–4.6;  $P < 0.006$ ) were at a significantly increased risk for poor treatment outcomes.

**Conclusion:** Patients that miss >10% of treatment and patients that miss more consecutive days of treatment with sporadic interruption patterns are at an increased risk for poor treatment outcomes. Identifying factors that underlie different interruption patterns will help guide program activities to minimize treatment interruptions among MDR-TB patients.

### OP-1074-28 Tuberculosis incidence in health care workers in Botswana

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**Background:** In 2008, WHO estimated TB incidence in Botswana at 710 per 100 000 in the general population. Several studies show that health care workers (HCW) have higher rates of TB however data from many African countries is lacking. This study aimed to determine the TB incidence in HCW in Botswana and describe their clinical and demographic characteristics.

**Design/methods:** A retrospective review of TB registers and interviews with TB Coordinators at six public hospitals, including the two national referral hospitals, for the period May 2009 to April 2010. Annual incidence was calculated as new TB cases in HCW per total number of ‘at risk’ HCW, defined as all HCW employed in clinical departments minus those on TB treatment. For accurate comparison with general population incidence we used the same WHO method that assumes a 2008 case detection rate of 0.63.

**Results:** Twenty-eight HCW were diagnosed with TB among 4006 at risk. Of this group, 17 (61%) were female and mean age was 35 years (range 24–55 years). We found documentation of HIV status for 23 (82%) HCW of which 11 (47.8%) were positive. Twenty-one (75%) HCW had pulmonary TB, 4 (14.3%) had extrapulmonary TB and 3 (10.7%) had both. Of those with pulmonary TB, 17 (80.9%) were smear positive. Four (14.3%) HCW were classified as ‘retreatment’: one default and three relapse cases. We estimated TB incidence at 1109/100 000 HCWs (95%CI 785–1433/100 000) in the population sampled.

**Conclusion and recommendations:** TB incidence rates among HCW in Botswana are higher than the general population and there is a high rate of HIV co-infection among HCW registered with TB. Adequate TB infection control measures are critical to protect HCW from nosocomial TB transmission.

### OP-1171-28 Significant decline in XDR-TB in the Philippines

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**Background and setting:** About 440 000 multidrug-resistant TB (MDR) cases were estimated globally in 2008. MDR-TB standard of care requires at least four drugs deemed effective, with the fluoroquinolones (FQs) and second-line injectable agents (SL-IAs) being the most potent. Resistance to both renders MDR-TB patients extremely drug-resistant (XDR).

The Philippines was estimated to have 13 000 annual cases of MDR-TB. Programmatic management of drug-resistant TB (PMDT) was in its pilot phase from 1999–2005 and expanded from 2006–2010 through public-private collaboration.

**Objective:** This study compares the XDR-TB rates during the pilot and expansion periods of PMDT. Conventional DST was done with quality assurance from supranational laboratories.

**Methodology:** A retrospective analysis of the XDR-TB rates during the two periods was done among MDR-TB patients. Resistance to any FQ, and to any SL-IA in both periods were also compared.

**Results:** Among 3397 MDR-TB patients tested to both FQ and SL-IA from 1999–2010, XDR-TB was 4.5% during the pilot, and 0.47% during the expansion ( $P < 0.01$ ). Among 3419 MDR-TB patients with FQ DST, resistance to any FQ was 50.2%, and 13.3%, respectively; among 3399 MDR-TB cases with SL-IA DST, the resistance to any SL-IA was 5.0% and 0.89%, respectively (both  $P < 0.01$ ).

	1999–2005 Pilot phase	2006–2010 Expansion phase	Total	<i>P</i> value
No. with DST to both FQ and SL-IA	818	2579	3397	
XDR-TB rate, <i>n</i> (%)	37 (4.5)	12 (0.47)	49 (1.4)	<0.01
No. with any FQ DST result	825	2594	3419	
Resistance to any FQ, <i>n</i> (%) <sup>*</sup>	414 (50.2)	345 (13.3)	759 (22.2)	<0.01
No. with DST result to SL-IA	820	2579	3399	
Resistance to any SL-IA, <i>n</i> (%) <sup>†</sup>	41 (5.0)	23 (0.89)	64 (1.9)	<0.01

<sup>\*</sup>Resistance to ofloxacin, ciprofloxacin, levofloxacin, moxifloxacin OR sparfloxacin.

<sup>†</sup>Resistance to kanamycin and/or amikacin.

**Discussion:** The significant drop in XDR and in the individual resistance to the FQs and SL-IA could be explained firstly by the fact that more chronic cases were treated during the pilot phase. Secondly, referrals from the public sector with no exposure to the two drugs slowly increased as PMDT was mainstreamed to the National TB Program (NTP) in 2006.

**Conclusion:** XDR-TB rates are expectedly higher in early PMDT as the 'backlog cases' are prioritized. More importantly, mainstreaming to the NTP and advocacy to the private sector are expected to address XDR-TB emergence.

## THE SPECTRUM OF TUBERCULOSIS MANAGEMENT ISSUE

### OP-377-28 Tuberculosis prevalence in a South African prison: time to implement intensive TB screening

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**Background:** Tuberculosis (TB) in prisoners is a major public health concern. TB prevalence in South African prisons is poorly documented. We present our findings of conducting TB screening in a Johannesburg prison (total population ~13 000).

**Methods:** Cross-sectional survey of sentenced male prisoners: random sample of already incarcerated prisoners at study start and consecutive sample of newly sentenced prisoners. All screened for TB using symptoms, chest radiograph (CXR) and two spot sputum specimens for microscopy and culture. Anonymized urine HIV testing done on those consenting. Follow up of all TB suspects at one month with repeat investigations for TB. TB was defined as  $\geq 2$  cultures positive for *Mycobacterium tuberculosis* or one culture positive for *M. tuberculosis* and compatible clinical features.

**Results:** From 09/2009–10/2010, 981 prisoners [53.6% (526) already incarcerated; 46.4% (455) newly sentenced] were screened for TB. 1.4% (14/981) were on TB treatment at enrolment. 2.5% (24/967) had previously undiagnosed TB. HIV prevalence was 24.2% (179/738). HIV-status and previous TB were associated with undiagnosed TB: prevalence was 5.1% (9/175) in HIV-positive and 1.6% (9/551)

Criteria	Prevalence % ( <i>n</i> = 829)	Sensitivity % ( <i>n</i> = 23)	Specificity % ( <i>n</i> = 806)	Positive predictive value, %	Negative predictive value, %
Cough $\geq 2$ weeks	9.4	34.8	91.3	10.3	98.0
Any of cough $\geq 2$ weeks, night sweats, weight loss (symptom trio)	27.9	43.5	72.6	4.3	97.8
Sputum AFB positive	1.2	21.7	99.4	50.0	97.8
CXR abnormality	7.6	60.9	93.9	22.2	98.8
Cough $\geq 2$ weeks or CXR abnormality	15.2	78.3	86.6	14.3	99.3
Any of cough $\geq 2$ weeks, night sweats, weight loss (symptom trio) or CXR abnormality	32.6	78.3	68.7	6.7	99.1



in HIV-negative individuals (OR 3.27; 95%CI 1.27–8.40); 6.5% (8/123) vs. 1.9% (16/844) in those with and without previous TB (OR 3.60; 95%CI 1.50–8.64). Performance of screening criteria (in 829 with complete data) is shown.

**Conclusion:** TB and HIV prevalence are high in prisoners in South Africa. There were a substantial number of undiagnosed TB cases within the prison. In this population, a combination of CXR or cough >2 weeks seems the most useful screening tool to identify patients needing further investigation. Prisoners should be screened at entry to the prison as a minimum, with regular intensified case finding thereafter. Infection control measures and isoniazid preventive therapy use must also be optimized.

### OP-385-28 Does CXR remain a useful component of the clinical diagnostic algorithm for smear-negative PTB?

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**Background:** In low resource settings, chest X-ray (CXR) remains a component of the WHO diagnostic algorithm for sputum smear negative pulmonary tuberculosis (PTB). However, in regions of high HIV seroprevalence, many patients with culture confirmed TB have 'atypical' or normal CXRs; some authors have therefore questioned the value of CXR in such algorithms.

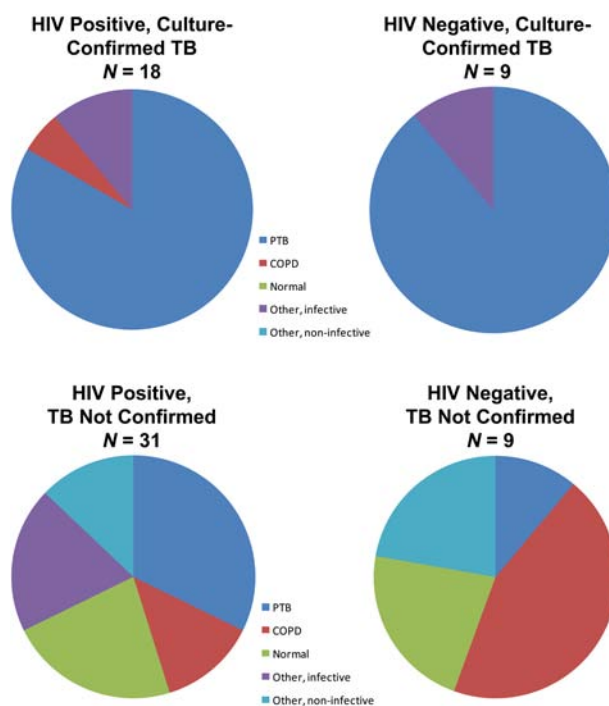
**Aim:** To determine if expert reporting of CXRs taken under routine, resource-limited settings improves the accurate diagnosis of smear negative PTB.

**Method:** 80 Malawian patients with negative sputum smears had mycobacterial culture performed as part of a parallel study. CXR had been interpreted by local clinicians, with no formal radiology qualifications, as 'consistent with PTB'. Films were delivered to a UK-based consultant radiologist blinded to HIV status, CD4 count and sputum smear and culture results, with the clinical vignette 'this patient presented with a cough for several weeks'.

**Results:** CXR reports were classified into five categories: Normal; PTB; COPD; other, infective; and other, non-infective. In HIV positive patients, microbiologically confirmed smear negative PTB was identified from the CXR with 83% sensitivity and 68% specificity, whereas in HIV negative patients, sensitivity and specificity were both 89%. In 50% of HIV negative patients without microbiological confirmation of PTB, the CXR was consistent with COPD.

**Discussion:** In comparison with the 'gold standard' of mycobacterial culture, expert reading of CXR improved both sensitivity and specificity in identi-

fying true cases of smear negative PTB regardless of HIV status. Additionally, the prevalence of undiagnosed chronic lung disease in this population was highlighted.



**Figure** Radiologically apparent diagnoses by HIV status and sputum culture.

**Conclusion:** CXR remains an important component of diagnostic algorithms in Malawi. Further training of local clinicians may improve accurate diagnosis.

### OP-396-28 Risk factors associated with tuberculosis infection among health care workers in Inner Mongolia, China

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**Background:** Reducing tuberculosis (TB) transmission in hospitals has become a central component of global TB control, particularly in countries with multidrug-resistant TB epidemics (MDR-TB). TB infection rates in healthcare workers (HCWs) can be used to assess the adequacy of a facility's TB infection control program. We measured the prevalence of TB infection using an interferon-gamma release assay and analyzed factors associated with infection among HCWs at two hospitals in Inner Mongolia, China, a

region with a high rate of TB (49 smear positive/100 000).

**Methods:** Between April and August 2010, we administered QuantiFERON® Gold In-Tube (QFT) tests and surveys to HCWs at an infectious diseases hospital and a general medical hospital. The survey asked about demographic characteristics, occupation, work location, TB disease symptoms, and exposures potentially associated with TB infection. We evaluated risk factors for TB infection (defined as QFT > 0.35 IU/ml) using a stepwise logistic regression model.

**Results:** Of 999 HCWs, 686 (69%) had a positive QFT. The prevalence of TB infection was greater in the general hospital (71%) than in the infectious diseases hospital (61%) ( $P < 0.05$ ). In multivariable analysis, being >40 years of age, spending >15 years as a HCW, working in the hospital with someone previously diagnosed with TB disease, and having daily contact with patients were independently associated with TB infection ( $P < 0.05$  for all variables). Self-report of BCG vaccination was protective (adjusted odds ratio = 0.63, 95% confidence interval, 0.45, 0.88).

**Conclusions:** The prevalence of TB infection among HCWs in Inner Mongolia is one of the highest reported in the literature. Infection was associated with hospital exposures. Healthcare facilities in this region of China need to strengthen their TB infection control measures.

#### OP-432-28 Depression is common in TB patients and predicts treatment abandonment

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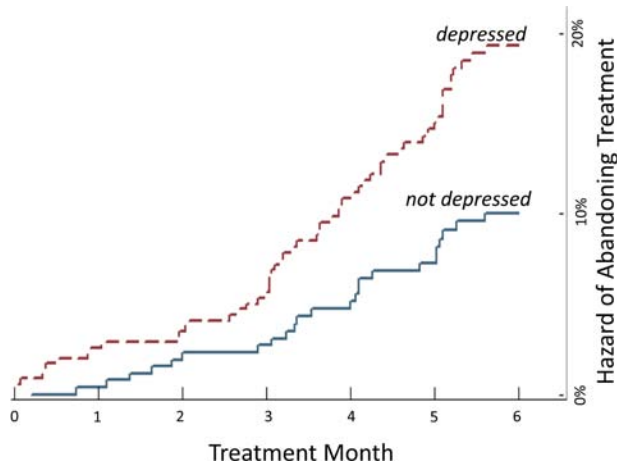
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**Background:** Tuberculosis (TB) is associated with poverty, stigma and marginalization, which are risk factors for psycho-morbidity, but little is known about the mental health of TB patients. We therefore studied interactions between TB, depression, socio-demographic factors and TB treatment adherence among the urban poor.

**Methods:** Over 7 years, patients with newly diagnosed TB and randomly selected healthy controls from shantytowns in Lima were evaluated in a case control study and the patients were then followed-up to determine their treatment outcome in a prospective cohort study. Each participant provided demographic and socio-economic data and completed a Beck Depression Inventory (II). Depression scores were adjusted for overlap with the physical symptoms of TB. Poverty was assessed with a composite socio-economic

index. Data were analyzed with linear, logistic and Cox regressions.

**Results:** TB patients ( $n = 1734$ ) had frequent depression (53%), severe depression (15%) and suicidal ideation (4.7%). Depression was more common and depression scores were higher than in randomly selected healthy members of the same community ( $n = 470$ ; both  $P < 0.005$ ), independently of poverty, education and other cofactors. For TB patients, higher depression scores were independently associated with female gender, poverty, incomplete schooling, illicit drug use, perceived discrimination and longer delay in seeking medical care for TB symptoms (all  $P < 0.01$ ). Follow-up of 1566 of these TB patients revealed that depression at the time of diagnosis was independently associated with a 1.8-times greater relative risk and 1.8 greater hazard (graph) of subsequently abandoning TB treatment (both  $P < 0.001$ ).



**Conclusions:** Depression was highly prevalent among newly diagnosed TB patients and predicted patients who later abandoned TB treatment. TB programs may optimize disease control, treatment adherence and quality of life by diagnosing and addressing the mental health issues that affect TB patients.

#### OP-696-28 Knowledge, attitudes and beliefs and adherence among patients treated for XDR-TB and HIV

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**Rationale:** Extensively drug-resistant tuberculosis (XDR-TB) and HIV involve complex treatment regimens and treatment outcomes are poor. Patient's knowledge, attitudes and beliefs (KAB) and adherence to antiretroviral therapy (ART) and TB medications

are critical determinants of behaviors around transmission, mortality and outcome.

**Methods:** Prospective cohort study of XDR-TB patients admitted to a South African public TB referral hospital from July, 2009 to April, 2010; had drug susceptibility testing (DST) revealing XDR-TB, and agreed to therapy. KAB were assessed by questionnaire administered by study staff in isiZulu at baseline, and adherence was assessed monthly thereafter. ART and second-line TB medication adherence was assessed by 7 day self-report.

**Results:** 47 XDR-TB patients were prospectively enrolled in the study. Median inpatient time 4 months and median follow-up 9 months. The majority were male (57%), young (median age 36), and HIV co-infected (79%). Among HIV co-infected patients 76% were on ART and median CD4 count at baseline was 298 cells/mm<sup>3</sup>. 84% self reported perfect ART adherence; 78% perfect TB medication adherence. At baseline 95% felt that XDR-TB was curable and that they personally would be cured, 29% did not believe HIV and TB were linked, 42% did not believe ART improves TB outcomes. Although 95% identified cough/airborne transmission as the predominant means of transmission, but separately 56% incorrectly identified routine contact as an important mode of transmission. 59% reported not having enough information about XDR-TB.

**Discussion:** XDR-TB HIV co-infected patients have incomplete baseline knowledge regarding modes transmission and connection between HIV and TB. Reported adherence through 7 day recall was high for both ART and second-line TB medications. Improved education for XDR-TB and HIV patients is indicated to improve outcomes. 7 day recall for complex regimens in XDR-TB and HIV in this population needs validation.

#### OP-1121-28 Concordance between programmatically- and laboratory-determined MDR-TB treatment outcomes in Peru

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**Background:** Confirmation of cure for an MDR-TB patient is based on laboratory tests for *Mycobacterium tuberculosis* growth on culture media. Testing takes 4–6 weeks and laboratory capacity is often limited in resource-poor settings; these factors contribute to a convention of programmatically-determined treatment outcomes. Outcome decisions dictate patient management and inaccuracies place patients at an increased risk of morbidity and mortality, and may contribute to community transmission of MDR-TB.

**Objective:** To examine concordance between programmatically-determined and laboratory-confirmed treatment outcomes among MDR-TB patients.

**Methods:** Data were abstracted from medical records of all MDR-TB patients in Peru who initiated treatment between August 1996 and March 2002. Patients with both programmatic and laboratory outcomes were included in the present analysis ( $n = 1658$ ). Laboratory outcomes were based on international standards requiring at least five consecutive negative cultures in the last 12 months of treatment to confirm cure.

**Results:** Using laboratory outcomes as the gold standard, clinicians had 98.9% sensitivity but only 45.7% specificity in assigning successful (cured or completed) treatment outcomes (vs. failed). 123 of 1152 (10.7%) patients declared cured and 27 of 287 (9.4%) categorized as completed by a clinician were bacteriologic failures. Overall, 10.4% of patients with programmatically-determined successful treatment outcomes still had positive bacteriologic results for MDR-TB.

**Table** Concordance of clinically-based and laboratory-determined treatment outcomes for MDR-TB patients in Peru

Clinical outcome	Laboratory outcome			Total
	Cured	Completed	Failed	
Cured	864 (75.0)*	165 (14.3)	123 (10.7)	1152
Completed	188 (65.5)	72 (25.1)	27 (9.4)	287
Failed	9 (6.4)	5 (3.6)	127 (90.1)	141
Total	1061	242	277	1580

\*Number of patients (row percentage).  
Totals may exceed 100% due to rounding.

**Conclusion:** Clinicians in Peru correctly identify most successful treatment outcomes, yet miss many treatment failures. Until rapid diagnostics are readily available, treatment decisions will continue to rely on clinical judgment. Due to the implications of premature discontinuation of treatment, accurate final treatment outcomes are critical. Studies are needed to identify means to improve the diagnostic accuracy of programmatically-determined MDR-TB treatment outcomes.

#### OP-1229-28 Increased risk of anti-tuberculosis drug-induced hepatotoxicity among patients with HCV co-infection

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**Background:** Georgia is a country with high prevalence of tuberculosis (TB) and hepatitis C virus (HCV) infection. There are limited data on the impact of



HCV co-infection among patients undergoing treatment for TB.

**Objectives:** To determine the prevalence of HIV, hepatitis B virus (HBV), and HCV infections among patients with TB in the country of Georgia and to determine whether HCV co-infection increases the risk of developing drug induced hepatitis among patients being treated for TB.

**Design/methods:** A prospective longitudinal study was carried out from 04.2007 to 09.2010 at the National Center for Tuberculosis and Lung Diseases, Tbilisi, Georgia. Newly diagnosed TB patients with no previous history of anti-TB treatment were enrolled in the study. Serological testing for HIV, HCV, and HBV serology at baseline and 'liver function tests' (LFT) at baseline and six monthly follow-up visits were performed as the diagnostic method for the study.

**Results:** 346 patients were enrolled in the study and serologic testing for HBV, HCV and HIV were available for 326 (94%) patients. The HCV prevalence was 21% (68/326), while the prevalence for HIV was 1.5% (5/326) and 4% (14/426) had active HBV infection (HBsAg+). Overall, 42 (13%) patients developed hepatotoxicity. Among the 227 patients who completed six months of anti-TB treatment, 27 (12%) developed grade I and II hepatitis. HCV co-infected patients were significantly more likely to develop hepatotoxicity (RR = 6.41; 95%CI 3.0–13.6,  $P < 0.001$ ). Patients with chronic HBV infection (HBsAg+) were not at increased risk of hepatotoxicity but this analysis was limited by the small numbers of patients that were HbsAg+.

**Conclusion:** HCV co-infection was common among patients with TB in Georgia. Hepatotoxicity during TB therapy was significantly more common among those with HCV co-infection but severe toxicity (WHO grade III or IV) was rare. Based on our findings HCV+ patients do not require more intensive biochemical monitoring.

## VACCINES, DRUGS AND DIAGNOSTICS: POTENTIAL NEW TOOLS

### OP-108-28 Novel therapeutic vaccines against tuberculosis using the cynomolgus monkey model

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**Aim:** Multidrug-resistant (MDR), especially extensively drug-resistant (XDR), *Mycobacterium tuberculosis* is a big problem in the world. We have developed

novel TB therapeutic vaccines, (HVJ-E/HSP65 +IL-12 DNA vaccine and granulysin vaccine).

**Methods:** DNA vaccine expressing *M. tuberculosis* heat shock protein 65 and IL-12 was delivered by the hemagglutinating virus of Japan (HVJ)-envelope. *M. tuberculosis* was intratracheally instilled into cynomolgus monkeys and then treated with the vaccine. Granulysin DNA was obtained from human CTL.

**Results:** HSP65+IL-12DNA vaccine provided remarkable protective efficacy in mouse models compared to the BCG vaccine. This vaccine also provided strong therapeutic efficacy against MDR-TB and XDR-TB in murine models (prolongation of survival time and the decrease in the number of TB). This vaccine showed synergistic therapeutic efficacy by the addition of granulysin DNA vaccine in mice. Furthermore, we extended our studies to a cynomolgus monkey model, which is currently the best animal model of human tuberculosis. BCG prime and HSP65+IL-12/HVJ vaccine (boost) by the prime-boost method showed a synergistic prophylactic effect in monkeys (100% survival). Furthermore, the vaccine provided therapeutic efficacy of prolongation of survival time (100% survival) and the augmentation of immune responses (IL-2 production) in TB-infected monkeys. Synergistic efficacy of this vaccine and granulysin DNA vaccine is now being studied in monkeys.

**Conclusion:** These data indicate that our novel vaccines might be useful against *Mycobacterium tuberculosis* including XDR- and MDR-TB for human therapeutic clinical applications.

Co-workers: Nishida Y, Nakatani H, Kano K, Kishigami C, Nishimatsu S, Nakura K, Nagasawa T, McMurray D, Hayashi S

### OP-554-28 Molecular detection of rifampin-resistant *Mycobacterium tuberculosis* from slides

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**Background:** The detection of mutations in the *rpoB* gene, using DNA extracted from slides, is a promising technique for quick detection of mutations related to resistance; being this technique able to monitor the TB MDR transmission without necessity of culture; which becomes this procedure relevant. Hence, this work has as purpose to extract the DNA from slides colored by the Ziehl-Neelsen method, for development of molecular detection of rifampin resistant *Mycobacterium tuberculosis* without the need to isolate this bacterium in culture.

**Design/methods:** The slides colored by the Ziehl-Neelsen technique were selected and the DNA was extracted utilizing 5% Chelex™, and amplified with specific primers to detect mutations in the *rpoB* gene. The PCR product was examined with a molecular



marker and run in 2.5% agarose gel electrophoresis, utilizing Tris-Borate EDTA 1× buffer. The DNA was sequenced for confirmation of *rpoB* gene mutations.

**Results:** The product of monoplex PCR has generated different mutation bands. The results of monoplex PCR agreed with the DNA sequencing. In the slides isolates, mutations 516, 526, 531 of *rpoB* gene were found by DNA sequencing and, consequently, generated the expected monoplex bands resulting from punctual mutations in these codons.

**Conclusion:** The monoplex PCR obtained from the slide DNA has not the purpose to replace the sensitivity test; however, it is fast and could function as a screening, reducing the time for the resistance diagnosis; which could result in the possibility of an early treatment for resistant TB.

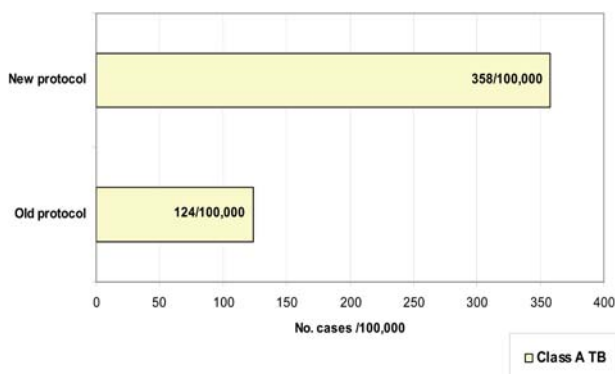
#### OP-717-28 Impact of changed passive TB screening protocol on the detection rates of active TB in migrants

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**Background:** Tuberculosis screening for US-bound migrants is guided by the US CDC's Technical Instructions for TB Screening and Treatment (TI). TI's from 1991 were revised in 2007, major changes involved sputum culture analysis and tuberculin skin testing. Implementation of the new TIs began in East Africa in 2008. This study compares the impact the protocol change made on detection rates of active pulmonary TB cases.

**Methods:** This study is a retrospective review of data extracted and analyzed from the IOM database, and results from field laboratories in Kenya and Tanzania for the period from Jan06–Dec09.

**Results:** 39 606 migrants to the USA from Kenya and Tanzania were screened between 01 January 2006 and 31 December 2009. Of the 23 980 applicants screened during 2006 and 2007, 774 sputum smears (3.2% of all applicants) and 104 sputum cultures (0.4%) were done. During the period 2008 and 2009,



**Figure** Laboratory confirmed class A TB cases.

a total of 15 626 applicants were screened, of which 1080 underwent sputum smear and culture testing (6.9% of all applicants). 1969 applicants were treated for TB in 06/07, of these only 373 (18.9%) were lab confirmed TB cases, while during 08/09, of the 1026 applicants who underwent treatment, 754 (73.5%) were lab confirmed TB cases. Active TB was detected in 41 applicants between 2006 and 2007 which made up 0.17% of all applicants screened, while between 2008 and 2009 a total of 59 cases of active TB were detected representing 0.38% of all applicants screened during that time. Total prevalence of 358/100 000 was detected in 08/09, while only 124/100 000 in 06/07.

**Conclusion:** Detection rates of active pulmonary tuberculosis in migrants increased almost threefold with implementation of the new TIs, while ethnic, demographic and other characteristics of the screened population remained unchanged.

#### OP-848-28 Group sequential trial designs can be used for speeding up the tuberculosis drug development process

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**Background:** Drug development for new regimens for the treatment of tuberculosis (TB) is a long and expensive process. It is not enough to demonstrate that a single novel compound has activity against TB, any new drug(s) must be evaluated as part of a 3- or 4-drug regimen. There is no established surrogate endpoint for long-term cure and therefore confirmatory phase III trials following patients for 18 months or more are considered necessary. In this research project, we review different adaptive designs for phase II and III trials adapting the most suitable for use in the TB drug development process.

**Methods:** We reviewed the extensive literature on group sequential and other adaptive designs developed and used in other disease areas. These include, but were not limited to, Simon's two-stage design, seamless phase II/III designs, stopping boundaries approach, multi-arm multi-stage designs, and treatment selection studies. The most appropriate designs were evaluated for use in the context of TB treatment trials and adapted where necessary.

**Results:** We developed a multi-arm multi-stage design for a phase II treatment regimen selection trial. We propose time to culture conversion as the most appropriate endpoint for such a trial. Multiple regimens involving various combinations of novel and proven drugs can each be compared against the standard control in a single trial. Multiple planned interim analyses for lack of benefit allow for ineffective regimens being stopped early in the trial, thus shortening the overall trial duration.

**Conclusions:** Novel trial designs are urgently needed

to speed the drug development process. Appropriate group sequential designs can be used to this end in phase II and phase III TB treatment trials without loss of scientific integrity or statistical validity. Such designs should be considered by both public and private research groups planning phase II and phase III TB treatment trials.

### OP-1321-28 Sterilizing activity of novel TMC207-containing combinations in murine tuberculosis

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**Background:** Novel regimens containing 2 or more new drugs are needed to transform the treatment of both drug-susceptible and MDR/XDR-TB. TMC207 (J) is a new diarylquinoline recently shown to improve sputum culture conversion when added to a background regimen for MDR-TB. In mice, combinations of J and pyrazinamide (Z) have sterilizing activity superior to the first-line regimen of rifampin, isoniazid and Z (RHZ). We undertook an experiment to evaluate the sterilizing activity of JZ-containing regimens and several J-containing regimens without Z.

**Methods:** BALB/c mice were aerosol-infected with  $\sim 4 \log_{10}$  CFU of *M. tuberculosis* H37Rv. Daily treatment began 2 weeks later. Controls received RHZ. Test regimens included 3-drug combinations of J (25mg/kg), Z (150mg/kg), rifampine (P, 10mg/kg), moxifloxacin (M, 100mg/kg), and PA-824 (Pa, 50mg/kg). Outcomes were lung CFU counts during treatment and culture-positive relapse 3 months after treatment.

**Results:** The mean lung CFU count at treatment initiation was 8.21 log<sub>10</sub>. After 2 months, JZP, JZM and PZM reduced the mean lung CFU count to <0.50 vs. 1.68, 2.70, 3.45, 3.74, 4.44, and 4.58 in the PZPa, JPM, PaMZ, PMPa, RHZ and JPaM groups. Whereas all mice receiving 2RHZ/RH for 4 months relapsed, 0% and 33% relapse was noted in mice receiving JZP and JZM for 2 months. All mice in other groups relapsed. Loss of Z reduced sterilizing activity but, at 4 months, 50%, 50%, 67% and 87% relapsed in the JPM, JPaM, PaMZ and PMPa groups.

**Conclusions:** While JZP may be superior in its sterilizing activity, JZM may represent an ultrashort regimen for MDR-TB. Regimens without Z were not as sterilizing, but JPaM was still more effective than RHZ. Therefore, a JZMPa regimen may represent a universal building block for all forms of TB which may be ultrashort in duration against Z-susceptible strains and remain superior to RHZ against strains resistant to R, H and Z.

### OP-1337-28 Long-term results of Study C and predictive factors for outcome

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**Background:** Fixed-dose combinations (FDC) of drugs for treatment of tuberculosis (TB) are recommended to prevent drug resistance. Study C investigated the efficacy and toxicity of a 4-drug FDC in the initial intensive phase of treatment.

**Methods:** Open label randomised controlled trial using a non-inferiority design with a 4% margin of non-inferiority. Smear positive patients were randomised to receive either an FDC (COMB) or separate formulations (SEPA) of isoniazid, rifampicin, pyrazinamide and ethambutol in the first 8 weeks of treatment.

**Results:** In a per protocol (PP) analysis, 546 of 592 (92.3%) patients had a favourable outcome in the COMB arm compared to 547 of 589 (92.9%) in the SEPA arm (risk difference (RD): -0.6%, 90% confidence interval (CI): -3.2, 1.9). In the mITT analysis in which changes for any reasons are classified as unfavourable 560 (81.9%) of 684 patients had a favourable outcome in the COMB arm, compared to 561 (83.4%) of 673 in the SEPA arm (RD: -1.5%, 90% CI: -4.9, 1.9). In a second mITT analysis in which patients who changed treatment for other than therapeutic reasons were classified according to their outcome at 30 months, 583 of 660 (88.3%) patients in the COMB arm had a favourable outcome compared to 588 of 658 (89.4%) in the SEPA arm (RD -1.0%, 90% CI -3.9, 1.8). In the PP population the factors with the strongest predictive effect of unsuccessful outcome were HIV infection (OR = 5.58, 95%CI 3.16, 9.84), culture positivity at 2 months (OR = 2.92, 95%CI 1.58, 5.38), ever smoked (OR = 2.18, 95%CI 1.39, 3.43) and male gender (OR = 1.73, 95%CI 1.03, 2.89). In the limited number of patients with available chest radiographs, bilateral cavitation was strongly associated with an unfavourable outcome (OR = 3.15, 95%CI 1.55, 6.43).

**Conclusions:** Compared to loose drug formulations, the 4-drug FDC regimen satisfied pre-specified non-inferiority criteria in two of three analyses, which supports recommendation for FDC use.

## IMPROVING THE QUALITY OF COVERAGE OF COLLABORATIVE TB-HIV ACTIVITIES

### OP-117-28 Missed opportunities for accessing HIV care among Tshwane TB patients under different models of care

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**Background:** The dual HIV/AIDS and tuberculosis epidemic is responsible for much of South Africa's burden of disease. This study aimed to compare access to HIV care for tuberculosis patients in settings with antiretroviral treatment (ART) and tuberculosis care under one roof ('combined sites') and settings with geographically separately rendered care, in Tshwane, South Africa.

**Methods:** Historical cohort study of patients registered with tuberculosis from Sept 2008 to March 2009, at 46 Tshwane TB treatment points (complete sampling at 4 combined facilities, every third patient at 42 separate facilities). Patients were followed up to 30 March 2010. ART initiation for HIV positive TB patients was established through linking of TB register patient identifiers to the electronic ART register of all patients on ART in Tshwane. Data analysis entailed univariate and multivariate analysis for predictors of ART initiation.

**Results:** Records of 636 and 1298 patients for combined and separate facilities respectively were reviewed. Trimetoprim/sulfamethoxazole prophylaxis and CD4 count recording were lower in combined than separate facilities, but the reverse was true for referral to HIV related care.

A higher percentage of patients eligible for ART initiation started ART in the combined than in the separate facilities (85.2% vs. 62.1%,  $P < 0.001$ ). In multiple logistic regression analysis, adjusted for facility clustering, the following variables were associated with increased ART initiation: attending a combined facility (AOR 3.78, 95% CI 1.92–7.43), a TB outcome different from defaulting or dying (AOR 3.05, 95% CI 1.81–5.14), and higher TB case load (AOR 1.41, 95% CI 0.95–2.10 for 2nd tercile, 3.16, 95% CI 1.27–7.87 for 3rd tercile).

**Conclusion and recommendations:** Having ART and TB treatment under one roof appears to increase ART initiation rates for HIV positive TB patients. Full integration of TB and HIV care is recommended to improve quality of care.

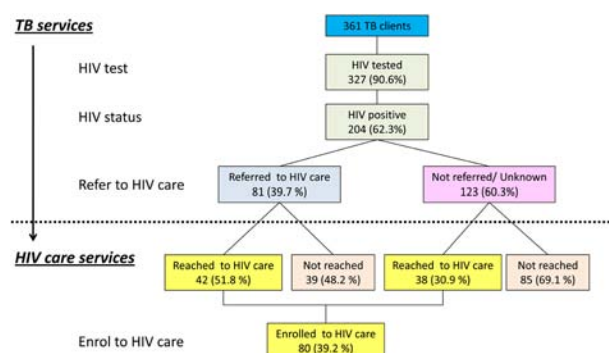
### OP-511-28 Successfully tested but not enrolled in HIV care: missed opportunities for TB patients in rural Zambia

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**Objectives:** The quality of treatment and care for TB-HIV co-infected patients may be affected by poor linkages between TB and HIV services. This study aimed to investigate the current situation of linkages between two services at the rural settings in Zambia in order to explore possible strategies to improve the quality of care.

**Methods:** The data of patients enrolled for anti-TB treatment at 14 health centres in Chongwe district from January 2009 to December 2010 were analyzed. The data from TB treatment registers and treatment records were reviewed. Among those tested HIV positive, referral to HIV services and provision of HIV care were further examined through HIV registers and care records.

**Results:** Over this period, 361 patients (male 58.4%, female 41.6%, median age 33.0 years) had started anti-TB treatment. Three hundred and twenty seven (90.6%) were tested for HIV, of which 204 (62.3%) were HIV positive. TB registers and treatment records indicated that 81 (39.7%) of co-infected patients were referred to HIV services. When these cases were traced at HIV registers to confirm their referrals, it was found that 42 (51.8%) of patients whose referrals were recorded at TB services and 38 (30.9%) of patients whose referrals were not recorded had actually reached HIV services and been enrolled to HIV care. Those who were enrolled to HIV care without TB treatment information were more likely to start NVP-based regimen even though they were on TB treatment with RFP ( $P < 0.001$ ).



**Figure** TB-HIV services linkages on TB clients in Chongwe district.

**Conclusion:** HIV testing for TB patients has been scaled up successfully. However referrals of co-infected



patients still remain as a challenge due to poor linkages between two services. Although ultimate goal would be to integrate both services, close monitoring of both TB treatment and HIV care for co-infected patients at TB clinic would help improve the quality of treatment and care for those patients in resource-limited settings.

#### **OP-751-28 Assessment of provision of TB-HIV integrated care at community level in KwaZulu Natal, South Africa**

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**Background:** A household survey was conducted in a rural district of KwaZulu Natal (KZN) to assess the extent to which TB-HIV integrated care are being implemented at community.

**Methods:** A household survey was conducted in four sub-districts of Sisonke district in KZN. A sample size of 3000 households (i.e., one adult per household) was calculated. The study population included all adults 18 years old or more in a household. Data was collected using a cell phone data collection system. Ethical clearance was obtained from the University of the Western Cape and written consent forms were signed by all participants.

**Results:** Out of 3867 household members interviewed, the average age was 40 years with minimum age of 18 years, maximum 99 years and the Std 17.7. The majority of participants (77%) were females while 23% were males. Most the participants (47%) were single and only 37.5% were married. Only 28% of participants completed primary school and 90% of participants were unemployed. 45% of the participants were counseled and tested for HIV and the positivity rate was 9% and 13.8% of participants were diagnosed with TB. The majority of participants (78%) were visited by community care workers (CCWs) in the previous year and 22% were not. Out of 3012 visited by CCWs, only 21% were screened for TB symptoms, 17% were HIV counseled and tested at home, 7% were on DOT-TB, 2% where receiving ART adherence and only 1.5% pregnant women were educated and counseled on feeding options.

**Conclusion:** The findings of this study suggest that most of participants in the communities were visited by CCWs. However, key services such as TB symptoms screening, TB contact tracing, and adherence support for TB, ART and dual therapy for PMTCT clients were inadequate. There is a need for enhancement of community participation in collaborative TB-HIV efforts.

#### **OP-771-28 Retention in care in a TB-HIV treatment programme**

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**Background:** HIV-infected TB patients are at high risk of mortality. Timely initiation of care and retention in care are essential for good treatment outcomes. We aimed to determine the incidence and risk factors for loss to follow-up (LTFU) and voluntary withdrawals (VW) among HIV-infected TB patients participating in a TB-HIV treatment and care program in Kinshasa, Democratic Republic of Congo (DRC).

**Methods:** Prospective cohort study of HIV-infected TB patients receiving antiretroviral treatment (ART) at 5 primary health care centers. Patients were classified as died, transferred, LTFU if they never returned despite at least 3 contact attempts, or VW if they withdrew permanently from the program. We identified risk factors for LTFU/VW using Cox regression.

**Results:** Among 412 adult TB patients on ART, 17 (4%) died, 58 (14%) were LTFU, 9 (2%) transferred, and 29 (7%) voluntarily withdrew during 4024 patient-months of follow-up (mean duration of follow-up 9.8 months). The incidence rate of LTFU or VW was 21.6 (95%CI: 17.5, 26.7) per 100 patient-months. Frequent reasons for VW were refusal to continue ART (28%) and travel to another region in the DRC (28%). In bivariate and multivariate analysis, younger patients (age <35 years) were at higher risk of LTFU/VW than older patients (age > 44 years) (unadjusted hazard rate (HR) 2.14; 95%CI 1.22–3.77). Patients with low education level (no or primary schooling) tended to be at higher risk of LTFU/VW compared to those with higher education level (adjusted HR 1.60; 95%CI 0.97–2.64). Patients reporting food insecurity tended to be less likely to be LTFU/VW compared to those who did not report food insecurity (adjusted HR 0.63; 95%CI 0.38–1.07).

**Conclusions:** One in 5 TB patients on ART were not retained in care. Coordinating transfer of care for patients who move during ART should be improved and better understanding of reasons leading to refusal to continue ART are needed to inform interventions to promote retention.

#### **OP-925-28 Quality of TB-HIV care as perceived by patients in municipal clinics in Bulawayo, Zimbabwe**

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**Introduction:** Patients' opinions on service quality and their satisfaction are important considerations when developing and implementing health services.



**Objective:** To assess patients' perceptions of quality of collaborative TB-HIV services provided by the municipal clinics in Bulawayo.

**Method:** A survey was carried out from May to July 2010 at three clinics where HIV-positive TB patients were commenced on antiretroviral therapy. One hundred and ninety seven randomly selected patients were interviewed using a pre-tested questionnaire to collect information on certain determinants of service quality.

**Results:** 156 (79%) respondents viewed the care they had received as good. The services were considered reliable by 171 (88%) patients. Drug availability was rated as good by 150 (76%) patients. 150 (76%) respondents felt that they had been adequately assisted to deal with their problems and treated with respect. Communication on TB-HIV management was well articulated in the opinion of 186 (94%) patients. Twenty eight (14%) patients wished to have more privacy during clinical examination. Waiting times up to 3 to 4 hours were found unacceptable by 59 (30%) respondents. Cost of travel and inconvenient clinic opening hours were found to be barriers to access to care.

**Conclusion and recommendations:** Overall, service satisfaction was found to be high. The department should take innovative measures to reduce waiting times and consider providing TB-HIV services also on Saturdays. Further decentralization of ART services is urgently required to reduce patients' travel costs. Regular clinic supervision should be carried out and it should include customer-care.

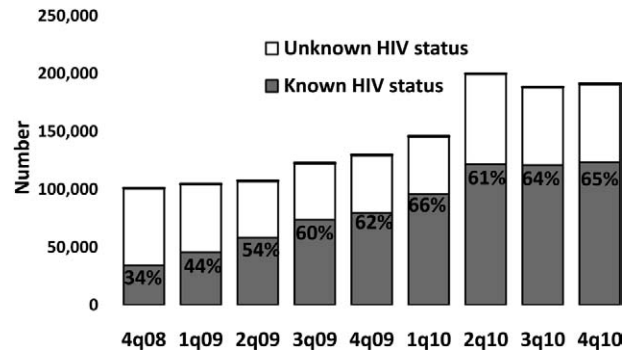
#### OP-949-28 Scale-up of intensified TB-HIV package in India

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**Background:** In India, an estimated 95 240 tuberculosis (TB) patients per year also suffer from HIV infection. To reduce the impact of HIV on TB patients, An 'Intensified TB-HIV Package' was introduced in 2008, including routine referral of TB patients for voluntary HIV counseling and testing, linking identified HIV-infected TB patients to HIV care and support including decentralized CPT and ART. By 2010 these services were scaled-up to cover 27 states (839 million population).

**Methods:** We reviewed the programme surveillance data from 19 states to evaluate the extent and impact of implementation of Intensified TB-HIV package, and to describe the success and future challenges of nationwide scale-up.

**Results:** From October 2008 till December 2010, the



**Figure** Trends in number (%) of registered TB patients with known HIV status, 4q08–4q10.

proportion of registered TB patients with known HIV status has increased from 34% to 65% (Figure). Of 480 752 TB patients registered in 2010, 41 476 (9%) were diagnosed as HIV-infected. The proportion of HIV-infected TB patients receiving CPT and ART is increasing; among patients registered October–December 2009, 93% and 53% of HIV-infected TB patients received CPT and ART respectively during TB treatment. In spite of these, the death rates among HIV-infected TB patients remain high (15%) as compared to HIV-negative TB patients (4%).

**Discussion:** TB-HIV services are rapidly-expanding nationwide, with increasing coverage of HIV testing among TB patients. Decentralized HIV testing matching TB diagnostic services is crucial for successful HIV case-finding among TB patients. High CPT coverage has been enabled by decentralized provision through the general health system, but linkage to ART remains a key challenge due to mismatch between centralized ART services and decentralized TB treatment. Future progress will be challenging as scale-up encompasses low-HIV prevalence with fewer HIV diagnostic and treatment services. In the interim, the programmes have enhanced monitoring of processes to link patients to HIV treatment.

#### OP-978-28 Capture-recapture analysis of TB-HIV co-infected patients in two regions in Kazakhstan

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**Background:** In Kazakhstan, tuberculosis (TB) patients are systematically screened for HIV and individual patient test results are registered and available at the national level. HIV-infected individuals should

be screened for TB, but individual patient data is not available on the national level. We aimed to establish the total number of co-infected patients in two regions of Kazakhstan.

**Methods:** Data on TB-HIV in both the TB and HIV/AIDS registers from two areas (Almaty City and the adjacent Almatinskaya oblast) in 2009 were compared to assess the true number of TB-HIV co-infected patients among their inhabitants in these regions. Patients from the prison sector were excluded as there is a separate TB register for the prison sector.

**Results:** For both regions combined, 75 TB-HIV patients were registered in the TB register and 82 in the HIV/AIDS register; of which 69 were registered as such in both registers. Three TB patients registered as HIV-positive were not registered in the HIV/AIDS register and three were wrongly registered as HIV-positive in the TB register. Twelve TB-HIV patients were mistakenly registered as HIV-negative in the HIV/AIDS register. Three co-infected patients who had died before start of TB treatment were not registered as TB patients at the AIDS center. Only 11 out of the 79 patients (14%) registered in the HIV/AIDS register that had not died before start of treatment, had been prescribed antiretroviral treatment (ART). The estimated total number of TB-HIV co-infected patients was  $87(72 + 1) \times (82 + 1) / (86 + 1)$ , for an HIV prevalence of 2.4% among TB patients.

**Conclusion and recommendations:** Gaps and mistakes were present with regard to TB-HIV patients in both registers. The collaboration between the TB and HIV/AIDS centers was strengthened, by means of a monthly exchange on new co-infected patients and the care they should receive. This should lead to improved quality of care and monitoring and evaluation regarding TB-HIV co-infected patients.

## NEW TOOLS AND APPROACHES

### OP-195-28 Blinded rechecking of sputum AFB smear using fluorescence microscopy

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**Objective:** To assess how blinded rechecking can be applied to fluorescence microscopy (FM) in a high throughput laboratory.

**Background:** The Hong Kong TB Reference Laboratory is a high volume laboratory examining around 400 sputum acid fast bacilli (AFB) smears daily using FM.

**Method:** After initial screening (by screener), all positive AFB smears are rechecked by an experienced medical technologist. Since 2003, random blinded

rechecking has been used as part of our internal quality assurance program. Around 2.5% (5% for 2003 and 2004) of all smears were randomly selected, re-labeled and assigned to each technician (re-checker) in turn every week. Selected smears were re-stained and re-examined within 2 months. Discordant slides between initial screener and re-checker were resolved by a controller who gave the final result of examination.

**Results:** For eight years from 2003 to 2010, apart from 2 discrete incidents of high false negative, all low false negative (LFN) errors (0.10–0.27%) were lower than the critical values at 95% sensitivity. However, LFN error (0.28–0.61%) found on the re-checker was far more prominent. There were considerable numbers of low false positive (LFP) cases found (0.03–1.05%) but subsequent mycobacterial cultures showed these LFP cases were all culture positive. Since all positive smears were re-checked initially by an experienced medical technologist, and both the screeners and re-checkers belonged to same group of trained technicians, this relatively poor performance of re-checkers and even the controllers might be due to fading out of stain and/or inefficiency of re-staining during rechecking.

**Conclusion:** In a high throughput laboratory setting, in order to minimise incidents of LFN errors, problems due to stain fading and re-staining must be solved before blind rechecking can be generally applied in the field for FM where culture is normally not routinely performed.

### OP-261-28 Critical review of the WHO African Region accreditation scheme for clinical laboratories

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Laboratories in low/middle income countries (LMIC) need fundamental improvement because quality laboratory services are essential for the decision making capacity of clinicians, health workers and public health authorities. To this end the World Health Organization's regional office for Africa (WHO-AFRO) developed a tiered accreditation system for clinical and public health laboratories in LMIC. One to five stars are accredited to the laboratory based on the level of compliance to a checklist (determined by using a scoring system). We performed a critical review of this WHO-AFRO accreditation checklist and formulated recommendations for implementation, harmonization and improvements. A framework was developed to analyze the contents, the focus points, and structure of the checklist. The review included a

comparison of the checklist with the ISO standard *ISO 15189: Medical laboratories—Particular requirements for quality and competence* and also an analysis of its scoring distribution. The analysis revealed many positive aspects but also points for improvement. It was observed that, although the content of the checklist covers all aspects of total quality management, the scoring distribution of the checklist is highly skewed towards resource management activities. This may lead to incorrectly performing quality management systems in laboratories still being accredited with one or two stars. In addition, we found that the checklist lacks guidance for managers on implementation of the checklist requirements. Overall, the launch of the checklist is an innovative initiative that should be promoted. For many countries that have no national regulation on quality management in clinical laboratories, this checklist may be a welcome instrument. Although a tiered accreditation system may be the most appropriate way for strengthening laboratories in LMIC, we recommend some changes and additions to prevent potential problems in the future.

#### OP-575-28 Cost of Xpert MTB/RIF for smear-negative TB suspects at primary care clinic in Johannesburg

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**Background:** When used at a point of care, all TB suspects positive on Xpert MTB/RIF can be initiated on treatment the same day, eliminating provider delay and loss to follow-up associated with waiting for culture results.

**Methods:** Provider costs for diagnosing smear-negative TB using Xpert or sputum smear microscopy plus liquid culture on 3rd sputum were analyzed using data from a study at Witkoppen primary care clinic. Costs for Xpert included operator (counselor), 4-cartridge platform and laptop, maintenance, calibration, and cartridges (FIND price of \$16.86 plus import costs). Public sector laboratory prices (2010) were used for microscopy and culture.

**Results:** Of 199 smear-negative TB suspects, 16 were Xpert MTB positive and 15 culture positive (including 5 Xpert negative). All 16 (100%) Xpert MTB positive patients were initiated on treatment the same day. Of the cultures, 38 (19%) were contaminated or missing. Culture positive patients were traced to provide results. On average, diagnosis took 51 days using standard practice (range 2–192). Of the 5 Xpert-negative, culture positive patients, only 1 initiated TB

treatment (20%). This rate of loss to follow-up (80%) was similar to baseline studies (72%). Cost per Xpert using average patient volumes at the clinic was \$23.57. Cartridges were 72% of the cost per test. Cost per specimen examined by microscopy and culture was \$16.07. Cost per TB diagnosis using Xpert or culture were \$293 and \$213, respectively. Cost per patient initiated on TB treatment was \$293 for Xpert, and \$1068 for culture assuming 80% loss to follow-up as observed in pilot (\$761 using baseline loss of 72%).

**Conclusion:** Long provider delays waiting for culture results means that most smear-negative TB patients are lost to follow-up prior to treatment initiation. While Xpert costs more than microscopy and culture per patient tested, the lower cost per patient initiated suggests that this rapid point-of-care test may be more cost effective.

#### OP-599-28 Point of care Xpert MTB/RIF for smear-negative TB diagnosis at a primary care clinic in South Africa

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**Background:** In research laboratory settings, the sensitivity of Xpert MTB/RIF for detection of smear-negative, culture positive TB is approximately 72%. Experience with this assay at point-of-care is limited.

**Methods:** Prospective study of 200 sputum smear-negative TB suspects at a primary care clinic in Johannesburg, South Africa. Xpert MTB/RIF was performed at point of care by a non-laboratory technician.

**Results:** Of the 200 smear-negative TB suspects, 145 (72.5%) were HIV-infected, with mean CD4 count 237 cells/mm<sup>3</sup> (IQR 89–337), and 32 (22.1%) were on antiretroviral treatment at TB suspect presentation. Almost all (186, 93%) presented with cough, of which 150 had cough for 2 weeks or more. Third sputum sample was positive on smear microscopy in 7 (3.5%), of which 2 were likely false positive as culture and Xpert MTB/RIF were negative. Culture (MGIT) was positive for *Mycobacterium tuberculosis* in 15 (7.5%) and non-tuberculous mycobacteria in 3 (1.5%) samples, negative in 144 (72%), contaminated in 12 (6%) samples. The Xpert MTB/RIF assay was positive in 16 (8%) patients. Compared to culture, sensitivity of Xpert MTB/RIF was 66.7%, specificity 99.3%, positive predictive value 91%, and negative predictive value 97%. None of the suspects, of which 17.5% had a history of TB treatment, were RIF resistant. All 16 Xpert positive patients were started on TB treatment on the day of assessment for smear negative TB. Among Xpert MTB/RIF negative

suspects, none of the 3 smear positive and only 20% (1/5) of culture positive patients started TB treatment. 21 patients started treatment based on CXR findings (1 for pleural TB).

**Conclusion:** Sensitivity and specificity of Xpert MTB/RIF at point of care by a non-laboratory technician was similar to performance in research laboratories. The greatest advantage of use of Xpert MTB/RIF at point of care was the ability to start treatment within 2 hours of assessment.

#### OP-745-28 Rapid detection of multidrug-resistant tuberculosis by MGIT 960 direct drug susceptibility testing

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**Background:** Rapid detection of multidrug-resistant (MDR) tuberculosis (TB) is extremely important so that effective treatment could be prescribed. This multi-center evaluation was designed to establish a standard protocol for direct drug susceptibility testing (DST) from clinical specimens for better management of drug resistant cases. The main objective was to evaluate accuracy of results and time saving using this approach as compared to routine indirect DST. Since MDR-TB is one of the main concerns in TB control program, we focused only on two drugs, isoniazid (INH) and rifampin (RIF).

**Methods:** This study was carried out in two different clinical laboratories with different patient populations and test parameters. Sputum specimens collected for routine diagnosis which were positive for acid-fast bacilli were included. Specimens were processed following the standard method for digestion, decontamination and concentration. The concentrated sediment was used to prepare smear for acid-fast staining, inoculate culture media for primary isolation and for direct DST. Positive culture isolates confirmed as *Mycobacterium tuberculosis* (M. tb) were used to perform indirect DST. The results obtained by direct DST were compared with indirect DST results. Mtb H37Rv(ATCC 27294) was used for QC testing.

**Results:** Of the 248 specimens processed, 216 (87%) direct DST results were reported. There were overall 3.7% discrepant results for INH and 2.8% for RIF. Time to result for direct DST ranged between 8 and 13 days with an average of 11 days.

Site	Average time to report, days	
	Indirect DST	Direct DST
Site 1	16	10
Site 2	18	11

**Conclusions:** Direct DST is a reliable method as results obtained had 96–97% concordance with indirect method. Results indicate that direct DST significantly reduces overall time to result by 6 days compared to indirect tests. This time saving could offer great help in prescribing effective treatment, especially in MDR cases. Direct DST can also be used for other first and second-line anti-TB drugs after a thorough evaluation.

#### OP-930-28 Comparison of real-time PCR with microscopy and culture for diagnosing TB meningitis in Indonesia

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**Background:** There is an urgent need to improve the diagnosis of tuberculous meningitis (TBM). Death from TBM is strongly associated with delays in diagnosis and treatment. Recent meta-analysis calculated that commercial nucleic acid amplification (NAA) assays for the diagnosis of TBM were only 56% sensitive (95%CI 46–66%), but some small studies suggest that in-house assays may be more sensitive. We evaluated real-time PCR targeted insertion sequence IS6110 among 230 patients with suspected meningitis in Indonesia.

**Methods:** Consecutive patients presenting with suspected TBM over a two-year period in a referral hospital in Indonesia were included. Pre-treatment CSF-samples were examined using microscopy (Auramin and ZN), cultures (Ogawa and Bactec), and real time PCR IS6110 with fluorescence-labeled probes using DNA extracted from large (7 cc) samples. Sensitivity of PCR was evaluated for patients with culture-confirmed and -unconfirmed TBM, and analyzed according to HIV-status.

**Results:** Among 230 meningitis cases, 202 were grouped as suspects of TBM. Using liquid culture as gold standard, the sensitivity of PCR was 95%, compared with 70% for Ogawa solid media, 21% for ZN, and 40% for Auramin. Among 97 patients with probable (but culture-negative) TBM, one third of whom were already taking TB-drugs, PCR was positive in 48% of HIV-negative ( $n = 75$ ) and 24% HIV+ ( $n = 21$ ). Specificity was 100% among 22 HIV-negative controls. Reagent costs for a single specimen are \$10.

**Conclusion:** In this setting, rt-PCR proved to be a quick, cheap and very sensitive and specific test for diagnosing TBM.



### OP-1219-28 Evaluation of GenoType® MTBDRs/ in clinical isolates from eight countries

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Line probe assays (LPA) for rapid molecular detection of mutations associated with rifampicin (RIF) and isoniazid (INH) resistance were endorsed by WHO for use in low- and middle income countries in 2008. Since then, LPAs for rapid detection of mutations associated with resistance to quinolones (*gyrA*), aminoglycosides/capreomycin (*rrs*), and ethambutol (*embB*) have become available. Multidrug-resistant tuberculosis (MDR-TB) isolates from the 'Preserving Effective TB Treatment Study' (PETTS) provided an opportunity to evaluate the GenoType® MTBDRs/ LPA with isolates from eight geographically diverse countries.

Locally confirmed MDR-TB isolates from Estonia, Latvia, Peru, Philippines, Russia, S. Africa, S. Korea, and Thailand were sent to the CDC. In addition, 42 pan-susceptible isolates from CDC's archives were randomly selected for LPA. Phenotypic drug susceptibility tests (DST) were performed by the modified proportion method on Middlebrook 7H10 media.

Phenotypic DST and LPA results are available for 255 isolates. Overall, MTBDRs/ identified mutations in 109/120 (90.8%) phenotypically ofloxacin resistant, 82/90 (91.1%) amikacin resistant, 80/105 (76.2%) kanamycin resistant, 57/72 (79.2%) capreomycin resistant, and 98/142 (69.0%) ethambutol resistant isolates. MTBDRs/ demonstrated 69.6% sensitivity (55/79) and 93.8% specificity (122/130) for detection of extensively drug-resistant (XDR) TB. First-run results were invalid in 3 of 255 (1.2%) isolates.

Repeat testing and DNA sequencing are underway to resolve discrepancies. To date, *gyrA* has been sequenced for 20 isolates. In 16 of these 20 (80.0%) cases, *gyrA* sequencing agreed with LPA results. Prior to routine use, laboratories should validate LPAs in parallel with phenotypic DST to determine performance characteristics in their programmatic and epidemiological setting.

## POSTER DISCUSSION SESSIONS

### IMPLEMENTATION OF COLLABORATIVE TB-HIV ACTIVITIES

#### PC-227-28 Scaling up TB-HIV interventions: the role of the National Coordination Committee in Uganda

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**Background and challenges to implementation:** In 2005, Uganda had TB and HIV prevalence of 646/100 000 and 6.4% respectively. About 50% of TB patients were co-infected with HIV and at risk of dying. At that time the country lacked TB-HIV guidelines and standardized TB-HIV services.

**Intervention or response:** With support from World Health Organization, the Ministry of Health formed the TB-HIV National Coordination Committee (NCC) with 20 Partners to coordinate the national response to the dual epidemic. Through 4 subcommittees, the NCC developed several guidelines to ensure appropriate response: TB-HIV policy guidelines, training modules and communication strategy. These guidelines were distributed and health workers trained on TB-HIV in all districts by December 2010. HIV testing was offered to TB patients while cotrimoxazole and antiretroviral therapy (ART) was offered to TB-HIV patients.

**Results and lessons learnt:** Based on national annual routine data from districts, the proportion of TB cases tested for HIV and TB-HIV cases started on cotrimoxazole improved from 27.6% and 52.5% in 2006 to 80.5% and 90% respectively by the end of 2010. However, the proportion of TB-HIV clients started on ART remains low (23%), partly because of utilizing the old WHO eligibility criteria of CD4 < 250.

**Conclusions and key recommendations:** National Coordination Committees can improve the implementation of TB-HIV collaborative services. Countries with high HIV prevalence should have a TB-HIV National Coordination Committee with active subcommittees to strengthen the implementation of TB-HIV collaborative activities.

### PC-479-28 TB patients' reasons for, and suggestions to address, non-uptake of HIV testing in Free State, Republic of South Africa

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**Aim:** South Africa endorses the global policy shift from client-initiated voluntary counselling and testing to provider-initiated testing and counselling (PICT), to facilitate uptake of HIV testing amongst at-risk populations in high-prevalence settings. This study explores why non-tested TB patients did not undergo HIV testing and reflects on TB patients' suggestions on how to improve the situation.

**Methods:** February–March 2008, a cross-sectional survey was conducted amongst 600 TB patients, in 61 primary health care facilities in four sub-districts of the Free State. Patient selection was done proportionally to the numbers registered at each facility in 2007. Patients were conveniently recruited as they left TB consultation rooms. A structured interview schedule was developed. Participation was voluntary, based on informed consent and guarantee of confidentiality. Data were subjected to bivariate tests and content analysis of open-ended questions.

**Results:** Almost one-third (32.5%) of respondents had not undertaken HIV testing for reasons including being 'undecided' (37.0%); experiencing fear (e.g., of testing HIV-positive, 19.0%); and perceiving themselves to be at low risk for HIV infection (13.4%); desiring to first deal with TB (12.5%); and because HIV testing was not offered (12.0%). Many patients expressed the need for support and motivation from health workers (33.3%), and from significant others (56.6%). Patients expressed a need for dissemination of TB-HIV information by health care workers (46.1%).

**Conclusion:** Patients did not undergo HIV testing for individual reasons as well as health system limitations. There is a need for dissemination of information on the TB-HIV link, as well as motivation and support to undergo HIV testing.

### PC-698-28 Current indicators of TB and HIV integration activities in Rwanda: performances, challenges and ways

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**Background:** Rwanda has a high burden of HIV infection and tuberculosis (TB). The Rwanda Ministry of Health initiated the National policy on TB-HIV integration activities in 2005. This policy was reviewed in 2009. We are reporting on TB-HIV activities indicators progress, challenges and ways forward.

**Intervention:** At initiation, the policy on TB-HIV integration activities was including systematic HIV

testing for all TB cases and enrollment of those with HIV infection, into HIV care within the TB service. They were also benefiting from a CD4 cells count, provision of cotrimoxazole preventive therapy (CPT) and antiretroviral therapy (ART) under direct observation. After completion of TB treatment, those HIV infected TB cases are transferred to HIV clinics for further follow up. In the last semester of 2009, HIV testing was extended to all TB suspected cases attending health facilities.

**Results:** During the last 3 years (2008–2010), HIV testing in TB cases was always  $\geq 96\%$  and  $\geq 34\%$  were HIV infected. CPT provision increased from 87% to 97%. The proportion of those under ART progressed from 39% to 67%. In 2010, 89% of TB suspects with unknown HIV status were tested for HIV infection, and 7.2% were found to be infected. All-causes mortality in TB cases (all forms) registered for treatment in 2009 was 9.4%, but 14.1% and 7.4% respectively in those with and without HIV infection.

**Conclusions:** The challenges faced during the implementation of TB-HIV integration activities are among others low performance of available TB screening tools, irregular TB screening in HIV infected people during their follow up visits and high mortality in HIV infected TB cases compared to HIV uninfected TB cases. Soon in Rwanda new TB diagnostic tools will be evaluated and introduced at peripheral level; ART policy will be changed to include all HIV infected TB cases, regardless of their CD4 cells levels. Also Isoniazide preventive therapy for HIV infected people has been already adopted.

### PC-723-28 TB-HIV co-infection: linkage is the real challenge in the implementation

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**Aim:** To assess the progress of phase-1 TB-HIV co-infection pilot intervention in selected districts of Pakistan supported by Global Fund. To improve the outcome of implementation in phase-2 and address the gaps in the linkages based on the lessons learned from phase-1.

**Methods:** Retrospective data analysis of the phase-1 was done. Data validation was done from patient recording registers. The patients and provider data has been linked with the issues and challenges identified during the quarterly TB-HIV Coordination meetings held in respective provinces.

**Results:** In total 16 representative sentinel sites were identified for intervention in all the four provinces of country. In total 22 046 (12 406 males and 9 640 females) were counseled and screened in three years (2008 to 2010). There were 614 refusals of HIV testing in tuberculosis patients after counseling. 51 males and 12 females have been diagnosed as HIV positive

while 227 (198 males and 29 females) were identified as tuberculosis suspects among PLHIV and 24 (22 males and 2 females) turned out positive for tuberculosis.

**Conclusion:** Keeping in view the yield it can be inferred that there is a strong need of strengthening the linkages between the two programs at the facility level in addition to the national and provincial level to improve the outcome of the implementation. The referral of PLHIV (people living with HIV) is low and it may be attributed to poor coordination between the TB and HIV clinics. Weak linkages and inadequacy of service are factors hindering the achievement of the desired outputs.

### PC-812-28 Identification of correlates for not reaching the ART centre in TB-HIV co-infected patients

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**Background:** Anti-retroviral therapy (ART) is freely available for people coinfecting with TB-HIV (PLCTH) in India. However, TB registry shows that many PLCTH referred to ART centre do not access therapy. This study aimed to determine the proportion of PLCTH not accessing ART and the reasons.

**Methodology:** This cross sectional study was conducted from October to December 2009 in a south Indian district using mixed methods. All PLCTH registered with TB programme in the 1st quarter of 2009 were selected for survey (283). Focus group discussions (FGD) were conducted with district programme managers ( $n = 5$ ), PLCTH who accessed ART ( $n = 12$ ) and who did not ( $n = 8$ ).

**Results:** This district had HIV prevalence of 2%, where one ART centre served 4.6 million population. Of the total 1340 TB patients registered, 1095 had their HIV test done, of whom 283 were positive and 53% of them accessed ART. Determinants of access were distance from ART centre (OR-3.15) and discordant couples (OR-24.3). Lack of finance (30.2%), serious illness (21%), refusal (15.7%), preference for private doctor (7.8%), lack of family support (7.8%) and fear of stigma (5.2%) were the barriers reported for not accessing ART. At the end of 8 months of TB treatment, 42% of the patients who accessed ART were alive in comparison to 20% who did not.

**Conclusion:** Long distances from ART centre and lack of finances are associated with not accessing ART. Decentralisation of ART services to sub-district hospitals is essential. There is a need to raise awareness to address stigma and related issues.

### PS-909-28 Early TB detection an entry to TB treatment

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**Background:** Tuberculosis is one of the leading causes of morbidity and mortality among people whose sero-status is reactive, in Zambia with the advent of HIV/AIDS for over two decades, TB has reached dramatic figures. The objectives of the study were to access the availability of TB preventive measures being put in place on PLHAs accessing ART from these canters, how often they are screened to identify TB suspects and rule out TB. The objectives of the study were to access the extent to which the TB-HIV collaborative services are implanted in the ART centers where PHIVs access their HIV services. Variables included knowledge on offering of such services in their respective ART centers.

**Methods:** The study instrument was an in-depth oral interview in which some answers were given orally and some in written. The sample consisted of 200 people living with HIV (PLWHA) on anti-retroviral therapy (ART) accessing their treatment from four ART centers in Lusaka.

**Results:** Of all the 200 clients interviewed, no single client confirmed being screened for TB as a routine checkup to identify TB suspects and rule out active TB without the presence of signs and symptoms suggesting a queried TB case. Only 2% of the respondents reported knowing that TB is preventable and curable. However, none of them knew about the existence of the Isoniazid Preventive therapy (IPT) in Zambia.

**Conclusion:** To dramatically reduce the global burden of TB by 2015 in line with the millennium development goals and the stop TB partnership strategies, an holistic approach is required where TB and HIV treatment centers should be integrated, so that PLHAs who develop TB have to access the treatment and care from the ART centers where they access their ARVs other than go to other health facility and increase costs in accessing the services.

### PC-953-28 The TB services' contribution in the scaling up of TB-HIV collaborative activities in Mozambique

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**Background:** In Mozambique WHO recommended TB-HIV collaborative activities have been promoted by the Ministry of Health since mid-2006. Among these activities, counseling and testing for HIV (C&T), cotrimoxazole preventive therapy (CPT) and anti-retroviral treatment (ART) are provided to reduce the burden of HIV among TB patients. The first two

are offered directly at TB service, while the latter is provided at HIV clinics.

**Methods:** We evaluated data on TB-HIV activities implemented at TB services nationwide, and reported to the National TB Program between 2007 and 2010.

**Results:** (See Table).

Year	Persons enrolled in TB services <i>n</i>	Enrollees who received C&T, %	Enrollees receiving C&T who were tested INSIDE TB services, %	Enrollees receiving C&T positive for HIV <i>n</i> (%)
2007	38 999	68	NA*	47 (12 563)
2008	40 806	79	NA*	60 (19 330)
2009	45 531	83	60	64 (24 451)
2010	46 174	88	48	61 (24 574)

Year	Enrollees positive for HIV receiving CPT, %	Enrollees receiving CPT who received INSIDE TB services, %	Enrollees positive for HIV receiving ART, %
2007	93	NA*	32
2008	92	NA*	30
2009	87	66	22
2010	97	58	25

\*NA= data not available at that time.

**Conclusions:** The TB service is an important entry point for TB-HIV patients. Many patients were tested for HIV status at TB service and most persons testing HIV positive received CPT directly there. HIV C&T for TB patients and CPT for those co-infected with HIV have increased over time. However, access to ART remained low, and this may reflect still weak linkages between TB and HIV services. The new WHO recommendation on universal access to ART for TB-HIV patients and possible integrated models of TB-HIV care (e.g., the 'one stop shop') may improve access to HIV care and treatment for co-infected patients.

#### PC-1063-28 Increasing trend of HCT uptake among registered TB cases in Nigeria, 2007-2010

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**Background:** The interaction between TB and HIV compounds the TB burden in the country. In addressing this problem, Nigeria revised the WHO recommended DOTS strategy through the adoption of the STOP TB strategy in 2006. In improving the TBHIV collaborative mechanisms, a national TBHIV working group was established in 2006 with expansion to 23 states out of the 36 states and FCT.

**Objective:** To evaluate progress made in the uptake of HCT services among all forms of TB cases notified at the national level from 2007 to 2010.

**Methods:** A retrospective study was carried out between 2007 and 2010 in which records of case notifications to the national programme by facilities within all states were analyzed according to HCT uptake, HIV prevalence among TB patients, and CPT and ART implementation among the co-infected.

**Results:** All states are presently implementing TB-HIV activities. The proportion of notified TB screened for HIV at national level has consistently been on the increase from 32% to 62.5% to 73% and to 79% in 2007, 2008, 2009 and 2010 respectively. Further review showed a low implementation rate of CPT and most especially ART (54% and 34% respectively) among TBHIV co-infected patients.

**Conclusions:** Well integrated HCT services within the TB programme with increasing trend of uptake. A large proportion of the co-infected are not receiving CPT and ART. Through supportive supervision conducted within this period, poor documentation and weak referral linkages & feedback mechanisms among health care workers within these facilities providing TBHIV joint activities are some factors found to be responsible for the low implementation rate of ART and CPT.

#### PC-1107-28 Early detection and treatment of HIV is associated with lower rates of TB in Indonesia

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**Background:** HIV-infected individuals are at increased risk for active TB; those with the lowest CD4 cell counts having the highest risk. Antiretroviral therapy (ART) decreases the risk of TB, but may also unmask subclinical TB. As such, earlier detection and treatment of HIV may affect incidence and diagnosis of TB. We correlated rates of TB with CD4 cell count measurements in a cohort of HIV patients in Indonesia.

**Methods:** From all HIV-infected patients enrolled in an open cohort in Bandung, West-Java since 2007, history of TB treatment was recorded at time of diagnosis. All patients received ART according to WHO criteria, and data on initiation of TB treatment were collected during follow-up. Rates of TB were related to CD4 count counts at time of enrollment in the cohort.

**Results:** From 1267 HIV-infected patients, 32.3% had a history of TB-treatment, and 12.0% received TB treatment during follow-up. Patients with low CD4 cell counts reported a moderately increased rate of



**Table** TB history and incident TB in a cohort of Indonesian HIV patients, according to CD4 cell count at time of enrolment

CD4 cells/ $\mu$ l	No. of patients	TB history %	TB during follow-up %
<25	274	42.7	27.7
26–50	135	39.3	22.2
51–100	148	35.1	16.2
100–200	173	31.2	3.5
>200	537	26.8	1.9
Total	1267	33.1	11.5

previous TB treatment (Table). During follow-up this difference was much more pronounced: 27.9% of patients with CD4 cells < 25/ $\mu$ l was treated for TB, mostly in the first months after starting ART, vs. 1.9% of those with CD4 cells > 200/ $\mu$ l (Table). Intensified screening and early diagnosis of HIV among risk groups in this setting has led to higher median CD4 cell counts at time of diagnosis, and to much lower rates of TB.

**Conclusion:** These are the first systematic data reporting rates of TB in HIV-infected patients in Indonesia. The increased rate of TB in prior to initiation of ART in patients with low CD4 cell counts reflects a longer duration of reduced immunity against TB, the >10-fold higher rate of incident TB in this group is probably due to ‘unmasking’ of subclinical TB in this group. This program shows how early detection and treatment of HIV reduce HIV-associated TB, and probably also limit transmission of TB to the general community.

#### PC-1178-28 Screening TB among HIV-infected pregnant women: role of symptom screen

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**Objectives:** Among HIV-infected pregnant women participating in a standard pulmonary tuberculosis (PTB) screening program, to determine the proportion with: 1) positive symptoms who have active TB and 2) negative symptoms who are deemed eligible for isoniazid preventive therapy (IPT) based on absence of radiological and clinical evidence of TB and tuberculin skin test status.

**Methods:** This is a retrospective cross-sectional study. A review of an existing data set for screening for PTB among HIV-infected pregnant women within the USAID-AMPATH program, Western Kenya was done. Data was prospectively collected between October 2009 and February 2010.

**Results:** A total of 190 patients were analyzed. The study participants had a mean age of 27 years and a

median (range): parity of 2 (0, 10); gravidity of 3 (1, 11); gestation at enrolment of 26 (10, 41) weeks and CD4 counts of 440 (24, 1408) cells/ $\mu$ l. Only 38 patients (20%) had a positive symptom/sign screen and 149 patients (80%) had a negative symptom and sign screen. Only 2 patients (20%) among the 10 patients who had presumptive TB as defined by suggestive chest radiograph had a positive symptom/sign screen. A total of 134 patients (70%) were deemed eligible for IPT.

**Conclusion and recommendation:** In this setting a high percentage of HIV-infected pregnant women are eligible for IPT. TB screening should be routine in all prevention of mother-to-child transmission of HIV (PMTCT) care programs in high TB burden areas. More studies needed to determine best screening protocols as well as feasibility of IPT in this population.

#### PC-1189-28 Progress indicators of the national TB-HIV working plan, Burkina Faso

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**Introduction:** The HIV epidemic is generalised in Burkina Faso with an HIV prevalence of 1.2% in the general population in 2009. In 2009, the overall prevalence of HIV among new TB patients was 20.3%. The TB-HIV national committee was established in 2008 by the National TB Program (NTP) and the National Committee on HIV/AIDS (CMLS/Santé). The national TB-HIV working plan 2010–2012 was endorsed by the Ministry of Health at the end of 2009.

**Objectives:** The three-year TB-HIV national plan has 5 specific objectives to be achieved by the end of 2012: 1) active case finding of TB should be performed in at least 50% of new HIV patients registered and in 100% of HIV patients starting antiretroviral therapy (ART); 2) 60% of HIV clinics should adopt infection control policies; 3) 95% of TB cases should receive an HIV test; 4) cotrimoxazole preventive therapy (CPT) should be started in 98% of TB-HIV patients; 5) ART should be started in 95% of TB-HIV patients. The National Committee did not adopt the strategy of isoniazid preventive therapy (IPT) for HIV infected persons.

**Results:** At the end of 2010, a total of 5482 TB cases were registered, of these 4726 (86.2%) were tested for HIV. Of the HIV infected TB patients, 809/841 (96.2%) had initiated CPT and 353/841 (42%) received antiretroviral treatment.

**Conclusions:** Tuberculosis active case finding is performed in HIV clinics but a standard form for notification is not yet available. TB infection control policies are not yet implemented. The development

and introduction of a recording and reporting system for active case finding among HIV infected persons and the promotion of infection control strategies are priority areas for intervention of the TB-HIV national committee in Burkina Faso. ART treatment of TB-HIV patients requires rapid expansion. HIV testing for TB patients and CPT of TB-HIV patients are on track. The need to reconsider the adoption of the IPT strategy is currently debated.

### PC-1209-28 Support supervision, mentoring and coaching to improve TB-HIV programme performance in Ngaka Modiri

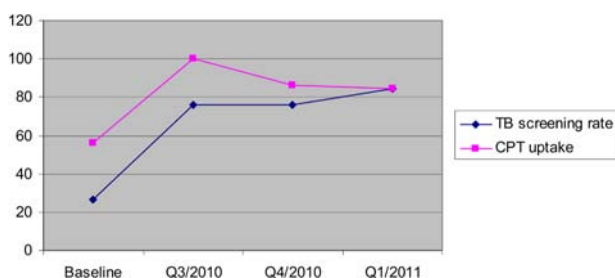
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**Background:** The burden of TB and HIV in South Africa remains high, with HIV prevalence in pregnant women at 29.4%, while TB incidence is reported at 970/100 000 in 2009. Ngaka Modiri Molema, a district in North West Province had an HIV prevalence among pregnant women of 25.1% in 2009; before intervention in the district by the United States Agency for International Development (USAID) TB project, the TB symptoms screening uptake was 26.8% in HIV+ patients and the Cotrimoxazole Preventive Therapy (CPT) uptake was 56% in coinfecting patients.

**Interventions:** Regular facility support supervision, mentoring and coaching are essential to improve TB-HIV program performance. Twenty five facilities were identified jointly by the USAID TB project and the district for technical support. The multidisciplinary team worked collaboratively to:

- 1 Develop quality improvement plans based on gaps identified in baseline assessments
- 2 Conduct regular in service training to facility staff on basic TB management, TB-HIV management and 3Ps
- 3 Introduce the TB symptoms screening tool
- 4 Provide regular support supervision, mentoring and coaching to facility staff

**Results:** TB screening for HIV infected clients improved from 26.8% in May 2010 to 89.2% in De-



**Figure** TB screening and CPT uptake in TB-HIV programme: Ngaka Modiri Molema district.

cember 2010. CPT uptake for TB-HIV co-infected patients improved from 56% in May 2010 to 84.5% in December 2010.

**Conclusions:** Regular facility support in the form of mentoring and coaching is critical to assist in the implementation of good quality TB-HIV services.

### COMMUNITY ENGAGEMENT AND COMMUNITY-BASED TB-HIV ACTIVITIES

#### PC-214-28 Scaling up TB-HIV integration: HIV testing among TB patients, community partnership and capacity building

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**Issues:** Peru has concentrated HIV epidemic and high TB incidence. Usually, collaborative TB-HIV activities focus at healthcare settings. Integral initiatives at both healthcare and community level are needed.

**Description:** 1 An itinerant health team provided free, HIV voluntary counseling and testing (VCT) to people affected by TB (PAT) in Callao, Peru. We tested 247 PAT, 45.3% had not been tested for HIV after TB diagnosis and 71.7% didn't use condom during last sexual intercourse. Overall, 2.8% tested positive for HIV.

2 Three community partners (2 HIV, 1 TB) designed and implemented TB-HIV Work Plans on their regions. Partners' exploratory studies showed: Absence of integral response to TB-HIV, HIV communities are more empowered than TB ones, bidirectional stigma/discrimination and TB-HIV training needs.

3 Workshops given to TB and VIH community leaders (TB-HIV training and sensibilization) achieved: Integration of participants around TB-HIV thematic (through joint identification of needs and mutual learning) and design of TB-HIV action plans. Workshops about VCT for PAT were given to health providers involved in direct care of PAT; previously to training, most of them didn't know how to perform VCT services.

**Lessons learned:** By providing innovative VCT services for PAT (itinerant health team), we identified a high percentage who had not been tested for HIV after TB diagnosis, and high rates of condom non-use. Partnerships are a key factor to identify local issues and possible solutions in TB-HIV, since community focus. Joint capacity building for TB and HIV communities contribute to knowledge sharing between them.

**Next steps:** To share learning of intervention and training in VCT with local government units. To strengthen partnerships with community to implement TB-HIV surveillance and incidence. To promote greater empowerment of TB communities to strengthen TB-HIV integral approach. To perform further investigations about HIV risk factors in PAT.

### PC-233-28 Capacity building for data-focused decision making improves uptake of HIV care and treatment service

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**Background and challenges:** Though data driven decision making is cost effective and key to improving HIV services delivery, uptake and HIV patient health outcomes, it is still not optimally utilized in poor resource settings. Which could be attributed to poor capacity of facility medical records staff in Nigeria impedes accurate and reliable data documentation, management and utilization for evidence-based decision making in rural health facilities?

**Interventions and response:** USAID funded Management Sciences for Health's Nigerian HIV Project supports the government of Nigeria in strengthening rural health facility's health systems. Capacity building workshops and continuous on site mentoring and supportive supervision were conducted for 31 facility medical records staffs. The training and mentoring sessions focused on data collection methods and reporting, identification and utilization of strategic indicators to provide information on facility performance and guide decision making for improved service delivery.

**Results and lessons learnt:** HIV and TB performance indicators showed an increase in uptake 9 months post intervention in the percentages of new PLWHA enrolled into care (74% to 84%), percentage of newly enrolled PLWHA patients screened for TB (36% (Males 637 and Females 1496) to 74% (Males 1498 and Females 3060).)

**Conclusions:** Capacity building in data use for informed and strategic decision making is an effective and cost efficient way to improve HIV services and increase uptake of care and treatment in low and middle income countries where innovative and cost effective strategies to improve service uptake have to be explored and replicated.

### PC-340-28 Sharing the experience from the THRio Study Community Advisory Board—THRio CAB

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**Background:** THRio's CAB is a community compliance committee for the study 'Impact of Widespread Use of TB Preventive Therapy for HIV-TB Co-infected Patients with Access to HAART in Rio de Janeiro, Brazil—THRio'. It was established in 2005 to increase community participation in the study. Over the past 5 years it became an interactive channel for researchers, health care workers and the civil society. It also created a baseline for accountability and engagement of the communities included in the study.

**Aim:** To spread THRio's goals and results; to disseminate the procedures used during the study's intervention; to create an independent source of information about the study for the communities involved and act as the liaison between the study team and the communities; to offer its members a learning opportunity to increase participation in research ethics committees and to increase community rights literacy.

**Methods:** The CAB's establishment resulted from intense dialog with researchers and groups related to the study, including health professionals, patients and the civil society. The CAB's members, all volunteers, determined its working frame, its policies and an annual meeting calendar. Training opportunities were offered to its members; the group developed educational materials. THRio's CAB also supported and participated in 10 TB-HIV Integration Forums.

**Results:** Sustainability of advocacy actions for the prevention of TB in HIV patients; strengthening of TB activism; creation of a sustainable human research ethics channel; publication of the lessons learned.

**Lessons learned:** Results express the collaboration and commitment of the people involved, who multiplied their efforts and partnerships with researchers, activists and community leaders. This resulted in the successful implementation of the World Health Organization's '3 Is' strategy—Intensified Case-Finding, Infection Control, Isoniazid Preventive Therapy.



### PC-427-28 Decentralised Doorstep TB and HIV care improves TB completion in a peri-urban setting

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**Background and objectives:** Peri-urban communities, in TB and HIV endemic settings, have high TB disease burdens and poor treatment outcomes. FDOT (Field based Directly Observed Therapy) Community Outreach Programme, offers doorstep DOT to patients residing in a peri-urban community, outside Durban,



KwaZulu Natal. The aim of the FDOT programme was to improve TB treatment outcomes by providing integrated TB and HIV care.

**Methods:** This retrospective analysis compared TB treatment outcomes for 331 participants enrolled into the programme between 2008 and 2010 to a historical database of 650 patients from this community receiving clinic based TB care from 2005 to 2008. Patients were referred to the programme from their local clinic upon diagnosis of TB. To ensure treatment adherence the FDOT nurse administered streptomycin and first line TB treatment during daily home-visits and twice weekly home-visits, respectively. As patient rapport became established, HCT was offered and eligible patients accompanied by the FDOT nurse, were initiated on HAART at a nearby ART site.

**Results:** The demographic profiles of the historical and FDOT cohort were similar however HIV status of the historical cohort was unknown. 85.2% (282/331) of FDOT patients received home based HIV counseling and testing (HCT), 59.9% (169/282) were co-infected with HIV and 17.7% (50/282) initiated on ART with the balance enrolled in pre-ART care. TB interruption rates decreased from 31.5% (205/650) to 0% (0/331),  $P < 0.0001$ ; completion rates improved from 26.0% (169/650) to 43.5% (144/331)  $P < 0.0001$ ; failure rates decreased from 7.8% (5/650) to 0.3% (1/331),  $P = 0.6699$ .

**Conclusions:** Decentralised care may be an effective strategy to improve TB treatment outcomes for patients in a peri-urban community and needs to be explored further.

#### PC-434-28 Using PLHIV as counsellors in VCT centres

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**Issues:** The use of PLHAs as counsellors in VCT centers will help in cushioning the effect of pre and post test counselling results. The role played by pre and post test counselling is vital in stopping HIV/AIDS infections and helps in the reduction of stigma and discrimination of people living with HIV/AIDS (PLHIV).

**Description:** Counselling is considered as a job for professionals like doctors, nurses, psychologists etc. Very little attention is paid to people living with HIV/AIDS. Counselling is meant to educate the client before and after the test which will enable the client make an informed decision about what ever would be the out come of the test. The training of 15 PLHA in Lusaka as counsellors yielded more than expected results. Apart from working in the city, they were also sent to the remote rural centers. Clients felt more at home and relaxed to discuss with PLHAs and witnessed an upsurge in the number of people who went for the HIV test. Those who tested negative had every reason to why they must protect themselves, while

those who tested positive were made to understand the facts about HIV infection and were encouraged to live positively. It was also interesting to know in the communities covered, the inhabitants were getting to know about the infection from those infected which further helped in breaking the walls of ignorance, misconception and information about the infection.

**Lessons learned:** Trained PLAs can achieve more result in counselling as they are more than willing to talk with regards to HIV test. Through their counselling, clients are given first hand information about stigma and discrimination from the PLHAs and how to combat them.

**Recommendations:** Adequate training should be given to PLHAs in counselling so that they can work in VCT centers and government hospitals as HIV/AIDS counselors.

#### PC-802-28 Modelo basado en la comunidad para mejorar tasas de tamizaje para VIH en pacientes con tuberculosis

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**Antecedente:** Por encima de una epidemia de tuberculosis, el Perú sufre una epidemia concentrada de VIH/SIDA. Estigma fuerte, pobreza, y una inadecuada infraestructura de servicios de salud son barreras considerables para lograr el tamizaje universal para VIH en pacientes con TB. Las estrategias existentes—consejería y pruebas de sangre voluntarias en centros de salud—no alcanzan abordar estos obstáculos.

**Objetivo y métodos:** Evaluar la aceptación y viabilidad de una estrategia basada en la comunidad, utilizando pruebas rápidas orales (no invasivos) para detectar y referir coinfección de VIH en pacientes con TB y sus contactos domiciliarios. Entre junio de 2008 y abril de 2009, promotores comunitarios ofrecieron consejería pre- y post-test y tamizaje con prueba oral (OraQuick) en visitas domiciliarias. En la zona de Lima Este, una área de bajos recursos con alta incidencia de TB y VIH, se ofrecieron las pruebas a 130 pacientes reclutados que fueron referidos por sus establecimientos de salud que iniciaban tratamiento de TB sin diagnóstico de VIH.

**Resultados:** Se logró intervenir en 22 establecimientos de salud y 52 domicilios. Hubo 106 participantes elegibles (99 pacientes y 7 contactos familiares); de ellos, cinco rehusaron realizarse el tamizaje para VIH, lo que dio un 94.3% de aceptación. De los tamizados, 3 pacientes salieron reactivos al tamizaje para VIH, los cuales se confirmaron con una prueba ELISA y se insertaron al tratamiento TARGA. Al término del proyecto, personal de salud en los establecimientos intervenidos solicitaron la continuación del tamizaje



oral para la detección de los casos de coinfección a tiempo.

**Conclusiones:** Un modelo comunitario combinado con pruebas orales logró una aceptación de 94.3%, superando tasas de aceptación de pruebas orales obtenidos en otros países y la meta de aceptación del Ministerio de Salud del Perú para 2014. La estrategia facilitó aceptación de la prueba y el ingreso oportuno al TARGA para los pacientes diagnosticados.

### PC-911-28 The discussion group brings together PLWHA

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**Background:** For a very long time, PLWHA keep to themselves. This phenomenon has resulted in the discrimination and stigmatisation of PLWHA. Our organisation, 'ONG ESPOIR' has instituted discussion groups for the PLWHA which are scheduled for the first Saturday of every month, between the hours of 9am and 11am. Each session has a precise theme and moderator for the best execution of activities. The home visitation team reminds the PLWHA of the Saturday meetings, on their rounds. As such, on the said Saturdays, they arrive on time. Some of them bring along their children so that they can also listen to the message to live responsibly, to reinforce what is preached to them in their various places of worship.

**Method:** To begin with, the group leader introduces the moderator. The other participants then introduce themselves by mentioning the first and last names, where they come from and their various religions. This breaks the communication the tension and barrier and hence prepares the participants adequately for the discussion. At each session, the participants dine together and also share refreshments. Usually the group discussions end with merry making or dancing which participants enjoy so much. The theme for the subsequent session is decided upon together by the participants. We end the sessions very satisfied.

**Result:** These activities encourage the PHAs to free themselves psychologically, attend medical consultations easily and especially to talk freely about their problems with close associates and relations.

**Conclusion:** We therefore invite partners to support this activity in order to assist those who for the lack of resources do not take part in these lively sessions. 'ONG ESPOIR', which has its offices at Cotonou, receives students for internship and training. The doors of 'ONG ESPOIR' are always open to all who desire to benefit from our experiences.

### PC-917-28 A community approach to TB prevention, case finding and treatment referral

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**Background:** In Zambia, a country with one of the highest TB burdens Africa, we embrace the WHO policy on collaborative TB and HIV activities. The aim is to decrease the burden of TB in PLHIV which has been a challenge as 70% of all detected TB cases are co-infected with HIV and TB still is the most common cause of death in PLHIV.

**Description:** With a grant from ZNAN, CITAM+ trained 20 former TB patients as treatment supporters to who conducted outreach activities to sensitize the community on prevention of TB, encourage testing for TB in households where there were PLHIV suspected of having TB and also referral to TB suspects in the community for treatment from the health centre. Strategies used include community drama, door to door sensitization and setting up of information desks at the health centre where people can access information about TB, HIV, Nutrition and dealing with side effects of medication from the perspective of former patients.

**Lessons learnt:** Within the 6 month duration of the project, with simple monitoring tools developed to monitor the activities of the treatment supporters in the community, 7200 households in Lusaka were reached with information about TB in 8 communities of Lusaka, 423 suspects referred for TB treatment and 14 400 people reached with information through the information desks set up in 2 health facilities.

**Recommendations:** Treatment supporters play an important role in scaling up access to TB-HIV services in the health centre as long as they have incentives for their efforts. There was increased knowledge on TB prevention, ICF and referral for treatment because project had motivated treatment supporters. There is need for increased partnership between the community, civil society and the government to address TB as health care providers alone cannot manage to meet this challenge.

### PC-928-28 TB-HIV diagnostic interventions in resource-poor areas: role of community sputum fixers in Tanzania

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**Background:** TB is among of the major public health problem in Tanzania. The National TB and leprosy program among of their strategy is intensive case finding. The coverage of diagnostic centers is very low and some areas are located very interior that it takes

hours to reach the diagnostic centers. PATH Tanzania has tried to scale up TB-HIV collaborative activities but still there are hard to reach areas. Therefore PATH introduced a cadre called sputum fixers; these are community owned resource persons. They screen the community looking for TB suspects. These TB suspects are those with complain of cough. They fix their sputum on slides and send them to the diagnostic centers. These sputum fixers are given bicycles to transport these slides to the laboratories for analysis. **Methods:** 10 sputum fixers were identified in five districts in Tanzania whereby the sputum of suspects were fixed and sent to laboratory for analysis. Any sputum positive of the two slides taken was regarded TB patients. Those with TB were counseled and tested for HIV.

**Results:** Out of 1195 suspects whose sputum were taken to laboratory for analysis 137 (8.7%) were AFB sputum positive and out of those with TB 30% were HIV positive.

**Conclusion:** Introduction of community owned resource persons (sputum fixers) helps in case identification and increase case detection and hence reducing incidence rate after proper treatment of TB and HIV in resource poor area. Partnering with community makes a great impact, should be taken on board.

#### **PC-972-28 Partnerships with community partnerships in scaling-up TB-HIV services: Kisarawe District experience**

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**Background:** Tanzania ranks 15th among the 22 high burden tuberculosis countries. Adult HIV prevalence is about 5.6, while co-infection rate is 50% among TB patients. TB-HIV activities established the year 2006 under USAID supported TB-HIV project through PATH. There were only four (18%) TB diagnostic and DOT centers. With this very few facilities to provide TB services in the District it was difficult to reach the people with TB in the community.

**Intervention:** Since 2007 PATH to involve the community interventions like training of Sputum fixers, School health project, Involvement of traditional healers, engage part II drug sellers, Community Own Resource Persons (CORPS) to create awareness.

**Results:** By December 2010 all 18 (81.81%) health facilities were DOT centers. HIV uptake among TB patients was 100%, Sputum fixers screened 178 suspects of which 17 (9.5%) were smear positive, Traditional healers, drug sellers suspected 312 patients, 67 (21.5%) were diagnosed of TB, CORPS visited 1162 families, suspected 15 clients, 6(40%) were diagnosed of TB, A total of 152 primary school teachers were oriented

on TB, HIV and TB-HIV and were able to train about 3000 students.

**Conclusion:** There is a need to build partnership with stake holders in the community to provide TB and HIV services. The engagement of community can play a vital role in scaling up TB-HIV. Specifically, the following are recommended: Continued Awareness creation in community, HIV training for HCWs, maintain and support sputum fixers, traditional healers involvement, Engage drug sellers CORPS should be motivated.

#### **PC-1184-28 Community dialogues as a tool for stake holder commitments towards TB-HIV interventions**

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**Background:** South Africa, with the third highest tuberculosis (TB) incidence in the world, is one of the 22 high burden countries; therefore, raising awareness and knowledge about TB amongst the population is a key intervention in response to the dual TB and HIV epidemics.

**Intervention:** Community dialogues have been identified as critical platforms for the United States Agency for International Development (USAID) TB Project to engage with different community stakeholders; they are aimed at strengthening the DOTS strategy by increasing awareness and knowledge about TB, dispelling common myths and misconceptions currently contributing to stigmatization, promoting behavioural change required to prevent TB infection, to increase TB case detection by encouraging uptake of services at different levels, and to increase TB treatment adherence. A two day workshop gives an overview of district situational analysis, involving community stakeholders in identifying issues around TB and TB-HIV, target audiences, partners and their key activities.

**Results:** Community dialogues translate in setting district objectives, producing collaborative action plan and targets over a one year period. The expected result is a rise in community participation in TB-HIV: increased awareness on TB signs and symptoms, increased health seeking behaviour for further screening, increased number in TB-HIV support groups in districts, adoption of safer infection control practices at home, increased referral of traditional healers patients to facilities and advocacy undertaken by community leaders (pastors/teachers/traditional leaders).

**Conclusion:** Community dialogues provide a platform for community members and stakeholders to come together and devise solutions for TB-HIV in the districts. These solutions are aimed at contributing to stigma reduction, reduced number of new infections, and increased adherence to treatment; as such they are essential components of the STOP TB strategy.

### PC-1199-28 Utilising mass media to mainstream TB-HIV messaging and change behaviour

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**Background:** South Africa, with the third highest TB incidence in the world, is one of the 22 high burden countries. Raising awareness and knowledge of TB amongst the population is a key intervention in response to TB and HIV in the country.

**Intervention:** The 'We Beat TB' mass media campaign was launched in July 2009; at the time of launch it was the only TB messaging in mass media. It uses television (TV) drama on national TV channels, TV and radio public service announcements on major TV and radio stations, talk shows on community radio stations, Rank TV at busy public transport transit areas, TV in public transportation services such as taxis and minibus taxis and a billboard campaign on play pumps and national billboards. Three message areas have been formulated: Treatment adherence, TB-HIV co-infection and Infection Control.

**Results:** The anticipated outcomes are an increased awareness and knowledge of TB signs and symptoms, an increased TB case detection at community level by encouraging uptake of services at different levels, an increased early presentation to facilities of people with TB symptoms, an increased TB treatment adherence, a dispelling common myths and misconceptions that currently contribute to stigmatization of TB and promotion of behavioural change to prevent TB infection. An evaluation of the number of people reached through the campaign was done, an award was received for the TV drama, the TB-HIV advert was the first ever on South African national TV.

**Conclusion:** The use of popular media helps to normalise public health messages and increase their acceptance by society. What people see and hear in the media forms the basis of conversations and leads to formulation and adaptation of new behaviours. These interventions are aimed at contributing to stigma reduction, reduced rate of new infections, and increased adherence to treatment; as such they are essential components of the STOP TB strategy.

### ADULT LUNG HEALTH/ INDOOR AIR POLLUTION

#### PC-18-28 Risk factors associated with MDR pathogens among patients with HAP in a university hospital

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**Background:** Hospital-acquired pneumonia (HAP) is the most frequent and the most severe nosocomial infection encountered in the intensive care unit (ICU) and thus, considered as an important public health problem. The aim of this study is to identify the risk factors associated with multidrug-resistant pathogens among patients with hospital acquired pneumonia admitted at a university hospital and to determine the incidence of hospital acquired pneumonia caused by multidrug-resistant pathogens.

**Methods:** All adult patients admitted either in the ICU or pay/charity wards exhibiting a clinically and bacteriologically documented HAP were included in the study. Patients charts were reviewed and data collected. The patients were monitored until the day of discharge.

**Results:** 137 cases of HAP were included, 95 (69%) developed HAP secondary to MDRO. The mean age was 56, predominantly females 80 (58%). Nosocomial pneumonia is highest in the ICU (75%). Among 155 organisms, 115 pathogens were MDRO. Three most common MDR pathogen isolated were: *Acinetobacter baumannii*, *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*-ESBL. Risk factors identified with the use of logistic regression: (1) >5 days hospital admission prior to HAP,  $P = 0.03$ ; (2) length of intubation or mechanical ventilation of >5 days prior to the diagnosis of HAP,  $P = 0.006$ ; (3) antibiotic use within three months prior to the diagnosis of HAP,  $P = 0.032$ ; (4) involvement of >1 lobe based on chest radiograph.

**Conclusions:** Early recognition of these risk factors and prevention intervention such as: early weaning

Patient's characteristics	Non-multi-drug resistant HAP N (%)	Multi-drug resistant HAP N (%)	p value
<b>Patient location</b>			0.191
Intensive Care Unit	13 (9%)	39 (28%)	
Wards	11 (7%)	23 (16%)	
<b>Time of onset of HAP</b>			
<5 days from hospital admission	10 (7%)	7 (5%)	
≥ 5 days from hospital admission	4 (3%)	14 (10%)	0.032
<5 days from mechanical ventilation	9 (7%)	13 (9%)	0.468
≥ 5 days from mechanical ventilation	19 (14%)	61 (46%)	0.006
<b>Chest radiograph findings</b>			
Involvement of >1 lobe	26 (16%)	73 (53%)	0.0418

from invasive mechanical ventilation, and adequate empiric antibiotic coverage for suspected multidrug-resistant organisms may help decrease morbidity and length of hospital stay. In future studies, it is suggested to develop an algorithm to evaluate these risk factors for HAP and prospectively test this algorithm in a validation cohort.

### PC-21-28 Applying the antibiotic de-escalation therapy in the treatment of hospital-acquired pneumonia

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**Objective:** To evaluate the effect of the antibiotic de-escalation therapy in the treatment of hospital-acquired pneumonia (HAP).

**Method:** Clinical experimental study.

**Results:** From 10/2008 to 6/2009, 82 cases of HAP included 41 cases applied the antibiotic de-escalation therapy (the trial group) and 41 cases of the controlled group. The average age was  $61 \pm 17$ . GCS was  $9.4 \pm 4.5$ . APACHE II was at  $17.6 \pm 6.5$ . The average onset time of HAP was  $7.3 \pm 4.5$  days. There were 36.59% cases of early HAP (<5 days) and 53.41% cases of late HAP ( $\geq 5$  days). Pneumonia induced by mechanical ventilation occupied 29.27%. Negative Gram bacteria were common in HPA such as *Enterobacter* spp. (26%), *Klebsiella pneumoniae* (17.4%), *Pseudomonas aeruginosa* (16.3%), and *Acinetobacter* spp. (15.2%). Positive gram bacteria was common in HAP as *Staphylococcus aureus* (2.2%). Besides, *Enterobacter* spp. was sensitive with carbapenem (>80%) and was resistant to ertapenem (100%); *Kleb. pneumoniae* was sensitive with carbapenem (100%) and ofloxacin (>85%); *P. aeruginosa* was sensitive with carbapenem (>80%) and piperacillin-tazobactam (87.5%); and *Acinetobacter* spp. was sensitive with colistin (100%) and ertapenem (33.3%). The effect of the antibiotic de-escalation therapy after 14 days in the trial group had improved 1.97 times higher than in the controlled group ( $P = 0.026$ ). Simultaneously, the average time for treating at ICU and for mechanical ventilation in the trial group were shorter than in the controlled group ( $18.4 \pm 7.4$  and  $14.8 \pm 8$  days vs.  $24.6 \pm 13.4$  and  $21.3 \pm 13.8$  days). HAP patients cured and transferred from ICU to another unit in the trial group were 1.55 times higher than in the control group (75.6% vs. 53.7%) ( $P = 0.012$ ). Rate of death in the trial group was lower than in the control group (17.1% vs. 36.6%) ( $P = 0.046$ ).

**Conclusion:** The effect of the antibiotic de-escalation therapy has high rate of success, low rate of death, and shortened period of hospitalization.

### PC-110-28 Validation of ISAAC questionnaire for asthma diagnosis in adults using pulmonary function tests

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**Introduction:** In Sudan the prevalence of asthma symptoms in adult Sudanese university students and workers has been investigated in Khartoum state (capital of Sudan) using a modified questionnaire of the International Study of Asthma and Allergy in Childhood (ISAAC) and it was found to be 9%. In this study we have investigated the prevalence of asthma symptoms in Sudanese adult university students and workers in Elobeid town western Sudan.

**Objectives:**

- 1 To determine the prevalence of asthma among Sudanese university students and workers.
- 2 To validate the modified ISAAC questionnaire by pulmonary function tests in subjects with asthma symptoms.

**Method:** A cross-sectional study performed in Elobeid town about 650 Km western Khartoum, the capital of Sudan during March 2010. A modified ISAAC questionnaire was distributed to university students and adults chosen by stratified random sampling. 412 subjects were included. Any subject with a positive response to asthma symptoms was interviewed by another questionnaire covering asthma symptoms, allergy symptoms and environmental factors. In addition, lung function tests had been performed to all those having asthma symptoms.

**Results:** 412 subjects were included. Prevalence of asthma according to wheeze hearing in the last 12 months was 6.7%. Wheezing is the most prevalent asthma symptom (96.6%), followed by breathlessness (76%). Most of the patients have intermittent symptoms. Validation of ISAAC questionnaire by reversibility test was 57% in asthmatic group.

**Conclusion:** 1. Prevalence of asthma among Sudanese adult university students and workers living in Elobeid town (West Sudan) is 6.7%.

2. Pulmonary function testing (reversibility test) is essential for asthma diagnosis particularly the intermittent and mild persistent asthma.

### PC-111-28 Correlation of allergic rhinitis and asthma symptoms in adult Sudanese asthmatics

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**Introduction:** The association between allergic rhinitis and asthma was recently emphasized. Estimates show that 60–78% of people who have asthma also



suffer from allergic rhinitis, which is implicated as a trigger for asthma attacks among adults and children.

**Objectives:**

- 1 To find out possible correlation of allergic rhinitis with symptoms of asthma.
- 2 To identify common trigger factors for asthma and allergy symptoms.

**Method:** A cross-sectional study performed in Elobeid town about 650 Km western Khartoum, the capital of Sudan during March 2010. A modified International Study of Asthma and Allergy in Childhood (SAAC) questionnaire was distributed to university students and adults chosen by stratified random sampling. 412 subjects were included. Any subject with a positive response to asthma symptoms was interviewed by another questionnaire covering asthma symptoms, allergy symptoms and environmental factors. Skin prick test (SPT) was performed to all those having asthma symptoms.

**Results:** 412 subjects were included. Symptoms of allergic rhinitis were found in 78.6% of the asthmatic group compared to 47.1% in non-asthmatic group. The predominant symptoms of allergic rhinitis in asthmatics were sneezing and runny nose triggered by dust in 78.6%, trees in 14.3%, animals in 7.1% and associated with eye itching and tear production in 78.6%. Positive SPT results: D.Pteronyssinus 78.6%, D.Farinae 64.3%, Grass Pollens 60.7%, Goat epithelium 60.7%, Mosquito 57.1%, Mixed Molds 46.4%, Dog Epithelium 46.4% and Cat Hair 28.6%.

**Conclusions:**

- 1 Allergic rhinitis is more common among asthmatic than non-asthmatic group which indicates the correlation of allergic rhinitis and asthma.
- 2 House dust is the most common trigger factor for allergy symptoms (78.6%).
- 3 Dust mites D.Pteronyssinus and D.Farinae are the most common implicated allergens in asthmatic group (78.6 & 64.3% respectively) which suggests their role in asthma and allergy.

**PC-242-28 Differential diagnostics of disseminated processes in lungs**

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**Aim:** To study structure of disseminated processes in lungs and methods of their verification.

**Materials and methods:** 87 case histories of the patients with dissemination syndrome of unclear genesis that were hospitalized in oblast TB hospital for two years are analyzed.

**Results and discussion:** 383 patients were treated in TB pulmonary department # 3 during 2009–2010, 87 (22.7%) of them were hospitalized with dissemination of unclear genesis. Our analysis showed that

15 (17.3%) of the patients had pneumonia, 43 (49.5%) had sarcoidosis, 8 (9.2%) were diagnosed with canceromatosis, 19 (21.8%) were diagnosed as pulmonary TB patients (including 10 or 52.6% with TB-HIV co-infection), 1 (1.1%) patient had fibrosing alveolitis, 1 (1.1%) had multiple bronchiectasis. Clinical diagnosis was confirmed by means of the following methods: in 44 (50.6%) cases diagnostics was carried out based on anamnesis, clinical symptoms, radiological data and trial treatment; in 20 (22.9%) cases patients were diagnosed by open lung biopsy, in 6 (6.9%)—by biopsy of peripheral lymph node, in 2 (2.3%)—by biopsy of musculocutaneous flap; in 1 (1.1%) case—by videothoracoscopy with biopsy of introthoracic lymph node; in 3 (3.4%) cases diagnostics was based on fibrobronchoscopy; 7 (8.0%) cases of TB were diagnosed by smear/culture examination; in 2 (2.3%) cases thoracic ultra-sound examination was used, in 2 (2.3%)—cytological examination of pleural exudation was applied.

**Conclusions:** This study revealed that sarcoidosis prevails among 87 cases with dissemination syndrome, and in 25 (58.1%) cases of 43 it was verified by means of instrumental methods. It allows us to conclude that full set of instrumental and laboratory methods should be used for opportune diagnostics of disseminated processes in lungs.

**PC-454-28 Solid fuels and indoor air pollution: partnership for scaling-up and care**

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More than 3 bn people burn solid fuels to meet energy needs. 2 million pre-mature deaths per year occur due to burning of solid fuels in unventilated kitchens. More than 80% people in LDCs and SSA primarily rely on solid fuels as compared to 56% in developing countries. As per WHO, number of people relying on biomass fuels will increase to 2.6 bn by 2015 and 2.7 bn by 2030 due to population growth. The situation is more alarming in LDCs and SSA and needs special intervention. More and more people have to be shifted to the use of modern fuels. This calls for an urgent change. Fund raising is one of the major concerns in bringing any transition and is normally viewed as a matter of public concern. However, if private sector joins hands in solving social issues, a lot can be done to improve the status of society and the under privileged in particular. This paper attempts to highlight how public private scaling up can help in reducing the use of solid fuels in Developing Economies and through it control the ill effects of IAP.

### PC-628-28 Prévalence des troubles respiratoires chez les femmes exposées à la combustion des biomasses

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**Introduction :** Les femmes sont constamment exposées aux fumées et gaz issus de la combustion du bois ; Cependant ces derniers sont peu étudiés. L'objectif de ce travail était d'évaluer la prévalence des troubles respiratoires chez les femmes les plus exposées.

**Sujets et méthodes :** Nous avons mené une étude descriptive, transversale et prospective auprès des femmes exerçant sur le site de fumage artisanal de poisson de Hwladodji à Cotonou. L'enquête a comporté un questionnaire explorant les antécédents pathologiques et les manifestations respiratoires pathologiques apparues au cours des 12 derniers mois. Elles avaient toutes bénéficié d'une spirométrie de dépistage.

**Résultats :** 84 femmes ont été incluses. L'âge moyen était de  $37 \pm 12$  ans, avec des extrêmes de 18 ans et de 70 ans. Plus de la moitié des enquêtées avait une ancienneté de plus de 20 ans et 61/84 (73%) exerçaient ce métier à plein temps. 70 (83%) décrivent au moins un symptôme respiratoire. Les symptômes déclarés étaient : la rhinite 77%, la toux 70%, la dyspnée 65% et 19% ont du cesser leur activité l'année écoulée pour raison de maladie pulmonaire. Les anomalies ventilatoires sont retrouvées chez 49% des enquêtées. Les anomalies portent sur VEMS/CVF < 0,8 : 3 (3,5%), DEP < 0,8 : 10 (11,90%), VEMS < 0,8 : 10 (11,90%).

**Conclusion :** La symptomatologie respiratoire est assez expressive contrastant avec les résultats spirométriques. Le suivi sur une longue période de ces femmes majoritairement jeunes va permettre de déboucher sur des conclusions pertinentes.

### PC-632-28 BPCO non tabagique en milieu tropical à Cotonou

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**Introduction :** Les études sur la BPCO sont rares dans les pays du sud. Au Bénin le feu de bois reste la principale source d'énergie pour la cuisson des aliments et les femmes sont constamment exposées aux fumées de bois. L'objectif de ce travail était d'évaluer la prévalence de la BPCO non tabagique chez les femmes qui du fait de leur activité professionnelle y sont plus exposés.

**Sujets et méthodes :** Il s'agissait d'une étude descriptive menée auprès des femmes exerçant sur le site de

fumage artisanal de poisson de Hwladodji à Cotonou. L'enquête a comporté un questionnaire explorant les antécédents et les manifestations respiratoires pathologiques. Elles avaient toutes bénéficié d'une spirométrie de dépistage. Les cas dépistés ont bénéficié d'un test de réversibilité à la ventoline pour confirmation.

**Résultats :** 84 femmes ont été recensées parmi lesquelles 31 âgées de 40 ans et plus sans antécédents de tabagisme ont été incluses pour l'analyse des données. L'âge moyen était de 49 ans  $\pm$  10 ans, avec des extrêmes de 40 ans et de 70 ans. Toutes les enquêtées exerçaient à plein temps. L'ancienneté moyenne était de 26 ans  $\pm$  14 ans, les extrêmes sont respectivement de 4 ans et 55 ans. La prévalence de la BPCO (VEMS/CVF < 70%) était de 3,2%, les sujets à risque (70% < VEMS/CVF < 80%) représentaient 6,45%.

**Conclusion :** La prévalence de la BPCO non tabagique chez les femmes de 40 ans et plus exerçant sur le site artisanal de fumage de poisson est de 3,2%. La mesure de l'exposition et la reproduction sur un échantillon plus grand pourront déboucher sur des conclusions, qui permettront la prise de mesure de santé publique.

### PC-764-28 Pneumopathie aigue communautaire : évaluation de la gravité et impact sur le pronostic

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**Justification :** La PAC est la première cause de décès par maladie infectieuse dans le monde. L'objectif de cette étude est d'évaluer l'impact des facteurs de risque de survenue de PAC, les facteurs de risques d'évolution défavorable et le score CRB 65 sur le pronostic.

**Matériels et méthodes :** Etude rétrospective de 3 mois : 01/12/2010 au 25/02/2011. Les critères d'inclusion sont : observation médicale, et une radiographie thoracique. Tous les dossiers non concluants sont exclus.

**Résultats :** Quarante six dossiers sur 356 recrutés (13%), et 36 retenus (10%), âge moyen 51,5 a entre 21 et 82a. Parmi eux 30 ont moins de 65 ans, avec prédominance masculine à 54%, sex ratio 1,25.

**Facteurs de risque de survenue de PAC :** Tabagisme 33%, ATCD infections respiratoires 6%, asthme 12%, diabète 3%, insuffisance cardiaque congestive 8%, cancer broncho-pulmonaire 3%, AVC 3%, épilepsie 6%, éthylisme 39%.

**Facteurs d'évolution défavorable :** Age > 65 ans 17%, insuffisance cardiaque congestive 8%, AVC 3%, BPCO 12%, ATCD pneumopathie bactérienne 3%, hospitalisation dans l'année 6%. Un score CRB 65 > 1 est retrouvé dans 72% des cas.

**Manifestations radiologiques :** Syndrome alvéolaire

67% dont 19% systématisé, syndrome interstitiel 8%, caverne 8%, pleurésie para-pneumonique 8%, atteinte bilatérale ou plus d'un lobe 33%.

**Evolution :** 75% de guérison, 17% de décès, sortie à la demande 6%, évadé 3%.

**Caractéristiques des décédés :** Age < 65 ans, hommes 83%, atteinte bilatérale, plus d'un lobe ou associée à une pleurésie ; score CRB 65 > 1 ; présence de facteurs de risque de survenue d'une PAC dans 50%, facteurs de risque d'évolution défavorable 50%.

**Conclusion :** Le pronostic d'une PAC est corrélé au sexe, à la présence de facteurs de risque de survenue d'une PAC, aux facteurs de risque d'évolution défavorable, aux lésions radiologiques et au score CRB 65 ans ; l'espérance de vie des Malgaches est inférieure à 65 ans.

### PC-1075-28 Burden of TB disease in Himachal Pradesh, Jammu-Kashmir and Uttarakhand, India

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**Aim:** To prevent women suffering with TB in mountain areas due to smoke of indoor pollution. These areas are low income areas and women's are involved in doing all major day to day activity. Solid fuel smoke causes damage to patients with asthma through the particles, gases and fumes it contains.

**Method:** 17 media sensitization workshops done through vernacular media persons and press club by IMCFJ organizing J2J in respective areas. A trained vernacular journalist knows about impact of indoor pollution causes firstly asthma and then tuberculosis. Distribute life lets and questionnaire as learning materials. 439 media persons trained and 637 stories generated in papers.

**Results:** Less cases of indoor pollution generated, Training local language journalists is an important vehicle for public awareness. Through the continuous trainings, majority of the journalists were more aware of the harms of indoor pollution. Trained journalists were able to identify and report on indoor pollution related stories independently, resulting in better researched and in-depth, locally relevant stories appearing in local papers. All major regional Hindi (16 papers with a circulation of more than 4 million copies a day).

### PC-1157-28 Initiating a National Asthma Care Programme: Kenya's 6-year journey

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**Background:** 3.6 million people in Kenya (10% of the population) suffer from asthma. It is the most common reason for emergency room visits among adults and 15% of urban children in the age group of 9–14 years. This is caused by under-diagnosis, mis-diagnosis and under treatment of asthma, arising from the lack of policy on asthma management, inadequate training of health care workers on asthma, inadequate health infrastructure with lack of essential equipment necessary for diagnosis, inadequate supply of essential commodities for management of asthma and poor societal awareness of the disease.

**Intervention:** The journey spearheaded by KAPTL gained momentum in 2005 with monthly consultative meetings resulting to the development of the asthma consensus statement and a countrywide training program on proper diagnosis and management. In 2008 KAPTL received a boost from the World Lung Foundation, that trained health workers through regional symposia and institutional training, developed and piloted asthma recording and reporting tools, set up 12 pilot clinics and provided Inhalers through the Asthma Drug Facility. Meanwhile; Kenya's NLTP became the Division of Leprosy Tuberculosis and Lung disease, with asthma under their mandate. The inclusion of the Practical approach to Lung Health in their 2011–2015 Strategic Plan was a step in the right direction.

**Results:** The Government's firm commitment to ensure that it provides a cost effective package for all persons suffering from asthma so that they may have productive lives was demonstrated with the launch of the Program and management guidelines.

**Conclusion:** Advocacy played a major role in the initiation and culmination of this journey, that brought together a robust Public, Private Partnership for the attainment of public health gains and created a strong Public, Private and Patient Partnership.

### PC-1160-28 Nintendo Wii therapy in the pulmonary rehabilitation for chronic obstructive pulmonary disease

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**Aim:** The Nintendo Wii video game system has many potential uses in therapy practice. The Wii is able to blend exercise and physical activity with video games.

In addition to the physical benefits discussed above, reported benefits to using the Wii in therapy sessions include an increase in patient compliance, anticipation for the next treatment session, and a boost in patients' socialization and self-esteem. Our aims were to assess and quantify the cardiorespiratory changes of COPD patients, from southern of Brazil.

**Methods:** We checked the vital signs (systolic and diastolic blood pressure—BP, heart rate—HR, respiratory rate—RR and peripheral oxygen saturation—OS) and dyspnea level of COPD patients at rest and after therapy and every minute until values returned to resting.

**Results:** We evaluated 10 COPD patients, both gender,  $67.11 \pm 10.96$  age and  $22.60 \pm 5.16$  body mass index. The disease level varies from mild to very severe (CVF =  $68.33 \pm 12.94$ ; VEF1 =  $44.76 \pm 18.56$ ; %VEF1 =  $63.89 \pm 23.39$ ). The BP (122/77 vs. 123/78), HR ( $88.40 \pm 10.49$  vs.  $86.10 \pm 12.46$ ), RR ( $21 \pm 4$  vs.  $22 \pm 4$ ), OS ( $95.40 \pm 4.14$  vs.  $95.40 \pm 4.16$ ) and dyspnea variables not significantly changed, at rest and after WII-rehab, for male and female. The OS was significantly lower in female than male at rest ( $90.00 \pm 3.46$  vs.  $97.71 \pm 0.75$ ;  $P = 0.000$ ) and after WII-rehab ( $90.33 \pm 4.50$  vs.  $97.57 \pm 0.97$ ;  $P = 0.002$ ).

**Conclusion:** Preliminary data show few differences in the cardiorespiratory system in COPD patients and reinforce the need to understand the mechanisms by which this happens in the disease process.

**Support:** Santa Cruz Hospital and Research Group Health Rehabilitation and its Interfaces, CCGS Physiotherapy Hospital.

### PC-1216-28 Pandemic influenza by A (H1N1) 2009 virus: factors associated with household transmission in Spain

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**Background:** In the recent influenza A (H1N1) 2009 pandemic, we observed the rapid and global spread of a new respiratory virus, whose transmission characteristics were not known, especially in the home. The aim of this study was to quantify this transmission and to identify associated factors.

**Methods:** Multicenter, descriptive, observational, retrospective and population-based study. We conducted a telephone survey of all cases reported to the epidemiological surveillance units of Navarra, Catalonia and Castellon, between weeks 44 and 48, in 2009. The information on the socio-demographic and clinical risk factors was obtained from both cases and their household contacts. A secondary case was de-

finied as the contact that had at least two of the following signs or symptoms: fever, cough, sore throat and runny nose. We calculated attack rates within the household (ARH). The identification of associated factors was conducted by calculating odds ratios (OR) and confidence intervals 95% (CI) by the logistic regression methods.

**Results:** There were 833 confirmed cases of influenza A (H1N1) 2009 and 2093 susceptible contacts. 53.2% of cases and 50.9% of contacts were male. The average age of cases was 27.5 years with a standard deviation (SD) of 20.7 and that of the contacts was 32 years (SD: 19.7). 237 secondary cases were identified. The average age of secondary cases was 29.5 years (SD: 16.6) and 13.7% had at least one chronic disease. The general ARH was 11.3% (IC 9.9–12.7). The age group with the highest ARH was 0 to 4 years (14.8%). In those 65 years the ARH was 1.6%. The factor most associated with the generation of secondary cases was the age of the contacts, so that the older reduced the risk of secondary cases (OR 0.08, CI 0.02–0.31 for those over 65).

**Conclusion:** Our data show that transmission of A (H1N1) 2009 virus in the home environment is important and affects mainly young people. Information is useful for future prevention strategies.

### CHILD TUBERCULOSIS INFECTION AND ISONIAZID PREVENTIVE THERAPY

#### PC-156-28 Implementation of a child contact register to assess TB household contacts in Eldoret, Kenya

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**Background:** Children exposed to smear-positive pulmonary tuberculosis (TB) are at a higher risk of TB infection and developing TB disease. The World Health Organization (WHO) recommends that all TB programs identify and screen child household contacts for symptoms of active disease. In developing countries where TB burden is often highest, an infrastructure to identify child contacts typically does not exist. At the Moi Teaching and Referral Hospital TB program, healthcare workers rarely asked active TB cases about their child household contacts. Without an operational child contact tracing system, children become victims to TB disease that can be particularly severe in HIV infected children and those <5 years of age.

**Intervention:** A child contact register (CCR) was designed and implemented into the existing TB program. Healthcare workers (HCWs) were instructed



to ask each pulmonary TB patient about any children <15 years of age in their home and record the information into the register. The adult index cases were advised to bring symptomatic children for medical evaluation.

**Results:** During the first 10 weeks of CCR use, HCWs interviewed 66 smear positive TB patients. 35 children <5 and 79 children ages 5–14 were identified as household contacts. The average ratio of children <5 exposed per positive smear adult was 0.5. 10 (9%) children exposed were reported as symptomatic. 84 children lived in a household whose index case was co-infected with HIV, yet 63 (75%) had never themselves been HIV tested. 12 of these untested children were <5 years of age.

**Conclusions:** Despite recommendations by the WHO to screen and evaluate young children in smear positive households, implementation of this recommendation is rarely carried out in resource-constrained areas. Implementation of a CCR in our TB clinic identified a surprisingly large pool of children at risk for both TB and HIV.

#### PC-260-28 TB risk among schoolchildren with different tuberculin reaction sizes in Hong Kong

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**Background:** In Hong Kong, neonatal Bacillus Calmette-Guerin (BCG) vaccination is regularly performed. There is an upsurge of tuberculosis (TB) in adolescents, but a similar pattern is also observed in areas not practicing BCG vaccination.

**Methods:** A total of 19 383 students aged from 6 to 10 and participating in the BCG revaccination programme from October 1999 to February 2002 were prospectively followed up by cross-matching with the territory-wide TB registries until December 31, 2010, using the identity card number as the unique identifier.

**Results:** After 214 753 person-years of follow-up, 44 active TB cases (22 culture-confirmed) were detected at an overall incidence of 20.5 per 100 000 person-years. The incidence differed significantly by baseline tuberculin skin test (TST) reaction sizes (13.0, 18.8, 22.5, 280.4 per 100 000 person-years for reaction size of 0–4 mm, 5–9 mm, 10–15 mm and 15 mm or more respectively,  $P < 0.001$ ). Consistent results were observed for culture-confirmed cases and after adjustment for gender and baseline age. For those with TST reaction size of 15 mm or above, the incidence of TB was significantly higher beyond the age of 15 than before that age (608.1 vs. 37.5 per 100 000 person-years,  $P < 0.001$ ). Although female gender

and older baseline age were independently associated with increased baseline tuberculin reaction sizes, they did not independently predict subsequent development of disease.

**Conclusion:** A strong TST reaction predicted TB in adolescents after an initial quiescent period. Reactivation of latent *Mycobacterium tuberculosis* infection, possibly related to changes in host immunity, might account for the upsurge of TB after puberty.

#### PC-342-28 Patients' direct and indirect costs for latent tuberculosis infection screening in Brazil

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**Background:** TST has several limitations for diagnosing LTBI. Several guidelines in developed countries recommend IGRA tests to replace or be added to TST. Elsewhere, we have compared the costs of these strategies under the Brazilian health system perspective. In the present study, we assessed direct (out-of-pocket) and indirect (lost hours) costs for patients and their families, comparing TST+QFT-GIT vs. TST.

**Methods:** We interviewed 95 contacts and HIV-patients who underwent investigation for LTBI. Information on direct and indirect costs, costs with extra help and family income was gathered. All patients were submitted to TST, the standard diagnostic test for LTBI in Brazil. TST+ subjects were invited to participate in a study on IGRA tests, of whom 50 accepted and underwent QFT-GIT. Hours lost were valued based on minimum salary in Brazil in 2010, considering the standard 44 weekly hour contract (US\$1.39/hour). Cost for tests were not accounted for, they are free of charge.

**Results:** Median family income/person living in the household was US\$284 (IQR 153–469). Median time spent for diagnosis using TST was 4.52 (IQR 2.65–6.79) hours (US\$6.28) and 4.92 (IQR 3.13–7.04) hours (US\$6.83) using TST+QFT-GIT. Direct costs were US\$5.39 (IQR 0–15.79) for TST alone and US\$6.30 (IQR 2.90–15.82) for TST+QFT-GIT.

**Conclusions:** Considering their low income, costs for patients to diagnose LTBI were high in Brazil. This should be accounted for in economic analyses which compare different diagnostic strategies. Additional blood tests such as QFT-GIT add little costs for patients undergoing TST.

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### PC-362-28 Can interferon-gamma or IP10 differentiate between TB infection and disease in African children?

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**Background:** Diagnosis of childhood tuberculosis (TB) is difficult in high TB burden settings. Interferon-gamma-induced protein 10 (IP10) has been suggested as a marker of TB infection and disease, but its ability to differentiate the two conditions remains uncertain. **Objectives:** To describe interferon-gamma (INF $\gamma$ ) and IP10 expression in children with TB infection and disease and controls to assess their potential to differentiate latent and active TB.

**Methods:** A cross sectional study in Awassa, Southern Ethiopia. 322 1–15 years old children with symptoms of TB (28 confirmed, 136 probable and 131 unlikely TB), 335 children in contact with adults with smear-positive TB and 156 community controls were enrolled. The tuberculin skin test (TST) and Quantiferon-In-Tube (QFT-IT) were performed and INF $\gamma$  and IP10 were measured in plasma supernatants.

**Results:** Children with confirmed and probable TB and contacts were more likely to have TST+ (78.6%, 59.3% and 54.1%, respectively) than children with unlikely TB (28.7%) and controls (12.8%) ( $P < 0.001$ ). Children with confirmed TB (59.3%) and contacts (44.7%) were more likely to have INF $\gamma$ + than children with probable (37.6%) or unlikely TB (28.1%) and controls (13.1%) ( $P < 0.001$ ). IP10 concentrations were higher in INF $\gamma$ + children independently of TST ( $P < 0.001$ ). There was no difference between IP10 concentrations of children with confirmed TB and contacts ( $P = 0.8$ ) and children with and without HIV ( $P > 0.1$ ).

**Discussion:** INF $\gamma$  and IP10 can identify children with TB infection and disease, but cannot differentiate between the two conditions. HIV status did not affect the expression of IP10.

### PC-445-28 Evaluating QuantiFERON-TB Gold In-Tube and tuberculin skin tests in children immigrating to the USA

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**Background:** The CDC's TB Technical instructions for immigration screening require that children 2–

14 years old have either a tuberculin skin test (TST) or an interferon-gamma release assay (IGRA) prior to immigration to the United States. Few data are available on the performance of IGRAs vs. TSTs in children. This study evaluates the performance of an IGRA, the QuantiFERON-TB Gold In-Tube (QFT), and TST in children who are immigrant visa applicants from the Philippines, Mexico, and Viet Nam.

**Methods:** Three medical screening sites for US immigrant visa applicants (Ciudad Juarez, Mexico; Manila, Philippines; and Ho Chi Minh City, Viet Nam) participated in the study. Enrollment of children 2–14 years old began in October 2010. After obtaining parental permission, blood was drawn, a medical exam was conducted, and a TST was placed. TSTs were read between 48 and 72 hours after placement. The cutoff for TST positivity was 10 mm.

**Results:** From October 2010 to January 2011, 446 children were enrolled in Manila; 231 (52%) were male. The mean age was 9.2 years. One hundred ninety-seven (44%) had a positive TST and 27 (6%) had a positive QFT. Only 26 (5.8%) were TST+/QFT+, 171 (38.3%) were TST+/QFT–, and 1 (0.22%) was TST–/QFT+. Agreement between the tests was poor ( $\kappa = 0.14$ ). Regardless of test, the proportion of children with a positive result increased with increasing age. Older age was significantly associated with a positive TST ( $P < 0.05$ ) and with a positive QFT ( $P < 0.05$ ).

**Conclusion:** In this population, the level of concordance between the TST and QFT was poor. Further analysis of the association between both tests with prior BCG vaccination, size of TST induration, culture results, and prior exposure to TB are ongoing. The correct interpretation of a negative QFT in children with a positive TST remains challenging, and future longitudinal studies are needed to determine the accuracy of the two tests in this vulnerable population.

### PC-473-28 Improving chemoprophylaxis for child contacts under the Indian National TB Control Programme

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**Background:** Contact screening and isoniazid preventive therapy (IPT daily for 6 months) is recommended for asymptomatic children <6 years who are household contacts of smear-positive pulmonary tuberculosis (PTB) patients enrolled in the Indian National TB Control Programme (NTP). However implementation is poor (27% in an earlier situational analysis).

**Objective:** To evaluate the effectiveness of additional documentation in improving adherence of health care workers (HCW) to the NTP's contact screening and IPT guidelines.

**Methodology:** A prospective study was conducted in two TB Units of Chennai, South India, where the earlier situational analysis was performed. Smear-positive PTB patients initiating treatment between November 2009 to January 2010 were identified as index cases. HCWs were trained on documentation procedures (a chemoprophylaxis register and separate IPT card for every child), and the process was evaluated by research staff using patient and HCW interviews.

**Results:** Of 162 index patients (123M, 39F), mean age 44 years, 156 were interviewed and 46 household children aged <6 years were documented. Of the 46, 38 had been identified by HCWs, 33 (72%) had been initiated on IPT and 20 children completed the course. Reasons for default included: migration, adverse drug events and default of index case. HCWs welcomed the IPT card and register, citing that they helped them to complete the tasks.

**Conclusion:** Under programmatic conditions, provision of a separate IPT card and register improved implementation of guidelines on the identification and screening of childhood contacts, and provision of IPT. However issues relating to non-adherence need to be addressed.

#### PC-481-28 Screening for TB in adolescents attending high schools in a high TB burden area

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**Background:** TB incidence peaks in early childhood but starts increasing again in early adolescence. School children attending high schools may be an accessible group for TB control programmes to improve case-finding. We investigated the value of different screening criteria for diagnosing TB in adolescents attending high schools.

**Methods:** Adolescents aged 12–18 enrolled from high schools in a high burden TB area near Cape Town, South Africa were screened for TB disease if they had any of following characteristics: TB related symptoms, a household contact within 3 years, a positive tuberculin skin test (TST) or positive QuantiFERON test (QFT). (Those who reported a prior episode of TB [10%] did not have a TST). All suspects had 2 sputum samples for smears taken on 2 separate days. If either or both samples were smear positive, the sputum was cultured. TB cases were defined as anyone with two positive smears for acid fast bacilli or one positive culture for *M. tuberculosis*.

**Results:** 6363 (58.2%) of 10 942 adolescents agreed

to participate. 55% of participants were TST positive (>5 mm) at baseline, 51% were QuantiFERON positive, 3.2% had at least one TB related symptom and 11.4% a household contact within 3 years. Sensitivity for 19 culture-positive TB cases diagnosed through study procedures was symptoms, 10.5%, recent household contact 26.3%, TST positive, 100.0% and QFT positive, 88.2% (TST and QFT calculations only on those with results). Positive predictive value for these groups was: 1.0%, 0.7%, 0.5% and 0.5% respectively.

**Conclusions and recommendations:** Symptoms and recent household contact were not sensitive predictors of TB disease. Measures of latent TB infection such as the TST and QFT were sensitive predictors of TB disease but their low positive predictive values limits the cost-effectiveness of such screening methods. Further research on biomarkers which are better associated with TB disease is needed to optimize case finding strategies.

#### PC-645-28 Interferon-gamma release assays and childhood tuberculosis: systematic review and meta-analysis

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**Background:** Children infected with *Mycobacterium tuberculosis* have significant risk of developing tuberculosis (TB) and benefit from preventive therapy. We assessed the value of Interferon-gamma Release Assays (IGRAs) and tuberculin skin test (TST) for the diagnosis of TB infection and disease in children.

**Methods:** Thirty-three studies were included assessing commercial IGRAs [QuantiFERON-TB Gold and In-Tube (QFT) and T-SPOT.TB] and the TST. Reference standards for infection were incident TB or TB exposure. Test performance for disease diagnosis was evaluated in studies assessing children with confirmed and/or clinically diagnosed TB, compared to children where TB was excluded.

**Results:** Two small studies measured incident TB in children tested with QFT and found weak positive predictive value. Association of test response with exposure—categorized dichotomously or as a gradient—was similar for all tests. For the diagnosis of disease, the sensitivity and specificity of all tests were similar. Stratified analysis suggested lower sensitivity for all tests in young or HIV-infected children.



**Conclusions:** Available data suggest that TST and IGRAs have similar accuracy for the detection of TB infection or the diagnosis of disease in children. Heterogeneous methodology limited comparability of studies and interpretation of results. A rigorous, standardized approach to evaluate TB diagnostic tests in children is needed.

### PC-655-28 Prevalence of latent TB infection and its risk factors in schoolchildren in Shanghai

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**Background:** As infected children represent a large proportion of the pool from which TB cases will arise, knowledge of the factors that influence latent tuberculosis infection (LTBI) in children are of importance to understand the transmission of M.TB infection in the community and adapt TB control activities.

**Objectives:** To determine the prevalence of LTBI and the relevant risk factors in schoolchildren from Shanghai, China.

**Methods:** In this cross-sectional study, we administered T-SPOT.TB and TB infection risk factor questionnaire to children who were aged 10 to 18 years from 3 primary schools, 2 middle schools and 3 high/junior college schools from Shanghai in 2010. Information requested on the questionnaire included child demographics, child and parent birth location, bacille Calmette-Guérin (BCG) vaccination, and a history and the duration of the contact to TB cases etc. The status of LTBI was defined by combination of the T-SPOT.TB and X-ray results.

**Results:** Of 960 school children enrolled, 364 were from primary schools and 143 from middle schools and 453 from high/junior college schools; 55.1% were male; 91.1% were vaccinated with BCG. Overall, 42 (4.4%) of children had positive T-SPOT.TB result, with a significant age-specific trend. And none demonstrated the TB symptom in X-ray and therefore was confirmed with LTBI. The exact logistic regression analysis of the variables showed that the positive T-SPOT.TB was associated with no BCG vaccination (adjusted odds ratio [OR]: 3.9; 95% confidence interval [CI]: 1.43–15.7) and the contact of TB (OR: 5.7; 95%CI: 1.38–12.5). For 37 children who had a history of TB contact, contacts of TB cases more than 5 hours significantly increased the positive T-SPOT.TB (40.9%), compared with those contacting TB case less than 5 hours (7.1%).

**Conclusion:** The intervention for TB contact (health education, routine medical examination and preventive therapy) should be of top priorities for TB control in children in Shanghai.

### PC-887-28 Serial IP-10, TNF- $\alpha$ and MCP-1 changes during INH treatment in latent tuberculosis patients

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**Background:** Isoniazid had the standard treatment to treat latent tuberculosis, but there still have 10–30% LTBI patients might develop tuberculosis later. This study evaluated the Serial IP-10, TNF- $\alpha$  and MCP-1 changes in patients with QuantiFERON-TB Gold In-Tube (QFT-GIT) test and the tuberculin skin test (TST) positive and received 9 months INH treatment in the long term care unit. We try to find out the potential marker to predict active TB develop during INH LTBI treatment.

**Design/methods:** Totally 49 residents had QFT-GIT positive and received INH 9 months LTBI treatment. During the treatment course, blood sampling was performed three times, one before treatment, another during the treatment (after 3 months treatment), and the other one aftertreatment. Serial interferon-gamma (IFN- $\gamma$ ), IP-10, TNF- $\alpha$ , MCP-1 were tested. Before treatment, the cytokine level for IP-10, TNF- $\alpha$ , MCP-1 were 243.71–185.68 pg/mL, 13.45–12.83 pg/mL, and 464.22–212.26 pg/mL respectively, During the treatment period, IP-10, TNF- $\alpha$ , MCP-1 were 286.85–301.12 pg/mL, 17.71–14.65 pg/mL, and 470.63–275.03 pg/mL pg/mL. After treatment, the IP-10, TNF- $\alpha$ , MCP-1 were 235.25–197.25 pg/mL, 13.23–11.79 pg/mL and 389.22–239.94 pg/mL respectively. More than 85% of patients had serial cytokine change within 15%, but nearly 15% had cytokine change more than 15%. Although the TNF- $\alpha$  level might increase during treatment, but finally the level had recovery after treatment. The MCP-1 seemed decrease gradually during the treatment course. Among these patients, there were 3 people had IP-10 gradually rise up. One had developed active later. The IP-10 seemed could help the diagnosis of QFT-GIT to early detect which people will develop tuberculosis or not.

**Conclusion:** Serial IP-10, MCP-1 and TNF- $\alpha$  but not IFN- $\gamma$  might help us to monitor the LTBI patient and to predict whether tuberculosis developed or not. Two-step blood tests including QFT-GIT initially and later use the IP-10, MCP-1 or TNF- $\alpha$ .



### PC-936-28 Performance of QuantiFERON®-TB Gold In-Tube for diagnosing active TB in high burden setting

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**Objective:** To assess the performance of QuantiFERON®-TB Gold In-Tube (QFT) for diagnosing active TB in children and adults in a TB endemic area.

**Methods:** Prospective cohort study including children suspected for TB and adults with active TB at a Tanzanian district hospital. Performance was assessed by comparing sensitivity, indeterminate rate and IFN- $\gamma$  levels of QFT, concordance with tuberculin skin test (TST) and risk factor analysis for positive and indeterminate QFT results.

**Results:** 211 children suspect for TB and 107 smear positive adults were included. The sensitivity of QFT and TST in children with confirmed or highly probable TB ( $n = 33$ ) was 18.3% (95%CI 3.4–33.6) and 6% (95%CI –2.4–15.3) respectively, the specificity was 90% and 98% respectively. In adults with culture confirmed TB ( $n = 74$ ) the sensitivities of QFT and TST were 86% (95%CI 78.0–94.3) and 89% (95%CI 80.3–96.7) respectively. The indeterminate rate in children was 27% and in adults 5.5%. The median levels of INF- $\gamma$  was lower in children than adults in both nil, mitogen and TB-antigen QFT tubes ( $P < 0.02$ ). Concordance between QFT and TST was 86% in children ( $k = 0.31$ ) and 79% in adults ( $k = 0.27$ ). Continued illness 6 months after inclusion was positively associated with positive QFT, adjusted OR 4.68 (95%CI 1.25–17.48) and death within 6 months of inclusion was positively associated with both positive and indeterminate QFT results, adjusted OR 8.50 (95%CI 1.84–39.26) and 4.02 (95%CI 1.58–10.20) respectively. Neither HIV, malnutrition, young age, TB treatment nor TB exposure were associated with positive or indeterminate results in the risk factor analysis.

**Conclusion:** We found a disturbingly low sensitivity and high indeterminate rate of QFT in children compared to adults. These results could not be satisfactorily explained by young age, malnutrition or HIV status and warrant further assessment of QFT in children in this kind of clinical setting.

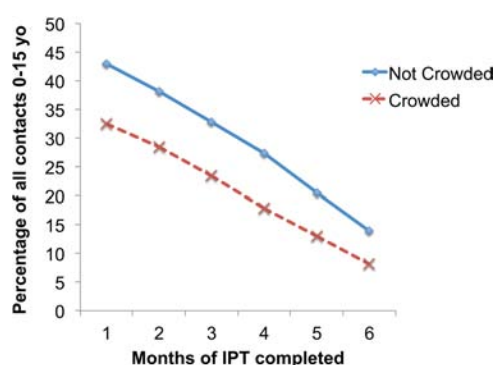
### PC-1248-28 Poverty impairs isoniazid preventive therapy for children in Peru

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**Background:** Isoniazid preventive therapy (IPT) reduces the risk of tuberculosis (TB) disease following exposure. Six months IPT is recommended and offered free to child contacts of TB patients in Peru, but before isoniazid is prescribed contacts must complete medical assessments. This requires several health center visits, which are free, but involve indirect costs such as transport that may be barriers for poor families. We therefore studied the equity of adherence with this TB control intervention.

**Methods:** We studied the number of months of IPT dispensed to 2339 TB patients to be given to their 5280 contacts aged 0–15 years. The study took place from 2002 to 2010 in 16 shantytown communities in Lima, Peru. IPT prescription records were generated at the point of patient care and were analyzed as the proportion of children who started each month of IPT. Two proxies of poverty were measured: the number of people sharing each shantytown residence (that were similar in size); and self-reported income per resident.

**Results:** IPT was initiated by 39% of child contacts of TB patients and completed by 12%. The median number of household residents was 7 (inter-quartile range 5 to 9). The geometric mean per capita income was equivalent to 29 US dollars (95%CI: 27 to 30) per month. IPT initiation and completion were significantly reduced in poorer households whether poverty was assessed by crowding ( $P < 0.0001$ , graph) or income ( $P < 0.0001$ ). The odds ratio of failing to complete IPT was 1.8 (95%CI: 1.5 to 2.2) for households that had above average crowding and 1.4 (95%CI:



**Figure** Association between crowding and completion of isoniazid preventive therapy (IPT).

1.1 to 1.7) for households that had below average income (both  $P < 0.01$ ).

**Conclusions:** Despite IPT being provided free of direct charges, poverty as assessed by crowding and low per capita income was associated with reduced IPT initiation and adherence. Socio-economic incentives and enablers may be required for the poorest members of communities to access even free TB control interventions.

## TUBERCULOSIS/MDR/EPIDEMIOLOGY

### PC-167-28 An epidemiological study to find out risk factors for multidrug-resistant tuberculosis

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**Introduction:** Drug resistant tuberculosis is a threat to tuberculosis control worldwide. Previous anti-tuberculosis treatment is a widely reported risk factor for multi drug resistant tuberculosis (MDR-TB), whereas other risk factors are less well described. In Nepal National Tuberculosis Control Programme initiated DOTS-PLUS Pilot project from September 2005 using standardized treatment regimen. Study of the risk factors for development of MDR-TB in the local context is likely to provide clues for strengthening treatment of MDR-TB.

**Objective:** To explore the potential risk factors for MDR-TB in Nepal.

**Methodology:** A matched case control study with a case: control ratio of 1:2 was carried out in three regions of Nepal. Fifty five cases and 110 controls were selected. Current MDR-TB patients on treatment from DOTS-Plus clinic were enrolled as cases. Controls were age, sex matched cured TB patients and who had completed treatment.

**Results:** The significant risk factors found in matched analysis were, HIV sero positivity, travel cost more than 50 NRs per day, contact history of TB, living in a nuclear family, non adherence to DOTS, distance to treatment centre more than 5 Km, previous history of TB, living in a rural area, unmarried, unemployment, living in a rented house, single bed room. In multivariate analysis except living in a rented house and single bed room other variables were positive significant predictors for MDR-TB in Nepal.

**Conclusions:** Many risk factors were related to the DOT. Strengthening of DOT services to tackle the identified risk factors can reduce the MDR-TB burden in Nepal. Association of HIV as a risk factor for development of MDR-TB needs to be further studied.

### PC-174-28 Quantifying the burden and trends of isoniazid-resistant tuberculosis, 1994–2009

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**Background:** Quantifying isoniazid resistant (INH-R) tuberculosis (TB) is important because INH-R reduces the probability of treatment success for individuals, may precede and facilitate the spread of multidrug resistance (MDR) in populations, and may reduce the expected benefits of isoniazid preventive therapy (IPT). **Design/methods:** We use data from population-representative surveys and surveillance reported to the World Health Organization between 1994–2009 to estimate the burden of INH-R among new and previously treated TB cases. We assess regional and national variation in burden and time trends where data permit. We also report INH-R levels in countries with high HIV prevalence ( $\geq 2\%$ ) to understand implications for IPT.

**Results:** 123 settings reported INH-R data since 1994. Among all TB cases, an estimated 14% (95%CI: 13–16%) had INH-R; this proportion was significantly lower among new (11%) than previously treated cases (29%). The Eastern European region had the highest risks of INH-R (33% of new; 63% of retreatment) and the West/Central European region had the lowest risks (6%; 17%). The risk of INH-R appears to be increasing in Peru, Botswana, South Korea and some Russian Oblasts, is stable in the Baltic states and decreasing in Hong Kong and Israel. Around one in four countries with HIV prevalence  $\geq 2\%$  have reported national data since 2000; in these locations 7% (95%CI: 5–9%) of TB cases had INH-R.

**Conclusions and recommendations:** Globally, one in seven incident TB cases has INH-R. The risk of INH is higher in retreatment cases and the overall burden varies considerably between countries. Few countries reporting data over time hampers assessment of INH-R trends and the scarcity of data from high HIV prevalence areas limits insights into the implications for IPT. Where trend data are available there is evidence of rising, stable, and falling risks of INH-R; further research and investment are required to uncover the implications of INH-R for TB control.

**PC-353-28 MDR-TB in the Netherlands: active case finding, transmission and acquired disease**

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**Background:** In tuberculosis (TB) low-incidence countries multidrug-resistant (MDR) TB is mainly a disease in foreign-born patients who acquired their infection abroad. The challenge in both low- and high-incidence countries is to early identify MDR-TB cases and to limit transmission. Moreover, adequate treatment of TB cases is important to prevent development of MDR-TB.

**Methods:** Data on MDR-TB cases were obtained from the Netherlands TB register for the period 1993 till 2009. In the Netherlands, epidemiological links between cases with clustering DNA fingerprints are routinely identified and reported, and were analyzed for MDR-TB cases using a transmission classification model. For recurrent cases with MDR-TB and a previous episode in the Netherlands, information was obtained from municipal public health services on mycobacteriological results and treatment outcome of the first episode.

**Results:** In the Netherlands, 0.8% of *M. tuberculosis* strains were multidrug resistant during the study period. In those 17 years, 187 MDR-TB cases were notified, out of which 7 in fact represented extensively drug-resistant (XDR) TB. One third (32%) of the MDR-TB cases were identified during screening, mainly through the screening program of immigrants entering the Netherlands. In 9 cases (5%) disease was caused by recent transmission in the Netherlands as revealed by DNA fingerprinting and epidemiological cluster investigation. In at least 8 cases (5%) MDR-TB was acquired after a previous treatment for (non-MDR) TB in the Netherlands.

**Conclusion and recommendations:** In the Netherlands, a high proportion of MDR-TB cases were identified through active case finding and a limited spread of the disease was observed. Still, several cases of acquired MDR-TB were identified in this low-incidence country. We recommend that low-incidence countries report on (the proportion of) MDR-TB cases actively found, those related to recent in-country transmission and those with acquired MDR-TB.

**PC-738-28 National Anti-Tuberculosis Drug Resistance Survey, Lesotho, 2008–2009**

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**Background:** In 2009 the World Health Organization (WHO) released revised guidelines about national surveillance of anti-tuberculosis (TB) drug resistance. The level of anti-TB drug resistance in Lesotho was unknown. We conducted a national drug resistance survey among new smear-positive TB cases in Lesotho to estimate the prevalence of drug resistant TB. This abstract presents preliminary findings.

**Methods:** From Jun 2008 to Mar 2009, we screened TB suspects from all 17 diagnostic microscopy centers in the country. We collected demographic and treatment history information from all sputum smear-positive cases. Sputum smear-positive cases were asked to submit samples for transport to the national TB reference laboratory (NTRL) for culture on Löwenstein-Jensen media. *M. tuberculosis* strains were tested by a supranational lab (SRL) for resistance to isoniazid (INH) and rifampin (RIF) using the Hain Genotype MTDR-Plus<sup>®</sup> assay, with confirmatory drug susceptibility testing using standard phenotypic methods.

**Results:** During the study period, 3342 sputum smear-positive cases were registered by 17 centers; 2320 (69.4%) sputum samples were received by the NTRL for culture. In total, 1058 (45.6%) samples were culture positive. Among these, 862 (81.5%) were new patients, 193 (18.2%) were retreatment patients, and 3 (0.3%) unknown. 168 (15.9%) samples were lost or discarded; 890 cultures were processed by the SRL. Among these, 886 were sub-cultured positive and included in the analysis, 2 were not *M. tuberculosis* and 2 were contaminated. Among 723 new patients with available culture results, 18 (2.5%) were resistant to at least INH and RIF; among 161 retreatment patients with culture results, 23 (14.3%) were resistant to at least INH and RIF. Two patients (0.2%) had unknown TB treatment history.

**Conclusion:** The possibility of multidrug resistance should be considered when treating smear-positive, culture-positive retreatment cases in Lesotho.

**PC-807-28 DR-TB in Nepal: a matched case control study**

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**Introduction:** Nepal has been implementing DR-TB case management since 2005. MDR-TB cases have been increasing and 910 cumulative cases at the end of 2010. Considering the increased cases rapidly, it is important to understand the risk factors for MDR-TB cases

**Objective:** To know the risk factor of MDR-TB by matched cases control study.

**Methodology:** MDR-TB patients on the treatment in clinic were enrolled as cases and controls were the age, sex matched paired with cured TB patients who has completed TB treatment in the same treatment centre and same ecological zones. 55 cases and 110 controls with 1:2 ratios were selected using standard rule for study. Confounding effect were minimised by matched pair between cases and controls. Data were collected by a trained research assistant using interviewer administered structured questionnaire and analysis was done using SPSS 13 version and logistic regression model were used for variables analysis.

**Results:** The following were the significant risk factors for MDR-TB in Nepal; types of family OR = 3.77 (95%CI = 1.58–9.05); place of living homes (own and rented) OR = 3.5 (95%CI = 1.77–3.67); numbers of bed rooms OR = 2.8(95%CI = 1.13–6.90); previous history of TB OR = 20.5 (95%CI = 4.76–88.2); non regularity of treatment for TB in the past OR = 19.4 (95%CI = 2.27–151), distance to DOTS clinic OR = 3.95 (95%CI = 1.52–10.2), travel cost to attend DOTS clinic OR = 6.5 (95%CI = 2.36–9.78), contact history of TB OR = 4 (95%CI = 2.0–7.9); HIV status OR = 15.9 (95%CI = 1.92–133). The following were not statistically significant; monthly family income less than NRs 5000 compared to higher, OR = 1.53 (95%CI = 0.78–3.03), fuel used for cooking OR = 0.63 (95%CI = 0.32–1.25), current weight OR = 0.75 (95%CI = 0.25–2.2) consumption of alcohol OR = 1.89 (95%CI = 0.86–3.85), place of living (urban and rural) OR = 0.24, (95%CI = 0.13–0.44).

**Conclusion:** These results obtained from this study provide information to guide program planning and management in policy level.

**PC-895-28 Survey of resistance to anti-tuberculosis drugs in Albania**

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**Background:** This is a cross-sectional survey in tuberculosis (TB) drug resistance involving new and re-treatment smear-positive cases of pulmonary tuberculosis in Albania during 2010.

**Aim:** The aim of this survey was to determine the incidence of anti-TB drug resistance (mono, poly and multidrug resistance) among new and previously treated patients in Albania.

**Methods:** During the study period all new cases and re-treatment cases were enrolled. Two smear-positive pulmonary samples were cultured from each patient on solid Löwenstein-Jensen (LJ) medium and liquid culture (MGIT). After species identification drug susceptibility testing was performed on TB strains by proportion method on LJ. All resistant strains and 20% of the sensitive were retested in the Supranational Reference Laboratory in Milan.

**Results:** The total number of TB cases was 466. 274 (59%) of them were pulmonary TB cases and 192 (41%) were extrapulmonary. 94% were new cases and 6% retreatment cases. Males (69%) were affected more than women (31%). TB occurred more in urban settings (53%) than in rural ones (47%). Incidence was 13.7/100000. 205 TB cases were confirmed by culture (174 pulmonary and 31 extrapulmonary). 5.9% of all the strains were monoresistant. The prevalence of monoresistance was 2.9% for streptomycin, 2.4% for isoniazid and 0.5% for rifampicin. 1.0% of all strains were found to be multidrug-resistant (MDR). We had only one case with primary MDR-TB.

**Conclusions:** We found that the overall prevalence of MDR tuberculosis was low. Studies of the last decade on TB resistance in Albania have shown similar results. Even though Albania went through political and socioeconomic constraints, unlike other Eastern European countries, prevalence of anti-TB drug resistance remained low. This is also supported by the fact that in neighbouring countries such as Italy and Greece the number of Albanian TB patients is smaller than the number of TB patients among other immigrants.



### PC-908-28 The prevalence of MDR-TB in rural China: a population-based cross-sectional study

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**Objective:** To describe the prevalence of drug-resistant and MDR-TB in rural China.

**Method:** The population based cross-sectional study was carried out in 6 selected counties, 3 from Shandong and 3 from Jiangsu province, in eastern China. All active TB patients diagnosed within 2 years were interviewed at the time of diagnosis, of whom sputum specimen were collected for culturing. Drug susceptibility test (DST) was performed for 1st-line anti-TB medicine on all isolated TB bacilli.

**Results:** Among 2225 subjects, 1581 were smear positive and 644 smear negative, 1918 were new TB cases and 307 were retreated. 1264 isolates were obtained with 1222 (96.7%) *Mycobacterium tuberculosis*, 40 (3.2%) NTM and 2 (0.2%) *M. bovis*. The overall rates of resistance were 22.1% (258), while resistance to both isoniazid (INH) and rifampicin (RIF) was 6.4% (78). The rates of MDR-TB were 8.8% (52) in the three counties of Jiangsu and 4.1% (26) in the other three counties of Shandong with statistically significant difference ( $P = 0.001$ ). Overall, no significant difference in MDR rate between new and retreated cases, and they were 6.4% while 6.7% (71) and 4.5% (7) respectively. The rates of MDR-TB in new cases were 9.5% (49) and 4.0% (22) respectively in Jiangsu and Shandong province ( $P < 0.001$ ), and 4.1% (3) and 4.8% (4) in retreated cases in Jiangsu and Shandong province ( $P = 1.000$ ).

**Conclusions:** The prevalence of MDR-TB was higher in rural China while the distribution was varied in different areas especially on the newly diagnosed TB patients. Standardized diagnosis and treatment strategies for drug-resistant TB are urgently needed for effective control of MDR-TB in rural China.

### PC-1037-28 Estimating the prevalence of anti-tuberculosis drug resistance in Western Ukraine

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**Background:** Eastern Europe suffers from high rates of drug resistant tuberculosis (TB). However, the magnitude in Ukraine remains unknown due to limited access to routine drug susceptibility testing (DST) country-wide.

**Objectives:** To estimate the prevalence of anti-tuberculosis drug resistance in Western Oblasts of Ukraine

and identify the proportion of cases with mono-, multi-, and poly-drug resistant profiles.

**Methodology:** We conducted a cross-sectional study of all culture-positive, pulmonary TB cases identified in in-patient care institutions in three Oblast (Chernivtsi, Lviv, and Rivne) from January, 2008 through December, 2008. Using solid culture media, DST was conducted according to agar portion method. Multi-drug resistant TB (MDR-TB) was defined as resistance to at least isoniazid and rifampin. Polydrug resistance is resistance to multiple anti-tuberculosis drugs, but not MDR-TB.

**Results:** A total of 2645 culture-positive, pulmonary cases were identified. 1485 (56.1%) were new cases with no prior history of tuberculosis or treatment, 1160 (43.9%) were considered recurrent cases due to previous episodes and/or treatment for tuberculosis. Among new cases, 664 (44.7%) had any drug resistance: 223 mono-resistant (15.0%); 146 (9.8%) MDR-TB; and 295 (19.9%) had poly-drug resistant cultures. Among recurrent cases, 606 (52.2%) had any drug resistance: 153 (13.2%) mono-resistant; 196 (16.9%) MDR-TB, and 257 (22.9%) had poly-drug resistant cultures.

**Conclusions:** High-rates of drug resistance among both newly diagnosed and recurrent TB cases suggests routine and universal access to drug resistance detection technologies are needed to determine appropriate treatment regimens. A national surveillance system is required to identify and monitor the long-term trends of anti-tuberculosis drug resistance in Ukraine.

### PC-1159-28 TB drug resistance profile at the National Reference Laboratory in Mozambique

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**Background:** Mozambique is one of the countries with the highest burden of tuberculosis (TB), it ranks 19th in the list of 22 TB high burden countries in the world. In absence of surveillance system, data from reference testing performed at TB National Reference Laboratory (NRL) plays an essential role as a source of information on the burden and trends of TB drug resistance. The NRL receive samples from throughout the country for culture and Drug Susceptibility Test (DST).

**Methods:** Records from all samples received at the NRL in Mozambique during 2010 for DST were retrospectively reviewed. Demographic and laboratory data from each record was collected and analysed.

**Results:** Between January and December of 2010, a total of 371 samples were tested for DST. The median age was 32 years old (IQR: 25–40 years). Most of the samples were from Maputo city (51.2%), Maputo

province (24.0%) and Gaza (14.8%). Most of the samples were from relapse cases (32.9%) and new cases (21.8%). Treatment failure, abandon of the treatment and suspicion of MDR represented 8.9%, 4.6% and 8.6% of the records respectively. Out of 358 records (96.5%) were culture positive. Rate of mono-resistance for isoniazid, streptomycin, rifampicin and ethambutol was 50.3% (180/358), 61.7% (221/358), 52.5% (188/358) and 89.9% (322/358), respectively. Rate of MDR was 46.4% (166/358).

**Conclusion:** Overall, our data suggest that the occurrence of MDR in Mozambique is higher than reported in the last survey, and demand that country-wide survey should be systematically conducted to calibrate these results.

### PC-1211-28 Implementing mobile phone-based data collection in a large cohort longitudinal study in Lima, Peru

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**Background and challenges to implementation:** In conducting a large-cohort longitudinal study with ~24 000 participants in Lima, Peru, a paper-based system is being used to collect data. Data is collected by study workers, and then entered using standard double-entry procedures into openMRS where the study records are then maintained electronically. Paper is then warehoused and stored as study record. The study uses over 40 separate forms for data collection and hundreds of thousands of forms will be collected over the life of the study. The opportunity exists to realize substantial logistical, operational and financial savings by implementing electronic-based data collection for this study.

**Intervention or response:** The author team has implemented the open-source software, openXdata, to enable the study to shift to electronic data capture on low-cost mobile phones. The form templates are entered into openXdata and can then be downloaded onto phones by the study workers whilst in the field. During the transition phase, forms are filled-in with the participant both on the phone and on paper. Once phone form has been tested, phone-based data collection becomes the original study record. The forms are uploaded to the server as soon as the participant interviews are completed. As the form is uploaded to the openXdata server a custom module of openMRS takes the uploaded data and enters it directly into the electronic record. This reduces the time to see data in the electronic system. Reduces errors and the need

for data cleaning as the original study record is now instantly in the electronic database. It also eliminates the need for time, effort, and money to be spent on printing, collating, distributing, collecting, and then warehousing paper forms.

**Results and lessons learned:** The transition is ongoing at the time of submitting abstract. Early testing has shown that field workers are comfortable using phone-based data collection after a day or so.

### PC-1264-28 Outcomes of TB-HIV collaborative activities in West Kinshasa, DR Congo

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**Setting:** Since 2002, collaborative TB-HIV activities were implemented in Kinshasa, DR Congo capital city in order to reduce HIV burden among TB patients. Several partners were involved as WHO, USAID, CDC, Global Fund, MSF, UNC, NTP, NAP. West Kinshasa TB Coordination accounts for 56 TB clinics. Currently, 20% of TB patients registered within the country are from Kinshasa.

**Objectives:** The aim of the study was to evaluate outcomes after the rolling-out TB-HIV activities from different pilot projects to a provincial level.

**Methods:** We did a retrospective review of all records reported by the all 56 TB clinics in 2010. From cases notification gathered in TB registers, we determine the major outcomes/indicators of the implementation of TB-HIV activities in West Kinshasa.

**Results:** In 2010, a total of 4191 smear positive TB patients were notified. 3990 did get access to VCT in 56 TB clinics. Preliminary data shows that 67% (2692) have been tested for HIV. Overall 16% (429) of TB patients tested are being found to be HIV positive. Of those co-infected patients, only 11% (47) did get access to ARV treatment.

**Conclusion:** Partnership in HIV-TB co-infection projects has boosted the implementation of TB-HIV activities in West Kinshasa. However services coverage is still limited due to the lack of adequate provisions of supply and funds. ART provision should be increased urgently for better quality of care in co-infected patients.

## MDR-TB MANAGEMENT I

### PC-250-28 Early detection of MDR cases amongst patients on category II DOTS

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**Aim:** MDR-TB has become a significant public health problem in India. It is an obstacle to effective TB control. Aim is to detect MDR cases out of the patients on Cat II DOTS especially the failure type as early as possible.

**Methods:** This study included smear positive Cat II patients registered during the period Jan. 1, 2009 to June 30, 2010 in Jhandewalan District, New Delhi covering a population of 6 Lacs. Out of total 337 smear positive retreatment cases, there were 240 relapses, 18 failures and 79 TAD (Treatment After Default) and others. Two sputum samples on consecutive days of Cat II failures at the start of the retreatment and of other patients who remained positive at the end of fourth month of treatment were sent to the IRL (Intermediate Reference Lab.) for sputum culture and DST. The sputum culture was done by solid Löwenstein-Jensen (LJ) media.

**Result:** The average time taken for the culture and DST report was 98 days. Of the total 337 retreatment patients, 24 were diagnosed as MDR cases and there were 20 deaths. Analysing the specific type of Cat II patients, 10/240 (4.2%) relapses, 6/79 (7.6%) TAD and others and 8/18 (44.4%) Failures were detected as MDR cases.

**Conclusion:** In view of high MDR amongst Cat II failures and long time taken for diagnosis by conventional LJ method, the sputum of at least Cat II failure patients should be subjected to rapid technique for culture and DST so that the MDR cases can be diagnosed and put on DOTS Plus treatment at the earliest to reduce transmission. Instead of waiting for four months, the sputum samples of other retreatment patients should be sent for culture and DST at the time of starting the retreatment.

### PC-256-28 Adjunctive surgery improves treatment outcomes among patients with multidrug-resistant tuberculosis

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**Background:** Treatment of multidrug and extensively drug resistant (M/XDR)-TB was not previously available in Georgia. The purpose of this study was to assess treatment outcomes among the first cohort of patients with M/XDR-TB treated in Georgia.

**Methods:** From 2008–2010, a prospective observational cohort study was conducted among all patients

initiating treatment for pulmonary M/XDR-TB. Multi-variable analysis was utilized to determine independent risk factors associated with poor treatment outcome. **Results:** Among 380 patients with M/XDR-TB, 71% were male, mean age was 38 yrs, and 13% had XDR-TB; 12% were newly diagnosed TB cases and 88% had been previously treated for TB. Overall, 53% had a good treatment outcome and 47% had a poor outcome (death among 59 patients [15%], failure among 37 [10%], and 83 [22%] defaulted). Patients with newly diagnosed M/XDR-TB were significantly more likely to have a good treatment outcome than retreatment cases (37 [80%] of 46 vs. 164 [49%] of 334; OR = 2.8, 95%CI 1.2–6.3). In multivariable analysis, history of previous TB treatment (OR = 2.8 95%CI 1.2–6.3), the presence of XDR-TB (OR 2.3, 95%CI 1.2–2.4), bilateral lesions on CXR (OR = 1.8, 95%CI 1.2–2.9), lack of sputum culture conversion after 4 months of therapy (OR = 3.0, 95%CI 1.9–5.0), and BMI < 18.5 (OR 1.97, 95%CI 1.1–3.4) were associated with a poor outcome. Those who had adjunctive surgery were more likely to have a good treatment outcome (OR = 3.7, 95%CI 1.5–8.7).

**Conclusions:** Overall, more than half of the first cohort of patients in Georgia treated for M/XDR-TB had a good treatment outcome including 80% of those with newly diagnosed M/XDR-TB. Adjunctive surgery appeared to be beneficial in treating patients with M/XDR-TB. Retreatment cases, the presence of XDR-TB, more severe disease (based on CXR findings) and low BMI were associated with a poor outcome. Additional studies are needed to further define the apparent beneficial role of surgery in the treatment of M/XDR-TB.

### PC-311-28 Risk factors of mortality among MDR-TB patients in Iran, 2002–2009

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**Introduction:** Multidrug-resistant tuberculosis (MDR-TB) is a major issue in control of TB. The aim of present study was to identify the risk factors of mortality in MDR-TB.

**Material and methods:** During 2002–2009, all patients with documented MDR-TB in only referral center, Tehran, Iran, who had at least 6 months of follow up, were recruited. All patients received standard treatment consisted of Ofloxacin, Prothionamide, Amikacin and Cycloserine. All demographic and characteristic factors were studied, comparing between the death group and the control group.

**Results:** 159 patients were included. 88 patients were male. The mean age was 43.6 ± 17.4 and 41.6 ± 18.9 respectively in death and control group. Outcome of treatment was: 118 (74.2%) cured, 4 (2.5%)



failure, 21(13.2%) dead and 16(10.1%) interrupted of treatment. There was no difference in sex, smoking, opium, co-disease, HIV status and cavitory lesions between death group and the control group ( $P > 0.05$ ). In univariate analysis developing adverse effects and using Amikacin less than 6 months were significantly higher in death group. In logistic regression analysis (multivariate), using Amikacin less than 6 month retained the statistical significance.

**Conclusion:** This study showed that using Amikacin less than 6 months can raise mortality rate in MDR-TB patients.

### PC-545-28 Surgery for patients with highly drug-resistant tuberculosis: a report of 82 patients

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**Objective:** MDR- and XDR-pulmonary TB (PTB) are serious public health problems associated with high morbidity and mortality. We sought to evaluate the role of surgery in the treatment of MDR- and XDR-PTB in the setting of DOTS-Plus implementation.

**Methods:** Medical records were reviewed for MDR/XDR-PTB patients undergoing thoracic surgery at the National Center for TB and Lung Diseases (NCT-BLD) in Tbilisi, Georgia from 2008–2010. Indications for surgery included MDR/XDR-PTB in patients with localized pulmonary disease, fit to undergo surgery, and either experiencing medical treatment failure or such extensive drug-resistance that failure was likely. 2nd-line anti-tuberculosis medical therapy was administered per standard protocols.

**Results:** 82 PTB patients (56 MDR, 26 XDR) with median age of 30 years and mean length of medical MDR-TB treatment of 346 days had thoracic surgery performed as adjunctive therapy. The most common surgical indications were high drug-resistance with likely treatment failure (76%) and medical treatment failure (17%). The following surgical procedures were performed: pneumonectomy (10%), lobectomy (52%), segmentectomy (32%), and thoracoplasty (6%). Rates of reoperation (4%), complications (9%) and post-operative death (0%) were low. Of 35 patients with complete follow up, 24 (69%) had a favorable outcome (22 cured, 2 completed treatment); 6 of 11 patients with unfavorable outcomes defaulted treatment (5 had negative cultures at default). There was a trend towards better outcomes in MDR (73%) as compared to XDR (56%) patients ( $P = 0.33$ ). Of 47 patients still receiving anti-tuberculosis treatment, 90% had negative postoperative sputum cultures.

**Conclusions:** Thoracic surgery was associated with a

high rate of favorable outcomes and a low rate of complications when used as adjunctive therapy in MDR/XDR-PTB patients. Adjunctive surgery appeared to improve outcomes compared to historical controls with highly resistant TB at our center.

### PC-549-28 Résultats d'un traitement standardisé de courte durée de la tuberculose multirésistante au Niger

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**Objectif :** Evaluer l'efficacité d'un traitement standardisé de courte durée chez des patients avec tuberculose multi-résistante (TB-MR) confirmée, n'ayant jamais été précédemment traités par des antituberculeux de deuxième ligne au Niger.

**Méthodes :** 44 patients avec TB-MR confirmée ont été évalués après un traitement de douze mois à base de gatifloxacine à haut dosage, clofazimine, pyrazinamide et ethambutol ; pendant la phase intensive de quatre mois, le traitement prévoyait en plus kanamycine, prothionamide et isoniazide à haut dosage. Tous les patients avaient donné leur consentement éclairé. Cette étude observationnelle prévoit un suivi de deux ans pour évaluer la fréquence des rechutes post guérison.

**Résultats :** Entre juillet 2008 et décembre 2009, 59 patients ont été mis sous traitement : pour 9, la TB-MR n'a pas été confirmée et 6 avaient une mycobactériose atypique. Parmi les 44 patients évalués (1 nouveau cas et 43 cas précédemment traités), 37 (84%) avaient accepté de faire le test du VIH et tous étaient séro-négatifs. Après quatre mois de phase intensive, 40 (90,9%) ont eu la conversion de la culture du crachat, 1 (2,3%) gardait la culture positive et 3 (6,3%) étaient décédés ; la conversion de l'unique culture positive a été obtenue au sixième mois après prolongement de la phase intensive. A la fin du traitement, 39 patients (88,6%; IC95%: 79,2–98) ont été déclarés guéris et aucun échec bactériologique n'a été enregistré. Aucun effet secondaire grave n'a été constaté. Trente-et-un des 39 patients déclarés guéris ont eu leur examen de suivi (frottis et culture) réalisé à 6 mois après guérison, et aucune rechute n'a été observée à ce stade.

Résultats	n	%	IC 95%
Guéris	39	88,6	79,2–98
Traitements terminés	0	0	
Décès	4	9,1	6–17,6
Echecs	0	0	
Abandons	1	2,3	2,1–6,7
Total	44	100	



**Conclusion :** Un traitement de courte durée, basé sur une quinolone de quatrième génération combinée avec des antituberculeux de deuxième ligne et de première ligne supposés être encore efficaces, semble avoir un taux de succès thérapeutique équivalent à celui du traitement de première ligne au Niger.

### PC-585-28 Drug-resistant tuberculosis among close family contacts in Georgia

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**Background:** Tuberculosis (TB) control has been greatly hampered by the continuing emergence of multidrug-resistant (MDR) and extensively drug-resistant (XDR) *Mycobacterium tuberculosis* in Georgia. We investigated the drug resistance of *M. tuberculosis* isolates recovered from close family contacts of patients with MDR- or XDR-TB in Georgia.

**Methods:** In 2010, one close family contact of a patient with XDR-TB and fifteen close family contacts of patients with MDR-TB were registered in Georgia. *M. tuberculosis* isolates from these contacts (having active disease) were tested for susceptibility to rifampin (RIF), isoniazid (INH), streptomycin (STR), ethambutol (EMB), ethionamide (ETO), ofloxacin (OFX), para-aminosalicylic acid (PAS), capreomycin (CM), and kanamycin (KM) using the absolute concentration method on Löwenstein-Jensen medium.

**Results:** In 40.0% of the cases, *M. tuberculosis* isolates from both MDR-TB patients and their close family contacts, showed one of the following identical drug resistance profiles: RIF-INH-STR ( $n = 1$ ), RIF-INH-STR-EMB-ETO-CM-KM ( $n = 2$ ), RIF-INH-STR-ETO ( $n = 2$ ), or RIF-INH-STR-EMB-ETO-KM ( $n = 1$ ). *M. tuberculosis* from the XDR-TB patient and its contact also exhibited an identical profile (RIF-INH-STR-EMB-ETO-OFX-KM). However, in 60.0% ( $n = 9$ ) of the cases, the drug resistance profiles of the *M. tuberculosis* isolates from MDR-TB patients did not match with those of the isolates from the close family contacts of these patients. Importantly, a great majority of these contacts (88.8%) carried either drug sensitive ( $n = 5$ ) or mono-resistant ( $n = 3$ ) *M. tuberculosis*.

**Conclusion:** Among other possible scenarios, different *M. tuberculosis* strains can be considered to be responsible frequently for TB infections in patients and their close family contacts in Georgia. There is an urgent need for advanced methods for rapid screening of drug resistance in, and for determining genotypes of *M. tuberculosis*, in order to design effective TB treatment and prevention strategies in this region.

### PC-638-28 Success in decentralisation of DRTB services in Kenya

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**Background:** MDR-TB surveillance in Kenya was started in November 2003 after the reference laboratory was refurbished. In 2004, Kenya requested the Green Light Committee to approve the treatment of MDR-TB patients in December the same year, Kenya was allowed to treat the first 40 patients, though this never started until 2008 when 2 referral facilities started offering the services namely Kenyatta National Hospital and Moi Teaching and Referral Hospital. A cumulatively 500 patients have been confirmed to have MDR-TB in the Central Reference Laboratory since 2003 to the end of 2010.

**Methods:** Over 700 health care workers were trained both locally and internationally on Drug Resistant Tuberculosis care services. The team trained includes medical doctors, clinical officers, nurses, laboratory technologists, pharmacists among others. The services began in 2 main referral centers and 2 private institutions, and then it spread to all provincial hospitals, later district hospitals and high volume health facilities where there were MDRTB patients. More than 220 patients have been put on treatment up to date. Drugs from UNITAID, Global Fund for over 390 patients has been procured. Patient support was provided through our partners, clinical teams involving key health care workers were formed to offer services and protective gear was also provided for infection prevention control.

**Results:** In 2008 there were only 2 sites offering DRTB services but rapid decentralization was enhanced and by 2010 35 more sites were opened. This reduced the waiting time before initiation of treatment. The cost of treatment also went down significantly because the patients were treated near home. 20 patients have been cured to date.

**Conclusion:** Centralization of the DRTB services is the single most hindrance to accessibility of DRTB treatment and thus National Tuberculosis Programmes should not shy off from decentralizing treatment regardless of resource availability.

### PC-681-28 Culture reversion among defaulters from MDR-TB treatment, Tomsk, 2000–2004

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**Background:** Tomsk's multidrug-resistant tuberculosis (MDR-TB) treatment guidelines require at least 16 months of treatment; at least 12 months after sputum culture conversion (CC). The treatment is lengthy and difficult for patients to finish and default is common.

**Objective:** Analyze positive culture reversion (PCC) among MDR-TB defaulters with registered culture conversion.

**Methods:** We analyzed a post-treatment follow up data from patients who started MDR-TB treatment in Tomsk, Russia between September 2000 and November 2004, had registered CC, and defaulted from treatment. We classified patients into 4 groups depending on the length of time between the date of final CC and the date of default. We defined CC as having at least two consecutive negative cultures 30 days apart.

**Results:** Among 623 patients enrolled in treatment, 125 defaulted, and 87 had CC at the time of default. We excluded 25 patients since they didn't have 2 years of follow up, and 9 because they started 'post default' TB treatment within the first 6–9 months of follow-up without any signs of bacteriological failure. The remaining 53 patients were available for analyses. PCC occurred in 21/53 (40%) patients; 18/21 (86%) had it within the first 12 months of treatment. PCC occurred in all 9 patients who defaulted <100 days after CC; in 7 out 16 (44%) who defaulted within 101–200 days after CC, in 2/9 (22%) who defaulted within 201–300 days after CC, in 2/10 (20%) who defaulted within 301–400 days after CC, and in 1/9 (11%) who defaulted >400 days after CC.

**Conclusion:** The rates of PCC are associated inversely with the length of treatment time post culture conversion. The rate relapse remains unacceptably high even in patients who defaulted one year after culture conversion. High PCC rates can be due to risk factors common to defaulters. More research is required to determine acceptable minimal treatment length and risk factors for default.

### PC-726-28 Treatment results after surgical interventions for patients with pulmonary MDR-TB within DOTS-Plus

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**Aim:** To study the efficiency of operative interventions at patients with MDR pulmonary TB in the conditions of program DOTS-PLUS.

**Methods:** Since 2000, there has been implemented DOTS-PLUS program for treatment of pulmonary MDR-TB patients in Tomsk and Tomsk Oblast. By 2010, this program has included 1496 from civilian population, among them, 167 (11.2%) have received some surgical interventions. Before the surgeries, 16 (9.5%) patients have been diagnosed with cavernous form of pulmonary TB, 44 (26.4%) patients with fibro-cavernous TB, 99 (59.3%) patients with tuberculomas, and 8 (4.8%) patients with other forms of pulmonary tuberculosis. Extrapleural thoracoplasty (5–6 ribs) has been used in 12.6% (21) cases, resection surgery in 86.2% (144) patients, including 16 (11.1%) patients with both lungs involvement.

**Results:** There have been analyzed some long term results of the surgical treatment for 149 (89.2%) MDR-TB patients. After 5 years of follow up in outcome noted: clinically cured in 126 (84.6%) persons, died 5 (3.4%) patients, treatment failure—9 (6%) patients, relapse—2 (1.3%), withdrew from the study—1 (0.7%), separation in 6 (4%) patients.

**Conclusions:** The process of complex MDR-TB treatment within DOTS-PLUS program involves following of a particular algorithm in work of a TB doctor, synchronism and understanding specifics of patient's condition from the side of a therapists along with a surgeon. Schema and duration of post-surgical chemotherapy (not shorter than nine months) have been decided according to several factors, such as: the results of DST for mycobacterium isolates from patients sputum before surgeries and from resection material, initially diagnosed form of a TB process, extension and complexity of surgical interventions, characteristics of residual process, and dynamics of clinical and laboratory results. Surgical interventions are one of priority directions in treatment MDR-TB of lungs.

### PC-918-28 No failure, no relapse among the first MDR patients treated with a 12-month regimen in Benin

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Since 2007, all the bacteriologically proven MDR cases identified through the resistance surveillance system among retreatment cases in Cotonou receive a

short course 12-month regimen if resident in Benin. The regimen includes 12 months of gatifloxacin, prothionamide, ethambutol and pyrazinamide, supplemented in the 4 first months by kanamycin (since 2008, isoniazid is included during the 4-month intensive phase, and clofazimine all along). Treatment is daily directly observed by a health worker. Bacteriological follow-up is done monthly during the first 4 months and then every 2 months, at each control a clinical follow-up is assured by a medical doctor (FK). In Benin, the intensive phase of the first line treatment is systematically and carefully directly observed daily by a health worker. That probably explains the very low number of MDR patients in spite the long use of rifampicin (more than 30 years), and the intensive surveillance of the resistance patterns among all the retreatment cases. Only 14 MDR cases living in Benin were identified from 2007 to 2009 (6 in 2007, 1 in 2008, 7 in 2009). Out of the 14 cases, 13 (93%) were cured, and 1 died. HIV testing is systematic and 2 women were found positive. Both are cured and each delivered a healthy baby in the year following their MDR treatment. For the patients diagnosed in 2007 and 2008, there is no relapse 12 months after the end of their treatment. There is considerable hope that short-course treatment for MDR is the future for most African countries.

#### PC-947-28 Risk factors associated with default from MDR-TB treatment, Uzbekistan, 2003–2008

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**Background:** The MSF project in Karakalpakstan region of Uzbekistan has provided MDR-TB treatment since 2003 according to WHO guidelines. Rates of default, defined as missing a minimum of 60 consecutive doses (all drugs), increased substantially in 2007 when program scale up occurred. This study aimed to identify a baseline high risk profile for defaulters, in order to target greater resources or improved care to this group.

**Methods:** Retrospective cohort analysis of baseline demographic characteristics and risk factors for default between defaulters and non defaulters from MDR-TB patients enrolled in treatment between 2003 and 2008. Data was routinely collected and entered into the MSF database over the course of patient treatment. Odds ratios and confidence intervals for risk factors for default were calculated.

**Results:** Out of a total of 705 patients enrolled, 142 (20.1%) defaulted from treatment, with the majority

defaulting within their first treatment year. Risk factors for default included being male (OR 1.45, 95%CI 1.00–2.10), aged over 45 (OR 1.59, 95%CI 1.02–2.49), a health care worker (OR 2.59, CI 1.14–5.86), and previous travel outside the region (OR 1.86, 95%CI 1.17–2.88). Protective factors for default included previous failure of Cat II treatment (OR 0.52, 95%CI 0.32–0.83), nausea at admission (OR 0.49, 95%CI 0.31–0.77) and resistance to Kanamycin (OR 0.49, 95%CI 0.30–0.81) or Capreomycin (OR 0.40, 95%CI 0.21–0.76) at diagnosis.

**Conclusion:** Default from treatment of MDR-TB is high in Uzbekistan. Baseline factors associated with default differed to those identified in other countries. Further work is required to investigate why these factors are associated with increased risk of default. This study is limited in reviewing only baseline factors, while patient and service factors may also be associated with default. Understanding the profile of those at higher risk of default will allow the program to target specific interventions to this group.

#### PC-1180-28 Line-Probe Assay for the diagnosis of MDR-TB in Burkina Faso: whom should we screen?

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**Aim:** Screening of MDR-TB using rapid, molecular tests, should target populations at increased risk of MDR-TB.

**Methods:** New smear positive TB patients registered in 11 TB clinics in Burkina Faso were enrolled if: relapses of category I and treatment after default (group 1); smear positive at month III during category I (group 2); failures of category I (group 3); failures of category II (group 4); relapses of category II (group 5); and contacts of MDR-TB patients (group 6). MDR-TB was identified on the basis of a GT-MDR-plus (Hain, Lifescience) test performed at the Supranational TB Laboratory in Milan, Italy. Factors associated with MDR-TB were identified by multivariable analysis.

**Results:** 142 patients were enrolled (77.5% male) distributed as follows: group 1,  $n = 30$ ; group 2,  $n = 33$ ; group 3,  $n = 32$ ; group 4,  $n = 27$ ; group 5,  $n = 17$ ; group 6,  $n = 3$ . 19.4% among the 98% who accepted to be tested, were HIV positives. 108 cases were positive for *Mycobacterium tuberculosis* DNA and 29 (26.9%) were identified as MDR-TB cases. The proportion of MDR-TB was 4.3% (1/23) in group 1; 12.9% (4/31) in group 2; 26.1% (6/23) in group 3; 63.2% (12/19) in group 4; 33.3% (3/9) in group 5

and 100% (3/3) in group 6. At univariate analysis the OR for MDR-TB diagnosis were: 3.26 (C.I. 0.34–31.3) for group 2; 7.77 (0.9–70.8) for group 3; 37.7 (4.1–343.9) for group 4; 11 (0.1–125.8) for group 5 (group 1 as reference). At the multivariable analysis being in group 4 was significantly associated with a diagnosis of MDR-TB ( $P = 0.001$ ).

**Conclusions:** Chronic TB patients are at significantly increased risk of MDR-TB. Patients failing category I and patients with positive smear at month III of category I treatment have a trend towards higher probability of MDR-TB and might be a priority target for screening with molecular techniques.

### PC-1271-28 Factors associated with relapse on MDR-TB treatment

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**Background:** Since 2000, Brazil has accumulated patient data on a systematic basis through its MDR-TB online surveillance system.

**Objective:** To investigate factors associated with relapse of MDR-TB treatment.

**Methods:** Non-concurrent cohort study of patients enrolled for MDR-TB treatment from January 2000 to December 2006. Survival analysis was used to estimate the time until relapse and the hazard rate for this event. The Cox proportional model was applied to investigate the relations among possible predictors of relapse.

**Results:** During the period, 402 (56.8%) of 708 treated patients were cured, average age was 39.9 years (41.6 and 36.4 years respectively for males vs. females); with male predominance (67%). Most patients (96%) had prior TB treatment, where 46% had three or more treatments. Only 20 (5%) of 402 patients had relapse and the rate was estimated at 1.74 cases per 100 000 person-days or 6.34 cases per 1000 person-years. Average time until the onset of relapse was 4 years, with a minimum of 2.9 years and a maximum of 5 years. Patients with relapse were younger than the 36.6 years average age. Relapse rates were higher: in women who had both pulmonary and non-pulmonary clinical forms; in those with non-cavitary radiological presentation; and in illicit drug users. Patients who underwent supervised treatment had fewer relapses. Other factors such as age, education, previous TB treatment, alcoholism and other co-morbidities were not related to higher rates of relapse. A Cox regression model using bivariate

analysis was used to detect the variables associated with relapse. After adjustment, none of the factors studied were found to be associated with relapse of MDR-TB treatment.

**Conclusion:** This data analysis shows that the factors: feminine sex; clinical form (both pulmonary and non-pulmonary); non-cavitary radiological presentation; and illicit drug use are possible predictors of relapse. Supervised treatment appears as a protective factor for relapse.

## CLINICAL TUBERCULOSIS I

### PC-19-28 Problématique de la tuberculose pulmonaire à microscopie négative à l'heure du VIH/SIDA

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Il s'agit d'une étude rétrospective de 5 ans, qui avait pour objectif principal d'étudier la tuberculose pulmonaire à microscopie dans 4 CDT de la tuberculose à Bamako, Mali. L'étude a porté sur l'ensemble des patients pris en charge pour TPM – dans les dits centres. Durant cette période d'étude 5425 cas de tuberculose pulmonaire a été recensés dans ces centres avec 432 cas de TPM – soit une prévalence de 7,9%. La prévalence de la TPM – varie d'un centre à l'autre. Il était respectivement de 16%, 6%, 4%, 3% au service de PPH, CS réf CV, CS réf CII, CS réf CVI. Le moyen de diagnostic le plus utilisé était l'association de la clinique, de la radiologie et de l'évolution sous traitement. La culture était également utilisée comme élément de diagnostic mais à faible proportion 0,5%. Au total 136 de ces patients ont bénéficié de la sérologie VIH et 54% de ces patients étaient séropositifs. Par rapport au traitement nous avons enregistré 58% cas de patients transférés, 31% cas de traitement achevé, 2,7% cas d'abandons et 7,87% cas de décès.

### PC-120-28 Diagnosis of pulmonary tuberculosis under Direct Observed Sputum Testing 'DOST'

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**Background:** Tuberculosis is a major cause of illness and death worldwide, especially in Asia and Africa. It accounts for 2.5% of the global burden of disease. Case detection rate in the Gedarf state is low as well as a high prevalence of smear negative *Mycobacterium tuberculosis*; the objective of the study was to compare the results of bacteriological examination of



tuberculosis suspects taken under direct observation, with specimens taken without observation in Gedarif state, Sudan 2011.

**Methods:** The design was an analytic study to compare sputum results taken from TB suspects under direct observation during collection of the specimens, and those taken without observation. Pulmonary TB suspects attending Gedarif TBMU were selected in alternate days as a study and a control groups. Patients in the study group were asked to collect a sputum sample for investigation to check the presence of AFB and observed while coughing and collecting the samples. The control group was not observed during collection of the specimens. Data were collected by a pre coded and pre tested questionnaire, results of the sputum were taken from the laboratory register. Analysis was done by SPSS version 13. A written consent was obtained from cases and controls.

**Results:** The prevalence pulmonary TB was 43% when the sputum was taken under direct observation, while it was 30% when taken without observation.

**Conclusion:** The sputum testing taken under direct observation provides more positive cases compared to results taken without observation.

#### PC-453-28 Serial change in C-reactive protein as a surrogate marker for response to TB therapy

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**Background:** CRP is an emerging biomarker for tuberculosis and is available as a point of care test. We investigated serial changes in CRP in ambulant smear-negative culture-positive patients in a high HIV prevalence setting.

**Methods:** 364 adult ambulant smear-negative tuberculosis suspects who completed 8 weeks of follow-up were evaluated. CRP was measured at baseline and weeks 2, 4 and 8. Changes in CRP in culture positive participants who started antitubercular therapy at baseline (tuberculosis group) were compared with culture-negative participants who did not start therapy and remained clinically stable for 8 weeks (not tuberculosis group). CRP was expressed as multiples above the upper limit of normal ( $\times$ ULN) for the assay.

**Results:** 347 participants had a complete set of CRP results: 125 (36%) had culture-positive tuberculosis and 86 (25%) did not have tuberculosis; the remaining 136 started antitubercular therapy, but were excluded from this analysis as cultures were negative. 135 of the 211 participants (64%) tested for HIV infection, of whom 112 (83%) were seropositive (median CD4 count 139 cells/microlitre [IQR 85–247]). Changes in CRP and percentage participants with

	Baseline	Week 2	Week 8
TB group			
CRP $\times$ ULN [IQR]	14.3 [7.1–22.5]	2.5 [1.0–6.6]	1.4 [0.6–3.1]
Not TB group			
CRP $\times$ ULN [IQR]	0.6 [0.2–1.6]	0.6 [0.2–1.6]	0.6 [0.2–1.8]

normal CRP in the two groups are shown in the Table. At week 2, 76% of the tuberculosis group and 17% of the not tuberculosis group showed a reduction in CRP  $\times$  ULN from baseline by  $>$ 50% (odds ratio 15 [95%CI 17–30]); at week 8 the values were 89% and 22% respectively (odds ratio 28 [95%CI 13–59]; *P* for trend  $<$ 0.0001 for the tuberculosis group, 0.8 for the not tuberculosis group).

**Conclusion:** In culture-positive smear-negative tuberculosis the CRP falls rapidly on therapy. CRP could potentially be used to monitor treatment response.

#### PC-463-28 Primary default tracing at chest clinics of Ojha Institute of Chest Diseases, Karachi, Pakistan

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**Objective:** To evaluate the magnitude and reasons of primary default among smear positive TB cases.

**Method:** Prospective study, conducted from 1st January 2010 to 30th June 2010. The TB suspects were asked for sputum Acid Fast Bacilli smear examination. Then sputum positive cases were checked for registration for treatment. Those who did not report for treatment initiation were labeled as 'primary defaulters (PD)'. They were then contacted on phone/home visit with the request to get registered for treatment. They were also asked about reasons for not reporting.

**Results:** Out of 7467 TB suspects 5167 (69.19%) submitted sputum. 1121(21.69%) were smear positive TB. 947 (84.5%) registered for treatment while 173 (15.5%) did not (PD). 91/173 (53%) were successfully traced and registered for treatment. 15 patients (8.6%) were taking treatment from physicians, 7(4%) were admitted without registration, 7 (4%) were suspected Drug-Resistant TB. 24 (13.87%) were untraceable PD. One patient was reported to have died at home due to unknown cause. The major reason for primary default was distance to clinic, i.e., 83 (47.97%). 12 (6.93%) defaulted due to loss of wages, 8 defaulted due to the timing of the clinic, 9 were not interested in taking treatment.

**Conclusion:** The primary default is high in the chest clinics of Ojha Institute. Proper counseling/default tracing will help to reduce the primary default rate.

**PC-627-28 Devenir des tuberculeux en régime de retraitement à Cotonou**

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**Introduction :** Le retraitement dans le cadre du PNT désigne un patient dont les frottis sont positifs et qui a déjà suivi un traitement antituberculeux pendant plus d'un mois. Le retraitement représente la dernière chance du patient qui risque de devenir tuberculeux chronique (MDR) si la prise en charge n'est pas correcte et totale.

**Méthodologie :** A partir des registres, une étude rétrospective a été menée sur tous les cas de tuberculose pulmonaire à bacilloscopie positive mis au régime de retraitement (2SERHZ/1ERHZ/5RHE) du 1er janvier 2005 au 31 décembre 2009 au CNHPP. L'objectif était d'évaluer les résultats du traitement des tuberculeux en régime de retraitement. Les résultats du traitement des nouveaux cas à bacilloscopie positive enregistrés au cours de la même période ont servi de comparaison.

**Résultats :** Les retraitements représentaient 521/4545 (11,46%) des TPM+ enregistrés au cours de la période. Des 521 dossiers, 389 étaient exploitables soit 74,66% des cas. Les rechutes représentaient 62%, les reprises de traitement après abandon 21% et 17% étaient des échecs. La séroprévalence du VIH était de 23%. Les résultats du traitement sont dans l'ensemble satisfaisants (78,40% de succès) et proches de ceux des nouveaux cas (85,11%). Le taux de perdu de vue est 12,6% vs. 6,12%, PS. Ce taux a connu une amélioration progressive au cours des années passant de 20% en 2005 à 6% en 2009. Les taux d'échec (2,18% vs. 2,30%) et de décès (5,10% vs. 4,87%) sont superposables. La séropositivité au VIH n'agit pas sur l'issue favorable du traitement mais il existait un taux de décès élevé chez les co-infectés (7,14% vs. 2,63%,  $P = 0,1375$ ). Le succès thérapeutique était de 76,61% pour les hommes et 85,71% pour les des femmes ( $P = 0,0027$ ).

**Conclusion :** Les résultats des patients en retraitement sont proches de ceux des nouveaux cas. Les efforts déployés qui ont permis l'amélioration continue du taux de perdu de vue doivent être maintenus et renforcés.

**PC-924-28 The impact of digital X-ray services on TB notification and treatment delay in Zambia**

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**Background:** In August 2009, a digital chest X-ray machine was installed at a large urban health centre that serves an unplanned high density residential area in Lusaka, Zambia.

**Objective:** The primary aim of this study is to describe the impact of the digital chest X-ray service on tuberculosis notifications and time from identification of a tuberculosis suspect to initiating treatment (treatment delay).

**Methods:** Operational retrospective research of tuberculosis notification, laboratory and chest X-ray data for quarter 4 2008 (prior to digital chest X-ray) compared to quarter 4 2009 (digital chest X-ray service in place). Variables analyzed include baseline demographics, HIV status, sputum smear status, tuberculosis notifications, and treatment delay. Continuous variables were compared using Student's *t* test and rank sum.

**Results:** There were 777 tuberculosis notifications in quarter 4 2008 cohort compared to 816 in quarter 4 2009. There was no significant difference in baseline demographics between the two years. Although, no difference was seen in number of X-rays performed in smear negative patients (both cohorts > 98%), the proportion of smear negative pulmonary tuberculosis notifications increased from 46.6% in 2008 to 53.4% in 2009 ( $P = 0.004$ ). Furthermore, treatment delay decreased from 6.1 days in 2008 to 4.2 days in 2009 ( $P = 0.0003$ ).

**Conclusion:** The introduction of the digital X-ray service at this health centre resulted in increased number of tuberculosis notifications with a higher proportion of smear negative pulmonary tuberculosis notifications. There was also a decrease in treatment delay. Overall, the digital X-ray service performs well in a resource constrained setting and widespread implementation could lead to more efficient diagnostic and treatment pathways.

### PC-965-28 Making the correct diagnosis: Zambian tuberculosis suspects enrolled in the WHO specimen bank study

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**Background:** High rates of tuberculosis (TB) disease in Zambia make accurate diagnosis and appropriate therapy critical. In 2010, TB suspects at an urban health center were offered participation in a WHO specimen bank study.

**Objective:** To determine percentage of TB suspects correctly started on therapy, defined by the presence of a positive culture.

**Methods:** This was a retrospective review of WHO specimen bank data collected from March 2010 to February 2011. A person who presented with symptoms, such as persistent cough lasting more than 3 weeks, weight loss and night sweats were considered TB suspects and offered enrollment in the WHO specimen bank study. Commencement of TB therapy was based upon history, physical, sputum smear microscopy and digital chest X-ray findings.

**Results:** 205 TB suspects enrolled in the study. Overall, mean age was 39.7 and 149 (72.6%) TB suspects were male. 135 (65.8%) were HIV infected. 102 (49%) TB suspects had positive sputum smear microscopy and 165 (80%) had positive cultures. 60 (44%) HIV infected individuals had positive smear microscopy. 165 TB suspects were started on TB therapy and 40 were not. 150 out of the 165 (91%) TB suspects were correctly commenced on therapy, as confirmed by positive culture. 15 of the 40 (37%), who were not started on therapy, should have been.

**Conclusion:** TB suspects enrolled in this WHO specimen bank study have a high rate of TB, as evidenced by high rates of positive sputum smears and cultures. A high proportion of TB suspects were correctly commenced on therapy. In this population, the existing WHO algorithms for the diagnosis of TB functioned well. Proposed algorithms for TB diagnosis in HIV infected individuals that include new diagnostic tools should not ignore results that can be obtained using existing algorithms.

### PC-1009-28 An analysis of causes of mortality in patients with tuberculosis in a North Indian hospital

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**Introduction:** In the present study we analyze the cause of death in TB patients in a tertiary care hospital for tuberculosis and respiratory diseases.

**Material and methods:** Medical records of all admitted patients with tuberculosis who died in this 520 bedded hospital were reviewed over a two year period. Information on demographic parameters, extent of disease (National Tuberculosis Association of USA), other investigations, ECG and ABG reports, drug resistance pattern, smoking, alcohol and other drugs intake were reviewed. HIV status whenever available was noted.

**Results:** 831 people died due to tuberculosis in this period, 71% were males and 29% were females. Majority of the patients were in the age group of 16 to 45. Most of them (77.4%) were Category II patients followed by Category I. 4.6% of the subjects were HIV positive and 13.2% were HIV negative. HIV testing was not done in 82% of the patients. Most of the expired patients had radiologically severe form of disease (95.4%), 3.7% had moderate disease and only 1% had mild disease. Other causes included massive haemoptysis in 7.5% respiratory failure in 1.7%, MDR-TB in 4.3%, sepsis in 4.8% and other associated medical illness in 11.4% (AIDS, dys-electrolytemia, hepatitis, DVT, diabetic ketoacidosis, acute renal failure and gastrointestinal perforation). 54.7% were non smokers and the remaining were smokers. 70% did not have history of alcohol intake.

**Conclusion:** Advanced form of the disease, and irregular treatment history are the two most common causes of death in patients of tuberculosis admitted to the hospital.

### PC-1019-28 Demographic, clinical and radiographic assessment of symptomatic, smear-negative PTB in a PPMD setting

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**Background:** The burden of tuberculosis control has long been a problem in our society. Much effort is being done to address the issue of case detection and treatment. Annually, numerous cases of pulmonary tuberculosis are being referred to Public-Private Mixed DOTS (PPMD), and in most instances, they are of sputum smear-negative type. Clinicians need to decide when to initiate empiric anti-Koch's treatment based only on symptoms and radiographic findings, as a delay in the commencement of treatment could cause further transmission of the disease. Thus, an advocacy, heralded by a TB diagnostic committee, of treating smear-negative patients suspected of having active TB disease was started.

**Study objective:** To recognize the clinical and radiographic characteristics as well as demographic profiles of all sputum smear-negative patients with symptomatic pulmonary tuberculosis enrolled in the Directly Observed Treatment Short-Course program of St. Paul

Hospital-Iloilo (DOTS-SPH) from January 2008 to June 2009.

**Design:** Retrospective descriptive study.

**Setting:** Public-Private Mixed DOTS (DOTS-SPH) in Iloilo City.

**Patients:** Total of 74, symptomatic, smear-negative TB patients enrolled in DOTS-SPH were included in the study.

**Results:** About half (51.4%) of the patients included in the study were females, mostly young adults (31.1%) in their productive years, residing in the urban areas (73.0%). Patients presented with cough (85.1%), backpain (64.9%), weight loss of >10% (44.6%), easy fatigability (44.6%), and chest pain (43.2%). Most patients were under Category I (58.1%). The most common radiographic finding is the presence of an apical/upper lobe infiltrates (79.7%).

**Conclusion:** Most patients presented with at least 3 or more constitutional symptoms, cough being the most common. The initiation of anti-Koch's medications relies mostly on chest radiographic findings and symptomatology of patients.

#### PC-1029-28 Evaluation of active, protein-unbound concentrations of rifampicin in Indonesian TB patients

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**Background:** Concentrations of TB drugs in plasma are thought to predict efficacy and adverse effects. Pharmacokinetic (PK) studies of TB drugs focus on total (i.e., protein-bound plus unbound or free) concentrations, whereas only free drug is active and able to diffuse to the site of action. We evaluate free plasma concentrations of the pivotal TB drug rifampicin.

**Methods:** Adult Indonesian pulmonary TB patients were administered a regular oral dose of rifampicin (450 mg, circa 10 mg/kg daily) together with other TB drugs before intensive PK sampling after 2 weeks of treatment. Total and free plasma concentrations of rifampicin were analyzed with validated HPLC methods, PK parameters were assessed with non-compartmental methods, and were compared between subgroups using the independent-samples T-test.

**Results:** Thirty-six patients were included (mean age 34 years, 39% male, mean BMI 18.6 kg/m<sup>2</sup>). The mean ratio of free and total exposure to rifampicin (AUC<sub>0–24h</sub>) was 10.3%, with a two-fold range in this free fraction (range 7.6–15%). The height of total plasma concentrations only slightly affected the free fraction. 11 malnourished (BMI ≤ 18.5, with mean

15.4 kg/m<sup>2</sup>) and 25 well-nourished patients (BMI > 18.5, with mean 20.0 kg/m<sup>2</sup>) showed no differences in AUC<sub>0–24h</sub> and peak concentration (C<sub>max</sub>) based on total and free plasma concentrations of rifampicin. Age did not effect rifampicin total or free concentrations, but female participants showed 25% higher total and free AUC<sub>0–24h</sub> than men.

**Conclusions:** The fraction of protein-unbound, active rifampicin in plasma varies two-fold amongst patients with the same total exposure, implicating that total concentrations in pharmacokinetic studies should be interpreted with caution. Based on active rifampicin concentrations, malnourished Indonesian patients are not at an increased risk of treatment failure. Further study on the effect of gender on the PK of rifampicin is warranted.

#### PC-1099-28 Digital radiography: a TB screening tool in Zambian prisons

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**Background:** In recent years, digital radiography has become available and affordable in developing countries. Tuberculosis (TB) control programs in different nations are evaluating the potential for implementation. We report on the performance of digital chest radiography as a TB screening tool in a Zambian prison.

**Methods:** Data was collected during program collaboration between Zambia Prisons Service (ZPS) and the Centre for Infectious Disease Research in Zambia (CIDRZ) and funded by TB REACH. A mass screening intervention was carried out in Lusaka Central Prison from January through March 2011. All inmates were evaluated for TB by symptom screening (any cough, fever, weight loss, or night sweats), fluorescence microscopy (FM), and digital chest X-ray regardless of the presence or absence of symptoms. Clinical officers made decisions regarding diagnosis and treatment based on these screening tools. Opt-out HIV testing was offered with TB screening.

**Results:** A total of 341 inmates were screened. HIV prevalence was 55%. TB was diagnosed in 57 (17%) inmates. Any symptom was present in 226 (66%), FM smear was positive in 3 inmates and abnormal chest X-ray in 72 (21%). Fifty three (74%) abnormal chest X-rays were compatible with TB. The most common reported abnormalities among TB patients were parenchymal (77%) followed by pleural (30%) and mediastinal (30%).



**Conclusion:** Digital X-ray out-performed smear in this prison population with high HIV prevalence. In patients with abnormal X-ray patterns, parenchymal abnormalities were more indicative of TB.

**PC-1196-28 Profil clinique des TPM– au CHU Kamenge et à l'Hôpital Prince Régent Charles à Bujumbura au Burundi**

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**Cadre :** Au Burundi, le nombre de cas de tuberculose toutes formes est passé de 6865 en 2008 à 7323 en 2009. Le nombre de TPM– a passé de 863 en 2008 à 1222 en 2009 dont 357 dépistés principalement par les structures sanitaires en Mairie de Bujumbura.

**Objectifs :** Décrire la démarche clinique à la base du diagnostic des TPM– dans deux hôpitaux de Bujumbura.

**Méthodes :** Une étude prospective, menée d'avril 2008 à mars 2009 au service de Médecine Interne du CHU de Kamenge et de l'Hôpital Prince Régent Charles a recensé parmi les malades hospitalisés ceux présentant des signes d'imprégnation tuberculeuse avec absence de BK dans les expectorations et présentant des anomalies radiologiques compatibles à une tuberculose avec absence d'apyrexie sous antibiothérapie non spécifique.

**Résultats :** Sur un total de 2544 patients hospitalisés, 623 cas de tuberculose toutes formes ont été dépistés (24,5%) parmi lesquels 20% sont TPM–. La tranche d'âge la plus affectée est celle de 20 à 39 ans (79% des cas). Parmi les antécédents médicaux, la tuberculose pulmonaire (17%) et les accès fébriles à répétition (13,6%) sont les plus fréquents. L'infection à VIH est présente chez 62,4% des patients TPM– contre 34% chez les TPM+ ( $P = 0,00017$ ) et plus de 45% des malades sont au stade III du Sida. Les motifs d'hospitalisation sont généralement la toux (84,8%), l'altération de l'état général (73,6%), les douleurs thoraciques (41,6%), la dyspnée (48%) et l'hémoptysie (11,6%). Les signes pulmonaires sont prédominants dans 68% des cas lors de l'examen clinique. La radiographie pulmonaire montre des images réticulo-nodulaires souvent bilatérales dans 38,3% des cas. Des épanchements pleuraux sont retrouvés chez 33% des cas. Néanmoins des images thoraciques normales sont observées chez 5,6% des malades.

**Conclusions :** La proportion des TPM– est en augmentation. Le diagnostic reste pourtant difficile et repose en milieu hospitalier sur les faisceaux d'arguments épidémiologiques, cliniques et radiologiques.

**TUBERCULOSIS TREATMENT ADHERENCE/CASE MANAGEMENT I**

**PC-137-28 Perceptions of an alcohol intervention programme for TB patients: a qualitative study from Chennai, India**

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**Background:** India is no exception with the challenges of poverty and high rates of alcohol use among men. However little is known about the adverse impact of alcohol abuse on TB management or on any alcohol intervention among TB patients. It is against this background that this study was planned, to gain insight into the perceptions of TB patients and providers on alcohol abuse and their perceptions on a feasible alcohol intervention programme.

**Methods:** A qualitative approach utilizing focus group discussions and in-depth interviews was conducted with 60 TB patients with AUD, health providers in TB clinics and family members of TB patients with AUD. The design included a strong focus on community based participatory approach.

**Results:** The salient findings of this study are that alcohol abuse influences patient's adherence for TB treatment. This included patients' fears around interaction of TB drugs and alcohol and the concerns of being reprimanded by health providers when they are non compliant due excessive intake of alcohol. While peer pressure is the most dominant triggering factor for alcohol abuse, the dual stigma of TB and being labeled 'alcoholic' results in many psychosocial problems. The urgency of an alcohol intervention program was stressed by patients, families and health providers. The study has also highlighted areas of intervention, type and feasibility of an acceptable alcohol intervention program for TB patients with AUD.

**Conclusion:** The study findings highlight the need for a feasible acceptable intervention programme for TB patients with AUD based on their needs and perceptions.

**PC-299-28 A pilot study on prevalence of alcohol use disorders among TB patients**

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**Background:** Many studies have documented an association between alcohol use and risk of tuberculosis (TB). Excessive alcohol intake has been reported as one of the major risk factors for treatment default and mortality under the DOTS programme. However screening for alcohol abuse is not a part of TB management in India. There is a dearth of information on

prevalence of Alcohol Use Disorders (AUD) among TB patients.

**Methods:** This was a cross-sectional cohort study among TB patients attending 4 corporation zones in Chennai during July to September 2009. Alcohol use disorder was reported (AUD) using a WHO developed Alcohol Use Disorders Identification Test (AUDIT).

**Results:** A total of 519 patients were registered during this period among which 19 were reported lost. Out of 490 TB pts, 29% (141) were found to consume alcohol and 52% (73) of 141 TB patients had an AUDIT score of >8 which reflected alcohol use disorder (AUD). Factors influencing AUD were patients who were 35 years or older, lower levels of education, monthly income of < Rs 5000, being separated or divorced and Category II patients.

**Conclusion:** Alcohol use disorder is a matter of concern among TB patients and needs to be addressed in the TB control programme. Effective measures and trained personnel to identify this disorder is an important requirement in the TB control program. The study findings stress the need to identify feasible intervention strategies for TB patients with AUD.

#### **PC-408-28 Active case finding in urban slums in Pakistan (Sindh Province) involving GPs using new diagnostic**

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The project is focused upon the neglected high risk population of urban slums in Pakistan. The slum population is assumed to be with high TB burden and the proportion of missing cases in large in this high risk population. The project is a randomized controlled trial with integrated intervention of active case finding, use of innovative diagnostic technique and engaging private providers. The target of the project is to detect 3000 smear positive cases. The main objective is to increase the case detection of smear positive TB through active case finding through chest camps, to test frontloading strategy and LED based fluorescence microscopy with high sensitivity and low default and to improve access to Quality DOTS by engaging private practitioners and CBO in target population. The project will be implemented in five selected tehsils of Sind province namely Karachi west, Dadu, Larkana, Sanghar, Thatta. The proposed activities are mapping of slums and GP's in the selected tehsils, training of GPs and lab technicians, arranging chest camps with community awareness activities, developing linkages between the existing public health facilities with private providers. The smear positive cases identified in the chest camps will be registered in separate TB03 register and the laboratory register will be maintained for each chest camp. The registered smear positive cases will be referred to the identified

private laboratory and the field officers recruited in the project will submit reports of chest camps to the national level. The project is ongoing and the data collected will be presented.

#### **PC-428-28 Clinical evolution of patients suspected of TB missing microscopic examination in rural Ethiopia**

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**Background:** To address the low tuberculosis (TB) detection rate in the Southern Region of Ethiopia, InterAide implements with the ministry of health a programme where facilitators and community mediators participate in the DOTS strategy including early referral and treatment support. Complemented by a partnership with Fondation Mérieux aiming to strengthen microscopy capacity in the rural region of Wolayta, this community-based programme has increased TB detection rate to 50% and treatment success to 93%. However only 70% of the referred cases attend the microscopy services, among whom 41% have a smear positive sputum. To understand the magnitude of the missed diagnostic opportunity a study has been carried out among the 30% defaulters.

**Intervention:** From June to November 2008, a follow up has been organized in Wolayta for 431 consecutive new defaulters. A comparison group has been set up with 468 consecutive cases of smear negative sputum considered as TB free by the OPD's clinicians. Their clinical condition has been checked by facilitators every 2 months during 6 months, and registered as improved, worsened or stable.

**Results:** A worsened condition has been observed in 5.3% (23/431) of the defaulters during the 6-months follow-up, including 1.2% deaths (5/431). During the same period a worsened condition has been observed in 4.7% (22/468) of the comparison group including 0.2% deaths (1/468), which indicates no significant difference between the 2 groups.

**Conclusion:** The TB-suspected cases having missed microscopic examination and those with smear negative sputum had a similar proportion of deterioration, i.e., about 5% in 6 months. Considering all deteriorations as tuberculosis, there was 8 times less TB among the defaulters than among those with a sputum smear performed. The effectiveness of the programme would therefore not be enhanced by specific proactive measures toward the defaulters.

### PC-491-28 Risk factors for tuberculosis infection among adolescents in rural Uganda

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**Background:** There is limited data on TB disease and infection among adolescents. For this reason, the Uganda TB vaccine trial site preparation project was started in 2008 and is being conducted in the Iganga/Mayuge demographic surveillance site which is located in a rural setting of eastern Uganda.

**Objective:** Assess risk factors for a positive tuberculin skin test (TST) among adolescents in rural Uganda

**Methods:** Adolescents aged 12–18 years were enrolled from schools and the community and followed-up for 2 years. Each enrollee received a baseline TST readable after 48 hrs.

**Results:** A total of 5000 adolescent were enrolled into the study and received a TST of which 4982 (99.6%) were available for reading. Of these, 802 (16%) had a positive TST ( $\geq 10$  mm). Among the 12–14 yrs of age, 13% were positive, 15–16 yrs, 16% were positive and 17–18 yrs, 21% were positive. The risk of tuberculosis infection in males was 1.5 times higher than among females, 95% confidence interval (CI) 1.3–1.7), 2.5 higher in those with a history of TB diagnosis contact (CI 1.7–3.5). The percentage of participants with a BCG scar increased with increasing age, from 59% in the age group of 12–14 to 72% in the age group of 17–18. Those with a BCG scar were 1.3 times more likely to have a positive TST than those without BCG scar (95%CI 1.1–1.6).

**Conclusion:** Adolescents with a positive TST have specific characteristics that may guide TB control policies.

### PC-598-28 Cost-effectiveness of DOT from the health care system perspective in different regions in Brazil

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**Background:** Directly observed treatment (DOT) has been promoted world-widely to increase treatment adherence. WHO has estimated that 8 million deaths were averted with this strategy. We analyzed the incremental cost-effectiveness rate (ICER) of DOT vs. self-administered treatment (SAT) in different regions in Brazil.

**Methods:** Healthcare system additional costs for DOT were calculated based on salary of staff responsible for DOT, since the same facilities are used for both strategies, during regular working hours, with no additional service costs. Salary information was gathered at the Municipal Health Departments, and doubled, to include fringe costs. The cost of each DOT visit was estimated to be a third of the cost of a monthly follow-up visit. The measure of effectiveness was treatment completion rate. Sensitivity analyses were performed to explore the degree of uncertainty of the treatment outcomes, the costs of follow-up and pill-collection visits, and the frequency of weekly pill-collection visits.

Table Sensitivity analysis for the incremental cost-effectiveness rate (ICER) of DOTs versus SAT under the health system perspective, considering different outcomes, salaries and frequency of supervision.

	ICER (US\$/ completed treatment), base case in bold		
	Curitiba/Paranáguá (South region)	Belém (North region)	Rio de Janeiro (Southeast region)
<b>Difference in percentage of completed treatment</b>			
Minimum (1%)	US\$ 57,078/ct	US\$ 39,310/ct	US\$ 35,650/ct
8%	US\$ 67,580/ct	US\$ 4914/ct	<b>US\$ 4940/ct</b>
11%	US\$ 4916/ct	<b>US\$ 3930/ct</b>	US\$ 3608/ct
23%	<b>US\$ 2351/ct</b>	US\$ 1709/ct	US\$ 1736/ct
25%	US\$ 2163/ct	US\$ 1572/ct	US\$ 1597/ct
28%	US\$ 1931/ct	–	US\$ 1427/ct
29%	–	–	US\$ 1378/ct
<b>Salary</b>			
-75%	US\$ 587/ct	US\$ 892/ct	US\$ 1235/ct
-50%	US\$ 1175/ct	US\$ 1786/ct	US\$ 2470/ct
-25%	US\$ 1763/ct	US\$ 2679/ct	US\$ 3705/ct
<b>Base case</b>	<b>US\$ 2351/ct</b>	<b>US\$ 3930/ct</b>	<b>US\$ 4940/ct</b>
+100%	US\$ 4702/ct	US\$ 7146/ct	US\$ 9881/ct
<b>Total number of visits</b>			
60 visits	US\$ 1836/ct	US\$ 2353/ct	<b>US\$ 4940/ct</b>
72 visits	US\$ 2057/ct	US\$ 2876/ct	US\$ 6056/ct
88 visits	<b>US\$ 2351/ct</b>	<b>US\$ 3930/ct</b>	US\$ 7547/ct
120 visits	US\$ 2939/ct	US\$ 4967/ct	US\$ 10,527/ct
168 visits	US\$ 3050/ct	US\$ 7059/ct	–

**Results:** The Table displays ICER in different states. Supervision strategies varied largely: from daily in Paranáguá to 3 times weekly (first two months) followed by twice weekly (4 last months) in most cities; performed by healthcare agents, nurse aids or nurses; at home (Paranáguá) or at the healthcare facility.

**Conclusions:** DOT increased significantly the rate of treatment completion, with exception to Rio de Janeiro, where it was modest. The high ICER (US\$4940/treatment completed—TC) in Rio de Janeiro, when compared to other states, is due to the modest outcome improvement. Conversely, the high effectiveness rates in Paraná resulted in the lowest ICER (US\$2351/CT). Sensitivity analyses showed the robustness of DOT cost-effectiveness and that the high impact on ICER caused by the reduction of frequency of supervision.

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### PC-647-28 Situation analysis on practice of patient kit management in selected townships of Yangon and Mandalay

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**Background:** TB drug management in Myanmar is developing dramatically. Standard operating procedure (SOP) for TB drugs and supply management was published. And relevant trainings were given almost all health workers in charge of TB control. After those activities, TB patient kits were introduced in 2007 in 38 pilot townships and are currently used in entire country of 324 townships. Based on our experience, NTP has to review and revise the current SOP and current practice to improve drugs and supply management. This is the first analysis on practice of patient kit management in Myanmar.

**Objectives:** 1. To assess effectiveness of training for patient kit management. 2. To explore the need and weakness in patient kit management.

**Study design:** A cross sectional township level treatment unit-based study.

**Study area:** Four townships randomly selected from 38 pilot townships.

**Target population:** 51 of TB coordinators and basic health staffs.

**Data analysis:** Observation check lists and face-to-face interview with structured interview questionnaires were employed. Collected quantitative data were analyzed by Epi-info 6. Descriptive analysis was done by data summarization for continuous variables. Categorical data were described in cross-tabulation.

**Results:** Majority of the staff correctly responded to questions on contents and quantity of patient kit, except 19 staff who have never seen Cat. II patient kit. Eighty-eight per cent of staff adjusted the number of blisters if the patient is in the lower or higher weight than average. Most staff (96%) understood that they need to return back left over drugs from died or defaulted TB patients to township TB coordinator. (63%) of the staff did not know how to manage supply box and reassembled kits.

**Conclusion:** In general, appropriate patient kit management is implemented but reassembled kit management should be strengthened. SOP and training on patient kit management need to be improved according to the findings of this research.

### PC-673-28 L'apport du partenariat dans l'approvisionnement des antituberculeux en RD Congo

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**Introduction :** La RD Congo à travers le PNLT est en partenariat avec le fond mondial, l'Action Damien pour l'approvisionnement de ces 24 CPLT en médicaments antituberculeux de 1<sup>e</sup> ligne. Deux portes d'entrée au pays, Kinshasa pour la partie Est et Goma pour la partie Ouest.

**Objectif :** Démontrer l'apport de ce partenariat dans l'amélioration de taux de guérison dans les 24 CPLT de la RD Congo.

**Méthodes :** Une estimation des besoins en médicaments faite par les 24 CPLT remonte au niveau de l'Unité centrale et celle-ci passe la commande en tenant compte d'un stock de sécurité de 6 mois, auprès de Fond mondial via le bénéficiaire principal et directement à l'Action Damien.

**Résultats :** Sur l'ensemble des médicaments reçus en 2009, 85% proviennent du Fond mondial, 10% de l'Action Damien et 5% du Gouvernement. Ceci a évité la rupture des stocks dans les 1381 centres de diagnostic et traitement que compte le PNLT.

**Conclusion :** Ce partenariat a contribué à 85% à améliorer le taux de guérison dans un pays dont le Gouvernement ne contribue pas sensiblement à la lutte contre la tuberculose.

### PC-891-28 Analyse des causes de faible observance au traitement anti-tuberculeux en zone urbaine à Madagascar

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**Contexte :** La ville de Mahajanga est le chef lieu de la Région Boeny sur la côte ouest de Madagascar. Avec près d'un million d'habitants, elle dispose de cinq Centres de Diagnostic et Traitement (CDT) sur les 10 CDT existants dans la région, et dépiste plus de 1000 cas de tuberculose (TB) chaque année, avec des taux de guérison insuffisants.

**Méthodologie :** Une analyse longitudinale par interrogatoire sur base de fiches questionnaires, et un suivi prospectif, ont visé à établir les obstacles au traitement, ressentis par les malades durant la période sous Traitement Directement Observé (TDO), durant l'année 2006. La corrélation avec l'observance aux contrôles bacillo-scopiques a été tentée pour analyser les facteurs du faible taux de guérison.

**Résultats :** Nous pouvons avancer comme obstacle à l'observance au traitement :

- le coût du trajet CDT-domicile en première phase (24,5% des malades),
- la longue attente au niveau des CDT pour (45,8%),
- la qualité d'accueil (48,1%) des malades,
- l'insuffisance d'information, sensibilisation (20,6%).
- 80% d'observance au contrôle bactériologique



**Conclusion/recommandation :** Cette étude permet de proposer comme stratégies :

- l'amélioration de l'accès au traitement par extension géographique des Centres de Traitement (CT) et la subvention des frais de transport.
- le renforcement des compétences des prestataires de soins et de l'organisation.
- une meilleure participation communautaire.

### PC-1071-28 Predictors of long-term outcomes for pulmonary tuberculosis patients

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**Background:** The Russian TB follow-up system permits to identify not only TB case treatment outcomes, but also long-term outcomes of patient treatment, which is especially important for regions with high levels of TB treatment interruptions. Comparison of TB treatment control effectiveness for new pulmonary TB patients (NC pts) registered before and after implementation of international TB treatment control principles in 2004 in Russia was provided based on long-term outcomes indicators.

**Methods:** Retrospective cohort study included NC pts registered in Yaroslavl city, Russia, in 2000–2003 (831 pts, Cohort 1) and 2004–2006 (614 pts, Cohort 2). Long-term outcomes were analyzed during 4 years. Recovery outcome was defined as a cured outcome to the 4th years after one or few courses of treatment. Lung cavity TB was considered as a severe TB form (CV).

**Results:** Cox regression analysis revealed that the following factors are permanently associated with both not TB- and TB-related deaths, for Cohort 1 and Cohort 2, respectively: unemployment (hazard ratio [HR] 2.6, 95%CI 2.0–3.5 and 4.4, 95%CI: 2.5–7.7), disabled (HR 2.8, 95%CI: 1.9–4.2 and 4.7, 95%CI 2.2–9.9), retired (HR 2.9, 95%CI 1.9–4.2 and 3.0, 95%CI 1.4–6.5), aged older 34 (HR: 3.1 95%CI: 2.2–4.3 and 2.5 95%CI: 1.5–4.2), passive vs. active detection (HR 0.7, 95%CI: 0.5–0.9 and 0.4, 95%CI: 0.2–0.6). TB-related death had association with CV (HR 5.1, 95%CI: 2.8–9.2). Culture-confirmed pts (cu+) had association with death from any causes (HR 1.3, 95%CI: 1.1–1.6). Outcome 'recovery' for cu+ was associated with cohort 2 (HR 4.3, 95%CI: 6.1–3.0) and negative relationship with CV and unemployment (HR: 0.7, 95%CI: 0.5–0.9 and 0.7, 95%CI: 0.5–0.97).

**Conclusion:** Long-term outcomes analysis showed the reliable increase of TB patients recovery as a result of implementation of international TB control principles, however social factors still provide a significant affect on the high level of unsuccessful outcomes.

### PC-1087-28 High rate of completion of preventive therapy for latent tuberculosis infection among asylum seekers

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**Setting:** The efficacy of preventive treatment for latent tuberculosis depends on the rate of completion of the treatment.

**Objective:** To assess the adherence to preventive treatment in a population of asylum seekers with latent tuberculosis infection recently arrived in Switzerland.

**Methods:** In a prospective cross-sectional study, asylum seekers recently arrived in two migration centers in the county of Vaud were screened with IGRA. Migrant with a positive test result were referred for a chest radiograph and a medical examination. After exclusion of individuals with active tuberculosis or prior therapy for tuberculosis, preventive treatment was offered to all participants except those with a contraindication. The adherence to treatment was assessed clinically during the monthly follow-up.

**Results:** From a population of 693 adults, 393 could be screened, and 98 (24.93%) had a positive IGRA test. Eleven did not attend the initial medical consultation. Among the 87 who were examined, eight received a full course of antituberculous therapy for documented or suspected active disease, 2 had already been treated for tuberculosis and 2 had a contraindication to the administration of preventive treatment. A preventive treatment was offered to 75 individuals (4R in 74 and 9H in one), of which 59 (78.7%) completed treatment. Thirteen (17.3%) did not attend the clinical control and two treatments were suspended because of inadequate adherence.

**Conclusions:** Prescribing preventive treatment to asylum seekers is a challenge. The vulnerability factors experienced by asylum seekers and the high mobility of this population make initial assessment of migrants and observance of the preventive treatment difficult but it seems possible to obtain a high rate of completion for migrants who accept the treatment by the coordination between nurses and medical practitioners and the efficacy of the management.

### PC-1154-28 Outcomes of MDR-TB patients treated in a TB housing facility versus outpatient DOTS clinics

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**Background and setting:** Selected multidrug-resistant (MDR) TB patients were managed in a TB housing facility under the Programmatic Management of Drug

Resistant TB program in the Philippines. The facility housed indigent patients who had no residence in Metro Manila and patients who were frequent treatment interrupters needing close treatment supervision. All patients were well enough to perform activities of daily living while in the facility and observed proper infection control measures.

**Objective:** We compared clinical characteristics and treatment outcomes of patients admitted to the TB housing facility versus patients who were managed on an outpatient basis.

**Methodology:** We reviewed records of patients with known treatment outcomes who were admitted to the TB housing facility from June 2004 to June 2010. A comparator group of patients treated at the outpatient DOTS clinics, matched for age and sex, was selected from the same period.

**Results:** By June 2010, 91 patients treated in the TB housing facility had known treatment outcomes. Compared with patients treated on an outpatient basis, patients admitted to the TB housing facility were more likely to have more than two previous TB treatment episodes (40 (53%) vs. 23 (32%),  $P < 0.03$ ) and were less likely to default while on MDR-TB treatment (9 (10%) vs. 20 (21%),  $P < 0.04$ ). No significant differences were noted in baseline sputum AFB smear, baseline DST, time to sputum conversion, rates of cure (71% vs. 61%), death, and treatment failure.

**Conclusion:** Treatment in a TB housing facility is a viable option for MDR-TB patients who have difficulty accessing outpatient DOTS clinics. Transmission of TB within the TB housing facility can be minimized through implementation of proper infection control measures.

## VACCINES AND DRUG DEVELOPMENT

### PC-51-28 Diagnostic accuracy of antigen detection tests for tuberculosis: a systematic review and meta-analysis

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**Background:** Diagnostic tests that detect *M. tuberculosis* antigens in body fluids of TB patients would

provide direct evidence of active infection and could potentially extend TB diagnosis to peripheral health facilities. We performed a systematic review to synthesize evidence on diagnostic accuracy of antigen detection tests for pulmonary and extrapulmonary TB.

**Methods:** Standard methods for conducting and reporting systematic reviews and meta-analyses of diagnostic accuracy studies were followed. Database searches for relevant studies in all languages were updated through August 2010. Test performance was summarized using bivariate meta-analyses that jointly modeled sensitivity and specificity.

**Results:** Overall, studies were considered to be low quality. Pulmonary TB: 47 studies (6540 participants), sensitivity (2 to 100%) and specificity (33 to 100%). Lipoarabinomannan (LAM) was the most frequently studied antigen (20 studies); among these studies, urine was the most common specimen evaluated (14/20 studies). Compared with HIV-uninfected patients [4 studies, sensitivity 14% (95%CI 4–38), specificity 97% (95%CI 86–100)], urinary LAM detection in HIV-infected patients (5 studies) yielded higher sensitivity [47% (95%CI 26–68)] and similar specificity [96% (95%CI 81–100)]. Extrapulmonary TB: 21 studies (1690 participants), sensitivity (0 to 100%) and specificity (62 to 100%). Types of specimens evaluated included cerebrospinal fluid (CSF), serum, biopsy, pleural fluid, urine, and lymph node aspirates. Tests detecting antigens in CSF yielded sensitivity 87% (95%CI 61–98) and specificity 84% (95%CI 60–95).

**Conclusions:** Published data on antigen detection tests demonstrate that no current test is sufficiently accurate for active TB diagnosis. Considering that such tests can be translated into rapid and inexpensive point-of-care tests, research to improve performance of these tests is imperative.

### PC-132-28 DIASKINTEST as a screening method during mass child health examination for tuberculosis in Russia

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**Setting:** The Russian Federation has developed a new efficient method for the detection of initial tuberculosis presentation, DIASKINTEST, which is a combination of two antigens, present in the virulent strains of Koch's bacilli and absent in the BCG vaccine strain and strains of other nonpathogenic mycobacteria.

**Aim:** To study the efficient usage of current diagnostic program as an alternative to the open patch test with PPD (PPD test with 2 TE) in conditions of screening programs for tuberculosis.

**Methods:** Children and teenagers, school and college students are divided into two groups by the method of total single-step survey. The first group comprises

of children (aged 7–14) in the quantity of 816 individuals, the second group comprises of teenagers (15–17 years) in the quantity of 422 individuals. Over 44% of children and teenagers had a positive take to PPD. The nature of sensibility to tuberculin in conditions of mass BCG immunization in the country does not allow to suspect local forms of tuberculosis in children, so they were not examined for tuberculosis. All children (in the quantity of 1238 individuals) were examined via DIASKINTEST. Only 4% of them revealed positive reactions to it. 7 patients showed the activity of local tuberculous changes during the X-ray examination. Thus, detection of local tuberculosis at the examination of all schoolchildren and teenagers with the help of DIASKINTEST made 0.56%.

**Conclusion:** The implementation of a new method of tuberculosis diagnostics as a screening method of examination of children and teenagers in the medical practice, which possesses a high specificity

#### PC-133-28 New DIASKINTEST skin test for diagnosis and early detection of tuberculosis

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At present, a new efficient diagnostic technique for the initial tuberculosis presentation—DIASKINTEST® has been developed in the Russian Federation. DIASKINTEST® is a tuberculous recombinant allergen in standard delution, it is a recombinant protein (ESAT/CFP) produced by the genetically modified culture *Escherichia coli* BL21(DE3)/pCFP-ESAT.

The objective of our work is the realization of a large scale post-marketing study based in the research institute of phthisiopulmonology of I.M. Sechenov Moscow medical academy and cohorts of TB dispensaries in the Samara and Ryazan Regions. A new technique of tuberculosis detection in high-risk groups by means of usage of a new skin test 'DIASKINTEST' in the complex examination was studied.

A group of 428 patient was formed by the total single-step survey method (comprising of 328 children and teenagers and 100 adults, aged 18–45) as well as 1250 children and teenagers from the risk group in tuberculosis. It has been determined that the preparation is safe and causes no unusual reactions in children, teenagers, and adults. It possesses a fast response, inasmuch as practically all tuberculosis patients had a positive take, and in case of active tuberculous process the degree of manifestation of positive reaction with DST was definitely higher than at tuberculin test, which permits to use DST to detect the activity process. The inclusion of a new technique in the complex examination of early detection of latent tuberculous infection in high-risk group allowed to significantly reduce the number of children and teenagers, who need preventive treatment. The study of

the test with the aim of differential exclusion of post-vaccinal and infectious allergy reduced the number of individuals, who need phthisiologist monitoring three times.

#### PC-152-28 Contrary to isoniazid, ethambutol does not antagonise rifampin/pyrazinamide combo

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**Background:** In mice infected with *Mycobacterium tuberculosis* there is an antagonism between H and RZ, and no antagonism between moxifloxacin (M) and RZ. Because E, like H, inhibits cell wall synthesis, E might also antagonize the RZ combination.

**Design/methods:** First, the human-equivalent dose of E for the mouse was determined. Second, 140 BALB/c mice were aerosol infected with  $3.67 \pm 0.13 \log_{10}$  of *M. tuberculosis*. Oral treatment for 8 weeks was initiated 2 weeks later with no drug, RHZ, RZ, RZM, RZMH, and H alone as controls; RZE, RZHE, and RZME as tests. Drugs were given 5 days a week at human-equivalent doses. Lung CFU counts were done the day after infection, on initiation and after 2, 4 and 8 weeks of treatment.

**Results:** E at 100 mg/kg produces an AUC in mice similar to E at 15–20 mg/kg in humans. At treatment initiation, lung log<sub>10</sub> CFU counts were  $7.23 \pm 0.08$ . During treatment with RZ combined or not with H or E, the ranking of bactericidal activity was: RZE  $\geq$  RZ > RZHE  $\geq$  RZH, confirming antagonism between H and RZ but demonstrating no antagonism between E and RZ. During treatment with RZM combined or not with H or E, the ranking of bactericidal activity was: RZM  $\geq$  RZME > RZMH, demonstrating no antagonism between E and RZM.

**Conclusion:** Despite its activity on cell wall and contrary to antagonism seen between H and RZ, E did not exhibit antagonism with RZ.

#### PC-221-28 Mycobacteria other than tuberculosis infection in pulmonary TB: 75 cases

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**Background and aim:** MOTT is especially seen in AIDS and non-immunosuppressant patients. Data relating to MOTT content in patients' sputum was evaluated for clinical importance.

**Material and methods:** From 2009–2010 at Sureyyapaşa Hospital clinics, 75 patients (30 (40%) women,

45 (69%) men, average age  $48.7 \pm 15.9$ ) with MOTT were determined with rapid test and NAP test in MGIT in 51.864 LJ, which had atypical growth. Identification was done with Hsp65PCRREA methods in 32 (43%) cases. Treatment management, radiology, bacteriology, co-morbidity, treatment outcomes were evaluated from medical records, telephone numbers and from TB dispensaries.

**Results:** 9 (28%) *M. abscessus*, 8 (25%) MAC, 5 (16%) *M. kansasii* was found with identification Hsp65PCRREA methods. 18 (24%) of 75 cases with ATS definition and treatment criteria with major and minor drugs was done. 25 (33%) of the 75 cases were treated with standard TB treatment. 8 (32%) of 25 was identified. 32 of 75 cases was followed up with no treatment. 23 (72%) of 32 had a positive culture. 43 cases were treated. 22 (51%) of 43 were cured, 3 (7%) of 43 were default, 4 (9.3%) died. 28 (86%) of 43 had drug resistance results. 21 (49%) had HR drug resistance, 24 (86%) had resistance to any drugs. 16 (37%) had previous TB treatment history. 8 (19%) had respiratory disease, 11 (26%) had non-respiratory disease. Radiologically Nodular 15 (32%), consolidation 18 (36%), cavity 16(32%) was determined.

**Conclusion:** In order to carry out the right treatment and epidemiologic evaluation, it is important to identify MOTT by culture methods.

### PC-337-28 Caractéristiques de la tuberculose pulmonaire à microscopie positive sous l'influence de l'infection

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**Contexte :** La tuberculose (TB) du sujet immunodéprimé par le virus de l'immunodéficience humaine (VIH) a des manifestations cliniques et paracliniques atypiques, non spécifiques.

**Objectif :** Décrire les caractéristiques cliniques et paracliniques de la TB liée au VIH.

**Méthodologie :** Etude prospective comparative de malades atteints de TB à microscopie positive (TPM+). De mai 2008 à septembre 2008 (5 mois), nous avons enrôlé 250 malades réparties équitablement selon le statut sérologique à l'infection VIH soit 125 malades TB-VIH (+) et 125 TB-VIH (-).

**Résultats :** La fièvre persistante, l'aménorrhée non gravidique et l'amaigrissement sont plus courants chez les sujets co-infectés avec un indice de masse corporelle (IMC) plus basse. L'hémoptysie était moins fréquente chez les sujets VIH+ (7,2% contre 31,2%). Sur le plan radiographique, les cavernes sont moins retrouvées chez les sujets co-infectés par la tuberculose et le VIH. Alors que les infiltrats et les atteintes interstitielles prédominaient chez les sujets séropositifs. Les cas de radiographie normale avait été re-

trouvée essentiellement chez les séropositifs (08 cas sur 09). Au niveau de l'hémogramme, l'anémie est classiquement présente dans la tuberculose quelque soit le statut sérologique VIH. Cependant, les patients séropositifs sont plus touchés (89,6%). Les taux d'anémie sont plus bas et sont corrélés aux taux de CD4. Par ailleurs, on note une fréquence plus élevée de leucopénie chez les séropositifs.

**Conclusion :** La tuberculose a des manifestations cliniques et paracliniques très variables.

### PC-386-28 Tumor necrosis factor-alpha inhibitors and tuberculosis: analysis of 6 year experience

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**Aim:** It is well known that tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) inhibitors which are highly effective in the treatment of connective tissue diseases (CTD), have a potential to activate latent tuberculosis (TB). In this study we evaluated 6 year data of the CTD patients under anti-TNF- $\alpha$  treatment.

**Method:** All CTD patients under anti-TNF treatment were screened and treated for TB according to National RAED II (Society for Research and Education in Rheumatology) Guideline. Chest X-ray and tuberculin skin test (TST) were performed to all patients. 9 months INH prophylaxis was given to those with TST  $\geq 5$  mm. Statistical analysis were done by using SPSS 15.0 statistical program.

**Results:** 2335 patients (1186 (51%) male, 1149 (49%) female) were screened. Mean age was  $40.32 \pm 14.67$ . 785 (33.6%) rheumatoid arthritis, 912 (39.1%) ankylosing spondylitis, 193 (8.3%) psoriatic arthritis, 85 (3.6%) Behçet, 65 (2.8%) Chron's disease. 142 (6.1%). Juvenile RA and 153 (6.5%) were other CTD. 792 (33.9%) patients treated with Etanercept, 725 (31.0%) Infliximab, 567 (24.3%) Adalimumab. 251 (10.7%) patients had missing data. 66 (2.8%) patients had TB history, 112 (4.8%) patients had diabetes history. TST was  $\geq 5$  mm in 1340 (57%) patients. 101 (4.3%) had radiological fibrous lesion, 12 (0.5%) had contact history with tuberculosis. 1308 (56.0%) patients were given INH prophylaxis. In 6 years, we diagnosed 4 (171/100 000) TB patients (6.5 fold of mean TB incidence of Turkey and 2.6 fold of İstanbul): 2 were miliary tuberculosis, 1 gastrointestinal TB and one relapse pulmonary TB patient of which only one received prophylaxis.

**Conclusions:**

- Patients under anti-TNF treatment have high risk of developing TB and need close follow up.
- National RAED Guideline seems to be effective in preventing TB disease in anti-TNF patients.



### PC-424-28 Cough—still a major clinical feature in TB patients?

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**Aim:** To establish whether cough is still a major clinical feature of pulmonary tuberculosis.

**Methods:** In the last quarter of 2010, we analysed 45 TB patients with pulmonary tuberculosis smear-positive for AFB, 41 males and 14 females, mean age ( $41.8 \pm 11.2$ ), hospitalized in the Institute. As a comorbidities, diabetes, COPD, renal failure, etc., were found in eight patients. HIV tests was performed in all patients (45/45) and all tested patients were negative.

**Results:** Coughing was the most frequent symptom 42/45 (93.3%), loss of body weight in 22/45 (48.8%) patients. Sweating as a symptom was present in 14/45 (31.1%). 12 of all patients had hemoptysis and chest pain as well (26.6%). 11 patients had weakness (24.4%), 7/45 patients had dyspnea (15.5%). The illness was discovered accidentally only in few cases. In most of patients the symptoms lasted approximately 51 days.

**Conclusion:** There are various statements regarding the number of patients with TB that cough. This study showed that more than 90% of our patients have persistent cough and that they coughed for a long time before visiting adequate specialized professional.

### PC-636-28 Itinéraire thérapeutique des malades tuberculeux pulmonaires à Abidjan

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**Introduction :** La symptomatologie de la tuberculose est polymorphe et non spécifique. De plus, en Afrique, toute pathologie chronique peut avoir plusieurs interprétations en fonction de la société et des croyances. De ce fait, le diagnostic peut être tardif responsable de propagation et de complications de la maladie.

**Objectifs :** Déterminer l'itinéraire thérapeutique et identifier les différentes structures consultées par les patients des patients tuberculeux pulmonaires.

**Méthodologie :** Il s'agit d'une étude prospective décrivant l'itinéraire thérapeutique des malades tuberculeux nouveaux cas avant leur prise en charge. Durant une période de trois mois (Mars à juin 2010) nous avons interrogé 252 patients TPM+ suivis au CAT d'Adjamé.

**Résultats :** La toux (98%), l'expectoration (84,5%) et les signes d'imprégnation tuberculeuse (88,1%), étaient les signes cliniques les plus fréquents. Les structures sanitaires publiques et privées, les tradipraticiens et les centre de prière ont été consultés par nos patients dans respectivement 66,7%, 23,8% et

13,5% des cas. L'automédication représentait 60,7%. Le paludisme était le diagnostic le plus évoqué. La tuberculose n'était évoquée qu'à une faible proportion. Les patients sans consultation préalable avant le CAT représentaient 3,2%. Seulement 15,1% des patients avaient leur diagnostic de tuberculose avant un mois contre 22,6% au-delà de 5 mois. Le délai diagnostique moyen était de 78,67 jours.

**Conclusion :** L'itinéraire thérapeutique des malades est varié responsable du retard diagnostic de la tuberculose. D'où la nécessité de former les agents de santé et d'éduquer la population sur les symptômes de la tuberculose.

### PC-728-28 Comparative analysis data of X-ray examination of patients suffering from MDR-TB

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**Background:** According to reports, efficiency of treatment of patients treated under program DOTS-PLUS varies from 61% to 77%. Thus failures in treatment are registered in 3%–14% of cases. For the purpose of revealing predictors of failure outcome of anti-TB therapy we have executed comparative analysis of the data of patients' radiological picture who were suffering from MDR-TB before they had started treatment.

**Methods:** 200 patients who were treated under program DOTS-PLUS from 2000 to 2008 have been included in study. Patients have been included in the first group with failure in treatment ( $n = 100$ ), the comparison group included effectively treated patients ( $n = 100$ ).

**Results:** Age of patients varied from 16 to 75 years, men in group of the surveyed persons were three times more than women (74% and 26% acc.). Infiltrative TB of lungs prevailed in both groups (35% and 47%,  $P = 0.11$ ). In the first group of patients with cavernous TB were four times more than in comparison group (36% and 9% acc.,  $P < 0.001$ ). At the analysis of the radiological characteristics of tubercular process it was revealed that 80% of patients who were treated inefficiently had subtotal and total defeat of a pulmonary tissue (18% of patients in control group,  $P < 0.001$ ). High intensity of black-out in a pulmonary tissue at every fourth patient in first group ( $P = 0.031$ ) testified to prevalence of caseous component in it. It is remarkable that in comparison group almost every fourth patient had no signs of pulmonary tissue's destruction on X-ray picture ( $P = 0.007$ ), or diameter of destruction was less 1 cm ( $P = 0.037$ ). Almost half of patients of the basic group had cavities ( $P = 0.026$ ) which were plural ( $P = 0.042$ ) and had diameter 4–6 cm ( $P = 0.042$ ).

**Conclusions:** Radiological predictors inefficiencies of treatment of patients with MDR-TB are extensive bilateral destructive defeats of lungs with presence of the polymorphic focuses bronchial dissemination and the expressed fibrous component.

#### PC-1046-28 Does training add value to a clinical trial site in preparedness for phase III TB vaccine trials?

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**Introduction:** Lack of research and consenting skills may hinder site development for clinical trials. These deficits may lead to poor execution of clinical studies such as jeopardizing the safety of study participants and suboptimal data quality.

**Methods:** A TB-vaccine site development project at KEMRI/CDC in Siaya, Kenya, funded by the European and Developing Countries Clinical Trials Partnership (EDCTP) and Aeras Global TB Vaccine Foundation (Aeras), established Tiegruok Professional Development Program in 2007. Train-the-trainer model delivered pre-existing fundamental training modules in clinical infectious disease (CID 1 and 2), basic epidemiology and biostatistics (EB 1 and 2) and informed consent process/skills; specialized trainings facilitated by TB Vaccine Sites Network (TBVACSIN) partners and site visits to similar projects. Written post training assessments where learners score 75% were used to evaluate comprehension.

**Results:** ~100 staff members working in the TB epidemiological studies took 3 basic research training modules in the following topics: CID; E&B prior to study protocols training and informed consent process/skills course delivered before contact with potential participants. Evaluation of staff knowledge revealed that EB was significant on post-test than pre-test (Means; Pre-test = 59.74, Post-test = 85.93 and  $P < 0.05$ , paired samples *t*-test). Specialized trainings included: 4 laboratory staff trained in TB culture methods in Italy. 19 staff trained in administering mantoux, 9 in reading chest radiographs, and 18 in sputum collection and gastric lavage. Tiegruok members and study coordinators visited partner sites with same model of training program and studies.

**Discussion and conclusion:** Training enabled staff to interpret clinical research concepts and terms prior to study protocol trainings. Majority of staff had no prior exposure to clinical research and delivered modules equipped staff to handle study procedures competently.

#### PC-1289-28 Tuberculosis infection in rheumatologic patients treated with tumor necrosis factor antagonists

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**Background:** The tumor necrosis factor antagonists (TNF-ant) are high effective agents, but their essential effect is to increase the risk of tuberculosis (TB) development.

**Aims:** To develop the procedure of TB infection screening and monitoring in patients on TNF-ant, adapted to Russian TB situation and feasible.

**Methods:** 262 adult pts (rheumatoid arthritis, 94; ankylosing spondylitis, 140; psoriatic arthritis, 20; Behçet's disease, 8) before and on TNF-ant were examined. Clinical exam, X-ray (additional CT in any abnormalities), tuberculin skin test (TST) and interferon-gamma release assays (IGRA) were performed.

**Results:** In all cases by primary screening active TB was rejected. In 20 pts residual TB abnormalities were obtained and latent TB infection (by TST) was detected in 94 pts. These 116 pts received preventive TB treatment (PT)—isoniazid 0.3 daily for 12 weeks. During the TNF-ant treatment (exam every 6 months) the active TB was excluded by clinical and X-ray exam, apart from 2 pts with passive-detected active pulmonary TB. In both cases active or latent TB was rejected after screening, PT was not administrated and TB look like primary infection. Another problem was to monitor latent TB, when positive TST (in 62 pts) cannot be strong argument for re-PT. Positive IGRA were obtained in 14 of these pts (22.6%) and reduced the number of PT quarter.

**Conclusion:** In countries with high and medium prevalence of TB not only screening before TNF-ant administration is essential. It is necessary to follow up all pts with regular (every 6 months) IGRA, which only can show the initial exacerbation of latent TB infection or new exogenous infection.

#### PC-1324-28 Producción y caracterización de anticuerpos monoclonales contra BCG México

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**Antecedentes :** El bacilo Calmette y Guérin (BCG) es la única vacuna aprobada para la prevención de la tuberculosis. La BCG presenta una eficacia protectora variable (0%–80%) atribuida, entre otros factores, a la heterogeneidad bioquímica y molecular de las subcepas BCG. Esto último hace necesario identificar y caracterizar proteínas inmunogénicas involucradas en la protección conferida por las subcepas

BCG. Una alternativa es la producción de anticuerpos monoclonales (AcMo) que reconozcan proteínas inmunogénicas únicas de cada subcepa BCG, en el presente trabajo se realizó la producción y caracterización de AcMo contra BCG México.

**Metodología :** La producción de los AcMo consistió de 4 fases: desarrollo del inóculo; inmunización de ratones BALB/c; fusión, selección y clonación de los hibridomas; y caracterización de los AcMo. La caracterización fue realizada determinando la reactividad cruzada con otras micobacterias por el método de ELISA y mediante la identificación de las proteínas reconocidas por los anticuerpos en inmunoproteomas.

**Resultados :** Los AcMo producidos reconocieron tres proteínas de la subcepa BCG México, dos forman parte de procesos metabólicos y la otra es una proteína hipotética conservada. La comparación de las secuencias de aminoácidos de éstas proteínas mostró que presentan regiones conservadas entre sí, las cuales pueden representar los sitios de unión al AcMo. Finalmente, los AcMo mostraron una reactividad cruzada con BCG Danesa y *M. abscessus*.

**Conclusiones :** Se lograron producir AcMo que reconocen 3 proteínas de BCG México, resultando útiles para el diseño de nuevos estudios para la caracterización de la cepa.

#### PC-1329-28 La secuenciación completa de BCG México la ubica dentro del grupo IV de la genealogía de vacunas BCG

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**Antecedentes :** El bacilo de Calmette y Guérin (BCG) es la única vacuna utilizada actualmente para prevenir la tuberculosis. Análisis de duplicaciones en tandem (DU) y regiones de diferencia (RDs) en las subcepas BCG permitieron la construcción de la genealogía de vacunas BCG, la cual las clasifica dentro de 4 grupos (DU2 tipo I-IV). Actualmente han sido descritos los genomas de BCG Pasteur (4374522bp) y Tokyo (4371711bp). *Mycobacterium bovis* BCG México no ha sido incluida en los estudios mencionados, por lo que nuestro objetivo fue realizar una caracterización genómica de la cepa.

**Métodos :** El DNA genómico de BCG México fue secuenciado por pirosecuenciación y Sanger. Los programas Phred/Phrap/Consed fueron usados para realizar el ensamble y los ensayos de calidad, mientras que la anotación se hizo con Artemis y el servidor RAST (<http://rast.nmpdr.org/>). El perfil genético de la cepa fue obtenido por PCR mediante la detección de regiones RD y DU. Adicionalmente, se diseñó un ensayo de PCR para la detección de RDMex01-03.

**Resultados :** *M. bovis* BCG México tiene un cromosoma circular de 4350386-pb con un contenido de G+C del 65%. Un total de 3981 genes fueron identificados, incluyendo 3904 genes codificantes (CDS), 3 rRNA, 45 tRNA y 29 pseudogenes. El análisis del genoma de BCG México, así como el perfil obtenido por PCR confirmó la pérdida de las regiones RD1, RD2, nRD18 y la presencia de la duplicación DU2 tipo IV. Por otra parte, la comparación de su secuencia con las de BCG Pasteur y Tokyo mostró que ésta es alrededor de 20Kb menor. Además, permitió identificar 95 polimorfismos de nucleótido simple (SNPs) y tres nuevas regiones RD (RDMex01, RDMex02, RDMex03). El PCR mostró que la RDMex-02(655bp) y la RDMex-03(2847bp) representan deleciones específicas en BCG México.

**Conclusiones :** Los resultados obtenidos ubican a la BCG México dentro del grupo DU2- IV de la genealogía de vacunas BCG.

#### TUBERCULOSIS IN SPECIAL POPULATIONS AND INSTITUTIONS

##### PC-239-28 Incidence of tuberculosis among health-care workers in Mongolia

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**Background:** Transmission of tuberculosis (TB) from patients to health care workers (HCWs) is a global issue. Our country is one of the 7 countries with high TB morbidity among 37 countries of the WHO, Western Pacific Region.

**Methods and findings:** We conducted a retrospective analysis of reporting form of new cases of TB at the Tuberculosis Department of National Center for Communicable Disease, Mongolia. Which is cases reported from 21 provinces and 9 districts of Ulaanbaatar city from January 2007 to December 2009. We obtained the list of HCWs with TB from 'line list of tempore office leave's' among health care workers in Human Resource Department of National Center For Communicable Diseases. We assessed 10237 reporting form of new case of TB. In 2007-2009, there were 43.3% (4436) unemployed people, 9.7% (994) students, 8.8% (901) pupils, and 7.0% (712) pensioners among all registered cases. Among total cases 18.5% were students. A total 111 health care workers were developed TB throughout country and it is 1.1% of total cases. A total cases of health care workers; 30.6% (34) nurses, 28% (31) doctors, 15.3% (17) house keepers, nurses are more affected by TB from other health care workers. Doctors working in



TB and the judicial department, surgeons, dentists, soum and family practitioners are most affected compared other doctors.

**Conclusion:** Health care workers working in tuberculosis hospital are at greater risk of developing tuberculosis. We need to more study and analysis of risk of tuberculosis infection and disease associated with work in health care settings.

### PC-399-28 Tuberculosis infection control knowledge and practices among physicians and nurses in Inner Mongolia

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**Background:** Healthcare workers (HCW) with direct patient care are at high risk of tuberculosis (TB) exposure. In some settings, teaching HCWs about TB infection control (IC) has been the primary method to reduce transmission of TB. We assessed knowledge and practices of HCWs about standard approaches to TB IC in Inner Mongolia, a region in China with high prevalence of drug-resistant TB.

**Methods:** From April–August 2010, we interviewed physicians and nurses from 43 facilities, including general hospitals, TB dispensaries, and local disease control centers in Inner Mongolia, using a standardized survey. The survey included 13 questions about TB IC and questions about demographics, occupation, and exposures potentially associated with TB infection.

**Results:** Of 2171 surveyed, 1213 (56%) were physicians, and 958 (44%) were nurses. Most (1448; 67%) reported that their department had written IC guidelines, and 1016 (47%) reported receiving IC training. Most correctly answered 8 questions about proper use of engineering controls and personal protective devices (range of correct answers 67–97%). However, 941 (44%) incorrectly answered that surface cleaning with bleach prevents TB transmission; in bivariate analysis, answering this question incorrectly was associated with not having IC training or guidelines, being >40 years old, male sex, being a physician, and smoking. When asked about mask use when caring for TB patients, 79% of nurses reported ‘always’ compared to 62% of physicians ( $P < 0.05$ ); overall, 40% reported that this mask was an N95 respirator.

**Conclusions:** Knowledge about TB IC methods was generally high among Inner Mongolia HCWs, but IC practices were suboptimal. Although false beliefs about surface decontamination should be corrected, efforts to strengthen IC in Inner Mongolia should

focus less on educating HCWs and more on regular audits, enforcement of existing rules and provision of appropriate masks.

### PC-400-28 Prevalence of tuberculosis disease and infection among health care workers in Inner Mongolia, China

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**Background:** Although healthcare workers (HCW) are known to be at high risk for tuberculosis (TB), few are screened regularly for infection and disease in high-burden TB countries. We analyzed risk factors associated with TB infection and disease in HCWs from one region in China.

**Methods:** From April to August 2010, we administered tuberculin skin tests (TST), chest radiographs (CXR) and surveys to HCWs from 43 facilities, such as general hospitals, TB dispensaries, and local disease control centers, in Inner Mongolia, China. We collected data on demographics, symptoms, and exposures potentially associated with TB. We defined suspect TB disease as having a cough > 14 days in the last month or a CXR consistent with TB, and TB infection as having TST induration > 5 mm, the standard definition in China. We collected sputum smears from suspect TB cases. We evaluated risk factors for suspect TB disease and TB infection using a logistic regression model.

**Results:** Of 2236 HCWs surveyed, 102 (5%) met our definition of suspect TB disease: 48 (2%) had cough > 14 days; 54 (2%) had a CXR consistent with TB; none had both. In multivariable analysis, being a smoker, having a hospital co-worker with prior TB disease, having <2 rooms in the house, and previously having TB disease were associated with being a TB suspect. Sputum smears were negative for acid-fast bacilli. TB infection was detected in 1537 (69%) participants. In multivariable analysis, infection was independently associated with men, increasing age, higher education, BCG, caring for TB patients, having a co-worker with prior TB disease, and having prior TB disease.

**Conclusions:** Many HCWs met the suspect TB disease definition. Although no TB cases were found, future studies should use more sensitive tests to accurately measure TB prevalence. Most HCWs had TB infection, which was independently associated with hospital exposures. Healthcare facilities need to strengthen TB infection control and routinely screen HCWs for TB.



### PC-465-28 Prevalence and risk-factors for pulmonary tuberculosis in prisons of the Republic of Tajikistan

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**Background:** High rates of pulmonary tuberculosis (TB) have been reported in prisons of the former Soviet Union. The behavioral, demographic and biological factors placing inmates in Tajikistan at high risk for TB have not been characterized.

**Design/methods:** We administered a cross-sectional behavioral and demographic survey to 1317 inmates in two prison facilities in Sughd province, Tajikistan along with radiographic and symptom screening for pulmonary TB. Cases were confirmed bacteriologically with direct sputum microscopy and sputum culture. Inmates already undergoing TB treatment were also surveyed. In-depth interviews were conducted with former prisoners to elicit relevant social and behavioral characteristics.

**Results:** We detected 47 cases of active pulmonary TB (a prevalence of 3.6%). Factors associated with a diagnosis of pulmonary TB were: HIV-infection by self-report (OR = 14.58; 95%CI: 3.09–56.98), history of previous TB diagnosis (OR = 10.14; 95%CI: 5.05–19.91), history of drug use (OR = 2.28; 95%CI: 1.02–4.69), and infrequent supplemental nutrition beyond scheduled meals (OR = 1.39; 95%CI: 1.09–1.82). In multivariate regression analysis, self-reported HIV-infection (AOR = 18.60;  $P < 0.001$ ) and history of previous TB (AOR = 10.35;  $P < 0.001$ ) were most predictive of active pulmonary TB. Self-reported HIV-infection was associated with injection drug use (OR = 17.8;  $P < 0.001$ ). Frequency of supplemental nutrition was strongly correlated with frequency of visits ( $R = 0.28$ ;  $P < 0.001$ ) and deliveries ( $R = 0.40$ ;  $P < 0.001$ ) from friends and family.

**Conclusion and recommendations:** In prison facilities of Tajikistan, HIV-infection, drug use and insufficient nutrition were associated with an increased likelihood of developing active pulmonary TB disease. Policies and programs targeted toward reducing the spread of HIV among injection drug users and toward improving the nutritional status of socially isolated inmates may help alleviate the TB burden in Tajikistan's prisons.

### PC-510-28 Tuberculosis in Germany: trends and trend indicators

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**Background:** Germany has a comparatively low tuberculosis (TB) incidence. Yet, the reduction in TB

notifications has been smaller in the previous two years (2009/2010) than before. Against this background, trend indicators proposed in the ECDC follow-up report to the Framework TB Action Plan were applied to Germany to monitor progress in TB control.

**Methods:** German case-based TB surveillance data electronically reported to the Robert Koch Institute since 2001 (cut-off dates: August 1, 2010; for 2010 data: March 1, 2011) were used to calculate trends in (i) TB case notification rates, (ii) MDR-TB case notification rates over 5 years, (iii) ratio of notification rates in children and adults, and (iv) mean age of TB cases over 10 years.

**Results:** From 2006 to 2010 we found (i) average annual decreases of 5.2% in TB notification rates and (ii) of 10.7% in MDR-TB notification rates. From 2001 to 2010 (iii) the ratio of children-to-adults notification rates was in average 0.23 and followed a mean annual increase of 2.2%; (iv) the mean age of TB cases had risen from 49.5 (in 2001) to 49.9 years (in 2010) corresponding to an average annual increase of 0.1%. All but indicator (iii) fulfilled the defined Action Plan targets. Preliminary data for 2010 revealed a significant increase in TB notification rates in children <15 years compared to 2008 (1.46 vs. 1.11 cases/100000 children; OR 1.31, 95% 1.03–1.67 CI,  $P = 0.023$ ).

**Discussion and conclusions:** The results of the indicator application suggest an overall decreasing TB trend and thus successful TB control. This outcome is challenged when considering the recent potential increase in childhood TB. In addition to the defined trend indicators, a thorough monitoring of the TB situation in children seems to be of paramount importance to assess progress in TB control.

### PC-578-28 Molecular epidemiology of *Mycobacterium tuberculosis* in a highly endemic prison

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**Background:** Combined with epidemiological investigations, *Mycobacterium tuberculosis* strain genotyping allows the identification of cases presumably due to recent infections and, thus, provides information on strain circulation. Previous molecular epidemiology studies on tuberculosis (TB) in prisons were carried out on case identified by passive detection.

**Methods:** In contrast, this one year-long prospective study was carried out in a highly endemic prison (1418 adult inmates, annual incidence rate: 8185/100 000) on cases identified by both passive and active detection including: (1) X-ray mass screening at the beginning of the study and one year later and (2) X-ray screening of all inmates entering the prison during the study period. *M. tuberculosis* strains were genotyped by RFLP.

**Results:** Out of the 94 strains available for genotyping, 79 (84.0%) belonged to one of the 12 identified clusters (2 to 22 strains each). The comparison of clustered ( $n = 79$ ) vs. not clustered cases ( $n = 15$ ) did not disclose any cluster-associated socio-demographic, penal, nor clinical risk factors. A history of TB was found in 22/79 (27.4%) clustered cases including 15 cases (68.2%) who had no evidence of active TB during the initial mass screening or screening at entry. The time-space distribution of clustered cases was consistent with transmission mostly related to micro-epidemics (including a microepidemic with 2 INH resistant and 2 MDR cases).

**Conclusions and recommendations:** Most TB cases, including cases with a history of TB, seemed attributable to recent infections acquired within the prison rather than reactivation of previous infections. Given the significant number of strains in circulation, environmental interventions (ventilation and illumination improvement, use of UV) and reduction of overcrowding seem indispensable, in addition to intensive case identification and treatment, to control TB in this highly endemic confined setting.

#### PC-811-28 Barriers to screening household contacts of tuberculosis patients in Viet Nam

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**Background and challenges to implementation:** Tuberculosis prevalence in Viet Nam, estimated at 197 per 100 000 in a recent National Survey, remains high despite the National Tuberculosis Program achieving high treatment completion rates over the past decade. Low case-detection is likely to be an important explanation for the ongoing pandemic. Active case-finding among high-risk groups such as household contacts may improve tuberculosis control by detecting disease early, however there are significant barriers to implementing such a programme in high-burden settings.

**Intervention:** We conducted an active case-finding programme among household contacts of tuberculosis patients in 4 districts of Hanoi, Viet Nam. Smear-positive tuberculosis patients were asked to invite all

current household members to attend an interview at a District Tuberculosis Unit (DTU). An interview, examination and chest X-ray were performed to screen contacts for active disease. A sample of contacts that did not attend the initial interview was contacted by telephone. A telephone survey of participants and survey of staff was administered to assess reasons for non-attendance.

**Results:** 244 patients and 531 household contacts agreed to participate, with 84% of identified household members attending the initial interview. Participation rates for household members identified by tuberculosis patients at the 4 DTUs were 98%, 98%, 90% and 53%. Factors identified by contacts that did not attend screening included: work commitments, distance from the clinic, distance between the clinic and the nearest X-ray facility and absence of symptoms.

**Conclusions and recommendations:** Engaging tuberculosis patients in a tuberculosis screening programme for household contacts is a feasible method of active case-finding in Viet Nam. Contact tracing programmes in high-burden settings must develop strategies to minimise the common barriers that deter this high risk group from being assessed.

#### PC-872-28 Support for expansion of tuberculosis infection control for all health facilities, Kigali, Rwanda

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**Background:** Data are limited regarding tuberculosis (TB) transmission in Rwandan health facilities. While health-care workers (HCWs) are assumed to be at higher risk, little is known about differences in TB infection risk according to type of facility. To inform national TB infection control guidelines, we assessed the prevalence of and risk factors for TB infection among HCWs in Kigali, Rwanda.

**Methods:** We conducted a cross-sectional survey among HCWs in Kigali during 2010. We purposively selected the public referral hospital, both District hospitals, and randomly selected 7 of 17 health centers. School staff in the catchment areas of selected facilities served as community comparison groups. We tested for TB infection using tuberculin skin testing (TST); induration  $\geq 10$  mm indicated TB infection. Standardized interviews were performed to determine factors associated with infection.

**Results:** Of 1131 HCWs and 381 school staff enrolled, the median age was 32 and 34 years, respectively; approximately two-thirds of both groups were

female. The TST positivity rate (TPR) was higher in HCWs (61%) than school staff (37%;  $P < 0.001$ ). There was no difference in TPR according to facility type; referral hospital (61%), district hospital (64%) and health center (59%) ( $P = 0.6$ ). After controlling for gender, age, HIV status, TB contact history, previous TB and household crowding, odds of a positive TST were 2.7 ( $P < 0.001$ ) times higher among HCWs than community controls. After controlling for similar factors among HCWs only, no differences in TPR were noted by department ( $P = 0.92$ ) or occupation ( $P = 0.77$ ) within a facility.

**Conclusion:** HCW's are at greater risk of TB infection, regardless of facility type, assigned department or occupation within facilities. TB transmission appears to be occurring in areas not previously considered to be high-risk. TB infection control practices should be scaled up and monitored in all Rwandan HF's and across the entire healthcare workforce.

#### PC-937-28 Spatial clustering of gender specific smear-positive tuberculosis incidence in Pakistan, 2007–2010

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**Background:** Sputum smear positive TB incidence rates are twice as high in females as in males, in the two western provinces of Pakistan, i.e., Baluchistan and NWFP, bordering Afghanistan. This gender disparity becomes markedly obvious in those districts that are heavily populated by Afghan refugee settlements.

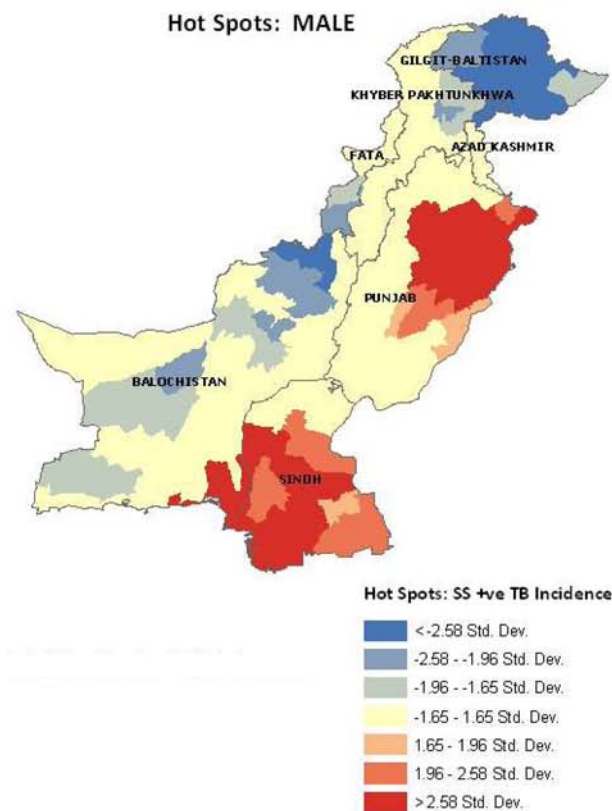
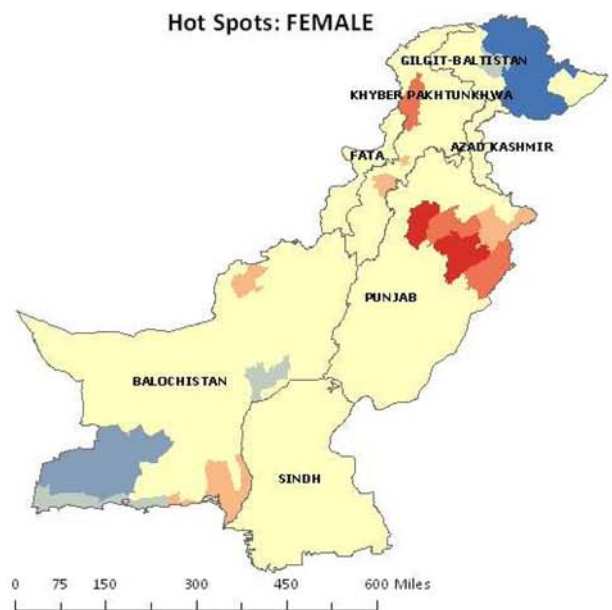
**Objective:** To use exploratory disease mapping to identify distinguishable spatial patterns in the distribution of gender specific SS+ve TB incidence in Pakistan and to follow through the trends of spatial clustering over the period 2007–2010.

**Method:** Exploratory spatial analyses were performed on gender specific SS+ve TB incidence, for the years 2007–2010, to describe and visualize spatial distributions, identify atypical locations or spatial outliers and to discover patterns of spatial association using ArcGIS 9.3.1 software.

**Results:** The Moran's Index and z-scores for incidence among males and females (2010) was 0.20 and 6.44, respectively while the high/low cluster index and z-score were 0.10 and 2.10 respectively, suggesting significant spatial clustering. Cluster and outlier analysis of gender specific TB incidence suggests significantly similar spatial clusters and few spatial outliers in various districts. Hotspot analysis revealed that geographical clustering of TB incident cases differs among males and females significantly.

**Conclusion:** Gender disparity and clusters of TB incidence were identified in geographically different regions of Pakistan. Further exploration of demographic

factors such as unemployment, socio-economic status and nutritional factors is required to explain these patterns of gender disparity.



Data obtained: Shapefiles accessed from:  
<http://www.pakresponse.info/MapCenter/GISData.aspx>  
 On March 1st, 2011.

&  
 National TB Control Program, Pakistan

Projection: UTM N42

Map created by: Sarwat Karam Shah & Omara Dogar

**Figure** Hot spot analysis (GETIS-ORD Gi\*) TB incidence SS+ve, 2010 Pakistan.



### PC-1065-28 TB screening in Canadian health care workers using interferon-gamma release assays

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**Objectives:** To evaluate the baseline prevalence of LTBI in Canadian HCWs using the QuantiFERON-TB Gold In-Tube (QFT), and to estimate concordance with conventional TST results, and association with known risk factors.

**Methods:** We are recruiting a cohort of health care workers who require routine TB screening. Upon providing consent, HCWs underwent first QFT-GIT, then TST. Data were collected via questionnaire on TB exposure and other risk factors, including occupational and personal exposure. QFT-GIT was performed as per manufacturer's instructions ( $\geq 0.35$  IU/mL) and TST was performed using 5 TU PPD ( $\geq 10$  mm).

**Results:** From 2007 to 2011, we completed testing on 335 HCWs working at one of four Montreal hospitals. Overall TST positivity was estimated to be 7.2% (24/335) (95%CI: 4.6–10.5), while the QFT positivity was somewhat lower 4.8% (16/334) (95%CI: 2.7–7.6). When restricted to Canadian born, positivity on both tests was lower: TST 2.9% (7/240) (95%CI: 1.2–5.9), QFT: 3.7% (9/240) (95%CI: 1.7–7.0). Among HCWs born in high TB incidence countries, the TST positivity was 26.1% (6/23) while the QFT positivity rate remained close to the overall cohort at 4.3% (1/23). Overall agreement between tests was 92.2%, ( $\kappa = 0.31$ ). The most frequent discordance was TST+/QFT- (17/335, 5.1%). Of these 17, 13 (76.5%) were foreign born, and 14 (82%) were BCG vaccinated, higher than the 37% vaccination rate in the whole cohort. When restricted to only BCG vaccinated HCWs, the agreement between TST and QFT decreased slightly to 85.4%,  $\kappa = 0.29$ . In multivariate logistic regression only BCG vaccination (OR = 5.34, 95%CI:1.5–18.7) and birth in a country with high TB incidence (OR = 5.3, 95%CI: 1.6–18.2) were associated with TST positivity. No factors were significantly associated with QFT.

**Conclusion:** In this cohort, QFT positivity was lower than the TST. HCWs with discordant results, particularly TST+/QFT-, were more frequently BCG vaccinated.

### PC-1108-28 Risks of tuberculosis among health workers in a general hospital in Jakarta

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**Background:** Hospital DOTS linkage (HDL) has been implemented in Jakarta to expand the coverage of the National Tuberculosis (TB) Programme. As the consequences, the hospital should implement prevention programme for their workers. This study aimed to identify risk factors associated with TB among hospital workers.

**Method:** A case control study implemented in one general hospital in East Jakarta. TB cases were defined by sputum smear for acid fast bacilli and unmatched two controls were selected with no history of having TB.

**Result:** In 2009–2010, 55 cases of TB were reported (prevalence = 2.4%), with one fatality. Of all cases, only 29 workers participated and the rest refused to take part. Risk factors of having TB were found for: age above 40 years (OR: 5.7, 95%CI: 2.1–15.3;  $P = 0.001$ ), length of working  $\geq 10$  years (OR: 7.1; 95%CI:2.4–21.5;  $P = 0.001$ ). Not using masks was associated with 4.5 times higher to become TB (95%CI 1.7–11.8). Also contact with adult TB patients increased the risk 3.7 (95%CI:1.1–12.3). There was no triage and separation for chronic coughing patients at the hospital admission. Rooming layout, ventilation and airflow, particularly in the TB service areas needs to be improved in order to prevent TB transmission.

**Conclusion:** Evidence showed that TB among health workers in that particular hospital, might be the result of transmission from TB patients in a conducive environment, although it was rare in endemic areas as Jakarta. Reactivation of TB might be still possible, although findings on this matter needs to be explored prospectively.

### PC-1158-28 Risk factors for TB-related mortality in South African gold miners

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**Introduction:** South African gold miners have some of the highest TB notification rates in the world (3821 TB cases/100 000 miners per year). In 1997, their TB case fatality rate was reported to be 3.6%, with a corresponding HIV prevalence of 27%. We evaluated risk factors for all-cause mortality in a cohort of South African gold miners with TB, and where anti-retroviral treatment (ART) is available for free.

**Methods:** Abstracted records from 1961 miners with active TB (between 2006 and 2008) were analysed



retrospectively. Data was censored at 1 year following TB treatment initiation. Cox proportional hazards models were used for the analysis of risk factors for mortality.

**Results:** 1869 miners diagnosed with TB were included in the final analysis, the median age was 43 years (range: 20–61 years), 1821 (97.5%) were male, 1123 (60%) were HIV positive, 225 (12%) were HIV negative, 521 (27.9%) had unknown HIV status and 80 (4.3%) died during follow up. The overall mortality rate was 5.01 deaths/100 person-years (pyrs) (95%CI: 4.02–6.23 deaths/100 pyrs). There were no deaths among HIV negative miners. Miners who were HIV-positive or HIV status unknown had a mortality rate of 6.05 deaths/100 pyrs (95%CI: 4.68–7.83 deaths/100 pyrs) and 4.96 deaths/100 pyrs (95%CI: 3.27–7.53 deaths/100 pyrs) respectively. HIV positive miners receiving ART had a lower mortality rate (adjusted RR: 0.45; 0.24–0.84). Mortality rates were also higher among miners receiving non-standard/MDR treatment regimens (adjusted RR: 5.30; 95%CI: 3.15–8.9) and those living in informal housing (adjusted RR: 2.81; 95%CI: 1.38–5.73).

**Conclusion:** These data illustrate that high coverage of HIV testing among TB patients is essential to ensure that appropriate treatment is given for both diseases, in order to reduce mortality.

### PC-1210-28 Situación de la tuberculosis en las prisiones de Paraguay, 2005–2009

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**Introducción:** Paraguay cuenta con 14 centros penitenciarios, muchos de ellos con una infraestructura inadecuada favoreciendo la transmisión de enfermedades transmitidas por vía aérea, entre ellas la tuberculosis (TB).

**Objetivo:** Analizar el comportamiento epidemiológico de la TB en personas privadas de la libertad (PPL), durante el período 2005–2009.

**Metodología:** Se realizó un estudio descriptivo a partir de las bases de datos de notificación del Programa Nacional de Control de la TB.

**Resultados:** Durante el período de estudio en las penitenciarías fueron identificados 4122 sintomáticos respiratorios (SR) con un promedio de 824/año, entre los cuales se identificaron y se notificaron 623 casos de TB todas las formas, con un promedio de 125/año. La incidencia de TB se incrementó de 1480/100 000 en el año 2005 a 2059/100 000 en el 2009, una incidencia 74 veces superior a la población general, considerando que la incidencia en la misma en ese año fue de 35,1/100 000. El 56% de todos los casos pertenecieron a la Penitenciaría Nacional de Tacumbú. Del total de casos, 596/623 (95%) fueron pulmo-

nares, y de estos el 93% (556/596) fueron BK+. El 3,2% (20/623) presentó coinfección TB-VIH/sida. La mortalidad fue observada en el 2,7% (17/623) de los pacientes. La tasa de curación aumentó de 49% en el 2005 al 83% en el 2009.

**Conclusión:** Durante los años de estudio se observó un aumento de la incidencia, que coincidió con un mayor número SR identificados y examinados en los centros penitenciarios. La TB pulmonar fue 22 veces más frecuente que la extrapulmonar y 93% de los casos pulmonares fueron confirmados por bacteriología, lo cual contribuye a la transmisión de la enfermedad. Futuros estudios son necesarios para identificar los factores asociados a las elevadas tasas de incidencia en las prisiones.

## PUBLIC-PRIVATE MIX I

### PC-189-28 Partnering with private health sector to control TB in Hhohho region, Swaziland

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**Aim:** To document best practices of partnerships in TB control.

**Background:** Swaziland is the highest TB burdened country in the world with the lowest treatment success rate of 68% and default rate of 12%.

**Methodology:** To ensure that even private patients benefit from free TB treatment thus preventing them from defaulting hence increasing treatment success rate. Two private hospitals and two private clinics with a high patient load situated in the capital city of Swaziland in Hhohho region were identified. Discussions with these health facilities on partnering with the National TB program to provide TB services were conducted. A memorandum of understanding between the two parties was signed. The health facilities were then accredited to be TB diagnostic units and were supplied with anti-TB drugs procured by government. Their duties were to detect TB by microscopy, provide TB free TB treatment, provide health education and follow up, conduct HIV testing and counseling, provide cotrimoxazole and ART for co-infected patients and do monitoring and evaluation.

**Results:** The treatment success rate in the Hhohho region increased from 53% in 2007 to 72% in 2009. The default rate decreased from 12% in 2007 to 8% in 2009.

**Conclusion:** Partnering of the NTP with private health sector has a positive impact on TB treatment outcomes.

### PC-222-28 PPM strategy between MOH and faculties and schools of nursing to prevent TB control

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**Aim:** According with ISTC, and the advice of PATH and NTP the network of Faculties and schools of Nursing in Nuevo Leon (23) has integrated a PPM project with MOH to improve the training curricula knowledge, practices, attitudes, included research to improve TB control efforts.

**Methods:** Conduct quarterly meetings to promote clinical cooperation and academic exchange to benefit people affected by TB. The Work Plan include: 1) Perform field activities in primary health care urban and rural facilities for people affected by tuberculosis and their contact; 2) Support and technical assistance between MOH and the network; and 3) Perform and annual meeting in applied research with the participation of students, professors and international guests.

#### Results:

Objective	Indicator	Outcomes
Engaging HR nursing institutions of in collaborative project to benefit people affected by TB	Alliance of 22 faculties and schools of nursing and one university health center	100% of institutions address academic issues of TB control
Improve awareness and knowledge of prevent TB transmission, and encourage people to seek care and complete treatment	Community meeting Promotion activities Education in waiting room Pamphlets Posters	231 activities in schools, communities and facilities 2486 people trained
Improve TB case detection	Quick survey of TB risk during 2010 Providing smear test	Surveyed 1719 persons 6.2% of respondents were collected the smear
Focus on people affected with TB through direct observation of treatment in facilities (DOTS)	DOTS treatment learning Interpersonal communication and counseling (IPCC)	During 2010, MOH reported 961 TB new cases. Students of nursing collaborated with 8% (77) of TB patients supervised DOTS.
Participation in epidemiological surveillance	Home visits to people affected with TB	Health workers made 898 home visits during 2010 Nursing students participated in contact study in 10 cases; applied 47 PPD and 210 BCG vaccine
Applied research to improve knowledge and awareness in TB issues	TB research	We have finished 17 projects. 52% of the Alliance has developed a TB project in applied research

### PC-358-28 Evaluation of two strategies to improve referral of TB suspects by pharmacies in Santo Domingo

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**Background:** Engagement of the private sector is a commonly recommended strategy for increasing tuberculosis (TB) case detection and managing treatment.

**Objective:** A blinded pragmatic trial assessed the effectiveness of two means to improve referral of TB suspects by pharmacies.

**Design/methods:** To evaluate the effect of the interventions upon recognition and referral of symptomatic clients, trained actors visited 167 pharmacies before and after exposure to seek advice for a standard set of chronic symptoms reflecting classical pulmonary TB. A comparison group (14, 8%) of comparable pharmacies was included. Pharmacies in the intervention arm received 1 or 2 detailing visits averaging 16 minutes each, and 37% (68) participated in motivational workshops of 1 hour. An unweighted score of 6 TB referral behaviors was constructed. Pharmacies received 1 point each for a) spontaneous recognition of TB symptoms, b) recognition of TB symptoms when suggested, c) recommendation to seek medical diagnosis, d) not attempting to sell medicines, e) having TB health education materials on site and f) referral to the TB program using a referral slip or brochure. Paired-analyses were conducted using a one-way repeat-measure ANOVA to detect a change in mean TB Referral scores and F statistics and odds ratio with 95%CI are reported.

**Results:** The mean post-test scores increased generally ( $F(1179) = 41.78, P < 0.001$ ) possibly due to leakage. However, TB recognition and referral behaviors

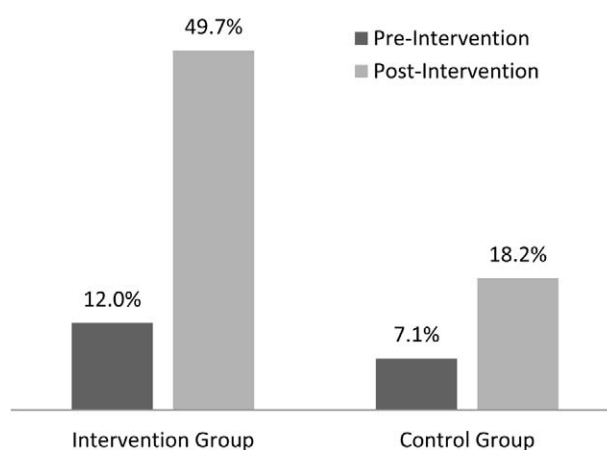


Figure Pharmacies' referral to the TB program (%).

were particularly improved among pharmacies exposed to interventions ( $F(1280) = 4.05, P = 0.045$ ). Compared to baseline, pharmacies in the intervention arm increased their spontaneous recognition of TB from 6.6% to 38.1% and were more likely to refer to the TB program (OR 1.6, 95%CI: 1.3–2.1  $P = 0.01$ ). Workshops were less acceptable than detailing visits and conveyed no additional referral benefit (48.5% vs. 47.1%). Unvisited pharmacies were more than twice as likely to offer to sell antibiotics.

### PC-369-28 Scaling up of public-private partnership in Bangladesh TB control: successes and system-wide effects

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**Background:** The NTP, 3 NGOs and the University of Leeds, UK have jointly developed and piloted a public-private partnership (PPP) model to involve Private Medical Practitioners (PMPs) in urban TB control in Bangladesh. Since 2007, the PPP model has been scaled up in three major cities: Dhaka, Chittagong and Sylhet.

**Objective:** To ascertain whether scaling up of the PPP model approach to engage PMPs has an effect on case notification rate.

**Methods:** Action research. Pre and post-intervention data were collected between February 2007 and December 2009 from the selected scale-up areas.

**Results:** Since the scale up of the PPP, a total 726 PMPs have been involved and trained. There has been steady rise in referrals from PMPs in the PPP scale-up areas. In Dhaka, of the total 17906 TB suspects examined, 3693 (21%) were referred by PMPs over the period of 2007–2009. The referrals of TB suspects were 49% in Chittagong and 13% in Sylhet over the same period. The systematic implementation can lead to greater and effective involvement of NGOs and PMPs. There is also a growing confidence, capacity and commitment of the NTP to embark on further scale up. Training plans for the PMPs have been drawn up and appropriate tools and guidelines are ready for use.

**Conclusions:** It appears feasible to further scale-up of the PPP. However, it is time consuming and requires deliberate efforts to plan and implement the scale up.

### PC-505-28 Implementing stand-alone practice (SAP) DOTS model: a patient-centered approach in private clinics

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**Objectives:** To describe a mechanism acceptable among private physicians to capture and report TB cases detected in their stand-alone private clinics to the National TB Program (NTP); to determine treatment outcomes of cases managed by these physicians.

**Background:** There are no mechanisms to report TB cases seen in the private clinics to the NTP except cases accessing DOTS facilities. Among DOTS-trained pulmonologists, only 43% actually referred to Private-Public Mix DOTS (PPMD) facilities, citing patient-related (82%) issues of confidentiality, convenience, outright non-willingness and feeling of 'being offended' when referred for 'free medicines'.

**Design/method:** Private TB cases refusing to be referred to DOTS facilities were managed under the Stand-Alone Practice (SAP) Model by participating private physicians using NTP treatment protocols and reported to the local city health office, through a formal linkage to a non-government organization (NGO)-based PPMD. Treatment partners were family members and clinic secretaries.

**Results:** In 6 months, 130 new TB cases were detected by 30 private physicians, 28 (22%) were smear-positive. 25 (19%) were referred to DOTS facilities, 2 (2%) failed to return after initial consult, and 103 (79%) managed under SAP. Of which, 7 (7%) completed treatment, 79 (77%) ongoing treatment, 15 (15%) defaulted and 2 (2%) died.

**Conclusion:** The elements of DOTS can be applied in private stand-alone practice clinics outside the traditional PPMD facilities by select physicians for patients who refuse to be referred to a PPMD through the SAP Model, still ensuring and enabling the reporting of these cases to the NTP.

### PC-507-28 Implementing system for enhanced, comprehensive, unified referral, recording and referral for TB

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**Objective:** To describe hospital referral system implementation to capture TB cases in private hospitals.

**Background:** Private hospitals account for a large number of unreported TB cases to the National TB Program (NTP). In 2007, 43% of TB suspects

consulted hospitals, 23.1% higher than in 1997. Presently, TB protocols are non-standardized in private hospitals and there is no established 2-way referral and reporting mechanisms. In 2005, only 7% of private hospitals in Metro Manila provided DOTS services, 8% were linked to DOTS facilities, and only 10% reported their TB cases to the NTP.

**Design/method:** SECURE TB, an intra- and inter-provider TB referral system, was implemented in 22 private hospitals (11 DOTS providing and 11 DOTS referring) in key cities and provinces in the Philippines. TB coordinators were identified as key facility implementers.

**Results:** From August 2010 to February 2011, 465 TB suspects were referred through SECURE TB mechanism and 387 (83%) of them were seen by TB coordinators. Of these, 310 (80%) were diagnosed TB cases (256 in DOTS providing, 54 in DOTS referring hospitals) of which 121 (39%) were new smear positive cases. 122 (48%) were enrolled in DOTS providing hospitals and 29 (54%) were referred by DOTS referring hospitals to DOTS providing facilities with 13 (45%) actually accessing the facilities.

**Conclusion:** Engaging private hospitals in TB case detection and management including a reporting system linked to the NTP will adequately capture TB cases seen in private hospitals and subsequently improve TB case detection and cure rates in the Philippines.

#### PC-583-28 Why has TB case notification become static? A retrospective analysis to find missing TB cases

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**Setting:** Pakistan ranks 6th among the high-burden TB countries. The incidence of TB is 231 per 100 000 and around 420 000 new TB cases occur each year. NTP was revived in 2001 and number of TB case notification increased dramatically from 20 707 in 2001 to 267 912 in 2010. Current Case Notification Rate (CNR) of new smear positive (SS+) and all type TB cases is 59 per 100 000 and 153 per 100 000 respectively. Although the case notification significantly improved from 2001 to 2007, it becomes almost static from 2008 to 2010. 248 678 all type TB cases were notified in 2008 and only small fraction of more cases were increased in 2009 (267 451) and 2010 (267 912). Globally, the trends in the CNR are also becoming static now.

**Objective:** To explore the possible cause of the static CNR in Pakistan.

**Methods:** Retrospective analysis of the 2009 and 2010 national data was carried out. The district wise analysis was made considering other variables like, population characteristics and other TB interventions (PPM, ACSM, MDR-TB and TB-HIV).

**Results:** Overall CNR of SS+ TB cases was static in Pakistan from 2009 to 2010, i.e., 59 per 100 000. Out of the total 134 districts, the CNR SS+ was increased only in 59 districts but decreased in 71 districts. The CNR SS+ was static in four districts. On the other hand overall CNR of all type TB cases decreased from 155 per 100 000 in 2009 to 153 per 100 000 in 2010. Out of the total 134 districts, the CNR all type was increased in 65 districts and decreased in 59 districts. The CNR all type was static in three districts. The CNR significantly improved in the PPM intervention districts. The CNR was lower in the non ACSM districts, although difference was not significant. Other program intervention has not direct effect on the CNR.

**Conclusion:** There is a need to improve PPM coverage, to improve CNR. The impact of the ACSM and other intervention should be also studied in detail.

#### PC-678-28 Evaluation of the TB care in public and private sector: a case of Coast Provincial General Hospital

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**Background:** CPGH TB control zone is the hardest hit by TB epidemic in Mombasa district. According to 2009, the incidence rate of TB was 619/100 000.

**Objective:** To evaluate TB care in public and private sector in CPGH-TB zone.

**Method:** TB and HIV dataset in the district TB register for the period from 1st January to 30 June 2010 were reviewed and for cohort data of same period in year 2009 was also reviewed and all medical records.

**Results:** 684 registered TB cases in the zone, 85% (580) received care in the public sector, 15% (104) received care in the private sector. In the public sector, 91% (528) were tested for HIV where 29% (155) were HIV positive. In the private sector, 90% (94) were tested for HIV, where 52% (49) were coinfected. Reviewing their social status, majority are employed and working reside in urban estates. TB patients in public sector reside in urban slums. In the public sector 40% (63) of the co-infected were put on ARV's, in the private sector ART uptake is at 59% (29), in the private facility, initiation of the ARV'S is done much earlier than in the public sector. The CPT uptake in both sectors was 100%. Partner testing was very low in both the private sector 13% and public sector at 9% respectively. As to 12 months treatment outcomes among the pulmonary smear positives, 83.4% of cases completed anti-TB therapy and cured, 1% died, 7% defaulted and 8.9% transferred out in those patients who received care in public sector; while those who sought care in private sector, 88.5% were cured, no death, 11% defaulted and no transfer out.



**Discussion:** Both sectors have to scale up DTC uptake to 95% and ART uptake to 80%. Treatment outcome, in private sector 88.5% complete their treatment and in public sector 83.4%. Defaulter rate is higher in private sector (11%), public sector 7%.

**Conclusion:** There is need to engage more private facilities to the level of TB diagnosis and treatment.

### PC-700-28 PPM and role of professional associations in tuberculosis care and control

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**Background:** Almost half of patients with tuberculosis in India initially consult private healthcare sector, where quality of care often do not meet national or international standards. However, the potential of professional associations to improve the condition is underutilised; considering the fact that Indian Medical Association (IMA) has a very vast network up to sub-district level with a membership of around 200 000.

**Objective:** To identify the challenges and barriers in engaging private practitioners in TB care and control and the possible role of IMA to overcome them.

**Methodology:** Focus Group discussion conducted on the sideline of IMA-GFATM-RNTCP-PPM Project in Kerala, India amongst national TB program managers, drug regulatory authorities and IMA leaders with regard to engaging private practitioners in TB Care and control, issues related to practise of ISTC and regulation of anti TB drugs.

**Results:** The challenges identified were related to behaviour of private and public sector, absence of notification of cases to national TB program by private doctors, non compliance of ISTC and irrational use of anti TB drugs. Solutions include capacity building, frequent dialogues, promoting ISTC by IMA, piloting models for encouraging case notification, taking up TB as a regular agenda in IMA monthly meetings and regulation of anti TB drugs.

**Conclusions:** These solutions incorporated into the project and the outcome will be evaluated during; and at the end of the project. This could result in widespread endorsement of ISTC by individual practitioners, and thereby the treatment of TB would be uniform, rational and evidence based.

### PC-732-28 A public private mix partnership model for augmenting TB control efforts in Chennai, India

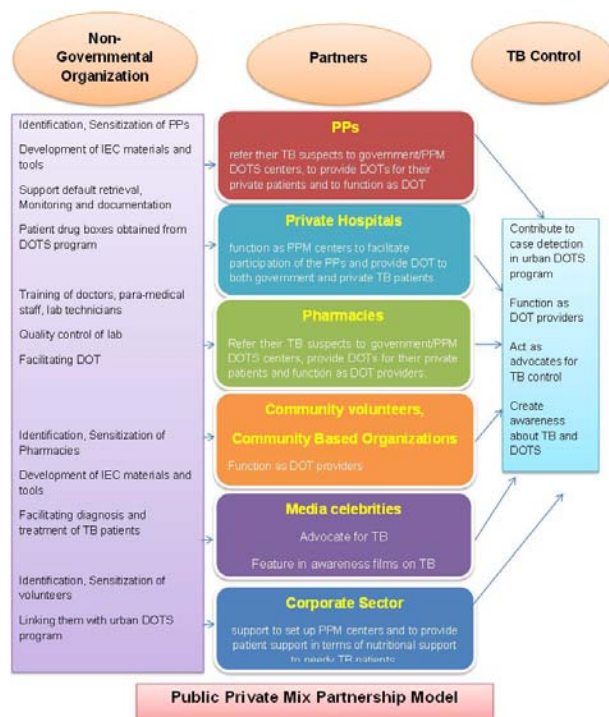
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**Background:** Challenges to improve TB care and control efforts in India includes low awareness about TB in the community, substantial number of TB patients remaining within private sector, poor access to quality TB services and different types of providers not engaged in tandem and in a sustained manner.

**Intervention:** A non-governmental organization (NGO) implemented (1999) non-profit model of PPM in Chennai, India with a population of 4.3 million, Objectives of PPM model were to

- increase access for TB suspects/patients to DOTS (Directly Observed Treatment, Short course) by sensitizing PPs, pharmacies, private hospitals
- increase awareness about TB and TB care services by engaging media celebrities, community volunteers, corporates, NGOs

**Results:** About 5264 TB patients were registered through PPM initiative over 11 years period. Nearly 2700 PPs (private practitioners) had been sensitized on DOTS, 15% of them had put their TB patients on DOTS and 7 PPM DOT centers were established. DOTS program provided logistics like treatment cards, laboratory supplies, registers and patient wise drug boxes to the PPs. About 854 pharmacies were sensitized on TB and of them 11% had referred their patients for DOTS or functioned as DOT provider. About 2583 community volunteers were and had functioned



as DOT providers. Several media celebrities and Corporates had also partnered TB control efforts.

**Conclusion:** The successful partnership model has highlighted an effective, sustainable PPM model implemented by identifying strengths and responsibilities of different stakeholders. The partnership had functioned synergistically without duplication to address gaps, challenges and scale up TB control efforts.

### PC-982-28 A systematic approach helps in engaging the work place for TB control programmes

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It is well documented that the workplace is a key area for addressing tuberculosis, as the workplace stands to derive multiple benefits from a TB free work zone. Connect, through a study, identified economic sectors at risk for HIV and TB and initiated TB HIV workplace programs in them. These programs covered a population of over 180000 workers, both formal and informal across 35 private sector companies. The employers initially had apprehensions due to lack of information, stigma and discrimination likely to be faced by employees having active TB and decrease in productivity. Likewise the employees harbored apprehensions of layoffs and social isolation if having active TB. Through a systematic approach of sensitizing the management, engaging community leaders, educating workers on TB, providing referral services and ensuring compliance Connect was able to overcome the initial fears and apprehensions faced by the employers and employees. Over a two year period more than 700 NSP cases have been detected, with over 400 completing treatment. Following this prolonged association with the Connect TB program, a few industries are willing to partner with the National TB Program (NTP) in their public private mix (PPM)



schemes and some have trained DOTS providers in their workplaces. It is recommended that for making the workplace receptive to NTP PPM schemes, confidence building measures such as the ones outlined in the guidelines for TB control in the workplace should be implemented prior to advocating for the various public private mix (PPM) schemes that most national TB programs focus on.

### PC-1059-28 Sustainability of public private mix for tuberculosis control in an urban setting of Nepal

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**Setting:** Lalitpur/Nepal. NTP developed a PPM model for TB control in 1998 in Lalitpur sub-metropolitan city. The model demonstrated a success which was then handed over to municipality. The model also been scaled-up in other major cities of Nepal.

**Objectives:** To assess sustainability PPM in Lalitpur and to understand the reasons for its success or otherwise.

**Methods:** Last ten years data (1998/99–2007/08) analyzed to determine case finding, treatment outcome and referrals by private health care providers using cohort. Sustainability was also assessed through in-depth interviews with key stakeholders including service providers and people with TB receiving treatment under the PPM.

**Findings:** Case detection rate shows a sustainable trend after handover of TB control services to local bodies. Treatment success rates among all forms of TB was around 90% with only 1% default during PPM implementation. Treatment outcome among new smear positive cases has been more than 85% in all years. A 27% people with TB were referred from private sector which is in continuous trend over the years.

**Conclusion:** PPM can sustain with clear roles, strong functional collaboration and coordination among stakeholders. PPM has maintained good level of case finding and considerably high treatment success with a good participation of private sectors in TB service delivery in the form of referral to DOTS centers. The increased access to TB services among population and effective takeover of TB services by municipality and the local health authorities contributed PPM to sustain and encouraged the NTP to scale-up in other cities.

**Acknowledgement:** Private health providers; people with TB and their families; NTP; Municipality; local health authorities and COMDIS for research funding.

### PC-1115-28 Public-private mix: increasing access to and quality of TB care in Ethiopia

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**Background and implementation:** Ethiopia ranks 7th among the 22 high TB burden countries. The national TB case detection rate is 50%, and only 37% of the TB patients are tested for HIV (WHO 2010 TB-Report). In October 2006, with the support of the USAID/Private Health Sector Program (PHSP) led by Abt Associates Inc., the Ethiopian Ministry of Health piloted public-private mix—TB treatment (PPM-DOTS) in 20 private health facilities (PHF). The program has since expanded to 83 facilities in 3 regions, Addis, Amhara and Oromia.

**Intervention or response:** PHSP, the Regional Health Bureau and Laboratory experts partnered to conduct joint quarterly supportive supervisions and quality evaluations of AFB microscopy in the 83 PHFs from October 2009 through September 2010. The team blindly reviewed 4689 AFB smears to verify the diagnosis and provided practical recommendations to meet EQA standards.

**Results and lessons learned:** PPM-DOTS facilities diagnosed a total of 12 709 TB patients, of which 2950 were enrolled for treatment in the diagnosing facilities, and 9759 were referred to other facilities to start treatment. Of those enrolled, 1504 (51.0%) TB patients were tested for HIV, of which 452 (30.1%) were found to be HIV-positive. The SS findings showed high level technical-competency, adherence with standards. The lab EQA results showed 1.7% discordance rate, 4.0% false negative and 0.8% false positive. These results were within the nationally set standards of 5.0% and 2% respectively. Suspicions and misperceptions were replaced with high degree of cooperation and demand for expanded role of PHFs.

**Conclusions and recommendations:** PPM-implementation enhances greater access to improved TB care for a large segment of Ethiopians. The findings advance trust and confidence among public and private health sectors in the scaling up of PPM-DOTS implementation nationwide, which can enhance the country's effort to achieve MDG and STOP TB targets.

### HEALTH SYSTEM FACTORS AFFECTING TUBERCULOSIS DETECTION

#### PC-264-28 Performance of health services and equity offering for the diagnosis of tuberculosis, Brazil

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**Setting:** The difficulty of incorporating actions for detection of tuberculosis (TB) in different health services may hinder early diagnosis of disease.

**Aim:** To analyze the performance of health services and equity offering for the diagnosis of TB.

**Methods:** This descriptive study, conducted in the municipality of Ribeirão Preto, Sao Paulo, Brazil. We interviewed 100 TB patients treated during the period of data collection, over 18 years and outside of prisons. Data collection was conducted in two phases, the first application of a structured questionnaire which sought to recover the route of illness from the onset of symptoms until the diagnosis of disease, and the second collection of secondary data from the state system of notification TB and the municipal system of electronic medical records. The analysis was performed using the technique of descriptive statistics.

**Results:** The specialized services are the most resolute in the diagnosis of TB, solves 90% of cases and provides more precisely targeted examinations to detect pulmonary TB (smear microscopy and X-ray), besides being a health service that patients receive more referred from Primary Health Care (PHC) and Emergency Room. Note that the Emergency Room health services are most popular among TB patients and those who request more laboratory tests, and in less than 43% of cases were asked to smear, performing well, 8% of diagnoses. The PHC is very requested by users, with a low percentage of test requirements as X-ray (15.8%) and smear (18.4%) and consequently the least made the diagnosis of TB (2%).

**Conclusion:** There was a perceived difficulty of incorporating activities for the diagnosis of TB in PHC services and Emergency Room, which facilitates the referral of cases to more complex services, which increases the time taken to solve the cases of the disease.



### PC-265-28 First contact care for TB diagnosis in primary health care settings in different regions of Brazil

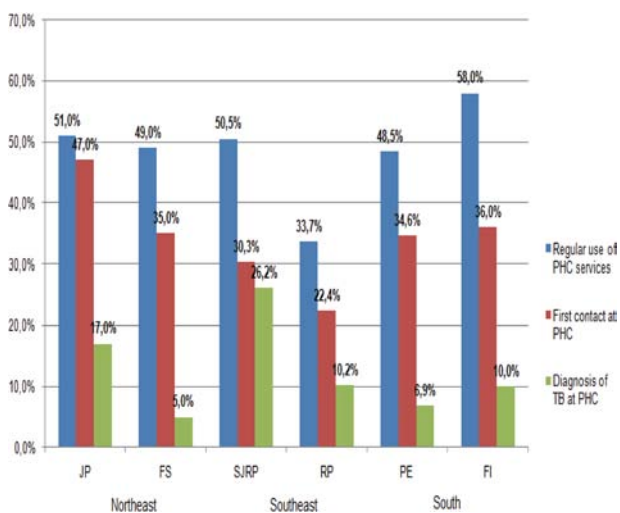
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**Background:** Brazilian guidelines for tuberculosis (TB) control and Primary Health Care (PHC) National Policy recommend that early detection and diagnosis of the disease should be made at PHC settings, the main gatekeeper for health care.

**Aim:** To analyze PHC services' performance in diagnosing TB at different regions of Brazil.

**Methods:** Exploratory study conducted with 699 patients in treatment of TB. Structured interviews on health care utilization, health services access, time and actions to TB diagnosis were conducted from July to November 2009. Priority cities for TB control were intentionally selected in 3 regions of the country: northeast (JP and FS); southeast (RP and SJRP) and south (PEL and FI). Proportions were calculated by each variable.

**Results:** Proportions of regular utilization of PHC units, first contact care at PHC settings and TB diagnosis made at PHC are shown in the Figure. Northeastern cities, despite having a higher Family Health Programme coverage and decentralized TB control system, didn't show an increased regular use of PHC or better performance in diagnosing TB. Regarding to TB diagnosis process, suspicion of TB by PHC health professionals showed proportions of 48.6% in FS to only 17.1% in PEL. None of the cities presented at least 50% of patients referring being identified as TB suspect cases at PHC services. Regarding to



**Figure** Proportions of regular utilization of PHC units, first contact at PHC settings and TB diagnosis made at PHC, Brazil, 2009.

sputum smear request at PHC, proportions are higher than 50% only in JP and RP. Time for diagnosis of these patients who had their first contact care at PHC services was delayed when compared to all patients interviewed, in all cities selected.

**Final considerations:** Though regional differences and specificities of health system organization, low proportions of diagnosis among PHC facilities present a need to investigate the existing barriers to incorporate TB surveillance and lead to a reflection on the importance of community-based services for DOTS activities expansion aiming an effective control of the disease.

### PC-316-28 Effectiveness of the first health care sought for early diagnosis of tuberculosis in Brazil

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**Aim:** To analyze the effectiveness of the first health service sought by patients for tuberculosis (TB) diagnosis in a large city in Brazil.

**Methods:** A descriptive exploratory study conducted from July to November, 2009, with 99 TB patients in treatment living in Sao Jose do Rio Preto, São Paulo through structured interviews based on a modified version of the Primary Care Assessment Tool, built to evaluate TB care in Brazil. Confidence intervals for proportions were used to analyze the indicators, and health services were classified as: PHC units, emergency services (ES) and specialized services.

**Results:** The first health service sought by the patient at the onset of TB symptoms was the ES (48.5%), followed by the PHC (30.3%). However, only 35.4% of interviewed were diagnosed at the first health service sought and the hospitals (specialized services) diagnosed the majority of cases (45.5%). ES and PHC were not effective in detecting cases mainly because of the low suspicion of TB (21% and 40% respectively) and the low sputum smear test request (29% and 43% respectively), resulting in high request of referral for consultation with other professionals (50% and 47% respectively). 75% of patients had to go up to 5 times to health services, with a time spent up to 30 days until diagnosis. Patients who sought PHC units (75%) were diagnosed later (60 days).

**Conclusion:** The PHC and especially the ES, despite being the most sought, were not effective for the diagnosis of TB. The sputum smear test is not prioritized to obtain the diagnosis given the low suspicion of the



disease. Effective control of TB implies in qualified human resources and supply/availability of diagnostic tests, and a health system where there is interaction and partnership between different types of services that comprise the health care network, focusing on early diagnosis of the disease.

### **PC-375-28 Respiratory symptomatic search by community health workers in Ribeirão Preto, Brazil**

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**Aim:** To describe performance of community health workers (CHW) in respiratory symptomatic search for tuberculosis (TB) control in Ribeirão Preto, Brazil.

**Methods:** A descriptive study conducted in December 2009 using secondary data, an observational guide and a structured questionnaire applied to 108 CHW. Indicators (mean value) of structure, process and results were built regarding to variables which present Likert scale measures. Indicators were evaluated as unsatisfactory (for mean values 1 and 2); regular (3) and satisfactory (4 and 5).

**Results:** It was found that primary health care (PHC) units showed a favorable structure to achieve respiratory symptomatic search, however, CHW performance to identify the symptomatic was poor (score = 3.9) for the investigation of cough in home visits and even from the index cases, only sometimes relating this symptom to TB suspicion. It is noteworthy to highlight that CHW report the symptomatic found on the coverage area to the supervisor nurse (score = 4.5), but they did not offer the sputum smear pot to the symptomatic (score = 1.8). Weaknesses identified were even greater for discussion of TB at the community (score = 1.5); establishment of partnerships in the PHC coverage area to perform symptomatic search (score = 1.9) and health education about TB for communities (score = 3.5). Only 6% of SR expected in the areas covered by PHC units was examined.

**Conclusion:** CHW's work process at the coverage areas enables a reflection of its role as an important partner for TB control. Despite PHC services present a favorable structure to perform respiratory symptomatic search, the performance of the CHW was unsatisfactory. Thus, the study highlights the need for a new logic of work capable to intervene on the real problems of the community, with advances in health education and intersectoral partnership to increase the TB cases detection, once that CHW, at the city studied, are located in areas with higher incidence of the disease.

### **PC-389-28 Circuits of care in Pacific tuberculosis: the case of Tuvalu**

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The research challenge is to understand the historical and contemporary context leading to high rates of tuberculosis in Tuvalu, an independent Pacific nation, and in the Tuvaluan community in New Zealand. This case study provides an opportunity to examine multiple partnerships involved in scaling up and care, especially when contrasted with some other Pacific nations, e.g. the Cook Islands, where TB is now rare.

Our study design includes historical, ethnographic and health promotion research in Tuvalu, the Cook Islands and New Zealand and the transnational space that citizens inhabit. We approach TB through a syndemic framework which includes interactions between TB and other health conditions, such as diabetes which is very prevalent, as well as with negative social conditions. Our research methods include: archival research, oral history interviews, participant observation, cultural mapping, in-depth interviews, analysis of existing demographic and epidemiological statistics, focus groups, and key person interviews and discussions.

Results to date, documented through this case study presentation include: the relevance of specific aspects of colonial history to the current TB situation, the contribution of the socioeconomic, political and environmental contexts of the communities to their health situation, key cultural considerations, e.g., of the status of 'educator' in these communities, and the impact of New Zealand immigration and related policies on health and wellbeing in both places.

Outcomes include new research and development on the intersection of health and education in Tuvalu and on New Zealand immigration policy and its effects on health in both places.

### **PC-449-28 Primary health care: health personnel performance in tuberculosis diagnosis, Ribeirão Preto, Brazil**

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**Background:** Based on the National Tuberculosis Program Guidance and on the number (177 464) of patients who went to Primary Health Care (PHC) services in Ribeirão Preto in 2009, it was expected to screen 8093 individuals for TB and identify 588 cases in this kind of facility.

**Aim:** To analyze the performance of the PHC personnel in tuberculosis (TB) diagnosis in Ribeirão Preto, Brazil.

**Methods:** descriptive study carried out in Ribeirão Preto, a priority city to TB control in Brazil, in 2009, through secondary data and interviews with 90 PHC services health professionals (doctors, nurses and nurse aid). Indicators of structure, process and outcome to health services evaluation were created.

**Results:** In relation to the structure, all facilities have supplies to smear sputum microscopy request, however, 26% do not have adequate place to conserve them. Professionals informed enough and little rotation of human resources, being that 73.3% feel capable to identify TB suspects. On care process, only 33.3% requests smear sputum microscopy. Although the nursing team has autonomy for this request, 74.6% refer the suspicious case to the doctor, who in majority (59.3%), requests X-ray. Professionals evaluate as good the time destined for the attendance of each patient and deny difficulties to speak about TB and request smear sputum exam. It was also verified a regular performance in active case finding and education in health about TB and a unsatisfactory performance in the community and other sectors involvement in TB control actions. Regarding the outcome indicators, only 4.3% expected suspects had been screened and only 4.6% expected cases had been identified.

**Conclusion:** Although professionals mentioned an adequate availability of supplies and knowledge to identify and detect TB cases, they do not request smear sputum microscopy and refer suspects for another care level, where most of cases are diagnosed.

#### PC-450-28 Active case finding from the community health worker's point of view, Natal, Brazil

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**Aim:** To analyze tuberculosis (TB) active case finding (ACF) in community health worker (CHW)'s point of view.

**Methods:** Descriptive study, carried out in Natal/RN, a priority city for TB control in Brazilian north-eastern, in 2009. The study population involves 646 CHW and the simple random sampling resulted in 108 CHW who worked in Primary Health Care (PHC) facilities. The ACF and the TB treatment are carried out by the PHC facilities with Family Health Strategy (FHS) predominance. For data collection, a structured questionnaire with Likert scales was used. Indicators of

health care services structure (supplies, laboratory, CHW's ability to TB and sputum collection orientation and to identify TB suspects), process (CHW activities in the community) and outcome (screened TB suspects) were created through proportions and means (Likert scale).

**Results:** The health care services structure for ACF presented deficiency in supplies availability (60% possess pots to sputum collection, 74% had TB suspects book registration; 28% had a place to conserve the sputum and 58% had a daily laboratorial collection). CHW felt capable to identify TB suspects (score = 4.4) and to orient about the disease (score = 4.7) and sputum collection (score = 4.2), however in many times they not suspect that the cough can be a TB symptom (score = 3.4). The actions in the community for ACF (score = 2.7) and sputum collection solicitation delivering (score = 2.2) was considered unsatisfactory. Based on the health care services population, 335 460 inhabitants, it was expected to screen 3355 individuals in 2009, however of these, only 11% had been screened by the FHS teams.

**Conclusions:** The CHW presented limitations to identify TB suspects and to develop activities next to community partners, which shows the necessity of new strategies to CHW qualification. Deficiency in the laboratorial rear for the sputum smear microscopy accomplishment was also identified.

#### PC-757-28 Delay in diagnosis of tuberculosis in the perception of managers of primary health care services

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**Aim:** Analyze the factors related to the delay in tuberculosis (TB) diagnosis based on the managers of Primary Health Care (PHC) services perceptions.

**Methods:** Qualitative and descriptive study. To produce the empirical issue was realized semi structured interviews, which were digitally recorded in the period between July to August, 2009. After the transcriptions of interviews, the information were organized with the resource of Atlas Ti Software, 6.0 version. The interpretation of data was supported by the methodological and theoretical approach of the Discourse Analysis, focusing on the Pêcheux pattern.

**Results:** The delay in TB diagnosis, on the manager's perceptions, has factors associated to disease, unhealthy (ill), services and health professional. To disease were mentioned characteristics of the bacillus; to ill person were indentified the TB stigmatization and the delay to look for health services; and to health services it was observed the excessive amount of

manager administrative functions. To professionals, was assigned the absence of educative practices with the community, not completion of search for respiratory symptomatic, low qualification of them to diagnosis TB within a staff working, low diagnosis suspicion and the recovery of high technology methods instead of the access to other easy methods.

**Conclusion:** The relation of the delay in the TB diagnosis between the low capacity of coping with the disease by the PHC managers, as a discursive event, bring divergent meanings to the TB control proposal by the PHC, on the perspective of the health surveillance. It was recommended an investment in the professional training to the development of a proactive management which incorporates the TB control at the PHC.

#### PC-991-28 Health care utilization of TB cases in rural Bangladesh at Matlab

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**Objectives:** To understand health care utilization of TB cases in rural Bangladesh at Matlab and to find the difference in health care utilization between ICDDR,B intervention and non-intervention area.

**Methods:** The study was conducted in rural Bangladesh at Matlab, in a population of about 220000. Half of the area was under active surveillance (intervention area) where, community health research workers (CHRW) visited all household once every month. They identified suspected cases of TB (cough > 21 days) among adults  $\geq 15$  years and referred them to nearest DOTS centre. In the other half, routine passive case detection was done by BRAC, a national NGO partner of NTP. Cases detected were interviewed by Field Research Assistant (FRA) using a structured questionnaire at their households after obtaining written consent.

**Results:** At this point of analysis a total of 251 smear positive pulmonary TB cases were identified, 113 (45.0%) from intervention area and 138 (55.0%) from non-intervention area. Among detected cases 183 (73%) were male and 68 (27%) were female. In the intervention area the first point of care seeking was pharmacies (24.7%), followed by non-qualified private practitioners (21.2%). Similarly, in the non-intervention area this was 26.8% and 29.7% respectively. In both areas, the initial measure taken by providers was prescription of drugs (73.7%), followed by investigations (26.2%). Referral to DOTS centre by any provider was altogether was about 18.7% of cases.

**Conclusions:** Initial care seeking by TB cases remained mostly in the private sector and by the non-qualified practitioners or through over the counter drug purchasing from pharmacies. First line care providers

preferred providing drugs or ordered investigations as an initial measurement. DOTS still remained underutilized in the initial care seeking mechanism.

#### PC-1042-28 Causes of patient and health system delays in three regions of the Russian Federation

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**Background:** Effective TB detection allows interrupting TB infection transmission by timely treatment. The goal of the study: to define factors that increase TB patient and health system delays in Russia.

**Method:** The retrospective cohort study included 689 new pulmonary TB cases (NC) registered in the 2nd quarter 2009 in 3 regions of Russia. Special questionnaires were completed based on medical documentation. 480 (69.5%) of NC were interviewed. For patient and health system delays (PDD and HSDD) the median, 25% and 75% quartiles (25%Q and 75%Q) were calculated, Delays longer than 75%Q were defined as extreme. 102 social and medical factors were evaluated.

**Results:** PDD median of 8 days (0–41) was 2.6 times shorter than the HSDD median of 21 days (10–42). Patients self-referred with complaints had longer PDD (median 21 days). Lack of health insurance (odds ratio [OR] 5.9; 95% confidence interval [CI] 1.2–29.0), homelessness (OR 5.3; 95% CI 1.0–27.6), alcoholism (OR 4.1; 1.3–12.9), living in rural area (OR 2.5; 1.6–4.1), unemployment (OR 1.8; 1.1–2.9), concomitant chronic respiratory diseases (OR 1.8; 1.0–3.0), dyspnea (OR 3.6; 2.0–6.1), productive cough (OR 3.0; 1.9–4.9) and weight loss (OR 2.6; 1.6–4.4) increased PDD. Chest pain, fever and active case finding shortened PDD. Lack of typical clinical signs and complaints, non-specific X-ray findings (OR 2.8; 1.8–4.2), ischemic heart disease or blood hypertension (OR 2.4; 1.1–5.0) increased HSDD. Typical complaints, positive smear results, cavities on lung X-ray, belonging to social risk groups shortened HSDD.

**Conclusion:** The study allowed to establish the allowed and extreme levels of diagnostic delays in the three regions of Russia. To shorten the PDD and HSDD it is necessary to organized screening among social risk groups, train primary health care doctors on TB control, improve health education of population.

### PC-1079-28 Tuberculosis: effectiveness of diagnosis on the triple border: Brazil, Paraguay and Argentina

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**Aim:** To evaluate the effectiveness of the diagnosis of tuberculosis (TB) in the first health care service sought after by the patient.

**Methodology:** Epidemiological study, cross-sectional type. A hundred and one TB patients in treatment in the city of Foz do Iguaçu, located on the border Brazil-Paraguay-Argentina, were interviewed from July to November 2009. The instrument of data collection was based on The Primary Care Assessment Tool, adapted for TB care. Indicators (proportions) were created, which were analyzed individually and in the Specialized Services, in Emergency Care and in Primary Care using confidence intervals for proportions.

**Results:** The proportion of patients who managed to have an appointment with a doctor in the same day was above 70% in all services. There was low suspicion of TB by the professionals in the first health service sought after by the patient. The request for sputum exams occurred in only 50% of patients in three types of health services. The percentage of X-ray exams required was small, however the Emergency Care was the most requested service in the first appointment with a doctor (30%). The guiding of patients to appointments and exams at other facilities was a tool used in all types of services. It was found a significant statistics association between Primary Care and the guiding of patients to have X-ray exams in another health service. The Primary Care presented the worst results in relation to the number of returns (median = 3 times) and passed time (median = 15 days) to diagnosis, for the Emergency Care and Specialized Services the time was 10 and 7 days, (median) respectively.

**Conclusion:** The first health service that the patient sought after failed to perform promptly the TB diagnosis, there is a need to improve exam ordering of diagnosis support. The most effective health service in the diagnosis of TB was the Specialized Services.

### PC-1185-28 Les agents de santé communautaire dans la lutte antituberculeuse au Burundi

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**Contexte :** Le Burundi est caractérisé par un relief très accidenté, rendant difficile l'accès aux structures sanitaires. L'accès est particulièrement difficile pour le dépistage précoce de la tuberculose et la prise supervisée des médicaments.

**Objectifs :** Décrire la contribution des agents de santé communautaires (ASC) dans la lutte antituberculeuse.

**Méthodologie :** Une exploitation des rapports trimestriels élaborés par les ASC et transmis au Programme National Lèpre et Tuberculose (PNLT) a été faite sur toute l'année 2010. Sur le terrain, 5427 ASC ont été formés à la suspicion et au suivi des cas tuberculeux sous traitement puis dotés de kits de travail (bicyclettes, parapluies, sacoche, manuel en kirundi, stylos, cahiers et outils de raportage).

**Résultats :** On note une amélioration de la détection de la tuberculose dans le pays : 4590 nouveaux cas TPM+ en 2010 contre 3974 en 2009 soit une évolution de 15,5%. Parmi les 4590 nouveaux cas TPM+ dépistés en 2010, 946 soit 20,6% ont été référés aux structures de soins par des ASC. Les taux de succès thérapeutique et de perdus de vue sont respectivement de 90% (supérieure à la cible OMS) et de 5%.

**Conclusion :** La détection et le suivi des tuberculeux au Burundi s'améliorent grâce à diverses stratégies expérimentées par le PNLT dont la contribution des ASC. Le PNLT devra encore explorer cette contribution en évaluant la satisfaction des malades tuberculeux bénéficiant des services des ASC.

## TUBERCULOSIS IN HIGH-BURDEN COUNTRIES I

### PC-228-28 Community vs. hospital-based multidrug-resistant tuberculosis management in adults: systematic review

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**Background:** Various models prevail in different countries for the programmatic management of multidrug resistance tuberculosis (MDR-TB) patients. Evidence comparing the effectiveness of these models is scarce.

**Objective:** We aimed to determine the effectiveness in terms of success rate of MDR-TB treatment in adult patients receiving ambulatory care from the



beginning (community based model of care) as compared to those hospitalized in the initial phase of therapy followed by ambulatory care (hospital based model of care).

**Methods:** Extensive electronic search was done for studies published till date (last search made on February 7, 2011) looking at the success rate of MDR-TB treatment. Studies looking only at the initial outcomes like time for culture conversion or culture conversion rate as well as reviews and case reports were excluded. Weighted average for the success (cure, probable cure and treatment completion) rate was calculated.

**Results:** Two hundred and sixty five studies were extracted of which 35 met the inclusion criteria: 11 studies looked at the success rate of community based and 24 at the hospital based model. No comparative study was found in this regards. Weighted average of success rate in patients in community based model was 57% (range 32–89) and in hospital based model was 59.5% (range 42–91).

**Conclusion:** Success rate of both models was >55%. However, comparison between community vs. hospital based models cannot be made and this research gap needs to be addressed by conducting good quality comparator study.

### PC-355-28 Recurrent TB among successfully treated pulmonary TB patients in Denmark

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**Background:** Prospective nationwide monitoring of tuberculosis (TB) treatment outcome (TOM) was introduced in Denmark in 2000. We report rates of recurrent TB among patients successfully treated for culture positive pulmonary TB in 2001–2007.

**Methods:** We included all patients notified in Denmark with initially culture positive pulmonary TB, who were reported as successfully treated according to WHO criteria (either cured or completed treatment), in the period 01 Jan 2001 till 31 Dec 2007. Patients were followed for recurrence of TB, irrespective of type, from end of treatment until 01 Jan 2010, with censoring at end of observation or date of death, whichever came first. Recurrence rates were calculated by Kaplan–Meier method. We performed Cox proportional hazards regression to estimate the effect of age, gender, TB status at inclusion (a history of TB before current episode or not) and nationality (Danish origin or not), on the risk of recurrent TB.

**Results:** A total of 1374 patients fulfilled the inclusion criteria and were followed for a mean of 4.5 years (standard deviation (STD) 2.2 years). Mean age was 40 years (STD 17 years) and 60% were men, 48% had Danish origin and 5% had a history of at least one TB episode before current episode.

A total of 47 patients (Kaplan–Meier method: 5.6%) had recurrent TB. Increasing age (hazard ratio (HR), 1.02; 95% confidence intervals (CI), 1.002–1.04), being of non-Danish origin (HR, 2.20; 95%CI, 1.15–4.19) and a history of TB at inclusion (HR, 3.52; 95%CI, 1.61–7.67) were significantly associated with risk of recurrent TB.

**Conclusions and recommendations:** In Denmark, during 4.5 years mean observation time the rate of recurrent TB was 5.6% among patients with culture positive pulmonary TB who had been successfully treated according to WHO criteria. Patients with a history of TB and non-Danish origin carry the highest risk of recurrence and needs special attention in the clinical setting.

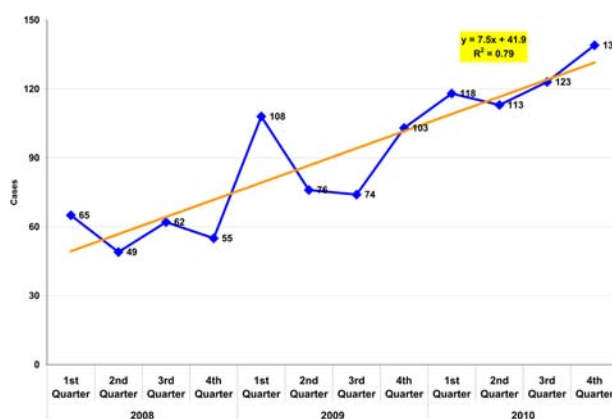
### PC-404-28 The trend in the epidemiological profile of TB retreatment cases in Northern Uganda

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**Background:** TB re-treatment cases are known to pose a harder challenge to control programmes due to their poorer outcome. Additionally, they may suggest a difficult clinical management as in the case of re-treatment after defaulting; or an underhanded problem of drug resistance as in the case of true relapse.

**Intervention:** Our programme assists TB control programme activities in Northern Uganda, a region whose HIV prevalence of 8.2% is higher than the national average of 6.4%. We collected and reviewed the periodic reports from all districts from the region from 2008 until 2010 and analyzed the following: time trend of TB re-treatment cases and their sex disaggregation; reasons for re-starting TB treatment; and outcome of TB re-retreatment cases of the previous cohorts (those who completed from 2007 to 2009).

**Results:** The number of TB re-treatment cases increased steadily from 2008 with 231 cases to 2010 when 493 cases were recorded (see graph). The increase is statistically significant in linear regression analysis ( $P < 0.001$ ). The ratio retreatment cases



out of all new TB cases also increased from 1 TB re-treatment case every 25 new cases to 1 every 13 new cases. Overall, 54% of all re-treatment were relapse/reinfections cases, while defaulters contributed to 40% of re-treatment and failure cases to 6% of them. The sex disaggregation of all re-treatment cases (71% male and 29% female) was not found to be different from the sex disaggregation of overall TB cases occurring in the region. Regarding treatment outcome, death was recorded for 9.7% of all re-treatment cases within the three years, while defaulting rate was at 4.9%.

**Conclusions:** In Northern Uganda, TB re-treatment cases are on the rise. Special attention should be placed on its pattern trend and causes that need to be further analyzed and closely monitored. In the medium term, the increasing number of TB re-treatment cases may jeopardize the efforts of the TB control programme and the achievement of targets.

### PC-539-28 Factores asociados a la no adherencia al tratamiento de la tuberculosis: un proceso multidimensional

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**Objetivo :** La administración completa del tratamiento de la tuberculosis constituye una de las principales herramientas para el control de la enfermedad. La preocupación por la adherencia al tratamiento surge debido a las consecuencias de su interrupción. El objetivo de este estudio fue identificar los factores relacionados con el paciente, su entorno y los servicios de salud que influyen sobre la adherencia a los tratamientos.

**Metodología :** Se realizó un estudio de caso-control en el Área Metropolitana de Buenos Aires. Los casos ( $n = 38$ ) y los controles ( $n = 85$ ) fueron los pacientes no-adherentes y adherentes respectivamente diagnosticados durante el año 2007, residentes y atendidos en hospitales de municipios seleccionados. El análisis de los factores predictivos de incumplimiento terapéutico se llevó a cabo mediante la regresión logística. Se realizaron entrevistas en profundidad, para indagar otros aspectos relacionados con la adherencia a los tratamientos.

**Resultados :** Los pacientes con viviendas precarias y con menor nivel de ingresos por hogar tuvieron más probabilidades de no adherencia. Asimismo, los pacientes que realizaban los controles en un hospital tuvieron más riesgo de no adherir al tratamiento que aquellos que los realizaban en los centros de atención primaria de salud. Se identificaron diversos factores que dificultan la adherencia al tratamiento relacionados con el costo del transporte, la distancia del servicio de salud y la ausencia del subsidio económico. El apoyo familiar y el tipo de atención recibida en el servicio de salud fueron identificados como importantes aspectos para la continuidad del tratamiento.

**Conclusión :** El riesgo de no adherencia al tratamiento se encuentra asociado a las condiciones de pobreza de los pacientes y a las características de acceso a los servicios de salud. La tendencia a desertar el tratamiento aumenta conforme se incrementan esas condiciones.

### PC-699-28 Patient experience in the integrated model of TB control programme in Zhejiang, China

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**Objectives:** To understand patient experience in the integrated model of TB control in Zhejiang Province China.

**Background:** TB service in China is predominately provided by small TB dispensaries. However, the low clinical capacity of TB dispensaries is a concern. Zhejiang Province is the pioneer in China to implement the integrated TB control model. The model involves general hospitals providing clinical treatment of TB patients, while the TB dispensary focusing on public health functions on reporting, drug supply, training and education. By the end of 2008, half of the province has implemented the integrated model.

**Methods:** Stratified sampling was employed to select four counties from relatively rich areas and three counties from relatively poor areas. In each county, 50 new and simple TB patients were recruited for structured survey, with a total of 352 patients. Their outpatient records and hospital charts, if available, were also collected from the general hospitals. In addition, 83 in-depth interviews were conducted with health providers and administrators.

**Results:** Patients in the integrated model visited less than 2 providers from the symptom onset to diagnosis, with a median delay of 23 days. Median treatment delay was 6 days between seeing the first provider and visiting the general hospital, while the delay between other departments and the TB clinic in the general hospital was 4 days. 11% of the patients received inpatient care in the general hospitals, which may be unnecessary for simple TB cases. Patient's average total medical cost was RMB 4086/USD 628, which accounts of 13% of the household income. The majority of patients (93%) were given liver improvement drugs, which accounted for 75% of patient total medical costs. On average, each patient paid RMB644/USD99 on liver improvement drugs.

**Conclusion:** The integrated model presented a nice integration of clinical service from general hospitals and public health service from TB dispensaries.

### PC-703-28 Patterns of health-seeking behavior among respondents with long-term cough: evidence from Myanmar

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**Setting:** There is no rigorous evidence-base on Health Seeking Behaviors (HSBs) among the Myanmar population with an experience of long-term cough. This study aims to fill this gap.

**Methods:** This Myanmar TB Prevalence survey was conducted in 2010 and deployed a sample size of 51 367 respondents. The survey incorporated items concerned with HSBs for respondents experiencing a cough of a long-duration in the recall period. Reports of HSBs relating to cough of a long duration act as a proxy for symptoms suggestive of TB.

**Preliminary results:** 3.0% of respondents reported experiencing cough of long-duration. Amongst those who ever had cough, a large minority (49.9%) sought care of any kind, 27.5% self-medicated and 22.6% took no action. Amongst those respondents, 27.3% sought care from pharmacies, 25.2% from 'traditional healers', 18.8% from health centers and 16.7% from GPs. A tiny fraction of respondents sought care from other categories of providers, including public hospitals. Amongst respondents seeking care, the majority (61%) sought care from untrained providers. Of those seeking care from trained providers, the majority reported seeking care from Public sector (61.1%) and a large minority from the private sector (39.9%).

**Conclusion:** Populations with long-term cough symptoms suggestive of TB often do not seek care or self-medicate. Of the 40 000 respondents who experienced cough of any duration only 8038 sought health care from a trained professional. The majority of those that do seek care access care through untrained providers. Those that seek care from trained providers access care through both the public and private sector.

### PC-759-28 Analysing private public mix working under the DOTS strategy for last five years in Punjab, Pakistan

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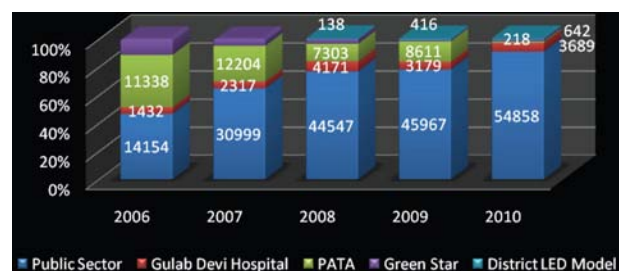
**Background:** Pakistan is a high burden country for tuberculosis. Punjab has 94.6 million population and bears 56% of country and one fourth TB burden of EMR. There are four models of PPM working in the province. Both public and private sector are contrib-

uting in TB control services. There is need to evaluate these models to learn lesson for future.

**Objective:** To evaluate the performance of PPM models practiced in Punjab Pakistan.

**Methods:** Study Design: Descriptive Observational study. Four models are practiced are: Tertiary care Models, Pakistan Anti TB Association (PATA) Model, Greenstar (General Practitioners GPs) and District LED Model (GPs). Study area: 36 districts of Punjab. Study Subjects: Cohort of patients registered under different models in year 2006 and 2010. Data Collection: From quarterly reports, Interview from DOTS staff with questionnaire.

**Results:** New smear positive case registered (CDR contribution) in 2006, 2007, 2008, 2009, 2010, by public sector were 14 154 (20%), 30 999 (43%), 44 547 (60%), 45 967 (58%), 54 858 (71%), by Gulab Devi Hospital 1432 (2%), 2317 (3%), 4171 (5%), 3179 (4%), 3689 (5%) by Pakistan Anti TB Association 11 338 (16%), 12 204 (17%), 7303 (10%), 8611 (11%), 642 (1%), by Green Star 3476 (6%), 2406 (3%), 1902 (3%), 590 (1%), 953 (1%) and by District LED Model 0, 0, 138 (0.2%), 416 (1%), 218 (0.3%) respectively. Treatment success rate in 2006, 2007, 2008, 2009 by public sector was 89%, 92%, 93%, 93% by Gulab Devi Hospital 67%, 78%, 73%, 71% by Green star 88%, 93%, 70%, 91% by District Led Model 0, 0, 95%, 89% (started from 2008) respectively. There is significant increase in case finding by public sector and decreased by private sector ( $P < 0.05$ ). Treatment success rate was achieved by all partners except tertiary care model.



**Figure** PPM; contribution in case finding.

**Conclusion:** The public sector is getting stronger and having more reliance of people while private sector is becoming significantly weaker. Case management by tertiary care model was poor.

**Recommendations:** The private sector should be strengthened and expanded.



### PC-897-28 Treatment delay is an alternative parameter to measure the size of the TB infectious pool

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**Aim:** The WHO-recommended 'Styblo rule' has been used to estimate incidence rate of TB for over two decades. Recent evidence suggests that the 'Styblo rule' does not accurately measure TB incidence. The objective of this study was to propose an alternative tool to monitor the infectious pool of TB at the local level.

**Methods:** Data obtained from the systematic registration of treatment delay in the TB program records of the West-Gojam Zone of Amhara Region in Ethiopia was used to estimate the size of the TB infectious pool. Four categories including smear-positive and smear-negative pulmonary TB (PTB) patients, retreatment cases (relapse and treatment failure) and undiagnosed TB cases were considered in the analysis. The total size of the infectious pool was calculated by multiplying the total number of infectious days recorded for each patient by the estimated infectious period for each category of TB patients.

**Results:** The infectious pool could be calculated by recording the treatment delay for new PTB cases and retreatment cases, and by estimating the number of undiagnosed TB cases in the community. Treatment delay of new sputum smear-positive TB cases contributed the greatest number of infectious days.

**Conclusion:** A systematic recording of treatment delay can be used as a quantifiable variable to monitor and estimate the infectious pool of TB, and trends in program performance at the local level.

### PC-1081-28 Impact of decentralization on treatment default and outcomes among MDR-TB cases

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**Introduction:** Current treatment for patients with multidrug-resistant tuberculosis (MDR-TB) in many parts of the world involves centralized care for 18–24 months. The reason for this approach is the complexity of caring for these patients and the fear of transmitting MDR-TB to the greater community if patients are not adequately treated. However, it is important to balance the need to protect the public with patient rights and autonomy, and cost of care.

**Methods:** A retrospective cohort study was conducted among MDR-TB patients in the Philippines to evaluate the role of decentralization on treatment

compliance and final treatment outcomes. Our analysis included all MDR-TB patients initiating treatment between 1999 and 2006 and had final treatment outcomes available. Treatment was centralized in MDR-TB treatment centers. Patients were eligible for decentralization of care to a local health site near their residence if they had converted to negative culture on the third month of treatment, had no uncontrolled side effects, and agreed to be transferred.

**Results:** Among 583 eligible MDR-TB patients, 167 (28.6%) were decentralized for continuing care. In multivariate analysis adjusted for age, previous TB treatment, history of alcohol use and number of drugs used in the treatment regimen, decentralization significantly decreased the risk of default by 70% (HR = 0.3, 95% CI 0.1–0.5,  $P < 0.001$ ). Of 147 patients who were decentralized and did not default or die during treatment, 93.9% ( $n = 138$ ) were successfully cured and 3.4% ( $n = 5$ ) completed treatment; only 2.7% ( $n = 4$ ) failed treatment. These treatment outcomes were not significantly different compared to patients that continued centralized care ( $\chi^2 = 2.5$ ,  $P = 0.28$ ).

**Conclusion:** Decentralization of care for MDR-TB treatment may be a reasonable approach to preserve patient autonomy while maintaining favorable outcomes. Further research is needed to evaluate the cost-effectiveness of decentralized models of care for MDR-TB treatment.

### PC-1192-28 Impact of community tracer teams on treatment outcomes among tuberculosis patients in South Africa

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**Setting:** Tuberculosis (TB) indicators in South Africa remain below global targets. In 2008, the National TB Program (NTP) implemented a community mobilization project in all nine provinces of South Africa to trace TB patients that had missed a treatment or clinic visit. Implementation sites were selected by TB program managers and tracer teams liaised with health facility staff to identify patients for tracing activities.

**Objective:** To assess the impact of the TB tracer project on treatment outcomes among TB patients.

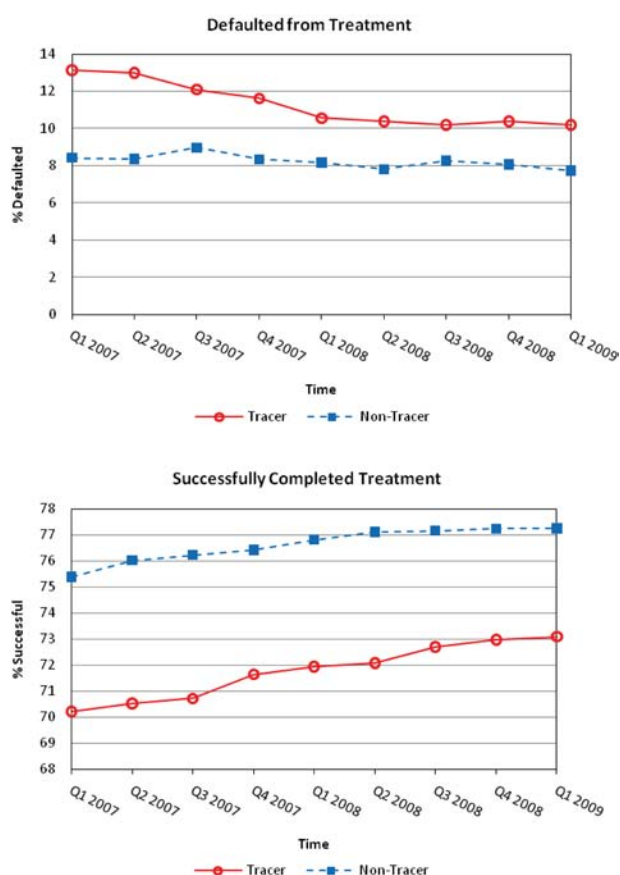
**Methods:** The study population included all smear positive TB patients registered in the national Electronic TB Registry (ETR) from January 2007–March 2009. Sites were the unit of analysis, with each designated as either tracer (standard TB program plus tracer project) or non-tracer (standard TB program only). Linear regression was used to evaluate changes



in treatment outcomes among patients registered in the ETR from January 2007 through the project period (January 2008–March 2009) between tracer and non-tracer sites.

**Results:** A significant difference between tracer and non-tracer sites from January 2007–March 2009 was observed for the proportion of patients who defaulted ( $P < 0.001$ ) and for the proportion with a successful (cured or completed) treatment outcome ( $P = 0.016$ ) (Figure). Models stratified by province revealed significant differences between the tracer and non-tracer sites in only 4/9 provinces for default rates and 5/9 provinces for treatment success.

**Conclusions:** Community mobilization of teams to trace TB patients may be an effective strategy to mitigate default rates and improve treatment outcomes. Additional research is currently underway to elucidate discrepancies across provinces and identify best practices; these findings will help guide the NTP in optimizing the adoption of tracing activities for TB control.



**Figure** Proportion of all smear positive TB patients that a) defaulted from treatment or b) successfully completed treatment, tracer vs. non-tracer sites January 2007–March 2009.

### PC-1249-28 Evaluation du dépistage et de la prise en charge des tuberculeux dans la zone sanitaire Parakou

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**Introduction :** Le Programme national contre la tuberculose a mentionné pour l'année 2009 des résultats performants avec un dépistage de 3987 cas de tuberculose toutes formes confondues. Le taux de succès thérapeutique de la cohorte des patients tuberculeux mis en traitement en 2008 était 89%. Cependant ces résultats globaux ne traduisent pas les disparités suivant les régions. Nous avons étudié l'évolution du dépistage et de la prise en charge de la tuberculose dans la zone sanitaire de Parakou/N'Dali qui comporte la plus grande ville de la région septentrionale du Bénin.

**Méthode :** Il s'agit d'une étude rétrospective allant du 1er janvier 2005 au 31 décembre 2009 qui a concerné tous les patients tuberculeux admis dans les deux centres de dépistage et de traitement de la zone sanitaire. Nous avons recueilli les données à partir des registres de consultation générale, celui du laboratoire et celui de l'enregistrement des tuberculeux.

**Résultats :** Sur 37 760 consultants, 5927 présentaient une toux (16%) ; parmi eux, il y avait 613 tousseurs chroniques (10%). Il ya une augmentation régulière des suspects examinés au laboratoire qui sont passés de 391 en 2005 à 844 en 2009, soit une hausse de 116%. Le nombre de cas de tuberculose toutes formes confondues est passé de 63 en 2005 à 103 en 2009 soit une hausse de 63,5%. En particulier les nouveaux cas de TPM+ sont passés de 51 à 73, soit une hausse de 43%. Alors qu'il n'était que de 16% en 2005, le taux de réalisation de la sérologie VIH a été maintenu au dessus de 90% depuis 2006. La séroprévalence VIH chez les tuberculeux est en moyenne de 20%. Le taux de succès thérapeutique chez les nouveaux cas de TPM+ a varié de 84% en 2005 à 93% en 2009.

**Conclusion :** Il y a une augmentation du dépistage de toutes les formes de tuberculose. La sérologie VIH est réalisée chez la quasi-totalité des malades et la séroprévalence était 20%. Le taux de succès thérapeutique s'est amélioré d'année en année pour atteindre 93%.

### PC-1260-28 Using mixed survey methods to investigate contact patterns of risk of TB infection in Zambia

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**Background:** Representative surveys in 2005 and 2010 demonstrated significant differences in TB incidence

across 16 Zambian communities. Interdisciplinary research aims to investigate if differences in contact patterns—between adults and between adults and children, can explain this variation.

**Methodological approach:** A ‘Broad Brush Survey’ (BBS) methodology maps key visible domains of relevance within a community. A 2005 BBS in all 16 communities was first analysed for data on population movement (exit, entry, by gender and age), places perceived to facilitate TB transmission (TB ‘hotspots’) and popular knowledge of TB transmission. In 2011, another BBS was carried out simultaneously by trained research assistants, with a stronger focus on ‘who bumps into whom’, ‘who hangs out where for how long’ and when and where adults spend time in the presence of children. In addition, a structured interview survey tool was piloted with a small number of respondents in each site. The BBS 2011 data were rapidly analysed by the fieldwork team and this data was used, alongside the pilot experience, to strengthen and adapt the structured survey tool. For example, watching TV/videos emerged as a significant activity. The survey tool is currently being administered to 160 individuals (selected from a 2010 TB Prevalence survey) in each of the communities. The final data will be analysed using modelling and qualitative approaches.

**Conclusion:** Driven by the intention to generate high quality data to understand variation in TB incidence, adopting a mixed interdisciplinary and methodological approach contextualized and strengthened the structured survey tool.

## TUBERCULOSIS IN HIGH-BURDEN COUNTRIES II

### PC-140-28 Tuberculosis transmission among people infected and not infected with HIV in Switzerland, 2000–2008

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**Background:** Tuberculosis (TB) incidence rates have been decreasing in high-income countries for decades, but HIV co-infected individuals and migrants from high-burden countries remain risk groups. The aim

of this study was to examine recent TB transmission among HIV-positive and HIV-negative TB cases in Switzerland.

**Methods:** All HIV-TB co-infected patients from the national Swiss HIV Cohort Study and a random sample of all TB cases notified to the National TB Surveillance Registry with a *Mycobacterium tuberculosis* complex isolate were included (sampling proportion 12.3% of all culture-confirmed Swiss TB cases). Molecular clusters as indication for recent transmission were determined by spoligotyping and 24-loci MIRU-VNTR, main phylogenetic lineages by single nucleotide polymorphism genotyping.

**Results:** Overall, 113 HIV-positive TB patients and 407 HIV-negative TB patients were included, for a total of 520 cases. 77.3% were born outside of Switzerland. We identified 35 molecular clusters with 90 clustered patients (17.3%, 95% confidence interval 14.2–20.8%): 20 clusters involved foreign-born cases only, four clusters involved Swiss-born cases only, and 11 were mixed clusters. Twenty-one HIV-positive patients (18.6% of all HIV-positive patients) were found in 15 different molecular clusters, six clusters involved at least two HIV-positive patients. The most prevalent phylogenetic lineage was the Euro-American (72.7%), the East-Asian (10.4%) and the Indo-Oceanic lineage (8.3%); the distribution remained stable over the study period with little evidence for another lineage emerging. Cavitory disease and smear-positivity were associated with recent transmission.

**Conclusion:** Recent transmission of TB was estimated to account for 17% of TB cases over a 9-year period. One third of clusters involved both Swiss and foreign-born TB patients. Among HIV-positive TB cases, at least half of recently acquired TB was due to transmission from HIV-negative contacts.

### PC-226-28 Multidrug-resistant tuberculosis in northern Taiwan, 2007–2009

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**Aim:** We conducted a survey to understand the main characteristics associated with multidrug-resistant tuberculosis (MDR-TB) in northern Taiwan.

**Methods:** From 2007 to 2009, 154 MDR-TB cases were notified. Demographic data of 152 cases were collected. Pre-XDR was defined as MDR *Mycobacterium tuberculosis* resistant to ofloxacin (OFX) or any one of the three injectable drugs (amikacin, capreomycin and kanamycin). One isolate of each case was analyzed using spacer oligonucleotide typing (spoligotyping), mycobacterial interspersed repetitive units-variable number tandem repeats (MIRU-VNTR) and first and second-line drug susceptibility testing. Cluster

is defined as at least two isolates with identical spoligotyping and MIRU-VNTR profiles.

**Results:** The majority of cases occurred in the age groups of >65 (25.7%), 45–54 (19.7%), and 55–64 (19.1%). In this study, 48.7% (74/145) cases were resistant to ethambutol (EMB), 38.2% (58/145) were resistant to streptomycin (SM), 15.8% (24/149) were resistant to OFX, 1.3% (2/149) was extensively drug-resistant (XDR), and 21.1% (32/149) was pre-XDR. Both pre-XDR and XDR were associated with EMB, SM, p-aminosalicylic acid (PAS), ethionamide (EA) and pyrazinamide (PZA) resistance with statistical significance. Retreated TB cases were significantly associated with EA and PAS resistance ( $P < 0.05$ ), while new cases had higher proportion of rifabutin resistance. We found 32.2% (49/152) of MDR-TB cases were in 18 clusters including 2 clusters with epidemiological links. Clusters were associated with OFX resistance ( $P < 0.05$ ). Furthermore, 49.3% of cases were infected with Beijing genotype *Mycobacterium tuberculosis*. In this study, Beijing genotype was significantly associated with EMB and SM resistance ( $P < 0.01$ ).

**Conclusion:** High rate of pre-XDR-TB need to be carefully managed to avoid emerging of XDR. Continuous surveillance is crucial for the development of proper therapy regimens.

#### PC-475-28 Initial default among TB and HIV co-infected patients after discharge from an urban hospital in South Africa

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**Aim:** To assess the referral outcomes of TB patients diagnosed at a hospital facility and referred for TB and HIV care at discharge, and identify factors associated with delayed presentation or initial default.

**Methods:** TB patients discharged during a 3 month period in 2009 were traced by reviewing files at the assigned TB and HIV referral clinics, or by telephonic contact and review of national death register. Patients presenting after 7 days for TB care or after 30 days for HIV care (corresponding to drug supply provided) were classified as late, or as defaulters if they never presented for care. Log-binomial regression was used to identify risk factors for presenting late or defaulting.

**Results:** Of 678 patients referred, 29% had smear positive pulmonary TB and 590 (87%) were HIV positive with a median CD4 count of 78 cells/mm<sup>3</sup>. Among the HIV-infected TB patients, only 20% were referred to the same site for TB and HIV care. Of the

593 (88%) patients referred within Johannesburg for TB care, 23.3% presented late, 21.9% defaulted and 1.2% died within 7 days. Of the 486 (82%) HIV positive referrals; 19.8% presented late, 37.7% defaulted and 0.6% died within 30 days. 21.7% and 18.5% presented at a clinic other than the one originally assigned for TB care or HIV care, respectively. Factors associated with late presentation or default for TB care were lack of education (RR 2.10 95%CI 1.31–3.35) and CD4 count < 50 cells/mm<sup>3</sup> (RR 1.32 95%CI 1.00–1.77). Factors associated with late presentation or default for HIV care were ART-naïve at hospital discharge (RR 1.53 95%CI 1.02–2.30), inappropriate referral (RR 1.93 95%CI 1.18–3.13) and not having a discharge letter (RR 1.27 95%CI 1.14–1.42).

**Conclusion:** Efforts to ensure continuation of TB and HIV/AIDS care should focus on appropriate communication of HIV and CD4 results, on integrating or simplifying care (referral to one site for TB and HIV care) and on referral support for the less educated and sickest patients.

#### PC-528-28 High early death rates and variations in mortality by type of tuberculosis and HIV status

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**Background:** Smear-negative and extrapulmonary TB occur more frequently in individuals with HIV and are more challenging to diagnose than smear-positive TB, particularly in resource limited settings.

**Methods:** Retrospective record review of adult TB patients at 14 primary care clinics in Kinshasa, DRC between January 2006 and March 2007. Incidence rate ratios were calculated, and multivariate proportional hazard analysis stratified by TB treatment phase and HIV status was conducted to identify factors associated with mortality.

**Results:** Of the 5685 TB cases, 3736 (66%) were smear-positive pulmonary TB (PTB), 1021 (18%) smear-negative PTB, and 928 (16%) extrapulmonary TB (EPTB). Almost all (90.5%) accepted HIV testing, and 933 (16.4%) were HIV-positive. HIV-positive patients presented more frequently with smear-negative PTB (37% vs. 17%,  $P < 0.0001$ ) and EPTB (23% vs. 14%,  $P < 0.0001$ ). Among HIV-negative patients, risk of death during the intensive treatment phase was higher among cases with smear-negative PTB (aHR 1.8, 95%CI 1.1, 2.9) and EPTB (aHR 2.4, 95%CI 1.5, 3.9). Independent of type of TB or treatment phase, HIV-positive individuals were at increased risk of death compared to HIV-negative patients (IRR



3.5, 95%CI 2.9, 4.4). Overall, mortality was higher among cases of smear-negative PTB (9%) compared to smear-positive PTB (6%,  $P < 0.0001$ ) and EPTB (6%,  $P = 0.005$ ). Compared to the continuation treatment phase, death was more common in the intensive phase for HIV-positive (IRR 2.5, 95%CI 1.8–3.4) and HIV-negative patients (IRR 2.6, 95%CI 2.0–3.5). Only 13.8% of HIV-infected patients gained access to antiretroviral treatment (ART). ART decreased the hazard of death by an estimated 36% (aHR 0.64, 95%CI 0.37–1.11).

**Conclusions:** In primary care clinics in a highly resource poor country, smear negative TB and EPTB among HIV-negative patients, and lack of access to ART among HIV-positive patients were the most important contributing factors to mortality.

### PC-589-28 Tuberculosis and HIV infection: public health emergencies in a prison of southern Brazil

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**Background:** Tuberculosis (TB) is a major public health problem in the prison system of Rio Grande do Sul (RS) State, Southern Brazil (27 600 inmates), where the 2008 TB incidence rate was as high as 740/100 000. The present study was aimed at evaluating, in the major prison of RS (4800 adult male inmates), the prevalence of active TB and HIV infection in order to introduce comprehensive control strategies.

**Methods:** Inmates housed in two blocks of this prison and who agreed to participate were interviewed, had a chest X-ray taken, independently of the presence of symptoms, and were tested (rapid test) for anti-HIV. Two sputum samples were collected for smear examination, culture and sensitivity testing from all patients with any pulmonary, mediastinal or pleural X-ray abnormality and/or anti-HIV positivity.

**Results:** Out of the 1918 inmates (median age: 27 years) investigated, 164 (8.6%) TB cases were identified including 15/164 cases (9.1%) already under treatment and 149/164 (90.9%) diagnosed during the survey. Out of these 149 cases, 101 (67.8%) were bacteriologically confirmed including 52/149 (34.9%) smear+ cases and 49/149 (32.9%) smear–/culture+ cases. Only 51/149 (34.2%) cases declared a cough > 3 weeks. A primary resistance to anti-TB drugs

was diagnosed in 4/94 (4.3%) cases (S: 1 case; H: 1 case; MDR, 2 cases). Anti-HIV was detected in 110/1667 (6.6%) inmates and in 20/150 TB cases (13.3%).

**Conclusion and recommendations:** The disclosure of this high level of TB and HIV endemicity engaged the health and justice departments to develop a partnership to implement in the prison control measures including chest X-ray screening at entry, training of the health professionals, information of inmates and guards, reinforced supervised treatment. A bacteriology laboratory (smear examination and culture) was set up within the prison and is now serving 12 other prisons of RS prison system where the control measures are being extended.

**Funding:** Global Fund Tuberculosis Brazil

### PC-684-28 Recurrent tuberculosis in Gauteng Province, South Africa: risk factors, management and outcomes

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**Background:** Recurrent TB has become an increasing problem in settings of high HIV prevalence and high TB incidence.

**Method:** A cross sectional review of data extracted from the Electronic TB Register of adult patients diagnosed with TB from all primary health care clinics serving an inner city Johannesburg region from 01.01.2008–31.12.2008. Data was extracted on potential risk factors for recurrent TB disease focusing on HIV.

**Results:** Among 3845 adults presenting with TB, 517 (13.5%) had recurrent TB, 318 (61.5%) were male and the median age was 35 years. Among 380 with recorded HIV status 343 (90%) were HIV+. Among 3328 patients presenting with their first episode of TB, 2085 had data on HIV status; 1676 (80%) were HIV+. 248 of 517 (48%) recurrent TB patients had a relapse after previous cure. Of 115 HIV+ recurrent TB cases with CD4 count recorded, 81 (70%) had CD4 < 200 cells/mm<sup>3</sup>. 42 of 77 (55%) HIV+ recurrent TB patients with recorded ART status were on ART at the start of TB treatment. Of 146 HIV+ recurrent TB patients with recorded data, 75 (51%) were on ART by the end of treatment. 200/517 (39%) had cultures sent; 102 were positive for *Mycobacterium tuberculosis*, of which 63 had drug sensitivity test (DST) results; 26 (41%) demonstrated multidrug resistance (MDR), 2 (3%) isoniazid mono-resistance and 35 (56%) were fully sensitive. The HIV status of 24 of 26 patients with MDR-TB was not recorded.



**Conclusion:** This study highlights a high proportion of recurrent TB associated with untreated advanced HIV. The high proportion of MDR-TB among recurrent TB cases highlights the need to ensure all patients have early culture and DST, as well as HIV testing, to ensure appropriate treatment for both HIV and TB and to prevent ongoing transmission of drug resistant TB. Recommendations include the upscale of ART initiation in TB-HIV co-infected patients and widespread health and laboratory education on improving culture and DST investigation in middle and low-income settings.

### PC-931-28 Epidemiological dimension of tuberculosis and AIDS in a big southeast city in Brazil

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**Aim:** To analyze the incidence of tuberculosis and AIDS in Campinas, SP, Brazil from 2001 to 2009.

**Methods:** This is an epidemiologic study of time series using secondary data from the Ministry of Health—Department of the Health System—DATASUS. The study includes new cases of tuberculosis and AIDS reported in the city of Campinas, near one million inhabitants, in the period of 2001 to 2009. The population used was obtained by the Brazilian Institute of Geography and Statistics (IBGE).

**Results:** The total number of new TB cases in the period 2001–2009 was 3533 with an incidence rate (IR) of 38.22/100 000. The highest IR was in 2001 (51.96) and the lowest in 2006 (30.40). The classification in pulmonary and extra pulmonary forms showed similar distribution. The disease affected more men than women with IR of 54.55 and 22.58 respectively. The risk observed between M/F was 2.4 higher in men than in women. For both the year of 2001 was accounted for the highest IR (70.95 and 33.69 risk M/F of 2.1) in this time series. Data regarding age are more expressive at the interval of 40–59 years with 59.51/100 000 mainly in 2001 with an IR of 75.81. AIDS in the period 2001–2009 had an incidence rate of 29.09 with a total of 2 689 recorded cases. In 2001 the values were the lowest (IR 14.4 and 141 cases) and in 2006 the highest incidence in the period (45.41 with 472 cases). The age distribution showed the interval of 30–39 with an IR of 69.54 (98.65 in 2006) followed by age 40–49 IR of 47.02 (75.78 in 2006).

**Conclusions:** Tuberculosis and AIDS have a similar epidemiological profile justified by the number of notifications per year and the largest concentration of cases among young adult males. Aids is a risk factor for TB hence the involvement of these two diseases may lead the patient to death. Monitoring the number of cases is important for planning strategies by health service seeking to reach specific targets for disease control.

### PC-1012-28 First survey on TB and HIV prevalence in the prisons of the Mbeya Region in Tanzania

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**Background:** Prisons are widely seen as reservoirs for TB infection and therefore pose a risk for increased transmission. Delayed diagnosis and difficulties to complete treatment in a prison setting lead to prolonged transmission and increased risk to develop multidrug resistant TB. The objective of this TB REACH funded intervention was to obtain reliable baseline data and improve and accelerate access to HIV-TB co-diagnosis and treatment in the prison population of the Mbeya Region.

**Methodology:** All prisoners held in three Mbeya prisons between 2nd November 2010 and 2nd March 2011 were screened for TB. Questionnaires on previous medical history and duration of incarceration were completed. Two sputum samples (morning and spot) were collected from each prisoner and examined by fluorescence microscopy. In addition, spot samples were tested by Xpert MTP/RIF® (Xpert) assay. Inmates with positive smear and/or Xpert result were referred for treatment initiation. All prisoners were offered HIV testing and staging during screening.

**Results:** 1304 prisoners from three prisons were screened. TB was newly diagnosed in 30 inmates (2.3%). Only 5 (16%) were diagnosed by smear alone, an additional 25 cases (84%) were found by Xpert. None showed Rifampicin resistance. 75% of all inmates agreed to HIV testing and counselling during screening. The HIV prevalence of 15% was within the range of the general population in Mbeya. 70% of TB positive inmates were HIV co-infected.

**Conclusions:** Although TB and HIV prevalence in Mbeya prisons was lower than anticipated, a rate of 2300 per 100 000 is about 13 times higher than the regional notification rate. Therefore it remains important to investigate the epidemiology of both diseases in order to contribute to the development and implementation of effective control programmes in this high risk group. Early case detection and treatment, resulting in lower transmission, would be important contributions to disease control and reduction in mortality.

### PC-1064-28 Why don't patients complete LTBI treatment? A prospective cohort study in the USA and Canada

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**Rationale:** Approximately 200–300 000 persons are treated for LTBI in the US annually, with reported LTBI treatment (TLTBI) completion rates ranging from 30–60% for 9-months of self-administered isoniazid (INH) treatment. The study objective was to identify modifiable factors associated with completion of TLTBI.

**Methods:** This prospective cohort study assessed factors associated with completion of TLTBI through interviews with persons who initiated TLTBI. The study was conducted at 12 CDC-funded TB Epidemiologic Studies Consortium (TBESC) study sites. Standard definitions of treatment completion were used. Interviews were conducted at treatment initiation and completion/cessation. Participants received usual care according to each clinic's standard of care. Multivariate analysis of risk factors associated with completion was performed.

**Results:** 1515 participants initiated TLTBI and 1299 had treatment completion information available. Of these, 664 (51%) completed TLTBI. In multivariate analysis, predictors of TLTBI completion included having health insurance, foreign birth, and expecting to stop LTBI medicines if they became sick (Table). Predictors of non-completion included history of substance abuse, adverse drug reactions, inconvenient clinic schedule, barriers to care, residential mobility, and unemployment. Knowing one 'can get TB through air' and that 'BCG offers protection' were also predictors of non-completion. Interviews with non-completers revealed concerns about tolerability/

toxicity, appointment conflicts, low prioritization of TB, and forgetfulness.

**Conclusions:** Half of patients who initiated TLTBI in our prospective multi-site study did not complete TLTBI. Tangible issues such as not having health insurance, substance abuse, side effects, and barriers to care need addressing to improve TLTBI completion rates.

### PC-1168-28 Are TB case notification rates declining in people living with HIV in Rwanda?

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**Background:** The number of TB cases in Rwanda has more than doubled since 1990, primarily due to the HIV epidemic. Since 2005, the national TB-HIV guidelines have included active TB screening of all people living with HIV (PLWH) and referral of all HIV-infected TB suspects for TB diagnosis and therapy, and antiretroviral treatment. We report on trends in TB case notification rates in PLWH at HIV care and treatment (HCT) sites supported by the International Center for AIDS Care and Treatment Programs (ICAP) in Rwanda.

**Methods:** From 2006 to 2010 all HIV-infected patients undergoing routine clinical monitoring in antiretroviral treatment (ART) and pre-ART services were screened for TB using a standardized five-question national tool based on TB symptoms. Patients who screened positive were considered TB suspects and underwent further diagnostic evaluation for active TB per national guidelines. Semi-annual routinely reported program data were reviewed.

**Results:** During the first semester (S1) of 2006, among 6941 PLWH enrolled in HCT services, 3608 (52%) PLWH were screened for active TB; of these, 65 (1.8%) were diagnosed with and treated for TB. The TB notification rate for S2 2006 was 1.07% (55/5135). The TB notification continued to decline further to 0.74% (91/12308) for S1 2009 and 0.58% (75/13017) for S2 2009. By the end of 2009, 83% (13017/15689) of patients enrolled in HCT services were screened for active TB.

**Conclusion:** Program data suggest a decline in TB notification rates. Further evaluation is needed to confirm this decline and to determine contributing factors such as early detection and treatment of TB, ART initiation, implementation of TB infection control measures, etc.

Predictors of treatment non-completion	P value	AOR	95% confidence limits	
History of substance abuse	0.0004	0.288	0.145	0.575
Adverse drug reactions	<0.0001	0.047	0.023	0.098
Schedule inconvenient	0.0395	0.766	0.595	0.987
Barriers to care (e.g., transportation, clinical hours)	0.0155	0.643	0.450	0.920
Residential mobility (number of times moved in past year)	0.0116	0.773	0.633	0.944
Lost job vs. didn't lose job	0.0312	0.163	0.031	0.849
Not working/non-initiator vs. did not lose job	0.0015	0.446	0.271	0.735
Understand 'can get TB through air'	0.0029	0.409	0.227	0.736
Know 'BCG offers protection'	0.0497	0.724	0.524	1.000
Health insurance	0.0404	1.478	1.017	2.148
Foreign birth	0.0486	1.492	1.002	2.222
Stop meds if feel sick	0.0073	1.596	1.134	2.245

### PC-1277-28 MDR-TB in Namibia: describing the characteristics of the 2010 cohort

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**Background:** Namibia is a sparsely populated country in Southern Africa with population of 2.2 million. In 2009, Namibia reported 13332 cases (634/100000) of TB. The 1st cohort of MDR-TB was described in 2009 after establishment of PMDT. A drug resistance survey (DRS) held in 2008 showed that 3.8% of all new smear positive cases and 16.5% of all relapse cases have multidrug-resistant (MDR) TB. In 2009, 275 cases of MDR-TB were reported.

**Interventions:** After having implemented a system of periodic review exercises, at which data is audited across health facilities, and HCWs are trained, it was possible to review the cases of MDR-TB that were being notified case by case.

**Results:** 214 cases of MDR-TB were reported in 2010, compared to the 275 in 2009 which may have represented a backlog of unreported cases. Age range was 3 to 76, with the mean and median at 36 years. Pulmonary cases accounted for 212 (99%) of cases. The HIV testing rate was 90.7%, with an HIV prevalence of 54.6% (106), not far from the 57% in the 2009 cohort and the 55% in the DRS. The sources of cases mirrored that reported in 2009, with 19 (9%) of cases being new; 58 (27%) of cases having been tested as relapses; 69 (32%) having been tested after failing first treatment, and 35 (16%) having failed re-treatment. Of note also is that 118 (55%) of patients with MDR-TB show resistance to ethambutol while 147 (69%) show resistance to streptomycin, again not very different from the previous year. In the 6-month interim outcome results for the 1st quarter of the year, 6-month culture conversion rate for MDR-TB

**Conclusions and key recommendations:** The high number of MDR-TB diagnosed after failure to initial treatment strongly warrants expansion of DST among new cases, while the 18% death rate at 6 months suggests late diagnosis, amenable by introducing rapid methods of DST.

### PC-1280-28 Temporal trends in drug-resistant TB and HIV co-infection treatment in KwaZulu-Natal, South Africa

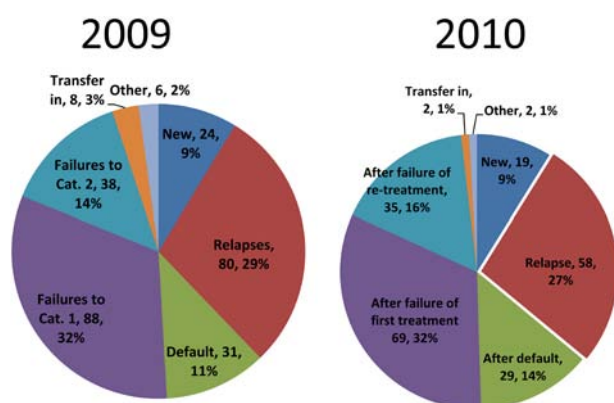
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**Background:** KwaZulu-Natal (KZN), South Africa, is the epicenter of a drug-resistant TB and HIV syndemic characterized by high mortality, increasing incidence of both HIV and drug-resistant TB, and poor treatment outcomes. We describe trends in HIV prevalence, antiretroviral therapy (ART), mortality, and treatment outcome in patients with multidrug-resistant TB (MDR-TB) and extensively drug-resistant TB (XDR-TB) in KZN.

**Method:** A retrospective chart review of patients admitted to a public TB specialist referral hospital in KZN for initiation of second-line TB therapy between 2004 and 2009. Eligible patients were adults with microbiologically confirmed MDR-TB or XDR-TB.

**Results:** 5267 eligible patients with either MDR-TB or XDR-TB during the study period were identified. Percentage HIV co-infected increased from 63% to 77% from 2004 to 2009 ( $P < 0.0001$ ). The proportion of HIV-TB patients on ART also increased from 12% to 59% during the study period ( $P < 0.0001$ ). Correlating with this increase in ART there was a decrease in deaths during the study period (30.5% to 5.3%). There was also an increase in XDR-TB admissions and a decrease in patients previously treated for TB ( $P < 0.0001$ ), possibly indicating increased primary transmission of resistant strains.

**Conclusion:** Admission data to the TB referral hospital in KZN reveals increasing numbers of HIV co-infected MDR-TB and XDR-TB patients. While still suboptimal, increasing ART utilization for HIV-TB co-infected patients and decreased deaths are positive trends. Increasing numbers of XDR-TB-HIV patients is troubling given the poor prognosis and negative implications for TB control.



**Figure** MDR-TB by registration group, Namibia

cases was 57% and defaulters 8%. If polyresistant cases are included, defaulter rate falls to 5.7%, suggesting better follow-up of cases.



## RAPID METHODS OF TUBERCULOSIS DIAGNOSIS I

### PC-224-28 Rapid detection of multidrug-resistant tuberculosis by direct drug susceptibility testing

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This study was carried out to evaluate if drug susceptibility test (DST) can be successfully carried out using direct DST procedures and if this approach would offer substantial time saving.

Sputum specimens were digested, decontaminated, concentrated by the laboratory routine procedure and were inoculated in BACTEC MGIT 960 as well as LJ medium for primary isolation. All the processed specimens which were AFB smear-positive were also used for setting up direct DST for INH and Rifampicin only. Antimicrobial mixture (PANTA) was added to all the inoculated DST tubes and the tubes were entered in the MGIT 960 instrument with 21-day protocol (BACTEC 960 PZA). Results obtained by direct DST were compared with those obtained by indirect DST by MGIT to establish accuracy and time saving by this approach.

Of a total 74 AFB smear-positive specimens set-up for direct DST, 58(78%) specimens yielded reportable results. Average time saving by direct DST as compared to indirect DST, which included time to isolate a culture and perform DST, was 5 days. When results of direct DST were compared with indirect DST, there was 94.8% concordance with INH and 95.7% with rifampicin.

These findings indicate that direct DST with BACTEC MGIT 960 system offers significant time saving and is a reliable method to detect MDR-TB cases.

### PC-302-28 Time saving direct HAIN (Genotype MTBDRplus and MTBDRsl) DST as compared to indirect (MGIT960) DST

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Though Hain's test for INH and RIF has been evaluated in many countries we planned to evaluate the performance and role of this test in our specific settings. We also included Hain's FL, AG/CP and EMB test which has not been evaluated extensively. The aim of this study was to establish performance of these tests as compared with culture-based test and the role of rapid results in our MDR patient program. Sputum specimens were digested and decontaminated (NaOH-NALC), concentrated by the laboratory routine procedure and were inoculated in BACTEC MGIT 960 as well as LJ medium for primary isolation. All AFB

smear-positive sputum specimens were used for setting up direct DST for First Line (INH, RIF) and Second Line (FLQ, AG/CP and EMB) by the Hain's test. DNA was extracted by using Genolyse kit protocol. Amplification done by GenoType MTBDRplus and MTBDRsl assay was carried out using the HotStar Taq DNA Polymerase from Qiagen. Hybridization performed on strips which are pre coated with wild type and mutant genes of RIF (*rpoB* gene), INH (*katG* and *inhA*), FLQ (*gyrA*), AG/CP (*rrs*) and EMB (*embB*) as well as indirect DST was carried out by using MGIT 960. Out of 196 AFB smear positive specimens setup for direct DST (Hain's), 146 (74.5%) yielded reportable results. Average time to report results by direct DST (GenoType MTBDRplus and MTBDRsl) was 2 days while indirect DST (MGIT 960), which included time to isolate a culture and perform DST, resulting a time saving of 17 days. When results of GenoType MTBDRplus and MTBDRsl direct DST were compared with indirect DST by MGIT 960), there was 91.2% concordance with INH, 95.2% with rifampicin, 96.3% with aminoglycosides (amikacin), 87.8% with fluoroquinolones (ofloxacin) and 63.16% with ethambutol. These findings indicate that direct HAIN's DST offers significant time saving with 74.5% reportable results from smear-positive. Improvement in the sensitivity with ofloxacin and amikacin is needed.

### PC-407-28 Diagnosis of pulmonary tuberculosis using colorimetric methods in high-burden resource-limited countries

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**Background:** Diagnosis of tuberculosis (TB) in high burden and resource limited countries requires rapid and simplified *Mycobacterium tuberculosis* culture methods. The colorimetric detection of *M. tuberculosis* growth is a rapid and simple method for drug susceptibility testing that could potentially be used for the detection of *M. tuberculosis* directly from sputum. We evaluated the performance of 2 colorimetric methods, the Nitrate Reductase Assay (NRA) and the Resazurin Tube Assay (RETA), to detect *M. tuberculosis* in sputum of TB suspects.

**Method:** Prospective accuracy study in Mbarara, Uganda, using the combination of Löwenstein-Jensen (LJ) and Mycobacterium Growth Indicator Tube (MGIT) as reference standard. The best quality of 2 specimens collected from TB suspects was decontaminated and inoculated in MGIT, LJ, NRA and RETA. The NRA and RETA results were read after 10, 14, 18 and 28 days of incubation.

**Results:** A total of 398 patients were enrolled. Reference standard was positive, negative or contaminated



in 87 (21.9%), 278 (69.8%) and 33 (8.3%) cases, respectively. The contamination rates were 12.8% and 6.6% for NRA and RETA, respectively. The sensitivities of NRA and RETA were 90.1% (95%CI 80.7–95.9) and 83.1% (95%CI 72.3–91.0) and specificities 92.2% (95%CI = 87.7–95.5) and 98.2% (95%CI 95.5–99.9). For the smear negative patients the sensitivities of NRA and RETA were 66.7% (95%CI 38.3–85.8) and 47.4 (95%CI 24.4–71.1) and specificities 92.7% (95%CI 86.9–96.7) and 98.6% (95%CI 96.1–99.7) respectively. The median time to detect a positive result was 10 days for NRA and RETA compared to 7 for MGIT and 23 for LJ.

**Conclusions:** Applied directly on sputum samples, colorimetric methods have low contamination rates, good sensitivities and rapid times to positivity. However, the high proportion of false positive NRA results and the moderate sensitivity of both methods in smear-negative TB suspects may question their utility in routine practice.

#### PC-532-28 TM-REST consortium: development of a platform for diagnosing TB and other poverty-related diseases

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**Background:** Drug-resistant *M. tuberculosis* strains are a threat to tuberculosis (TB) control worldwide and more advanced, fast and affordable technologies are needed to strengthen laboratory capacity for diagnosis of multidrug resistant (MDR) cases.

**Aim:** An EU Funded Project to develop a new rapid diagnostic tool for MDR-TB using a lab-on-chip (LoC) platform suitable for testing other poverty related diseases.

**Methods:** The LoC (In-Check™) provides an all-in-one device for fast amplification of target DNA followed by hybridization on a low-density microarray. Most relevant mycobacterial species are identified by targeting the 16S rDNA and IS6110 insertion sequence. Probes specific for mycobacterial species were designed. A multiplex PCR was developed to amplify *rpoB*, *katG*, and *inhA* as the most frequently mutated genes involved in resistance to rifampin and isoniazid in species belonging the *M. tuberculosis* complex. Specific probes targeting the hot-spot region of *rpoB*, the

codon 315 of *katG*, and nucleotides -15 and -8 in the promoter region of *inhA* were designed.

**Results:** The In-Check™ platform was evaluated on isolates and smear positive clinical specimens. Selected probes allowed identification of *M. tuberculosis* complex, *M. avium*, *M. intracellulare*, *M. simiae*, *M. kansasii*, *M. scrofulaceum*, *M. abscessus*, *M. chelonae*, *M. xenopi*, *M. haemophilum* and *M. fortuitum*. The assay detects the following mutations involved in drug resistance: D516V, S531L (*rpoB*), S315T (*katG*), and c-15t, t-8c, t-8a (*inhA*). Other mutations at codons 533, 526 (*rpoB*), and 315 (*katG*) are identified by a negative signal from wild-type probes. Detection limit is 10 000 bacteria/mL.

**Conclusion:** The In-Check™ platform represents an innovation for its simplicity of use, rapidity and cost-effectiveness and it is particularly suitable for different diagnostics purposes. This is the first device for molecular detection of malaria and TB on the same platform. This assay is undergoing field test in Uganda.

#### PC-643-28 Validation of the Roche LightCycler Mycobacterium Detection Kit

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**Background and objectives:** To validate the Roche LightCycler® Mycobacterium Detection Kit (MDK), (real-time PCR technology) for the rapid detection of *M. tuberculosis*, *M. avium* and *M. kansasii*.

**Methods:** All specimens ( $n = 1324$ ) submitted for tuberculosis culture investigation, as per CDC guidelines was collected over two days, in addition to smear positive specimens, which were collected within 5 days ( $n = 188$ ). Auramine-O staining and culture using the MGIT 960 system were carried out on all specimens. Differential testing was done by either the Capillia test or the MTBDRplus® LPA. DNA was extracted from the residual specimen using the MAGNAPURE instrument and amplified on the LightCycler® by making use of the MDK. The tiered standardized diagnostic algorithm (SDA) results were considered to be the gold standards for diagnosis.

**Results:** Three of the 17 LightCycler runs were invalid since the internal controls failed to amplify, resulting in a final number of 1292. The sensitivity, specificity, positive predictive value and negative predictive value for smear microscopy against the site-specific SDA tests were 77.82%, 95.12%, 91.76% and 86.01%, respectively. The results for the Roche MDK in contrast were 91.04%, 72.79%, 64.10%, and 93.82%, respectively. The respective values for the MGIT 960, and differential testing were; 87.90%, 79.11%, 73.99%, 90.63%; and 90.71%, 79.64%, 74.15%, and 93.01%, compared to the Roche MDK.

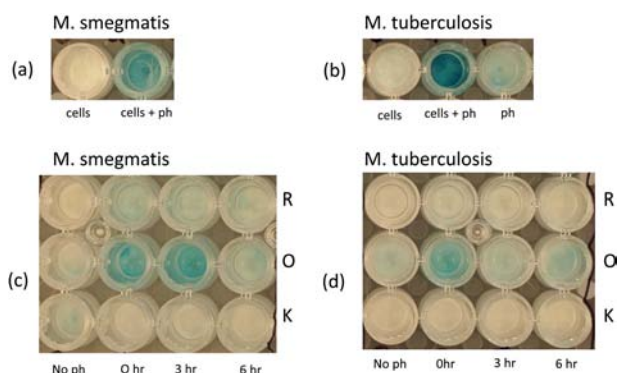
**Conclusion:** The assay detected 76.6% of confirmed TB cultures, but also detected 20.8% false positives when compared to culture and PCR negative specimens. It was found in this setting that the assay and instruments was not very user friendly and does not save time due to the initial heat-kill of the specimens prior to DNA extraction. This assay may be valuable in low-throughput settings.

### PC-694-28 A novel 'blue spot' reporter phage assay for TB drug susceptibility detection within 24 hours

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**Background:** As the incidence of MDR-TB and XDR-TB increases, new tools for rapid detection and drug susceptibility testing are urgently needed. An inexpensive diagnostic test requiring no additional equipment or training would be an important advance in TB management at the community level. We constructed a mycobacterial reporter phage using the *lacZ*/B-gal system. *M. tuberculosis* cells infected with the phage produce blue spot easily discernable by naked eye. In the presence of drugs, resistant cells produce blue while susceptible cells show strong blue signal loss.

**Design/methods:** Mycobacterial reporter phage phAE467 expressing *lacZ* under the P<sub>Left</sub> promoter of L5 was constructed using the temperature sensitive derivative of TM4. The phage phAE467 infects and



**Figure** Cells infected with mycobacterial phage phAE467: (a) *Mycobacterium smegmatis* (mc<sup>2</sup>155) 10<sup>5</sup> cells/ml resulting in a blue positive result, contrasted with uninfected cells. (b) *Mycobacterium tuberculosis* (mc<sup>2</sup>6230) 10<sup>5</sup> cells/ml resulting in a blue positive result, contrasted with uninfected cells and phage alone. (c-d) *M. smegmatis* and *M. tuberculosis* cells treated with Rifampin (R), Ofloxacin (O) and Kanamycin (K), with phage infection at progressive time points. Diminished blue color compared to non-drug infected wells (panels a and b above) indicates drug efficacy in susceptible TB.

expresses the reporter gene but does not lyse the cells at 37°C. Stains of *M. smegmatis* (mc<sup>2</sup>155) and *M. tuberculosis* (mc<sup>2</sup>6230) were grown in liquid culture, incubated with drug and phage at various time points, and then spotted onto a 96-well filter-bottom plate. X-gal substrate was added and changes in blue color were assessed.

**Results:** Initial tests detect drug susceptibility at 10<sup>5</sup> cells/ml within 24 hours (Figure). The presence of blue color indicates metabolically active TB cells. The absence of blue color after overnight treatment with rifampin or kanamycin demonstrates strain drug susceptibility. Treatment with ofloxacin leads to a more gradual decay in color intensity.

**Conclusion:** While further study is necessary to improve sensitivity of the assay and test in drug resistant TB strains, this promises to be a powerful tool for the diagnosis of MDR/XDR-TB.

### PC-768-28 Rapid molecular testing for multidrug-resistant tuberculosis in NRTL, Mongolia, supported by WHO/TDR

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**Background:** The aim of the present study is to assess the performance and feasibility of molecular line probe assay for the rapid detection of rifampicin and isoniazid resistance in the setting of Mongolia.

**Methods:** The study covered 150 MDR-TB suspects from Ulaanbaatar city July 2009 and May 2010. Patients' sputum specimens were subjected to conventional culture and DST, and to LPA using Genotype MTBDRplus.

**Results:** A total of 109 *M. tuberculosis* isolates and 41 smear-positive sputum specimens were tested by GenoType MTBDRplus assay. Of 109 isolates, 10 and 3 were INH- and RIF-resistant, respectively, with 39 of MDR-TB strains. The correlation of indirect LPA and conventional results was observed: the sensitivity, specificity, PPV and NPV for RIF resistance were 100%, 98.5%, 96.9%, and 100%, respectively; 98.0%, 100%, 100% and 98.8% for INH resistance, respectively; 98.3%, 100%, 98.4%, and 98.7% for MDR, respectively. As for the 41 *M. tuberculosis* isolates from smear-positive specimens, weren't INH- and RIF-resistant, respectively, with 21 of MDR-TB strains. Correlation of direct LPA and conventional results: the sensitivity, specificity, PPV and NPV for RIF resistance were all 100%, respectively; all 100% for INH resistance, respectively; 98.3%, 100%, 98.4%, and 98.7% for MDR, respectively. Our study found high proportion of S531L substitution (MUT3) with 80.6% of all RIF-resistant strains, corresponding to

83.3% of MDR. Other mutations in 530–533 were common, as detected by the lack of binding to WT8 probe. Of all INH-resistant strains, 34.3% had a mutation in *katG*, and 64.3% had a mutation in *inhA*. Three strains had mutations both in *katG* and *inhA*. **Conclusion:** The Genotype® MTBDRplus assay represents a rapid, reliable and highly accurate tool for early detection MDR-TB for the routine direct detection of *M. tuberculosis* strains and of strains resistant to INH and RIF in smear-positive, highly infectious patients within 1 to 2 days.

### PC-852-28 Analysis of patterns of multidrug resistance in *M. tuberculosis*

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**Objective:** To implement analysis of patterns of multidrug resistance (MDR) in *M. tuberculosis*.

**Materials and methods:** Patterns were studied at 81 MDR-TB patients including 35 XDR-TB patients (MDR-TB with resistance to ofloxacin, aminoglycosides and/or polypeptide), being under treatment in CTRI RAMS. Drug susceptibility tests were done by the BACTEC method.

**Results:** 8 MDR-TB patients had resistance to 3–5 (4 in average) TB drugs. All patients had resistance to isoniazid (H), rifampicin (R), streptomycin (S), 3 patients to ethambutol (E) and ethionamide (Eto), 2 patients to pyrazinamide (Z). 38 MDR-TB patients treated with TB drugs before had pattern of resistance to 5–8 TB drugs (6 in average). All TB patients had resistance to H, R, 92.1% of patients had resistance to E, 86.8% to S, 73.7% to Z, 60.5% to Eto, 39.5% to ofloxacin (Ofx), 34.2% to amikacin (Am) and 15.8% to capreomycin (Cm). 2 patients were diagnosed with XDR-TB and they had resistance to 6 and 7 TB drugs. Besides resistance to the 4 first-line drugs H, R, S and E they had resistance to Am, Ofx, and 1 patient had resistance to Eto. 33 XDR-TB patients previously treated by TB drugs had pattern of resistance to 7–9 drugs (8 in average). All patients had resistance to H, R, Ofx, 97.0% of patients were resistant to Am and E, 93.9% to S, 81.8% to Eto and Z, 54.5% to Cm.

**Conclusion:** Analysis of patterns of primary MDR (including XDR) showed that patients had resistance to 1–3 first-line TB drugs and ethionamide in addition to resistance to isoniazid and rifampicin (for XDR additionally to ofloxacin and amikacin or capreomycin). Drug resistance patterns at MDR-TB (including XDR-TB) patients previously treated by TB drugs include from 5 to 9 TB drugs of the first- and second-lines, what is necessary to take into account choosing empirical regimens of chemotherapy.

### PC-854-28 Evaluation of the Genotype® MTBDRplus assay directly on smear-positive fine-needle aspirates

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**Background:** Seventy-three percent of all tuberculosis cases in South Africa are co-infected with HIV and extrapulmonary disease is common. Six thousand fine-needle aspirates (FNA) of lymph nodes are received annually at the Mycobacteriology Referral Laboratory, Johannesburg for the diagnosis of tuberculosis. The FNA specimens are processed for smear (Auramine O, WHO grading system) and culture prior to identification and drug susceptibility testing by the Genotype® MTBDRplus (HAIN Lifescience). The Genotype® MTBDRplus has been validated for use directly on smear-positive respiratory specimens and on culture-positive specimens. The aim of the study was to evaluate the performance of the Genotype® MTBDRplus directly on smear-positive FNA specimens.

**Methods:** Ninety-nine unprocessed smear-positive FNA specimens were analysed directly by Genotype® MTBDRplus according to the manufacturer's protocol for smear-positive respiratory specimens. The specimens were subsequently cultured in the MGIT 960 system (Becton Dickinson). Results of the Genotype® MTBDRplus performed directly on the FNA specimens and on the positive MGIT cultures were compared.

**Results:** Results of the Genotype® MTBDRplus performed directly on the FNA specimens and on the positive MGIT culture were concordant in 90% of specimens analysed. Genotype® MTBDRplus results that were discordant were more likely to occur with FNA specimens that were scanty smear positive or that consisted predominantly of neutrophils.

**Conclusion:** The Genotype® MTBDRplus was successfully performed directly on smear-positive FNA specimens with no modifications to the manufacturer's protocol. In addition, FNA specimens did not need to undergo decontamination prior to performing the Genotype® MTBDRplus. Integrating this testing into a routine TB diagnostic algorithm will decrease time to detection of drug-resistant tuberculosis.



### PC-919-28 Evaluation of the Xpert® MTB/RIF assay for rapid detection of *M. tuberculosis* and rifampin resistance

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**Background:** The GeneXpert MTB/RIF assay is a real-time PCR test that will simultaneously identify *M. tuberculosis* complex (TB) and detect rifampin resistance, which is an excellent surrogate marker for MDR-TB resistance, directly from clinical specimens in less than two hours. The aim of the present study was to evaluate the effectiveness of this technique in respiratory and extra-pulmonary samples in a laboratory ability for mycobacterial culture without specialized technical molecular biology unit.

**Methods:** Two hundred fourteen samples submitted for routine smear and conventional liquid and solid culture methods from three microbiological laboratories were used to evaluate the MTB/RIF assay. We tested 174 respiratory and 40 extra-pulmonary samples prospectively.

**Results:** Among culture-positive samples, the assay identified all samples with smear-positive tuberculosis and 71.4% (10/14) with smear-negative tuberculosis (Table). The sensitivity was 88.8% and the specificity 100%. The assay was negative for 11 Non Tuberculosis Mycobacteria (MNT) culture-positive samples, including those smear-positive. Amongst the 32 samples detected by MTB/RIF assay as compared with phenotypic drug-susceptibility testing, 30 were correctly identified as sensitive to rifampin. For two samples detected as resistant, no *rpoB* mutations associated with rifampin resistance was found using GenoType MTBDRplus as alternative method, as well as phenotypic testing.

Results	Pulmonary samples	Extra-pulmonary samples	Total
Xpert- Smear- Culture-	139	28	167
Xpert- Smear- Culture+ TB	4	0	4
Xpert+ Smear+ Culture+ TB	20	2	22
Xpert+ Smear- Culture+ TB	4	6	10
Xpert- Smear+ Culture+ MNT	2	4	6
Xpert- Smear- Culture+ MNT	5	0	5

**Conclusion:** Its rapidity, simplicity and low laboriousness make the technique a good candidate for routine use in many clinical laboratories. This assay, validated on respiratory samples, seems to be usable for extra-pulmonary samples.

### PC-1031-28 Performance of thin-layer agar versus Mycobacterium Growth Indicator Tube for TB diagnosis

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**Background:** TB diagnosis method using sputum smear microscopy is simple to perform but has a low sensitivity. Löwenstein-Jensen (LJ) culture is more sensitive, but takes 6–8 weeks to provide the results. TLA and MGIT are two new methods which can be potential alternatives for TB diagnosis under programmatic settings in high burden countries. We aim to test the performance of TLA and MGIT for diagnosing TB cases in Jogjakarta, Indonesia.

**Methods:** TB suspects who were registered in 2 lung clinics in Jogjakarta, Indonesia, were asked to submit spot sputum samples in addition to the routine spot-morning-spot samples required by the national TB program algorithm. The samples were processed for MGIT, TLA, and LJ culture in the microbiology laboratory of the Faculty of Medicine, Gadjah Mada University to detect the presence of *Mycobacterium tuberculosis*. We evaluated the sensitivity and specificity of MGIT and TLA using LJ as the gold standard. We also calculated the mean duration for a positive result.

**Results:** From 1st August 2010 to 10th December 2011, we collected 398 sputum samples. The sensitivity of TLA and MGIT are 73.8% and 76.5% respectively, while the specificities are 94.1% and 92.3%. The mean durations to a positive result are 13.12 days and 19.77 days respectively.

**Conclusion:** TLA and MGIT have comparable accuracy, but TLA has shorter duration to provide positive result.

### PC-1069-28 Contribution of Xpert® MTB/RIF assay in the management of patients with smear-positive tuberculosis

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**Aim:** Because of its contagiousness and the emergence of multidrug resistance strains, tuberculosis (TB) remains a major public health problem. The conventional diagnosis is based on the detection of *M. tuberculosis* complex (MTC) by culture. At the University Hospital of Clamart (France), we systematically perform the automated Xpert® MTB/RIF assay (Cepheid), a nucleic acid amplification-based diagnostic system, on smear-positive samples. This test simultaneously



detects within 2 hours the presence of MTC and rifampicin (RIF) resistance, marker of multidrug resistance (MDR). We evaluated over one year period the impact of this rapid test in the management of suspected TB disease.

**Methods:** 22 patients for which a Xpert® MTB/RIF assay was directly performed on smear-positive samples (98% pulmonary samples and 2% of extrapulmonary) were included. Clinical data were analyzed and Xpert® MTB/RIF results were compared to those of cultures and Genotype MTBDRplus assay (Hain).

**Results:** The M/F ratio was 13/9 with a mean age of 45 years [15–83], 16 patients were born outside metropolitan France, 2 were HIV positive, 4 had a work of health/social. 21 and 1 patients present respectively a pulmonary and axillary abscess. We observed 100% agreement between the results Xpert® MTB/RIF and the other two methods, for the identification of strains (17 MTC, 1 *M. intracellulare*, 1 *M. kansasii*), and the detection of RIF resistance (1 MTC RIF resistant). The rapid detection of susceptibility to RIF directly on sample helped establish a rapid and proper management of both patients and contacts. The negative results Xpert® MTB/RIF test have permitted to remove the airborne precaution for 2 patients with nontuberculous mycobacteriosis.

**Conclusion:** In our study, the test Xpert® MTB/RIF has allowed to confirm or invalidate the diagnosis of TB for 100% of patients. It helped to reinforce the airborne precaution and quickly adjust the treatment, thereby preventing the spread of TB and MDR-TB.

#### PC-1097-28 Evaluation of a manual nucleic acid amplification test for tuberculosis detection

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**Aim:** To improve the diagnostic capacity of microscopy centers and replace labor-intensive and often insensitive smear microscopy, simpler and more accurate tests are urgently needed. We aimed to determine the performance of a rapid nucleic acid amplification test, LAMP (Loop-mediated isothermal amplification), in combination with a simple, manual sample processing method, for the detection of pulmonary tuberculosis (TB).

**Methods:** A multi-center, blinded, cross-sectional study was carried out between March 2010 and January

2011 at four reference laboratories to evaluate the performance of LAMP compared to smear microscopy, solid culture and liquid culture. Consecutive TB suspects were enrolled and provided 2 sputum specimens each. We report here the preliminary results of this evaluation.

**Results:** A total of 902 adults with suspected TB were included. In smear-positive, culture-positive cases, the overall sensitivity of a single, direct LAMP compared to two direct smear microscopy and four cultures was 76.1% (95%CI 71.5–80.1) and 52.0% (95%CI 44.7–55.2) in smear-negative, culture-positive cases. The LAMP specificity was 94.0% (95%CI 91.7–95.8) among smear-negative, culture-negative cases. Specificity was significantly lower in one of the four sites (92.0% compared to >95% for the other three sites).

**Conclusions:** This assessment confirms the good sensitivity of LAMP, particularly in smear-negative, culture-positive cases for the detection of pulmonary TB. Further studies are ongoing to determine the cause of the suboptimal specificity at one of the sites and the feasibility of implementing TB LAMP at microscopy centers in disease-endemic countries.

#### PC-1156-28 The impact of the genotype MTB-DR plus test on time to diagnosis and treatment of MDR-TB in Rwanda

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**Background:** Multidrug-resistant (MDR) and extremely drug-resistant (XDR) tuberculosis (TB) are a critical public health problem in sub-Saharan Africa. Effective diagnostic technology to identify drug resistant cases at treatment onset would eliminate this problem, but availability of these tools remains limited in high burden TB settings. Line probe assays, rapid polymerase chain reaction (PCR) based tests would be a tool of choice.

**Method:** From January to December 2010, all samples submitted for routine drug sensitivity testing (DST) according to national algorithm were tested by LED microscopy and culture on Löwenstein-Jensen (LJ) at the National Reference Laboratory (NRL). DST was done by proportion method and PCR on either sputum or isolates. Laboratory turn-around time (TAT) was compared for the three techniques and its impact on death rate before second-line treatment initiation was assessed.

**Results:** 249 isolates were tested by the proportion method on LJ culture; 144 (58%) isolates were tested by MTBDRplus tests on culture and an additional 20 (8.03%) MTBDRplus tests were done directly on

sputum samples. In total ninety patients were confirmed MDR-TB. The median laboratory TAT was 79 days for the proportion method, 50 days for the GenoType® MTBDRplus on culture and 3.5 days on sputum ( $P < 0.01$ ). Only 4 patients died before second-line TB treatment was initiated. This represents a significant decrease in the death rate before initiation of second line treatment from 15% in 2008, 12.5% in 2009 to 4.4% in 2010.

**Conclusion:** In comparison with existing DST methods, the GenoType® MTBDRplus assay reduced time to diagnosis and treatment of MDRTB cases in Rwanda. This technique should be scaled up and future studies are ongoing to evaluate GenoType® MTBDRplus assay sensitivity and specificity for INH, RIF and MDRTB compared to the proportion method and MGIT 960, as well as the cost associated with widespread implementation.

#### PC-1257-28 Improvement of extra-pulmonary tuberculosis diagnosis by liquid culture systems *Mycobacteria Growth*

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In the last decade the incidence rate of extrapulmonary tuberculosis (EP-TB) has increased. The lymph nodes and pleural TB are the principal localizations of EP-TB.

In order to improve EP-TB diagnosis, we evaluated a manual liquid-based medium and nonradioactive system, *Mycobacteria Growth Indicator Tube* (MGIT), with individual clinical specimens collected in reference laboratory in Tunisia between 2009 and 2010.

The main purpose was to compare the rate of recovery of *Mycobacterium tuberculosis* complex and the time to detection comparatively to solid culture in Löwenstein-Jensen medium (LJ).

1382 clinical samples were studied (lymph nodes biopsy, pleural liquid, pus . . .), were inoculated on both LJ and MGIT and incubated at 37°C for 60 days. MGIT culture were detected on a 365-nm UV transilluminator.

Among these specimens, 140 were positive (10.1%), 39 were smear positive (27.9%) and 101 smear negative. LJ and MGIT culture recovered respectively 54 (38.6%) and 126 (90%) samples. Cultures were contaminated in 3.3% of cases.

The overall mean time to detection was 26.1 days for LJ and 11.9 days for MGIT.

MGIT has shown a better sensitivity in diagnosis of EP-TB with significant reduction in reporting culture for *M. tuberculosis* complex.

It can be used in developing countries laboratories even in absence of automation.

## IMMUNOLOGY/PATHOGENESIS

#### PC-330-28 Urinary neopterin levels discriminate active from latent *Mycobacterium tuberculosis* infection

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**Background:** A biomarker to discriminate active from latent *Mycobacterium tuberculosis* infection could help in exclusion of occult pulmonary and extra-pulmonary tuberculosis and avoid under treatment of those patients. Neopterin is an aromatic pteridine released by macrophages in response to stimulation by interferon gamma and excreted unaltered in the kidney.

**Objective:** To assess whether urinary levels of neopterin can discriminate between latent and active *M. tuberculosis* infection.

**Methods:** Urinary neopterin/creatinine ratios were determined in patients with active and latent *M. tuberculosis* infection before start of treatment and controls without *M. tuberculosis* infection. Latent *M. tuberculosis* infection was defined as reactive interferon gamma release assay for *M. tuberculosis* in the absence of clinical and radiological evidence of active disease. Neopterin was measured with an ELISA system.

**Results:** Seven patients with active tuberculosis (two extra-pulmonary), 27 patients with latent *M. tuberculosis* infection and seven controls were recruited. There was no difference in age or gender between groups. Urinary neopterin/creatinine ratio was significantly higher in patients with active tuberculosis (412.8  $\mu\text{mol/mol}$ , 95%CI 89.7–735.8) than patients with latent *M. tuberculosis* infection (147.5  $\mu\text{mol/mol}$ , 95%CI 114.0–180.8,  $P < 0.01$ ) and controls (122.2  $\mu\text{mol/mol}$ , 95%CI 71.2–173.1,  $P < 0.01$ ). ROC curve analysis revealed an area under the curve of 0.81 (95%CI 0.62–0.99) for this parameter. A cut-off of 349  $\mu\text{mol/mol}$  showed 100% diagnostic specificity in detection of active tuberculosis in people with *M. tuberculosis* infection.

**Conclusions:** Urinary neopterin/creatinine ratios are significantly higher in patients with active tuberculosis compared to patients with latent *M. tuberculosis* infection or controls. These findings suggest that neopterin appears to be a suitable marker to reflect tuberculosis disease activity.

**PC-533-28 *M. tuberculosis* Central Asian Strain1 isolates with RD149 deletions demonstrate reduce intracellular persistence but elicit increased TNF- $\alpha$  secretion in THP-1 monocytes**

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Central Asian Strain 1 (CAS1) strains are the prevalent *Mycobacterium tuberculosis* genogroup in Pakistan. CAS1 strains carry deletions in RD149 and RD152 regions; however significance of these deletions is unknown. Growth in broth, and persistence within the THP-1 human monocytes of CAS1 strains with RD149 and concurrent RD149-RD152 deletions, of CAS1 strains without deletions and laboratory reference strain, *M. tuberculosis* H37Rv was compared. *M. tuberculosis* induced TNF- $\alpha$ , IL6, CCL2 and IL10 secretion in THP-1 cells was determined.

In broth culture CAS1 strains without deletions grew faster than strains with RD149 ( $P = 0.024$ ) and concurrent RD149-RD152 ( $P = 0.025$ ) deletions and also in comparison with H37Rv ( $P = 0.036$ ). CAS1 strains with RD149 deletions showed reduced intracellular persistence compared to H37Rv ( $P = 0.038$ ), CAS1 (without deletions,  $P = 0.029$ ) and CAS1 with RD149-RD152 deletions ( $P = 0.037$ ). All CAS1 strains induced higher levels of TNF- $\alpha$  and IL10 in THP-1 monocytes than H37Rv. However, within CAS1 groups, strains with RD149 deletions induced higher TNF- $\alpha$  secretion as compared to strains without deletions ( $P = 0.013$ ). No difference was observed between levels of IL6 and CCL2 induced by the strains. CAS1 with RD149 deletions from extrapulmonary sources grew faster in THP-1 cells and induced lower levels of TNF- $\alpha$  and IL6 than strains from pulmonary sources.

These data suggest that CAS1 strains without deletions grow faster and induce higher levels of macrophage modulatory cytokines than H37Rv. RD149 deletion appears to reduced intracellular persistence and increase TNF- $\alpha$  in these strains. Amongst CAS1 strains with RD149 deletions, higher growth and lower cytokine response of extrapulmonary isolates may provide an advantage for dissemination.

**PC-595-28 Immunophenotyping of lymphocytes and monocytes in patients with tuberculosis in Brazil**

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**Background:** Tuberculosis (TB) is a major health problem worldwide. The cellular immune response plays an important role in determining the outcome of infection and disease due to *Mycobacterium tuberculosis*.

The aim of this study was to determine the changes taking place in the lymphocytes and monocytes sub-populations, in the blood of patients with pulmonary and extrapulmonary TB.

**Design/methods:** This cross-sectional study was done at Hospital das Clínicas, Universidade Federal de Minas Gerais, Brazil.

**Results:** A total of 20 patients with pulmonary TB, 14 patients with extrapulmonary TB, and 20 healthy volunteers with negative tuberculin skin test (TST) was studied. Some markers were evaluated by Flow cytometry, such as: CD3, CD4, CD8, HLADR, CD56, CD16 and CD14. There were no significant differences in the values of CD4 and CD8 lymphocytes among the groups. However, these phenotypes express more HLD-DR in TB patients with any clinical form. Pulmonary TB patients showed more NKT cells (CD3+CD56+) than extrapulmonary TB patients and control volunteers. Moreover, extrapulmonary TB patients presented decreased levels of mature NK (CD3CD56+CD16+) and NKdim (CD3CD56+dimCD16+) cells, when compared with pulmonary TB and control patients. The percentage of monocytes 'like' (CD14+CD16+) did not differ between groups, but TB pulmonary and TB extrapulmonary groups showed increased levels of pro-inflammatory monocytes (CD14+CD16+HLADR++). There were significant changes in the cellular immune response, particularly affecting the CD4, CD8 lymphocytes and monocytes, in the immune response against the bacillus. In addition, greater participation of NKT cells in pulmonary TB, and smaller participation of mature NK and NKdim cells in extrapulmonary TB subjects were also observed.

**Conclusion:** Thus, we can infer that these cells are involved in modulating the immune response and the occurrence of pulmonary and extrapulmonary forms of TB.

**PC-597-28 Cytokine production by double negative cells in tuberculosis and its correlation**

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**Background:** Recent studies have reported an important role of double negative (DN) alpha/beta and gamma/delta T cells, in the organism defense against intracellular pathogens. The aim of this study is to evaluate the cytokines profile produced by DN cells, in severe and non severe tuberculosis (TB) patients.

**Design/methods:** Twenty patients and ten healthy volunteers presenting negative tuberculin skin test (TST) were studied.

**Results:** Peripheral blood mononuclear cells were cultured in vitro for 48 hours. Then, the intracytoplasmic



cytokines production was evaluated by Flow Cytometry, using the following markers: CD4, CD8,  $\alpha\beta$ ,  $\gamma\delta$ , INF $\gamma$  and IL10. It was observed that 88.9% of the DN $\alpha\beta$ + and  $\gamma\delta$ + cells of non severe TB patients were great producers of IFN- $\gamma$ , whereas 100% of DN $\alpha\beta$ + and 88.9% of DN $\gamma\delta$ + cells in severe patients were great producers of IL-10. The overall production of cytokines by the cellular subpopulations studied in each subject was evaluated, and it was found that in the non severe TB 44% of DN $\alpha\beta$ + cells presented inflammatory profile, 44% showed a mixed profile, and none a regulatory profile. While in the severe TB, none of these cells showed inflammatory profile, 44% presented a mixed profile and 56%, regulatory profile. The DN $\gamma\delta$ + cells analysis showed 33% with inflammatory, 56% mixed, and none regulatory profiles in non severe patients; and none with inflammatory, 56% mixed and 33% regulatory profiles in severe patients. Moreover, there was a negative correlation between IFN- $\gamma$  and IL-10 for non severe TB ( $r = 0.47$  and  $P = 0.05$ ) and severe TB ( $r = 0.62$  and  $P < 0.05$ ) patients.

**Conclusion:** Thus, it is possible to infer that both, DN $\alpha\beta$ + and DN $\gamma\delta$ + cells of patients with non severe pulmonary TB, present predominant inflammatory immune response that could help to control the infection, when compared to predominant regulatory immune response, as occurring in patients with severe pulmonary TB.

#### PC-774-28 Utility of simple laboratory tests for the diagnosis of meningeal tuberculosis in resource-constrained settings

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**Background:** Tuberculous meningitis is a life threatening condition for which there is a lack of consensus concerning diagnostic criteria. Peruvian national guidelines suggest the use of lymphocyte predominance, as well as high protein and adenosine deaminase levels in CSF as key elements in the diagnosis, but no formal assessment of these criteria has been done. Our objective was to evaluate these laboratory tests criteria for diagnosis of meningeal tuberculosis.

**Design/Methods:** We included patients with clinical suspicion of meningeal tuberculosis admitted to a third level hospital in Lima, Peru. We evaluated the presence of CSF white cell count  $> 5$  with lymphocyte predominance, elevated proteins ( $>45$  mg/dl) and high adenosine deaminase ( $>5$  U/L) levels as predictors. We hypothesized that the presence of the three criteria can reliably confirm the diagnosis of TB meningitis while the absence of all of them can exclude the disease. Reference standard for diagnosis was a

composite one including liquid media cultures, PCR and expert opinion.

**Results:** 64 patients with clinical suspicion of meningeal tuberculosis were included. Mean age was 40.3 years and 72% were females. 29 patients had a final diagnosis of meningeal tuberculosis (17 of them were bacteriologically proven). The 12 patients that fulfilled the three diagnostic criteria had a final diagnosis of meningeal tuberculosis. On the other hand, 4 out of 16 (20%) patients without the three criteria had a final diagnosis of meningeal tuberculosis. Results were similar when excluding non-bacteriologically proven cases. In particular, adenosine deaminase activity levels in CSF showed high specificity (97%) and positive predictive values (94%).

**Conclusion and recommendations:** The combination of mononuclear pleocytosis, high protein and adenosine deaminase levels in CSF can be used as reliable criteria for diagnose meningeal tuberculosis meningitis and start treatment. However, their absence cannot rule out diagnosis.

#### PC-792-28 Mechanisms of progressing of pulmonary tuberculosis

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**Background:** Death of patients with secondary tuberculosis is often associated with progressive pulmonary tuberculosis. The focus in clinical practice is given to dissemination of tuberculosis through bronchi because of the development of panbronchitis.

**Aim:** To assess the nature of dissemination of the progressive pulmonary tuberculosis.

**Methods:** We undertook a retrospective analysis of autopsy material (81 cases, including 70 males and 11 females in the age group of 29 to 49 who died from progressive pulmonary tuberculosis) for the period of 2007–2010. All patients were treated at the regional TB hospital, and duration of illness varied from 1 year to 5 years.

**Results:** Morphological study allowed to establish signs of progressive pulmonary tuberculosis:

- The presence of medium and large cavities with diameter of 4 to 6 cm predominantly located in the right lung;
- The presence of tuberculous panbronchitis;
- The presence of polysegmental tuberculous pneumonia;
- The presence of tuberculous lymphadenitis of hilus.

**Conclusion:**

- 1 Dissemination of pulmonary tuberculosis involves a complex mechanism of propagation of the inflammatory process in the respiratory tract and lymph vessels.
- 2 Analysis of 81 autopsies demonstrated that tuberculous lymphadenitis was not diagnosed in any of the cases when the patient was alive.



### PC-956-28 Autophagy and susceptibility to *Mycobacterium tuberculosis* infection

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**Background:** *Mycobacterium tuberculosis* is an intracellular pathogen which primarily infects dendritic cells and macrophages. *M. tuberculosis* resides and multiplies within a host-derived phagosome where it persists through interference with phagolysosome biogenesis. Induction of autophagy, an innate immune defense mechanism against intracellular pathogens, is associated with augmented mycobactericidal activity of macrophages through increased phago-lysosomal fusion in vitro. The process of autophagosome formation is driven by the activity of the autophagy-related genes (ATG) and host genes which regulate autophagy. Some studies found associations between susceptibility to tuberculosis and polymorphism on autophagy genes, such as P2X7 and IRGM, while other studies examining the autophagy gene ATG16 found conflicting results.

**Methods:** We examined the expression of 36 ATG in monocyte-derived macrophages infected with live BCG and H37rv. In addition, we examined SNPs in a selection of autophagy-genes in 1000 Indonesian sputum-positive TB patients and 1000 matched health controls. Using literature review and NCBI SNP database we selected 19 SNPs (from 13 genes) on ATG with the highest percentage of heterozygosity and strongest clinical association.

**Results and conclusion:** Expression of some ATG in macrophages was downregulated following infection with *M. tuberculosis* H37Rv but upregulated after infection with the less virulent BCG, suggesting that impairment of autophagy may predispose to active TB. Gene polymorphisms associated with active TB in the cohort of Indonesian subjects will be presented, and the implications for future research will be discussed. Autophagy appears to play an important role in protection against *M. tuberculosis*, as shown by these in vitro and patient studies.

### PC-967-28 Specific diagnosis of latent TB sent via mail: IGRAs on paper

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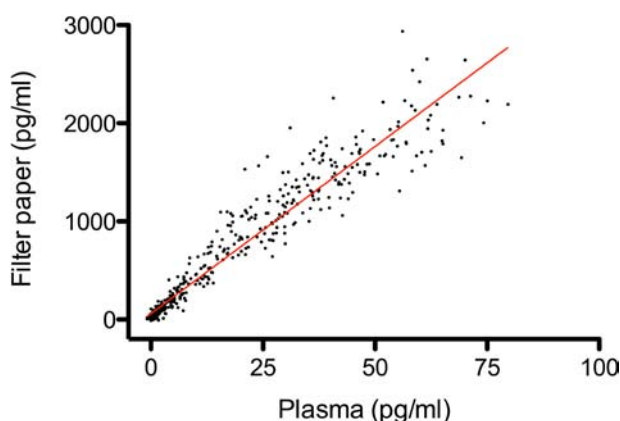
**Setting:** IFN- $\gamma$  release assays (IGRAs) are the most accurate diagnostic tests for latent TB. IP-10 is a

chemokine expressed in concert with IFN- $\gamma$ , but in >100 fold higher levels.

**Objectives:** To investigate whether IP-10 in plasma from *M. tuberculosis* specific antigen stimulated whole blood dried and stored filter paper was stable and could be used for TB diagnosis.

**Methods:** In Spain, whole blood from 78 patients with culture confirmed TB, and 109 healthy controls were subjected to Quantiferon (QFT) testing. Following, IP-10 was measured in plasma supernatant using ELISA and 25 $\mu$  aliquots were dried on Whatman903 filter paper. Filter paper was sent by the standard postal service to Denmark where 2 discs were cut from the filter paper using a normal office 6 mm hole punch. The amount of IP-10 in filter paper was measured using ELISA.

**Results:** Median P-10 levels in TB patients were 1.073 pg/ml (IQR:437–1820) and 27.3 ng/ml (IQR 12.8–45.5) in filter paper and plasma; and in controls 44 pg/ml (IQR:21–105) and 1.0 ng/ml (IQR 0.3–2.0), respectively ( $P < 0.0001$  for both). The correlation between filter paper and plasma IP-10 was very high ( $r^2 = 0.93$ ), figure. The Area Under the ROC curve was comparable 0.89–0.91 for both IP-10 tests and IFN- $\gamma$  and the 3 tests had comparable sensitivity and specificity 74–78% and 100–98%, respectively (all n.s. differences)



**Conclusion:** Plasma from *M. tuberculosis* antigen stimulated blood can be dried on filter paper and transported over long distances at ambient temperature before analysis. Compared to the currently available IGRAs, the filter paper version allows for high throughput centralized analysis, and could increase the dissemination of specific tests for LTBI in resource restraint settings where IGRAs as we know them today are too complicated to do.

### PC-1162-28 Smoking is a risk factor for indeterminate and false-negative interferon-gamma release assay results

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**Rationale:** 10–40% of Interferon Gamma Release Assay (IGRA) results are indeterminate or false negative and often the reason is unknown. Several studies have demonstrated that cigarette smoke impairs interferon-gamma (IFN- $\gamma$ ) responses to antigen and mitogen stimulation, but the impact of smoking on IGRA performance is unknown.

**Objectives:** To evaluate smoking as a risk factor for indeterminate and false negative IGRA results in patients with pulmonary TB from a TB- and HIV-endemic setting.

**Methods:** 80 HIV-positive and 112 HIV-negative patients with bacteriologically confirmed pulmonary TB were tested with the QuantiFERON-TB Gold In tube (QFT-IT) and a Luminex based IP-10 test. Twenty-four of 192 were smokers. The association between indeterminate or false negative QFT-IT or IP-10 test result was determined by multivariate analysis for the following potential risk factors: sex, HIV-infection, smoking and alcohol consumption.

**Measurements and main results:** Smokers had lower antigen dependent IFN- $\gamma$  (median 22 vs. 79.5 pg/ml,  $P < 0.01$ ) and IP-10 (median 939.4 vs. 2446.2,  $P < 0.01$ ) levels and more smokers had an indeterminate or false negative QFT-IT (50 vs. 26%,  $P = 0.03$ ) and IP-10 test result (58 vs. 24%,  $P < 0.01$ ). By multivariate analysis, we found a strong association between smoking and indeterminate or false negative result by both the QFT-IT (OR 7.0, CI: 2.2–22.5) and the IP-10 test (OR 10.8, CI: 3.3–35.4). ORs for HIV-infection were 3.7 (CI: 1.8–7.5) and 4.4 (CI: 2.1–9.5) respectively.

**Conclusions:** Smoking increases the risk of having a false negative or indeterminate IGRA results. IGRA test results should be interpreted with care in smokers.

### PC-1235-28 Evaluation of latent tuberculosis infection in health workers by quantiferon and tuberculin skin test

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**Introduction:** It is estimated one third of the world population is infected by *Mycobacterium tuberculosis* (TB) and the risk factor of TB infection is contacting with TB patients.

**Aim:** To evaluate the parameters affecting the tuberculin skin test and QuantiFERON-TB Gold tests and the results of both tests used in health care workers for confirming latent tuberculosis infection (LTBI).

**Method:** 94 health care workers who work in Yedikule Chest Diseases and Surgery Hospital participated to this study. The demographic characteristics of cases, working hours and the number of BCG scar were recorded. Tuberculin skin test were applied to all patients and QuantiFERON levels were measured

**Results:** The TST and QTF-G positivities had similar dispersion in gender groups and work types. There were a statistically significant relation between the levels of QTF with work times and ages of all participants. It was determined that there was a statistically significant relationship between positivity of QTF with TST positivities and TST endurance diameters.

**Conclusion:** In this study the findings indicated that QTF is very usefull in determining and following LTBI as a confirming test for healthcare workers who have close and longterm contact with tuberculosis patients and whose TST tests were positive.

### PC-1279-28 Loss of receptors CD27 and CCR7 on *M. tuberculosis*-specific T cells at the site of infection marks active TB

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**Background:** Enumeration of *Mycobacterium tuberculosis*-specific, interferon-gamma (IFN- $\gamma$ ) expressing CD4+ T-cells at the site of infection accurately identifies active tuberculosis (TB). To find additional markers for immune diagnosis, T-cell differentiation markers CD27 and CCR7 were studied on T-cells from both peripheral blood and the site of infection of patients with suspected active TB.

**Methods:** 13 patients with lymphocytic exudates (10 pleural, 2 ascites, 1 arthritis) suspicious for TB were prospectively studied. Flow cytometry for intracellular detection of IFN- $\gamma$  in CD4+ T-cells as well as surface receptor staining (CD27, CCR7 and CD45RO) were performed after overnight stimulation of peripheral blood mononuclear cells and lymphocytes

from the site of disease with early secretory antigenic target (ESAT)-6.

**Results:** In 6 patients active TB was confirmed. As expected, TB patients were shown to enrich *M. tuberculosis*-specific IFN- $\gamma$  expressing CD4+ T cells at the site of infection when compared to blood ( $P < 0.05$ ). No enrichment of *M. tuberculosis*-specific T cells was found in 7 patients with non-TB disease. Both CD27 and CCR7 significantly decreased on CD4+ T cells in TB patients (CD27, median: blood 94.1%, site of infection: 63.6%, CCR7, median: blood 79.9%, site of infection: 43.9%;  $P < 0.05$ , respectively). This finding was even more striking within the memory (CD4/CD45RO+) subset. In contrast, in the non-TB group even an increase of CD27 on the CD4+ and CD4/CD45RO+ subset in the exudates was noted ( $P < 0.05$ ).

**Conclusions:** Active TB can not only be diagnosed by the enumeration of *M. tuberculosis*-specific, IFN- $\gamma$  expressing T cells. Additional signatures such as the decrease of T cell associated CD27 and CCR7 at the site of infection hold promise as new diagnostic tools.

#### PC-1325-28 Sobrevivencia y multiplicidad de diferentes subcepas de *Mycobacterium bovis* BCG en macrófagos de la línea celular THP-1

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**Introducción:** La vacuna de *Mycobacterium bovis* BCG es el único tratamiento para prevenir la tuberculosis y se ha demostrado que la eficacia protectora es muy variable. La protección que confiere la BCG depende de la subcepa empleada además de factores del hospedero y ambientales. La mayoría de las investigaciones se apoyan en la respuesta inmune adaptativa por lo que nuestro objetivo es evaluar la respuesta inmune innata, así como las vías de señalización entre las diferentes subcepas de *M. bovis* BCG en macrófagos humanos.

**Metodología:** Macrófagos THP-1 se infectaron con las subcepas BCG Moreau, Tokio, Danesa, Tice, Phipps y México con un índice de Multiplicidad de 1:10. Se determinaron las bacterias viables a las 4 y 72 h post-infección por ensayo de cuantificación de ATP, se evaluó la producción de nitritos en el sobrenadante y el perfil de citocinas pro-inflamatorias.

**Resultados:** La subcepa BCG México fue fagocitada en mayor número aunque no persistió en el macrófago, al contrario, la subcepa Phipps fue fagocitada en menor proporción pero presentó mayor índice de multiplicidad. Tres de las subcepas se multiplicaron con eficiencia por lo que la producción de nitritos por parte de los macrófagos fue mayor.

**Conclusiones:** Existen variaciones en la persistencia de las seis subcepas BCG estudiadas en macrófagos,

la subcepa Phipps presentó una mayor multiplicidad. La activación del estallido respiratorio en macrófagos infectados con las subcepa BCG Japón, Danesa y Phipps es mayor que la producida con la infección por BCG Moreau, Tice y México. El perfil de citocinas fue distintivo de cada subcepa.

#### PC-1327-28 Producción y caracterización de anticuerpos monoclonales contra *Mycobacterium avium*

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**Antecedentes:** *Mycobacterium avium* perteneciente al complejo de *M. avium* (MAC) es la principal causa de infecciones producidas por el grupo de las micobacterias no tuberculosas y el cuadro clínico es similar a las infecciones producidas por *M. tuberculosis*. Es necesario contar con un método sensible, específico y rápido para la identificación de *M. avium*.

**Objetivo:** Producir anticuerpos monoclonales contra *M. avium* y su caracterización mediante un ensayo de reactividad cruzada y la identificación de las proteínas reconocidas por este anticuerpo monoclonal por medio de inmunoproteomas.

**Método:** Ratones BALB/c fueron inmunizados vía intraperitoneal con *M. avium* irradiada, se fusionaron los esplenocitos y células del mieloma del ratón con mayor respuesta humoral. Las clonas de *M. avium* que presentaron la mayor reactividad por medio de la técnica de ELISA se usaron para su expansión. La caracterización comprendió la identificación de la proteína reconocidas por los anticuerpos por medio de inmunoproteomas y la reactividad cruzada por el método de ELISA.

**Resultados:** Los anticuerpos monoclonales reconocieron 4 proteínas de *M. avium*, tres de metabolismo y una hipotética. Por lo que respecta a la reactividad cruzada, el mayor reconocimiento se obtuvo con *M. avium* de aislamiento ambiental y *M. avium* de aislamiento clínico, las otras especies de micobacterias no tuberculosas no presentaron reactividad cruzada, mientras que las especies pertenecientes al complejo de *M. tuberculosis* presentaron reactividad variada.

**Conclusiones:** Los anticuerpos monoclonales obtenidos reconocen a *M. avium* subespecie hominissuis y la capacidad de reconocimiento fue similar para *M. avium* ambiental y *M. avium* clínica. Estos anticuerpos son útiles para el desarrollo de nuevas herramientas diagnósticas.



## TUBERCULOSIS DIAGNOSTICS: MICROSCOPY AND CULTURE

### PC-23-28 Comparison of bronchoscopy and sputum induction techniques in the diagnosis of sputum smear-negative

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Patients symptomatic of tuberculosis do not always reveal acid-fast bacilli and are recommended to undergo further tests including fiberoptic bronchoscopy and sputum induction. This study aims to compare the diagnostic test characteristics of sputum induction and bronchoscopy techniques in the diagnosis of PTB among symptomatic, sputum smear-negative patients. Search was done through MEDLINE, the Cochrane Controlled Trial Register <http://clinicaltrials.gov>, and bibliographies of relevant trials to obtain studies meeting inclusion criteria. Two investigators independently extracted data and assessed for quality as suggested by Whiting et al. Sensitivity and specificity, diagnostic odds ratios and their forest plots as well as the SROC curve and its area under the curve (overall summary of test performance) were determined for each test. Heterogeneity was analyzed using  $\chi^2$  and  $I^2$  statistic. Publication bias was evaluated and analyses were performed using statistical software (Stata, version 10.0). Five prospective studies were obtained. The pooled summary indices showed that sputum induction sensitivity is 0.57 (95%CI 0.51–0.63) and specificity is 0.99 (95%CI 0.97–1.00). Whereas for bronchial lavage, the sensitivity is 0.42 (95%CI 0.34–0.51) while specificity is 0.99 (95%CI 0.97–1.00). Sputum induction showed more heterogenous results for sensitivity ( $\chi^2 = 48.5, P = 0.000$ ) compared to bronchial lavage ( $\chi^2 = 10.17, P = 0.0172$ ). Sputum induction has better sensitivity, comparable specificity and higher level of overall accuracy compared to bronchial lavage in diagnosing for sputum smear negative tuberculosis. It is our recommendation that sputum induction be used first if there is a need to further obtain sputum specimen for patients suspected of having tuberculosis that have negative spontaneous sputum smears or are unable to produce sputum spontaneously.

### PC-188-28 Performance of microscopy compared to culture for tuberculosis diagnosis in induced sputum samples

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**Background:** Improved detection of pulmonary tuberculosis is needed to improve control and reduce the global burden of the disease. Resource limited settings rely on examination of sputum by microscopy to diagnose the disease but the sensitivity of the test is poor and case detection rates are low. Sputum induction is proposed as a way to improve sample collection and enhance the sensitivity of the test. We undertook a systematic review of studies comparing the sensitivity of microscopy and culture in induced sputum samples.

**Methods:** We ran duplicate searches of databases (up to October 2010) and searchable websites of major HIV and tuberculosis conferences (up to November, 2010) to identify studies comparing the performance of microscopy and culture on induced sputum samples.

**Results:** 18 studies met our inclusion criteria. The overall success of the induction was high 96.2% (95%CI 94.5–97.9), while adverse events associated with sputum induction were infrequent and mild. The sensitivity of microscopy compared to culture ranged from 0% to 77.8%, with an overall pooled estimate of 41.8% (95%CI 30.3–53.2,  $\tau^2 = 0.50$ ); only two studies reported on specificity of microscopy compared with culture. Yield was higher for sputum induction compared to nasopharyngeal aspiration and gastric lavage; and equally well compared to bronchoalveolar lavage and physiotherapy.

**Discussion:** Sputum induction is useful people who are negative on spontaneous smear microscopy or unable to expectorate spontaneously, and is well-tolerated by children and adults, irrespective of HIV-status. Smear microscopy is a practical alternative to culture in remote settings.

### PC-298-28 Mycobacterial culture yields from gastric aspirates collected with and without sodium bicarbonate

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**Background:** TB among children is an important public health problem and an indicator of recent



transmission of TB in the community, yet remains neglected due to poorly defined diagnostic criteria. Microbiological confirmation of pulmonary TB in children relies on culture of gastric aspirate specimens (GAs). NaHCO<sub>3</sub> is commonly used to neutralize the acidic pH of gastric aspirates. Here, we evaluate if neutralization of acidic pH of GA improves *M. tuberculosis* culture yields in children

**Methodology:** 116 children of either sex, aged 6 months to 14 years (median 117 mo and IQR 79–144 mo) attending pediatric TB clinics, Delhi, India. Subjects, with clinical and radiological criteria consistent with suspected PTB, underwent gastric aspiration and at least 5 ml of GA was collected. Each GAs was divided in to two equal aliquots; one neutralized with 5 ml of NaHCO<sub>3</sub> (100 mg/ml) while the was processed directly. The samples were processed in a blinded manner by the modified Petroff's method. After decontamination, suspension was used for ZN staining and BACTECTM MGIT culture.

**Results:** Out of 232 GAs, 56 (24.1%) samples were culture positive for *M. tuberculosis*. GAs without neutralization gave superior *M. tuberculosis* culture yield (21.5%, 50/232) as compared to GAs neutralized with NaHCO<sub>3</sub> (16.4%, 38/232) ( $P = 0.023$ ). There was 66.5% agreement between the two procedures. Six (2.6%) and 18 (7.8%) samples were additionally positive from NaHCO<sub>3</sub> neutralized and plain aliquots, respectively. There was no significant difference in time-to-detection using the MGIT-960 system [median 24.6 days (IQR: 12–37 days)] [ $P = 0.9$ ]. The contamination rate in non-neutralized GAs was 3.9% and 17.2% in neutralized GAs ( $P = 0.001$ ).

**Conclusions:** Acidic pH of GAs does not hamper growth of *M. tuberculosis* in liquid cultures. Moreover, neutralization of GAs results in unacceptably high culture contamination rates. We recommend that GAs should not be neutralized with sodium bicarbonate prior to culture for *M. tuberculosis*.

### PC-354-28 The use of microscopic observational technique in HIV-positive, smear-negative patients in Uganda

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**Setting:** Patients co-infected with TB and HIV/AIDS are harder to diagnose, more likely to be sputum smear negative on AFB and have a higher mortality. Uganda it is estimated 50% are co-infected with HIV. Microscopic Observational Technique (MOT) has the potential to address the issue of the difficulty in diagnosis of TB in smear negative HIV/AIDS patients.

**Aim:** To evaluate the effectiveness and usefulness of MOT using only patients with confirmed HIV/AIDS with clinically suspected TB (using WHO guidelines) with smear negative sputum.

**Methods:** The study was a cross-sectional observational study. Samples were collected from 383 patients recruited in HIV centres in Kampala, Uganda from July 2008 to July 2009. Processed sputum specimens were inoculated in parallel into MOTS and Bactec 960 MGIT culture systems and compared with gold standard of PCR assay. The patients were over the age of 18 and able to give informed consent. Sputum samples had AFB performed at the sample sites and if had two negative AFB smears, included in the trial. The median and range times to each end point for the different methods were calculated as well as the sensitivity, specificity, positive predictive value and negative predictive value.

**Results:** A total of 396 patients provided two samples of sputum for the study. See Table for sensitivity and specificity of MOT and MGIT. The time to positive result for MOT was median 20.5 days and 31 days for MGIT.

**Table** Sensitivity and specificity of MOT compared with the MGIT result

	MGIT result (gold standard)		Total
	Negative	Positive	
MOT result			
Negative	716	6	722
Positive	10	44	54
Total	726	50	776

**Discussion:** The sensitivity of MOT was slightly less than previously shown. The specificity and negative predictive value of MOT were above 98%. The time to positive result was longer than expected for both techniques. The reason for this is unclear but may represent the lower bacterial load in HIV patients with smear negative sputum. Overall, MOT provided additional accurate results faster than MGIT for this difficult to diagnose population.

### PC-509-28 Culture mycobacterial yield of early morning and spot sputum samples among adolescents in rural Uganda

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**Introduction:** Adolescents are at a high risk of active TB development and it is quite difficult to collect quality sputum samples from them for TB diagnosis. Efficient and effective means of sputum collection to allow early diagnosis are needed. This study provides information on the mycobacterial yield of early morning and spot sputum sample cultures for TB diagnosis to inform practices.

**Objective:** To compare mycobacterial yield obtained by early morning and spot sputum sample cultures among adolescents.

**Study design:** Retrospective cohort.

**Materials and methods:** Sputum samples were obtained from participants in a prospective adolescent TB cohort of 12–18 years of age enrolled from September 2009 to December 2010 in the Iganga/Mayuge Demographic Surveillance Sites (DSS). Samples were decontaminated and digested using sodium hydroxide/sodium citrate and NALC method and inoculated in BBL MGIT 960 TM tubes and two Löwenstein-Jensen (LJ) tubes, incubated for up to 8 weeks. Mycobacterial yield and time-to-detection (TTD) were compared in samples that had mycobacterial growth from at least one media tube. Only 102 completed early morning and spot samples (48.0% and 51.9% respectively) were analyzed for this study.

**Results:** Early morning sputum detected of 6.8% *M. tuberculosis* and 47.0% mycobacterium other than tuberculosis (MOTT) while spot samples detected 4.9% *M. tuberculosis* and 41.1% MOTT and it was not statistically different ( $\chi^2 = 0.5774$   $P = 0.447$ ). There was no statistically significant difference in mean MGIT-TTD (6.14 days,  $\chi^2 = 22.68$ ,  $P = 0.305$ ) for the spot and early morning samples.

**Conclusion:** There is no statistically significant difference in the mycobacterial yield obtained by culturing either early morning or spot samples among TB suspected adolescents in Iganga/Mayuge, Uganda.

### PC-565-28 Clinical impact of false-negative sputum smear microscopy result, Gujarat, India

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**Background:** With >5 years of implementation of external quality assurance (EQA) for sputum smear microscopy in 718 designated microscopy centers (DMCs) in Gujarat state of India, reduction in false negative results was not analysed previously for clinical impact or extension the clinical impact of EQA on TB control activities.

**Methods:** Retrospective cohort study. Records were reviewed for all patients evaluated by diagnostic sputum smear examination at all 718 DMCs in Gujarat in 2009, whose sputum smears were found to have false negative errors during random blinded re-checking (RBRC) of slides at district level. All laboratory registers were reviewed for evidence of repeat sputum examination and TB registers reviewed for evidence of subsequent initiation of anti-TB treatment within subsequent 12 months.

**Results:** In 2009 in Gujarat, of 1284226 total slides

examined under the RNTCP, 77 172 (6%) were re-checked according to the EQA protocol. Among 139 patients with false-negative diagnostic sputum results, 26 (19%) were put on initial anti-TB treatment, 37 (27%) underwent Repeat Examination, of which 28 were initiated on treatment within median duration of 43 days and total 85 patients were not initiated on treatment (61%). Among 109 patients with false-negative errors in follow-up examination, 39 (36%) failed to have their intensive phase of anti-TB treatment extended as per national guidelines, and 38 (35%) patients with AFB-positive at the end of treatment were mis-classified as 'cured', and hence failed to receive drug-susceptibility testing or re-treatment.

Clinical Impact of false negative errors in sputum microscopy on clinical care.

	<i>n</i>	%
Smear-positive TB patients with at least 1 slide with false-negative results on diagnostic examination	139	100
Initiated on anti-TB treatment	26	19
Underwent repeat diagnostic sputum microscopy	37	27
Initiated on anti-TB treatment within 12 months	54	39
Not initiated on anti-TB treatment	85	61
Sputum-positive TB patients with at least 1 slide with false-negative results on follow-up examination	109	100
No clinical impact	32	29
Missed extension of intensive phase of anti-TB treatment	39	36
Missed detection of sputum-positive results at end of treatment, not referred as MDR-TB suspect, and outcome misclassified as 'cured'	38	35

**Conclusions:** Most patients with a false-negative diagnostic sputum smear result subsequently fail to initiate anti-TB treatment, and 2/3rd of those with false negative follow-up results have treatment curtailed or fail to receive evaluation for MDR-TB. Sputum smear microscopy EQA programmes that reduce false-negative results can substantially improve clinical care.

### PC-601-28 Use of bronchoscopic lavage and gastric washing in diagnosis of tuberculosis suspects

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**Objectives:** The aim of the study was to evaluate the frequency of use of gastric washing (GW) and broncho-alveolar lavage (BAL) and their mycobacterial diagnostic contribution in suspected pulmonary tuberculosis (PTB) patients without sputum in private clinic (PCL) and public hospital centers (PHC).

**Methods:** From January to November 2010, GW and BAL from suspected PTB patients were sent by a PCL and the PHC to the 'National Centre against

Tuberculosis' laboratory for analysis. The frequency of specimen use by health center was determined. Furthermore, the presence of acid-fast bacilli (AFB) was determined via direct microscopy. The results were compared using  $\chi^2$  standard or  $\chi^2$  Mantel-Haenszel.

**Results:** GW and BAL were performed in 224 patients (male, 59.8%; mean age,  $45.8 \pm 16.6$  years in adults and  $2.8 \pm 2.9$  years in 30 children whom age < 15 years). Among children, GW was used to 94.4% in PHC, and BAL to 75% in clinic ( $P \leq 0.0001$ ). For any technique performed, samples were used to 33.3% in clinic and to 66.7% in PHC. Among any age, the study included 91.6% of BAL in clinic and 73.3% of GW in PHC ( $P \leq 0.0001$ ). Overall, investigations included 79.5% of GW or BAL in clinic and 20.5% in PHC (OR = 53.8; CI95%: 18.49–156.63,  $P \leq 0.000$ ). For any sample material used, AFB smears-positive were 4.5% (GW, 9.1% and BAL, 3.7%,  $P = 0.109$ ).

**Conclusion:** The frequency of invasive techniques use is higher in PCL (79.5%) than in PHC (20.5%) (OR = 53.8). The mycobacterial diagnostic contribution was more important in GW (9.1%) than in BAL (3.7%).

#### PC-605-28 Sodium hypochlorite sedimentation method, optimises AFB smear microscopy for tuberculosis diagnosis

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**Background:** Direct sputum smear microscopy is the primary diagnostic tool in NTP case finding, but has a relatively low sensitivity especially in individuals co-infected with HIV. This study aimed to compare the sodium hypochlorite sedimentation method and direct sputum smear microscopy in the detection of AFB in sputum smears.

**Methods:** One hundred twelve sputum samples collected from tuberculosis patients from August to October 2010 were processed in parallel at the Public Health Laboratory, Sta Cruz, Manila. Smears were prepared directly from sputum samples (DSSM) and the remaining sputum was processed using the 5.25% sodium hypochlorite (commercial bleach) sedimentation method. All of the smears were examined and read under the oil immersion field and graded according to the National Standard Reference Scale. The differences in the treatment methods was analyzed using the McNemar  $\chi^2$  test.

**Results:** The 5.25% sodium hypochlorite method have a higher AFB yield (30.36%) as compared to the DSSM (13.40%) and this difference is statistically significant ( $P < 0.000$ ). Both methods gave negative results for 77 sputum specimens while 14 sputum smears were found positive by both methods. Thirty four sputum specimen were detected as AFB positive by the sodium hypochlorite method, while only

**Table** Comparison of positive cases detected by DSSM and sodium hypochlorite method

AFB reading	Direct sputum smear microscopy method <i>n</i> (%)	Sodium hypochlorite method <i>n</i> (%)
Positive for AFB	15 (13.40)	34 (30.36)
Negative for AFB	97 (86.60)	78 (69.67)
Total	112 (100)	112 (100)

15 sputum specimen were detected as AFB positive by DSSM.

**Conclusion:** The use of sodium hypochlorite improves AFB detection and can provide protection to health workers from risk of laboratory TB exposure. It makes microscopy safer and easier to perform making it suitable for low resource setting and appear to be promising in HIV-high prevalence population. The impact on case detection and treatment using three sputum specimens processed routinely using this method in a health center set up might be feasible and acceptable.

#### PC-693-28 Maximising the public health benefit of liquid culture for TB diagnosis in low-resource settings

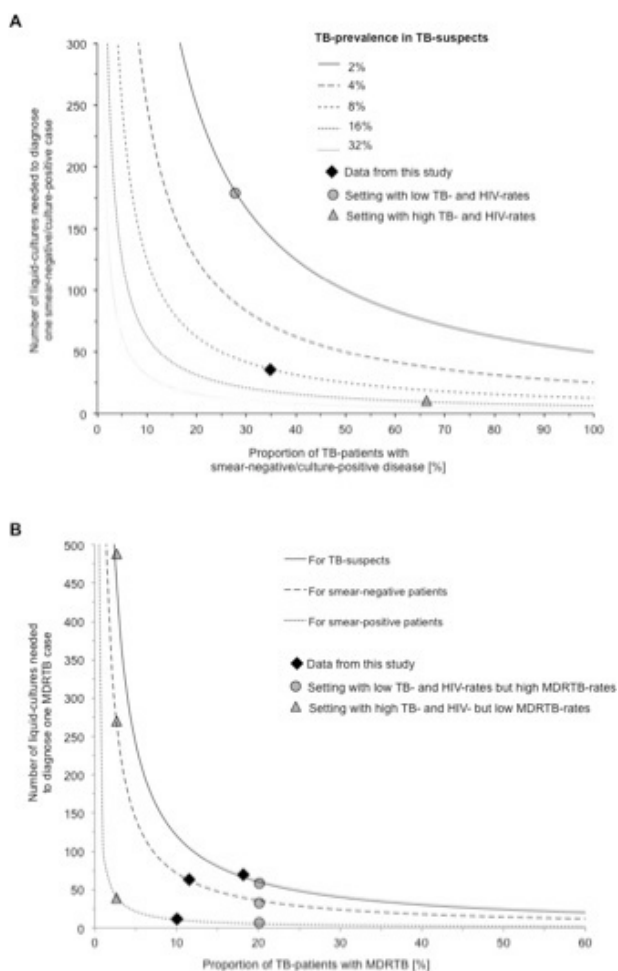
S G Schumacher,<sup>1,2,3</sup> M Tovar,<sup>1,2</sup> E Ramos,<sup>1,2</sup> T Valencia,<sup>1,2</sup> C Osario,<sup>1,2</sup> M Llacza,<sup>1,2</sup> A Gavino,<sup>1,2</sup> C A Evans.<sup>1,2,4</sup> <sup>1</sup>IFHAD: Innovation For Health And Development, London, UK; <sup>2</sup>Laboratory of Research and Development, Faculty of Sciences and Philosophy, Universidad Peruana Cayetano Heredia, Lima, <sup>3</sup>Asociación Benefica Prisma, Lima, Peru; <sup>4</sup>Department of Infection and Immunity & Wellcome Centre for Clinical Tropical Medicine, Imperial College London, London, UK.  
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**Background:** Multidrug-resistant (MDR) and smear-negative TB cannot be diagnosed by smear-microscopy, the only widely available TB-test. A scale-up of modern TB-diagnostics is in progress but little is known concerning optimal implementation-strategies. We determined priorities for implementation to maximize public health benefit where resources are too limited for universal testing.

**Methods:** Liquid-culture with microscopic-observation drug-susceptibility (MODS;  $n = 3982$ ) was evaluated to determine the cost and clinical impact (1) of 1 liquid-culture versus 3 smear-microscopy tests for diagnosing TB in TB-suspects and (2) MDRTB-testing in TB-patients. A model was developed to extrapolate these findings to settings with different TB epidemiology.

**Results:** Despite liquid-culture having 1.5-times greater sensitivity than smear-microscopy (98% vs. 65%,  $P < 0.0001$ ), in Lima (figure, diamonds) 34 TB-suspects needed to be tested with liquid-culture for each clinically important diagnosis made (1 smear-negative case detected, cost US\$484) whereas only 10 smear-positive TB-patients needed to be tested with liquid-culture for each clinically important diagnosis





made (1 MDR-TB case detected, cost US\$142). In contrast, we calculated that in an African setting (figure, triangles) with higher TB-prevalence in TB-suspects, a higher proportion of smear-negative TB and lower MDR-TB rates, less than 10 liquid-cultures would have been necessary to diagnose each TB-suspect, whereas more than 50 liquid-cultures would have been necessary to detect each case of MDR-TB in smear-positive TB-patients. Calculations are also shown for an Eastern European setting (figure, circles).

**Conclusion:** This evidence guides how limited resources for modern TB-diagnostics can be most efficiently employed to maximize their potential utility. This contrasts test-accuracy versus potential public health benefit and demonstrates marked heterogeneity in priorities for the use of modern TB tests in different settings.

## PC-730-28 Sputum collection and transportation system improved case notification and reduced patient cost in India

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**Background:** Tuberculosis diagnosis in India relies on decentralized sputum microscopy centers, but access to these centers is still challenging for much of the rural population. We sought to evaluate the effect of a SCTS in Gujarat State on utilization of diagnostic services and case notification, as well as review operational feasibility and cost effectiveness.

**Objectives:** To assess the impact of the SCTS on TB suspects examination rates (SER), case notification rates (CNR), quality, travel cost and time for patients and provide recommendations for scale-up.

**Methods:** Non-randomized interventional study: SCTS was implemented in a 2.5 million population areas with limited health centre access in 5 districts of Gujarat in January 2007, with 38 sputum collection centres (SCC), innovative transport box (figure), dispatch list, honorarium for transport, staff training and monitoring. We reviewed laboratory and TB registers, and administered questionnaires for providers and patient followed by Focus Group Discussions (FGD) with staff involved. Results were compared with historical controls.



**Figure** Innovation—model of sputum transport box.

**Results:** Compared to 2006, introduction of SCTS in 2007 was associated with a 22% increase in smear-positive CNR, compared to 5% CNR increase observed in 2006 relative to 2005. In interviews of 2010 patients, 90% reported increased convenience of travel to SCCs. For one-way trip, patients saved mean travel cost of Rs 11/- and mean travel time of 38 mins.



Cost of transport to DMC per month (Rs 240/-) was more effective than establishing a microscopy centre. FGD revealed that the SCTS saved patients time and money, facilitated early detection and prompt treatment, but raised concerns on specimen quality.

**Discussion:** Systematic and planned implementation of SCTS improved case notification and was operationally feasible, cost-effective and reduced time and cost to patients from inaccessible areas. Concerns raised on quality of specimens need attention while considering larger scale-up.

### PC-874-28 Contamination reduces sensitivity in the BD MGIT liquid culture system

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**Background:** The automated liquid culture system BD MGIT<sup>®</sup> offers relatively fast time to detection of TB, and a high sensitivity. MGIT cultures are prone to contamination by patient and environmental flora. Reducing the contamination rate requires more aggressive sample treatment causing a loss of viable mycobacteria, thus reducing culture sensitivity.

**Methods:** Sputum samples had been collected from 292 adults suspected to have TB for a different study. Results of conventional testing using liquid culture (BD MGIT) were compared with results of PCR testing (GeneXpert MTB/RIF<sup>®</sup>) done on cryopreserved aliquots from the samples. MGIT cultures which were flagged positive by the instrument, or which were incubated for 8 weeks without positive result, underwent confirmatory acid-fast bacteria (AFB) staining. In samples with positive AFB stain, species determination by line probe assay was done.

Samples that were flagged positive by the MGIT instrument, but which did not yield acid-fast bacilli on any confirmatory stain were declared contaminated. False negativity of MGIT culture was assumed if a sample was tested positive by PCR, but culture did not yield *M. tuberculosis* complex.

**Results:** Of 600 samples with all results available, 523 (87%) were MGIT instrument positive. 391 instrument positive samples were finally declared AFB negative and contaminated. Of these samples, 36 (9.2%) yielded a positive result in Xpert testing, while only 2 of 76 MGIT instrument negative samples (2.6%) yielded a positive Xpert result ( $P = 0.064$ ).

**Conclusion:** We retested cryopreserved sample aliquots using a highly specific PCR method. *M. tuberculosis* complex DNA was detected in 9.2% of contaminated samples, and in 2.6% of MGIT instrument negative samples. We thus conclude that sample contamination reduced MGIT sensitivity. This loss of

sensitivity should be compared to a loss of sensitivity caused by more aggressive decontamination regimens in a prospective setting.

### PC-1021-28 Strong association of quality of sputum specimen and quality of laboratory results

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**Background:** The quality of the sputum specimen is known to have an effect on AFB microscopy and culture yields. However, limited data assessing the performance of MGIT 960 under field conditions and AFB microscopy depending on quality of sputum specimen is currently available.

**Design/methods:** We conducted a cross-sectional analytical study of the performance of MGIT 960 and the factors associated with positive cultures on all samples processed at the Botswana National Tuberculosis Reference Laboratory between April and September 2010.  $\chi^2$ ,  $t$  test and McNemar test were used for the analysis.

**Results:** Overall, mucopurulent (MP) specimens had a yield of 29.8% (340/1142) vs. a yield of 15.3% (171/1117,  $P < 0.001$ ) isolates from salivary specimens (SS) specimens. Among patients with new smear positive, the recovery yield was 94.8% (105/115) from MP specimens and 66.1% (41/62,  $P < 0.001$ ) from SS. Overall, smears were positive on 31.8% (410/1289) MP specimens while AFBs were detected only in 14.2% (174/1229) of SS ( $P < 0.001$ ). The proportion of MP specimens was higher in re-treatment cohort (53.2%, 677/1273) than in new patients (47.2%, 465/986;  $P < 0.01$ ). 53.1% (580/1093) and 47.7% (259/543) specimens were of MP quality from HIV positive and HIV negative patients, accordingly ( $P 0.03$ ) while overall proportion of good quality specimens was 51.1% (1289/2518).

**Conclusion and recommendations:** There is a strong association between MGIT 960 culture recovery and smear positivity rates and quality of sputum specimens which remains after adjustment for HIV status and patient category. Laboratories and TB programs should incorporate the proportion of good quality sputum specimens as an indicator for performance.

### PC-1132-28 Performance and acceptability of the ZEISS Primostar™ fluorescent microscopy for the detection of *Mycobacterium tuberculosis*

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**Background:** Lack of trained laboratory technologists and numbers of tuberculosis (TB) suspects results in increased workloads with negative impact on TB case finding. The currently widely available Ziehl-Neelsen (ZN) light microscopy is time-consuming with poor sensitivity even under optimal conditions. Introduction of Primostar™ iLED microscopy developed by ZEISS in collaboration with FIND using auramine staining may improve TB case finding at high volumes sites in Rwanda.

**Methodology:** In 2009 the Rwanda National TB Program and the National Reference Laboratory (NRL), supported by FIND and in partnership with Columbia University, introduced iLED microscopy at one high-volume referral hospital (CHUK) in Kigali and at a rural Nyamata District Hospital (DH). A demonstration study was carried out at two sites from June 2009 to May 2010 to determine acceptability and effectiveness of iLED microscopy in comparison to fluorescence microscopy FLUOLED developed by FRAEN. ZN microscopy was taken as the gold standard.

**Results:** The results obtained with iLED are highly comparable to ZN in Nyamata: positivity rate of 10%. However, in the context of CHUK (high volumes setting), iLED was observed to be more sensitive than ZN with a positivity rate of 31.1% compared to 7.3% obtained with ZN during the implementation phase. The comparison between iLED and FRAEN in Nyamata showed comparable results with a positivity rate for samples of 11.3%. At the CHUK, out of 752 samples analyzed, Primostar iLED performing better with a rate of 11%, compared to the positivity rate of 8.8% achieved using FLUOLED.

**Conclusion:** Fluorescent microscopy with Primostar iLED system proved to be more suitable than FLUOLED in detecting AFB from paucibacillary samples. Based on the ease of use, the acceptability was greater for both microscopes with the laboratory technicians. Additionally, auramine staining is faster as it reduces the time necessary for the examination by more than half.

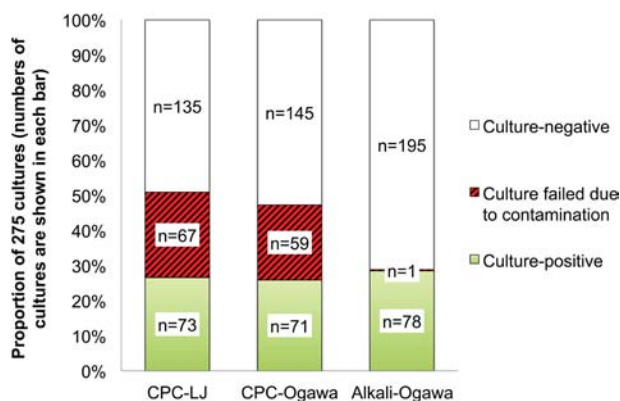
### PC-1213-28 Tuberculosis diagnostic culture after sputum decontamination with cetylpyridinium chloride

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**Background:** Sputum culture is the gold standard test for diagnosing pulmonary tuberculosis (TB). Prior to culture, sputum is usually alkali-decontaminated, killing salivary contaminants to allow the detection of slower growing *Mycobacterium tuberculosis*. However, alkali-decontamination also kills most of the *M. tuberculosis*. The disinfectant cetylpyridinium chloride (CPC) may decontaminate sputum without killing *M. tuberculosis*, potentially increasing diagnostic sensitivity. We therefore evaluated CPC for pulmonary TB diagnosis.

**Methods:** 275 patients with suspected pulmonary TB expectorated 2 ml sputum concurrently into an empty tube and 2 ml sputum into another tube containing 2 ml CPC. The sputum was subjected to standard modified-Petroff alkali-decontamination and then cultured on acidified-Ogawa medium. The sputum-CPC mixture was applied directly to Löwenstein-Jensen (LJ) medium (and also to acidified-Ogawa medium).

**Results:** Considering only the 193 samples that had interpretable (i.e., uncontaminated) results in both tests, CPC had significantly greater sensitivity, detecting 99% (73/74) of positive cultures vs. 88% (65/74) with alkali-decontamination ( $P = 0.03$ ) and there was no difference in speed ( $P = 0.8$ ) or numbers of *M. tuberculosis* colonies detected ( $P = 0.8$ ). However, CPC cultures were uninterpretable because of contamination much more often than alkali-decontamination (25% vs. 0.4%,  $P < 0.0001$ ). The greater sensitivity of CPC was outweighed by more frequent CPC failure due to contamination, i.e., considering all cultures (graph) 32% (87/275) were culture-positive; CPC detected 84% (73/87) of positive cultures, whereas alkali-decontamination detected 90% (78/87,  $P = 0.4$ ). Culture results were similar



whether CPC-processed sputum was cultured on LJ or Ogawa medium (graph).

**Conclusions:** Collecting sputum into CPC and applying the mixture directly to culture medium is simple and sensitive but is not suitable for routine diagnostic use because a quarter of cultures fail due to contamination.

## HUMAN RESOURCE DEVELOPMENT: HEALTH WORKER TRAINING

### PC-143-28 Students' role in advocacy: Rio de Janeiro TB League celebrates one decade of battle against TB

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**Background:** Teaching of TB in most health schools in Brazil is insufficient and inappropriate to engage students in the battle against the disease. Innovative and active learning processes are necessary.

**Intervention:** In 2001, 20 medical students who were working in a research project on TB mortality founded the Rio de Janeiro TB Scientific League as a response to the reality they were confronted to. The main goals of the league are to independently develop educational, research and community-based activities in collaboration with the academy, the NTP and NGOs. On the occasion of its 10th anniversary, we revised the work developed by the League.

**Results:** Since 2001, symposia were organized every two years to select new members and 200 undergraduate students were enrolled. Eighty-eight abstracts were presented at 14 international and 21 national conferences and 18 full articles published with these students' co-authorship. They have participated in 23 educational community-based activities and have an official sit at the TB-NGOs Forum/RJ and at the Brazilian branch of the Stop TB Partnership. The league also collaborates with Gama Filho, McGill and Johns Hopkins Universities and the Brazilian TB Research Network (REDE-TB).

**Conclusion:** Students are an important workforce in the battle against TB. The TB League contributes to engage and prepare future healthcare professionals to deal with TB. It is also a powerful tool to sensitize the general population to deal with the challenge of TB and to produce innovative knowledge. In Brazil, the TB league is a unique organization.

### PC-238-28 Knowledge of tuberculosis among urban and rural health care workers in Mongolia

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**Background:** Tuberculosis (TB) morbidity and mortality has been one of the emerging issues in the health sector of our country. Knowledge of TB among health care workers is urgent in the proper management of TB.

**Methods and findings:** We conducted a cross-sectional descriptive qualitative study. A total 572 doctors and health professionals were selected thorough random sampling from 4 provinces and 3 districts. Among these, 39.9% (228) were working at the primary health care level, 31.3% (179) in secondary and 28.8% (165) in the tertiary level. Around 99% of participants knew that TB is spread by coughs and sneezes from infected person. However, one of every three respondents answered TB can be transmitted when sharing cups, dishes and other cooking utensils with the infected person; one in every ten people, shaking hands with the infected person; and one in every four people, through mother to child transmission. Such misconception is common among the health professionals, especially among nurses of the secondary and tertiary level health of health care. Nearly 50% and 86.9% of participants had knowledge regarding the TB symptoms and highly infective cases, respectively. There are some misconceptions that TB patients should buy TB drugs from the pharmacies, or try traditional medicines and follow religious rituals.

**Conclusion:** Knowledge of doctors and health professionals regarding the transmission, BCG vaccination, TB drugs and treatment were insufficient nationwide. Medical education on clinical management of TB patients is needed for health care workers

### PC-376-28 Partnership for health care workers' continuous training on tuberculosis

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J L Rocha,<sup>3</sup> D Barreira.<sup>1</sup> <sup>1</sup>National Tuberculosis Programme (NTP), Brasília, DF, <sup>2</sup>Ataulpho de Paiva Foundation (FAP), Rio de Janeiro, RJ, <sup>3</sup>Management Sciences for Health (MSH), Rio de Janeiro, RJ, Brazil. e-mail: olga.rodrigues@saude.gov.br

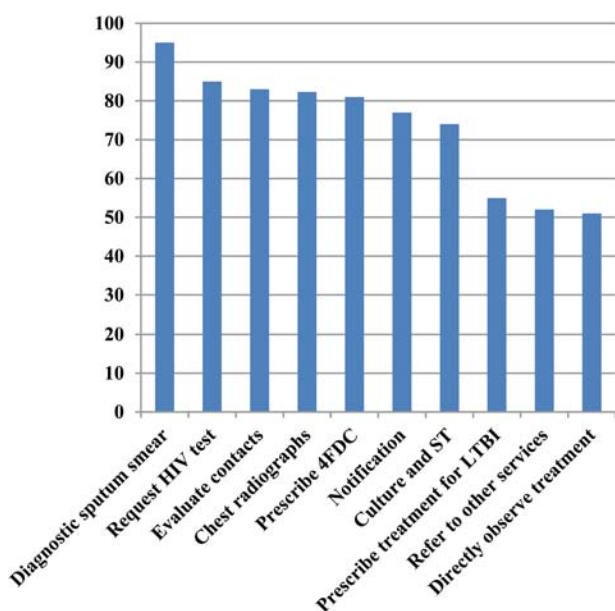
**Background:** Brazil ranks 19th among 22 tuberculosis (TB) high-burden countries. The incidence has been steadily declining during the last decade and is currently around 38 cases/100 000 inhabitants. In 2010, the National TB Program (NTP) and its advisory board revised the national guidelines. Among others, new recommendations included a four drug fixed dose combination (4FDC) regimen. The NTP recognized



the need for training of healthcare workers (HCW) in the new guidelines and organized, in partnership with Management Sciences for Health (MSH), from August to October 2010, a 2-day iterative workshop in each of the five Brazilian regions. The aim of this work was to assess their compliance to the previous guidelines through a questionnaire applied at the beginning of the workshop and their evaluation of the usefulness of this kind of training.

**Design/methods:** All trained HCWs were invited to answer the self-reported questionnaire. Out of 452 trainees, 375 answered the survey and 238 directly involved in patient care were included in the compliance analysis, of whom 93% were physicians or nurses.

**Results:** Among respondents, 23% worked for less than 3 years in the TB program. Their compliance with previous guidelines (maintained in the new guidelines) regarding TB control activities is displayed in the Figure. Among the 375 responders, 90% declared that the training was useful for their daily practice.



**Figure** Percent of compliance with national guidelines among 238 HCW in Brazil.

**Conclusion and recommendations:** In Brazil, besides scaling up training on the new recommendations, it is necessary to continuously refresh HCWs especially because there is high turnover of personnel. Based on these results, a partnership with MSH and Ataulpho de Paiva Foundation (FAP) was established and 27 new trainings (one in each state of the country) will be held from February to August 2011. Non-governmental Organizations partnerships are fruitful for professional training and should be largely encouraged.

### PC-429-28 Partnerships as a strategy for sustainability of training activities in the field of tuberculosis

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**Background and challenges to implementation:** In Brazil, capacity building for the future health professional do not contemplate enough the content about tuberculosis. This is a consequence of a fragmented model curriculum that does not involve the reality from the public health services. The education is poorly integrated and dependent on high technology and little or no relation to the social and epidemiological reality of the population. It doesn't stimulate partnership with other areas that can help on prevention and control of tuberculosis.

**Intervention or response:** The Global Fund for TB Brazil supports and invests in training of the facilitators and participants, discussing the best way to the sustainability of capacity building for effective change in the way of work and that reflects in the daily health units. Using a questionnaire answered by the teachers about training sustainability (24), we pointed some important issues to discuss the continuity of the actions of the training.

**Results and lessons learnt:** Participants listed some important issues for effecting the necessary changes to training and implementation of continuing health education. Most mentioned that joint action, intersectoral partnerships and strengthen the technical factors, political and financial sustainability of training.

**Conclusion and key recommendations:** We need to think further about the need for intersectoral work and set to TB control activities to reduce vulnerability of citizens and provide a common response to problems such as low detection and treatment adherence.

### PC-433-28 Training helps to enhance partnership in the prevention and control of tuberculosis

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**Background:** In Brazil, tuberculosis continues to advance in the most vulnerable population due to some factors such as social inequality and population concentration. The Global Fund for Tuberculosis Brazil FGTB, in an effort to fortify DOTS strategy and reach vulnerable populations, invests in training for health professionals and civil society.

**Intervention:** In the period from May 2007 and July 2009, the FGTB in set with Programs of Control of TB(PCT) had carried through qualifications to support the DOTS expansion in the 57 cities supported for the FGTB. A questionnaire was sent and the answers made possible a reflection on the strategies implemented in the first phase and it reoriented the activities for the next phase of the project.



**Results:** 32 (56%) managers answered it. In these 32 cities function 2016 units of health, of these 897 (44%), one or more professional had enabled in strategy DOTS. The PCT coordinators of 20 cities (74%) affirmed that the qualifications contributed for implantation of strategy DOTS. Five coordinators (18%) answered that training had not contributed and cited managemental factors and human resources as impediments. They cited the necessity to sensitize managers and involve them in the qualifications as a way to give continuity and support to TB control, as well as to extend the institutional partnerships. The concurrence with other factors of reinforcement to strategy DOTS was emphasized: guarantee the access to the patient (support for transport and food), adequate physical space for the taking of the medication.

**Conclusion:** Suggestions had been made for attainment of the support of the qualification process that it does not finish in the proper course. Continued education as well as maintenance of annual qualifications had been suggested, in view of the rotation of human resources and the necessity of local partnerships.

#### **PC-618-28 Community TB DOTS to reach the unreached population: preliminary result**

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**Aim:** TB services need to be brought closer to the remote area by integrating TB services into community based health activities.

**Methods:** Assessment was done to categories remote area in three provinces and to identify potency of the area. Guideline and module were developed by the NTP Indonesia and others sector related. Socialization was done gradually from province to the village. Training of the health officer and the volunteer was done in the district. Preliminary data, result and lesson learn after 3 months implementation in the community based health services were analyzed.

**Results:** There are 3 provinces selected as the pilot area. From October 2009 to February 2011 periods there are totally 54 villages involved. 54 midwives/nurses had been trained. 270 volunteer had been trained. After the training, exactly since November 2010 until February 2011, the midwives and the volunteer implement TB services in the community based health activities, called Poskesdes. There is only one province (Lampung) which had been conduct monitoring and evaluation meeting. Other two provinces plans to have the meeting on 2nd week of March. Data from Lampung shows that total number of suspects referred by volunteer are 95 suspect and number of suspect diagnose as sputum smear positive TB

which continued their treatment in Poskesdes are 4 patients. There are no side effect and drop out reported.

**Conclusion:** Even though the pilots just could be analyze completely after 6 months implementation in the Poskesdes, preliminary result shows that community TB DOTS achieves an encouraging result. Corrective actions to speed up and scaling up the implementation will be centered in 2 essential strategies: 1) *Service improvement* by improving health education methods and material and review guideline of the implementation; 2) *Program strengthening* by developing regulation of the role and function of other sectors related to improve TB DOTS Community.

#### **PC-659-28 Increasing political commitment effort through ACSM training**

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**Background:** Decentralisation in Indonesia has started in 2001 which allows distric government to be more in charge in their finace and budgeting including health financing in TB. Political commitment in TB financing is relatively low. Previous financing study has shown that district government allocate less than 2 procent for TB (CHRUI, 2007).

**Aim:** To develop cross program collaboration between TB program and health promotion program in district level in carry out ACSM activities in order to increase political commitment of district government.

**Method:** Since end of 2009, NTP Indonesia has conduct ACSM training for TB program staff and health promotion staff as capacity building effort in ACSM to act as ACSM local focal point. They will work as a team in carry out TB ACSM activities as advocation effort.

**Conclusion:** The post training evaluation has not yet conducted but the training has made the two health program work together as a team that has increased their close collaboration.

#### **PC-675-28 Competency needs assessment of NTP provincial staff**

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**Background:** NTP with support of TBCAP has developed a five years human resource development strategic plan. Although a need base learning trajectory is required within this strategy to improve the capacity of NTP staff for quality STOP TB strategy implementation, there has been no needs assessment for trainings based on capacity of staffs. Thus, to develop

this trajectory competency assessment has been done to find the weak or lacking competencies to be addressed.

**Method:** A set of self assessment tools were developed along with a guideline to assess lacking required competencies and to list and prioritize those competencies. The competencies were divided in three main areas (Technical, Managerial and General). By these tools, 24 provincial TB coordinators (PTC) and 25 provincial Lab supervisors (PLS) assessed by themselves.

**Results:** Prioritized technical areas for lacking competencies by PTCs were MDR-TB (87%), TB-HIV (75%) and Urban DOTS/PPM (53%), for PLS; those were Quality assurance (68%), Training methodology (52%) and TB-HIV (40%). For managerial areas, PTCs selected conducting research (79%), drug management (41.7%) and M&E (37.5%), while PLSs prioritized joint supervision (24%), M&E (20%) and data management (20%). In general areas, 91.7% of PTCs and 100% of PLSs selected English language and for computer and internet it was PTCs (79.2%) and PLSs (100%).

**Conclusion:** This assessment revealed that capacity of staffs should be developed in new interventions such as MDR-TB, TB-HIV or PPM, for which there have been not enough opportunities for learning. However, previous trainings strategies should be critically reviewed, because certain areas such as quality assurance or M&E, for which there have been enough opportunities for learning, were identified as lacking competencies.

#### PC-718-28 Contest organising experience among medical staff of TB service in Donetsk Region, Ukraine

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Tuberculosis (TB) incidence and mortality remain high in Ukraine. Qualified and adequate medical staffing level plays an important role in countering the TB epidemic. In order to improve motivation of employees in TB service to work within complex epidemiological TB situation in Donetsk region two contests were held: 'The Best professional' in 2008 and 'The Best young TB specialist' in 2010. The aim of this paper is to summarize the results of the contests. In 2008 75 medical workers of TB service participated in the contest in the 6 nominations; in 2010 25 young professionals under the age of 35 years took part. Contests were held in three stages. The first stage took place at the local TB institutions. The selection criteria

for rating were TB indicators from the workplace of each specialist. The second stage was held in 2 rounds on the basis of the Regional clinical TB hospital. 300 tests 4 types of situational tasks were developed for contests. International standards, regulations MoH of Ukraine and Regional TB Program for 2007–2011 were used for developing the tests. The main contest condition was the anonymity: examiners didn't know whose work they checked. Contest held in 2010 differed from the previous one by better technical equipment, innovative technologies, computers, improved tasks for assessing both practical skills and theoretical knowledge. Multidrug-resistant TB and HIV-associated TB were the most difficult questions. Questioning was done. Participants saw public interest in TB specialist work. It was indicated that they want to continue to work and improve their skills. 18 finalists were selected in the 6 nominations to participate in the 3rd stage in 2008 and 4 finalists in 2010. The finalists were awarded with prize money and souvenirs. Thus, the competition contributes to motivation of medical service staff to work in condition of TB, allows estimating the weaknesses in training and paying more attention to these issues during trainings.

#### PC-780-28 Education and training needs of TB nurses and related workers in the Northern Pacific Region

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**Objective:** To identify the base level of health qualifications, past TB specific education and the training needs of Nurses and Related Workers working in TB Programs within the US Affiliated Pacific Islands (USAPIs).

**Background:** The Australian Respiratory Council, an Australian based non government organisation has been involved with partner agencies (World Health Organisation, US Centres for Disease Control, the US National TB Controllers Association and the Secretariat of the Pacific Island Communities) in developing and delivering regional and in country training for health care workers in TB prevention and control strategies within the Pacific. The work to date has focused on developing training programs and resources and the creation of a support network for nurses and related workers within the Pacific Island TB Programs. This network involves monthly teleconference across the Northern Pacific that includes case management and clinical discussion and an educational session on a range of clinical and public health issues. To guide future training activities a survey was undertaken.

**Methodology:** A literature review was undertaken to identify survey tools. In 2010, an electronic survey was developed from an existing US tool and modified for the Pacific context. Northern Pacific jurisdictions were invited to complete the survey.

**Results:** Twenty respondents from 8 jurisdictions completed the survey. This represents all (100%) jurisdictions and 47% of the Nurses and Related Workers employed at the time of the survey. Roles of respondents, qualifications, past TB specific education/training undertaken were analysed. The priorities, format, professional requirements and barriers for training were identified and analysed.

**Conclusion:** The approach to training and capacity development within the Pacific is evolving. This survey demonstrates the needs, priorities and preferred format for training for Nurses and Related Workers in the USAPIs.

#### **PC-1135-28 BCC (behavior change communication): an important tool used in the prevention and control of tuberculosis**

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**Introduction:** The state of Rio de Janeiro stands out due to a higher incidence rate of TB in the country. Several initiatives have become more efficient strategies to increase the decentralization of control of the disease, especially among health professionals involved in primary care programs. With support from the Global Fund (GF), the BCC workshops are held with the participation of professionals and health workers, community leaders, clergy, counselors, NGO Forum and TB users. Lasts 8 hours. May contribute to increased understanding of cultural aspects and vulnerabilities of different community groups, community partnerships to identify, discuss the stigma of the disease, transmission, treatment adherence, among other topics. From the local reality identify the risks of contracting TB, problems and solutions relating to their practices. In addition to developing strategies aimed at adherence and cure of patients.

**Objective:** To evaluate the BCC workshop as a powerful tool in tuberculosis control, especially with regard to the search, identification and referral of respiratory symptoms (RS), besides facilitating the implementation of the DOTS strategy in the priority cities in RJ state.

**Methods:** We used the form (default) individual evaluation of the workshop, as well as impact indicators such as number of microscopies performed (6 months before and after the workshop).

**Results:** Positive reviews related to the workshop, from the records in the evaluation form. In addition

to an increase of 23 to 30% of requests for smear was performed in cities where the workshops.

**Conclusion:** The workshop lasts BCC deemed appropriate by the participants, is low cost and his teaching includes all levels of culture. One can attribute the increase to smear the workshop, as during any other strategy was crafted in the municipalities, for this purpose.

#### **PC-1226-28 Using modern computer technologies for TB training in Ukraine**

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Ten-year experience of conducting trainings with technical and material support by WHO allowed employees of the Pulmonology and Phthisiology Chair of Donetsk National Medical University (DNMU) to establish the knowledge assessment system (KAS) of the participants using the latest computer technologies. The system includes: Bank of tests, pre- and post-training computer testing, computer processing by Moodle (Modular Object-Oriented Dynamic Learning Environment). Each test takes 30 minutes. Each participant receives a personal code for training and 25 tests at the beginning and at the end of training. 1 minute is provided for 1 test. Each correct answer receives 4 points. The maximum number of points that a student can get is 100. The system allows each participant to assess himself and to identify own mistakes, and trainers can quickly and efficiently assess participants' knowledge, identify weaknesses in their background in any issue. Anonymous test results are displayed and ranked from highest to lowest value. We have analyzed the results of 4 3-day trainings. 80 persons were trained. At the beginning of training the minimum average score was 20, and the maximum was 68 points; at the end—36 and 92 points respectively. The results of the questioning showed that students appreciated KAS, and noticed that it has increased their motivation to learn. Thus, we created the system of assessing the level of knowledge of trainees which can significantly reduce the time for testing and checking the results, assess the level of knowledge without bias, spend more time to discuss the most difficult issues and organize discussions according to the need of trainees, increase their motivation to learn.

## TUBERCULOSIS IN PRISONS

### PC-343-28 Risk factors influencing the final treatment results of 150 DR-TB patients in prison

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**Aim:** Analysis of risk factors influencing to reason-out 'failure' and 'death' among DR-TB patients on treatment with 2nd line anti-TB drugs.

**Methods:** Medical records of first 150 DR-TB patients enrolled in treatment with 2nd line anti-TB drugs in penitentiary sector of Azerbaijan have been analyzed in accordance to WHO Guidelines on DR-TB management. 21 of this patients were ex-prisoners followed-up in civilian sector after release from prison in frame of Tripartite Agreement signed between Main Medical Department of the Ministry of Justice, Ministry of Health and International Committee of the Red Cross.

**Results:** Since April 2007 to May 2009, 150 DR-TB patients were enrolled to treatment with 2nd line anti-TB drugs. Treatment results of them are as stated below: 'cured' 108 (72%), 'death' 12 (8%), 'failure' 15 (10%), 'default' 15 (10%). Patients with 'dead' and 'failure' reason-out had broader resistance rate, two-sided destruction (cavernous) TB and majority of them had co-infection with Hepatitis C during integration to treatment.

**Conclusion:** Resistance rate, spread level of tuberculosis process and concomitant pathologies are risk factors significantly influencing to treatment results. It is necessary to continue surveillances for evaluation of their role more precisely.

### PC-435-28 Structure evaluation of DR-TB patients and early sputum conversion rate in prisons in Azerbaijan

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**Aim:** To analyze structure dynamics of DR-TB patients integrated to treatment according to patient category/process extent in lungs, and sputum conversion rate during first 6 months of treatment in penitentiary sector for the period 2007–2010.

**Methods:** Information from data base for DR-TB patients on treatment with 2nd line drugs has been used. Treatment in penitentiary sector of Azerbaijan is carried out in accordance to WHO MDR-TB Programme Management Guidelines. Sputum conversion has been evaluated on the basis of culture investigations results.

**Results:** Since April 2007 all DR-TB patients in penitentiary sector of Azerbaijan have been enrolled in

treatment with 2nd line drugs. In the last 2 years priority is maximally early enrolment of DR-TB patients in treatment, once DST results are available. Among patients enrolled in treatment in 2007–2008 prevailed patients of 'failure' (94.4%) category, 'relapse' category patients made up 5.6%. In 2010 'failure' category patients made up 47.2%, 'new' 14.2% and 'relapse' 28.3%. During 4 years two-sided destructive processes decreased from 63.6% to 31.1%, TB processes without destruction increased from 3.0% to 21.7%, one-sided destructive processes were observed in 33.4–47.2% patients. Sputum conversion during first 6 months was achieved in 64.6% patients in 2007, 61.5% in 2008, 76.0% in 2009 and 81.4% in 2010.

**Conclusion:** Analysis of purposeful enrolment to treatment on earlier stages, reflects positive results: decrease of cases with two-sided destructive processes, increase of cases without destruction and increase of sputum conversion rate in first 6 months of treatment.

### PC-458-28 Challenges and achievements in Brazilian prisons: coordinated actions for TB control

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**Background and challenges to implementation:** In Brazil, 494 237 people are living under the custody of the Penitentiary System. The Ministries of Justice (MJ) and Health (MH) established in 2003 the National Policy for Health in the Penitentiary System (NPHPS) in order to organize the access of inmates to public health services. Due the confining and overcrowding conditions of prisons, the population there is exposed to lots of health risks for disease, such as tuberculosis (TB), much more than the general population.

**Intervention or response:** The NPHPS has been supported by intersectoral actions aiming to join political and technical efforts from various programmatic areas of the MH, Health in Prison Coordination, National TB Programme, Department of HIV/AIDS and Viral Hepatitis; the National Penitentiary Authority; United Nations Office of Drugs and Crime; and Pan American Health Organization. The results were the Brazilian Workshops for TB Control in Prisons and a specific chapter about the disease in prisons in the new TB guidelines (2010). Among the workshops outcomes are the identification of gaps on the policy implementation, the establishment of national recommendations and how to detect and treat TB in prison.

**Results and lessons learnt:** To improve real conditions of health in prisons throughout the country, it is



necessary to develop consistent integrated approach between government, civil society and international organizations. The workshops were an opportunity to involve different actors of health, justice and Non-Governmental Organization (NGO), detect challenges and gaps and identify next steps.

**Conclusions and key recommendations:** A training project for NGO members who work in prisons is expected to be implemented in 2011; the National Policy is under revision; TB and HIV control in prison settings is being developed; an assessment of health teams working in prisons will be carried out.

### PC-677-28 Provision of follow-up TB treatment for released prisoners in the Republic of Khakassia, Russia

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**Setting:** Republic of Khakassia, Russian Federation.

**Objectives:** Collaboration of the Khakassian Republican branch of the Russian Red Cross (RRC) with the Federal System of Sentence Execution in the Republic of Khakassia started in December 2002 when the Agreement on a TB Programme implementation by the International Federation of Red Cross and Red Crescent Societies was signed.

**Methods:** The model of collaboration between penitentiary and civilian sectors of a Public Health with participation of the Republican branch of the RRC was developed. Information on released TB prisoners is sent to the regional branch of the RRC one month prior their release. Medical coordinator of the RRC, jurist and psychologist of the Programme consult TB prisoners before their release. Those specialists are provided with a free access to the territory of a prison. They have a discussion with prisoners and inform them about the ongoing in the Republic TB Programme, get information on their relatives, addresses where they will be living after release. After a meeting with a prisoner medical coordinator give information to nurses of the RRC who visit members of his/her family and other relatives and inform them on issues of TB prophylaxis (inform about TB infection, symptoms, hygiene and disinfection regulations). Moreover, they inform about released TB prisoners TB doctors in a primary health care in urban and rural areas. After release TB prisoner goes to the RRC local branch and nurses follow him/her to a TB doctor for recording and further treatment. During the period of treatment all patients receive social support—items of food, clothes, reimbursement of transportation from home to a hospital and back.

**Results:** During the period of collaboration from December 2002 to January 2011 126 consultations of released prisoners with a jurist and 189 consultations

with a psychologist were provided. 80% of former prisoners continue TB treatment at civilian TB facilities after release.

### PC-779-28 The Brazilian Global Fund Programme 'TB control in prisons': challenges and strategies

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**Background and challenges:** In Brazil, over 490 000 inmates live in overcrowded prisons (occupation level: 165%) where tuberculosis (TB) is highly endemic: in some states, the TB incidence rate among inmates is 35 times that of the general population. However, most states did not develop a structured prison TB control program.

**Intervention:** Implemented since 2007, jointly with the National TB program, in the 11 metropolitan regions with highest TB burdens, the Brazil Global Fund TB program is based on the involvement of health and justice administrations altogether with NGOs. It comprises mainly: 1) National and regional meetings to identify optimal control strategies and stimulate partnerships between health, justice and civil society; 2) Interactive educational sessions (1983 persons trained) for guards, health workers and inmates; 3) Edition of guidelines and educative material; 4) Implantation, inside the state prison systems, of TB diagnostic centers (DC) with laboratory for sputum examination and X-ray (7 state DCs created until now); 5) Definition of routine procedures for TB diagnosis and treatment; 5) TB screening at entry in prison; 6) Operational research programs ( $n = 5$ ) concerning, e.g., active detection and education.

**Results and lessons learnt:** The program is well received but hampered by: 1) Low motivation of prison health workers, underpaid and subject to precarious work contract with high turnover; 2) Security constraints limiting activities with inmates and their access to prison dispensaries; 3) Deficiency of the social control of prison health services. But synergic partnerships were created between state TB and prison programs and an important increase was observed in the number of cases detected and cured.

**Conclusions and key recommendations:** Sustained political commitment, human and financial investments and social mobilization are needed to insure access to health for the Brazilian inmates not as a privilege but as a Constitutional right.

### PC-905-28 Tuberculosis care and control services in prisons, India: a situational analysis

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**Background:** Prisons are dynamic venues where at risk groups congregate exacerbating TB disease and its transmission. TB prevalence rates in prisons usually exceed those in the community. TB amongst prisoners affects general population through transmission when prisoners are released or transferred to another facility and via prison staff and visitors. This study discusses the TB care services in 98 major prisons across India, challenges to TB control in prisons and recommendations to address this challenge.

**Method:** A cross sectional survey was conducted across 98 prisons in the country (2007) seeking information on facilities for TB screening, diagnosis and treatment and availability of trained healthcare staff.

**Results:** In the 98 prisons, total prisoners in the past year were 106 107. Of these TB patients diagnosed were 3203 of which 2129 (66%) were put on DOTS and 1074 (34%) were lost to treatment. Only 34% prisons reported screening for TB at the time of entry. While 62% of prisons had a trained healthcare provider only 48% had a health facility in their premises of which only 10% were equipped to perform sputum microscopy. While 82% of the prisons had treatment services for TB available only 48% had a separate cell for TB patients.

**Conclusion:** Most of the prisons lack diagnostic and treatment services for TB. Even after diagnosis a significant proportion of patients are lost to treatment. Inadequate screening for TB on entry in the prison, lack of availability of trained healthcare provider and inapt segregation of TB patients increases the risk of transmission amongst prisoners and prison staff substantially.

**Recommendations:** Prisoners should have the same access to TB care services as general community. Screening for TB on entry and infection control measures in prisons will help in controlling the high prevalence of TB amongst this vulnerable group

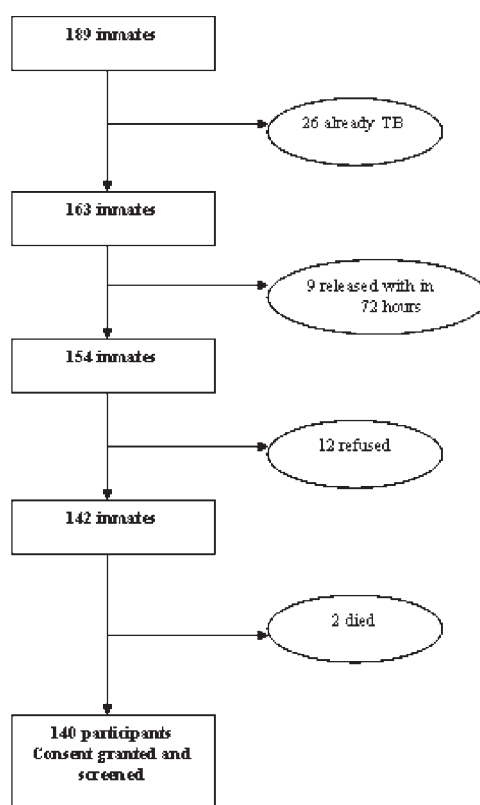
### PC-944-28 High prevalence of TB-HIV co-infection in a Malaysian prison

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**Background and challenges:** Tuberculosis (TB) remains a major health problem in Malaysia, particularly in correctional facilities, where concentration of people with risk factors (including HIV infection) and the closed environment, amplifies TB development and transmission among prisoners. TB screening inside correctional facilities is non-existent and

diagnosis is made only after presentation with clinically significant disease. TB screening of HIV+ prisoners, all housed within a segregated HIV unit was conducted to assess the magnitude of active and latent TB infection in Malaysia's largest prison.

**Methods:** All HIV+ prisoners underwent structured survey, including the WHO TB symptoms survey. Tuberculin skin test (TST) was read at 72 hours and blood sampled for CD4 quantification. Participants screening as likely for active TB disease were further assessed, including sputum induction and CXR examination. Subjects with latent TB infection (LTBI) and 9 months remaining incarceration time are offered isoniazid preventive therapy (IPT).



**Results:** Of the 189 HIV prisoners, 26 (14%) participants had active TB and were receiving anti-TB medication. TST was conducted for the remaining 140 participants who granted consent: 89% were male, mean age = 37 years, mean body mass index = 23 and 91% were injecting drug users. Mean CD4 count was 435.2 cells/mL while 46% had a CD4 count of  $\leq 350$  cells/mL. Only 6% were on ARV treatment. Previously undetected active TB was found in one subject and TST+ prevalence ( $\geq 5$  mm) was 85% with 56% of participants having a TST  $\geq 15$  mm.

**Conclusions:** Both active and LTBI were high in this setting among HIV+ Malaysian prisoners. In order to effectively abrogate the growing TB epidemic in Malaysia, immediate implementation of an evidence-based approach to TB control within Malaysian

correctional facilities is required to address the Three Is recommended by WHO: intensive case identification, infection control and Isoniazid preventive therapy.

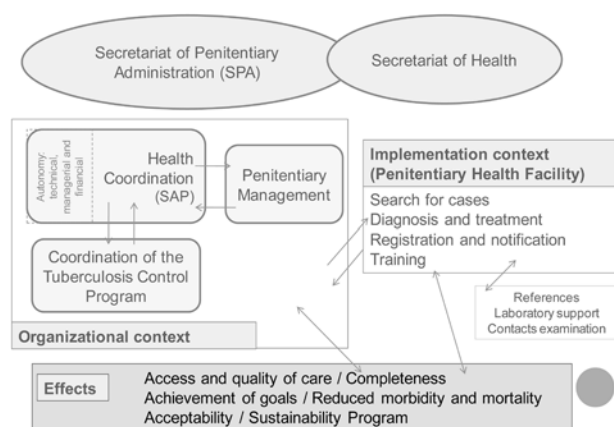
### PC-960-28 Evaluation model of a tuberculosis control programme in Brazilian prisons

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**Background:** The evaluation of Tuberculosis Control Program (TCP) in Brazilian prisons enables the understanding of the reasons for the successful actions in a different context and population group. This population is a priority of the National TCP because of the high incidence of tuberculosis. The building of theoretical models allows the evaluation of policies and programs to go beyond the dichotomic view of input x results. An evaluation study based on program's theory shows the mechanisms which lead to changes. **Objective:** To conduct an availability study (AS) of the TCP's evaluation in Brazilian prisons, considering the description of the intervention, the development of program logic model and the theoretical model of evaluation. This first step could help determine the focus and evaluative purposes.

**Methods:** Qualitative and quantitative approaches that were used. The AS was executed through documentary analysis and interviews with managers and technicians of the Health Coordinator of the Secretariat of Penitentiary Administration (SPA) as well as with directors of prison health units.

The results were: description of the program identifying the goals and objectives; a preliminary understanding of how the program operates; modeling of available resources, planned activities and expected impacts; development of a theoretical model



**Figure** Theoretical model of tuberculosis control program in Brazilian prisons.

of assessment, identification of users and stakeholders of the evaluation and reaching an agreement with the users regarding the assessment procedure.

**Conclusion:** This study gave an important base for the agreement by the prison staff involved in the formative assessment. It was important in identifying the need, feasibility and rationalization of assessment resources. It will help for the development of a multiple case study in Brazilian prisons.

### PC-971-28 Enhancing TB screening in Zambian prisons: programme implementation challenges and successes

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**Background:** High TB and HIV rates, poor health services, overcrowding and lack of resources are common in Zambian prisons. We describe a TB REACH-funded program collaboration between Zambia Prisons Service and the Centre for Infectious Disease Research in Zambia (CIDRZ) to scale-up HIV and TB screening and treatment in Zambian prisons.

**Methods:** In preparation for the program, we performed intensive sensitization and training among inmates, prison officers and clinicians. Selected inmates were trained as peer educators to mobilize inmates and assist with screening. Linkages with Ministry of Health (MOH) were strengthened to allow referral for HIV and TB (including MDR-TB) treatment. The program included exit, mass, and entry HIV and TB screening. Baseline exit screening was conducted to assess TB prevalence. Mass screening of inmates and prison staff was carried out using smear microscopy, mobile digital radiography and culture. Entry screening of new inmates was implemented using symptom screening and smear microscopy.

**Results and lessons learnt:** We sensitized 49 prison officers and 2256 inmates, trained 57 prison clinicians, 78 prison officers, and 73 peer educators. 263 inmates were screened at exit, 814 through mass screening and 102 at entry. Challenges to implementation included: low motivation and understaffing among prison officers, difficulty retaining inmate peer educators, and infection control due to overcrowding. Recognition of these issues prompted further education of staff, greater inmate involvement, and infrastructure improvements including isolation cells.

**Conclusions and key recommendations:** Strong partnerships between Zambia Prisons Service, MOH and CIDRZ along with the collaboration of prison officers, clinicians and inmate peer educators are required for the successful initiation of this program. Recommendations for other programs include the need for infrastructure development and inmate involvement.

**PC-1201-28 Détection de la tuberculose dans quatre prisons au Burundi, 2007–2008**

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**Cadre :** La lutte contre la tuberculose en milieu carcéral fut renforcée au Burundi dès 2007 par la création des CDT dans les dispensaires de quatre prisons (Mpimba, Gitega, Rumonge et Ngozi) et par le dépistage actif. Au cours des campagnes de détection semestrielles, les suspects de tuberculose sont identifiés et des échantillons de crachats sont prélevés pour la recherche des BAAR.

**Objectif :** Evaluer la détection et la prise en charge de la tuberculose en milieu carcéral.

**Matériels et méthodes :** Une étude descriptive a été conduite dans les quatre prisons en 2007 et 2008. Les données ont été collectées à partir des registres de laboratoire et de la prise en charge de la tuberculose.

**Résultats :** Au total, 655 suspects de toux se sont présentés au cours des campagnes de 2007 et 432 en 2008. En 2007, sur le nombre de prisonniers s'étant présenté pour toux, seuls 391 sur 655 soit 59,7% réunissaient les critères pour la recherche de BAAR. En 2008, ce chiffre est passé à 260 sur 432 prisonniers soit 60,1%. En 2007, seuls 3 TPM+ ont été détectés, soit moins de 1% des suspects ayant bénéficié de la recherche de BAAR. Ce chiffre est passé à 3% en 2008.

**Conclusion :** Peu de malades sont dépistés dans les prisons malgré les efforts déployés. La détection de la tuberculose à travers les campagnes n'est pas satisfaisante. Il est nécessaire que le PNLT recherche une approche plus efficace afin de détecter les cas dans les prisons.

**PC-1247-28 Alliance Programme Tuberculosis and prisons to search for cases in Mexico**

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**Objective:** To diagnose cases of tuberculosis in the prison population.

**Methods:** We call on the country's 32 states for case-finding for pulmonary tuberculosis (PTB) in prisons. Coordination was conducted with prison authorities and medical personnel who care for patients, to guide the search for respiratory symptoms on admission to prison and make the diagnosis and enter treatment is strictly supervised.

**Results:** Search was conducted with respiratory symptoms in 193 prisons in 2009, 19.986 respiratory symptoms were studied, we identified 340 cases of pulmonary tuberculosis, 271 (80%) were cured, 15 (4%) completed treatment, 5 (1%) failures, 15 (4%) deaths, 20 (6%) dropouts, 10 (3%) transfers, 4 (1%) remain in treatment.

**Conclusions:** Working in coordination with the prison authorities and the tuberculosis program gives good results for the search for cases of pulmonary tuberculosis, which can control the transmission of the disease in these risk groups.

**PC-1269-28 Global Fund financing of TB control activities in prisons**

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**Background:** Global Fund remains the single largest international donor for TB control and it accounts for 84% of all external finances for TB control. Global Fund supported activities include interventions in prisons.

**Objectives:** To map the extent and scope of TB control activities in prisons through Global Fund financing.

**Methods:** Review of Global Fund's documents and data to analyse the distribution, characteristics and budgets of TB control activities in prisons between 2003 and 2010.

**Results:** Out of 105 countries with Global Fund-supported TB programs, 52 (50%) delivered TB treatment and/or ACSM activities within prison settings. Wide variation exists among geographical regions with regard to the coverage of TB services for prisoners; from 10% of countries in Southern African region to over 80% in the Eastern Europe and Central Asia region. Fourteen out of 27 high burden MDR-TB countries delivered TB services in prison/correctional facilities with Global Fund support. Over 70 TB grants delivered interventions in prisons with 64% of principal recipients of grants from the government sector.

**Conclusion:** There is scope for further expansion of TB control activities in prisons which could contribute to expanding access to TB care in prison settings and achievement of global TB control targets.

**KEY TOBACCO CONTROL STRATEGIES AND INTERVENTIONS****PC-124-28 Local governments lead breakthrough for tobacco control in Japan**

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**Objectives:** Japan has weak tobacco control measures in spite of its adoption of the WHO Framework Convention of Tobacco Control requiring parties to implement effective means to protect people from



second-hand tobacco smoke (SHS). A national law referring to public smoking only calls for smoking bans in public facilities, leaving the population largely unprotected. In this context, cities began implementing ordinances to restrict smoking in public places. We reviewed these municipal interventions and analysed their patterns.

**Methods:** Based on the case study approach, copies of original ordinances restricting smoking in outdoor/indoor public places and documents showing the process of legislation such as governmental records and media, were examined focusing on scope, development, implementation, enforcement and impact.

**Results:** Most ordinances concern outdoor bans. A total of 112 cities implemented ordinances to restrict street smoking, mostly in limited areas, while five cities either completely or conditionally prohibited smoking in all streets. The most common objective was beautification and cleanliness of streets, whereas nine referred to SHS and/or the health impact of smoking.

Indoor smoking restrictions were found in one place. In 2009, Kanagawa Prefecture introduced an ordinance aiming to prevent exposure to SHS by regulating smoking in public facilities. The ordinance has significant, health-affecting exemptions such as designated smoking rooms. The Governor's intensive campaign facilitated the legislation, and this initiative has inspired other local governments to begin preparing for smoke-free legislation.

**Conclusions:** Japanese local governments are taking the initiative to protect people from SHS, pre-empting national action. However, their restrictions are still limited and there is much scope for expanding bans to increase protection. In addition, the multiplier effect of municipal action is likely to create opportunities for national action.

### PC-201-28 Breaking the impasse: lesson learnt from tobacco control legislation in Indonesia

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**Objective:** This paper provides an overview of how difficult it is to make tobacco control legislation in Indonesia. Several challenges arise from the government, the tobacco industry, and some members of the House. Faced with this situation, some NGOs are involved in Indonesian tobacco control network (ITCN) introduce some materials or ideas on tobacco control in legislation such as Act No. 36 of 2009 on Health. This method is effective because the focus of the tobacco industry only deter the enactment of the Bill on Tobacco Products Control Impact on Health and the Bill on FCTC Ratification.

**Materials and methods:** This study uses depth interviews with activists of tobacco control in Indonesia.

In addition, this study also used secondary data in the form of a discussion document Act No. 36 of 2009 on Health.

**Results:** 1. Tobacco industry always seeks to obstruct and impede the enactment of Bill on Tobacco Products Control Impact on Health and the Bill on FCTC Ratification. 2. ITCN uses a new strategy by introducing some materials on tobacco control in legislation that correspond with other health related acts, among others the Health Act. 3. This method is proved effective because tobacco industry never suspected and expected that tobacco control materials were being introduced on related Acts. 4. The introduced or inserted materials are on smoke as addictive substances, smoke free areas, and pictorial health warning. 5. In the future, this way will also be applied in the discussion of the revision of the Act on Broadcasting on comprehensive banning on advertisement, promotion, and sponsorships issues. While increasing tax issue will be inserted in the discussion on the revision of the Act on Excise.

**Conclusion:** In the midst of impasse and opposition standing points from some parties in Indonesia, there are ways of implementing legislation on tobacco control in Indonesia, that is by inserting rules in to various legislations.

### PC-211-28 Evidence-based legal intervention of anti-tobacco campaign: a success story in Tamil Nadu

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The Director of Public Health and Preventive Medicine in Tamilnadu India is designated authority for implementing the COTPA-2003 (Cigarettes and other Tobacco products Act-2003) enacted in the Indian parliament. With the support of Civil Society this directorate launched many programmes to generate awareness among the public against tobacco. Campaigns include Smoke-Free Chennai project, intensive implantation of the COTPA-2003. Mass media campaign and Capacity Building workshop for the elected representatives and stockists and sellers of the tobacco products. State Tobacco Control cell was formed and law enforcing unit is established. The unit consists of three members' squad across the state. 2500 squads were formed and web based reporting system was created to enter the activities of enforcement of COTPA. Monitoring committees at different levels were formed to monitor and review the progress of implementation. This Directorate has implemented the section 4, 5, 6 and 7 to 10 of COTPA 2003. Section 4 is prohibition of smoking in public places, section 5 prohibitions of advertisements of cigarettes and other tobacco products, section 6 is prohibition sale of tobacco products to minors and also 100 yards

from educational intuitions. This act was enforced in Tamil Nadu from October 2nd of 2008 in letter and spirit. The results are the evidences. As on Feb 10, 2011 total 37724 persons were fined and amount Rs.4.281million were collected. The fine amount for smoking in public places is Rs. 200 (4 USD). The impact and success are 122 villages have been declared as smoke-free villages and two districts have been notified as Smoke-Free districts. 96% public places are smoke-free and there is no advertisement and events promoting cigarettes and tobacco products in Tamil-Nadu. More than 98% educational intuitions in Tamil Nadu are smoke-free.

### PC-229-28 The role of municipalities in tobacco control

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**Objectives:** Smoking and secondhand tobacco smoke (SHS) causes cancer, respiratory and cardiovascular diseases. However, only a small part of the world's population is protected by effective measures. While a national law protecting all the people in a country is ideal, cities can often pass legislation sooner than countries. City leaders can also directly advocate for national smoke-free laws. Our study aims to facilitate local action by illustrating the experience and highlighting good practices among 10 selected cities in their process of becoming smoke-free.

**Methods:** Case study based on evidence from a wide range of local sources. Cities implementing smoking bans in public places (whether with exemptions or not) were identified, and their interventions and processes were examined.

**Results:** Three implemented local smoke-free ordinances, two enforced existing national laws, two implemented smoke-free measures as a result of a royal announcement, and two implemented local tobacco control programmes. Although WHO FCTC Article 8 Guidelines recommended total elimination of tobacco smoke in indoor public places/workplaces/transport as the only effective measure, some of the cities allowed smoking areas under specific conditions. Civil society played an important role by urging city governments to take action, helping them to build effective partnerships and to conduct awareness campaigns. Communication with stakeholders including messages adjusted to each stage of the process was essential. Awareness of smoke-free laws and SHS and effective enforcement were key to maximizing compliance.

**Conclusions:** Using their powers and resources, municipalities can pass/enforce local legislation or im-

plement anti-tobacco programmes, and there are certain elements key to becoming a smoke-free city. Municipal success may trigger national-level actions or that of other cities and countries, and thus contribute to worldwide protection from exposure to SHS.

### PC-613-28 Ban smoking indoors as an evidence-based policy to create smoke-free area regulations in Bogor City, Java

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**Background:** Secondhand tobacco smoke (SHS) contains a deadly mix of 4000 chemicals. At least 50 of these toxic chemicals can cause cancer and other serious illnesses. SHS also contains small particles called particulate matter (PM<sub>2.5</sub>) that can be inhaled deep into the lungs. Although there are other sources of PM<sub>2.5</sub>, a major source in indoor places is smoking and burning tobacco products. The goal of the research was to provide evidence to create smoke free area regulation in Bogor city, Indonesian SHS level in public places and work places in Bogor in order to support the advocacy to create smoke free area regulation.

**Methods:** The objective of this study was to monitor PM<sub>2.5</sub> levels and smoking behavior in public places and work places in Bogor. Monitoring was conducted for 30 minutes in a sample of hospitals, government offices, restaurants, and entertainment venues. In total, 57 locations in 27 buildings were monitored.

**Results:** The study found an average PM<sub>2.5</sub> level of 150 µg/m<sup>3</sup> in all places and 268 µg/m<sup>3</sup> in entertainment venues with evidence of smoking. This is about 200–300% higher than PM<sub>2.5</sub> levels in outdoor air. In some entertainment venues, PM<sub>2.5</sub> levels were over 1000 µg/m<sup>3</sup>. Tobacco smoking is a major contributor of PM<sub>2.5</sub> indoor air pollution in the Bogor government offices, entertainment venues, restaurants, and hospitals. Levels of PM<sub>2.5</sub> were highest in entertainment venues, followed by restaurants, government offices, and hospitals.

**Conclusions:** Banning smoking indoors is a powerful way to get the clear air. 100% smoke-free law is mandated.

### PC-775-28 Smoke-free Initiative: a development agenda of Clean and Green Bali

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**Background:** Bali is one the World tourists' destinations with population about 5 million. The Provincial Government's vision of clean and green Bali by 2015 could be fulfilled by eliminating indoor air pollution

due to tobacco smoke. The key strategy to eliminate tobacco smoke is introducing 100% smokefree (SF) indoor policy. Health Law 2009 also requires local government must initiate smoke free environments on its territory.

**Objectives:** To explain the efforts for 100% smoke-free policy development in Bali province.

**Methods:** Building local stakeholders' commitment, generating local evidence, technical support from national and international partners, building local political commitment and media engagement.

**Results:** Bali SF alliance was formed consisting of more than 20 organizations from government and non-government sector. We obtained written commitment from each organization to support SF policy development and enforcement. Consultation meetings organized in all 8 district of Bali; obtained a strong support to have SF policy. Public opinion conducted in one of the districts of Bali shows more than 98% support towards SF. A legal team drafted the 100% smoke-free policy ensuring 100% SF in all public places, work places and public transports. The draft was already endorsed by the provincial government. It will be tabled at the provincial parliament in April 2011. It is expected to get approved by July 2011.

**Conclusion:** Governor's commitment and local stakeholders' engagement is crucial to initiate SF policy in Bali. Bali Provincial Health Office leads the SF initiative in Bali.

#### **PC-814-28 Government initiatives to implement FCTC in Bangladesh**

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Bangladesh was the first signatory country of FCTC and has launched several important initiatives to ensure implementation of FCTC to improve health for its large population. Bangladesh government has passed a comprehensive law entitled 'Smoking and Tobacco Products Consumption (Control) Law-2005' containing the major articles and provisions of FCTC. Government ensures participation and cooperation with national and international tobacco control organizations and government bodies to acquire updated information regarding tobacco control policies and other related information and to support international cooperation. Government of Bangladesh has formed a national body 'National Tobacco Control Cell (NTCC)' to strengthen law enforcement and monitor law violation by the tobacco companies. Government has also framed a National Strategic Plan of Action for Tobacco Control, 2007–2010 to protect the people from tobacco usage by promoting cessation programs, protecting non-smokers from second-hand smoke and by reducing tobacco consumption. In order to implement tobacco control law at the

grassroots level, government has formed tobacco control taskforces at three administrative levels: national, district and sub-district level. Mobile courts are being run throughout the country to enforce the law, with the empowerment and active participation of taskforces. Government has established cooperation between government and NGOs in the country. In law implementation process, NGOs are working as watch-dog and monitoring tobacco control law violation by the tobacco companies. Government has offered training for the local level organizations on tobacco issues to work on the local level with efficiency. This multi-faceted approach helps ensure progress towards strong implementation of the FCTC in Bangladesh.

#### **PC-1010-28 Assessing the impact of capacity building programmes for tobacco control in India**

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**Background:** Public health programmes face a number of challenges due to a lack of skills capacity. The technical and management development trainings conducted by the Union address to bridge this gap by building technical knowledge about tobacco control interventions and management of health projects. Since 2007, the Union has conducted 12 courses of the International Management Development Programme and six technical workshops. Three of the technical workshops brought together staff under India's National Tobacco Control Programme and included expert presentations, experience sharing of progress and challenges from states, group work, and role play.

**Methodology:** Trainings were evaluated by the Kirkpatrick framework and variables measured include participants' post-training evaluations, learning, application of acquired knowledge, and organizational impact made by the trained individual. Emphasis was given to assessing the application of learning to the participants' work in the field of tobacco control. A structured questionnaire was administered to those who had participated in both the technical as well as management development programmes conducted by the Union, within one and 24 months after they had attended the courses. The training course participants were from the government and NGOs who are engaged in health system and academic work profiles.

**Conclusion:** The technical as well as management trainings have added to the numbers and technical prowess of tobacco control advocates. There is an increase in knowledge regarding the strategies employed for tobacco control and enforcement of legal provisions to reduce tobacco use. The number of

applications to the BI grants programme has also increased along with better management of grants projects. These trainings have also provided an interface between civil society and government. The workshop reports have been submitted to the Ministry of Health as recommendations to improve programme implementation.

### PC-1145-28 Introducing tobacco control into national TB control programmes: experience from a pilot in India

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**Introduction:** India is the highest TB burden country globally, and also has a high prevalence of tobacco use and mortality from smoked tobacco use. In 2010, the Revised National Tuberculosis Control Programme (RNTCP) and the National Tobacco Control Programme (NTCP) coordinated to discuss the potential to introduce tobacco cessation within the RNTCP. Stakeholder consultations were held in two NTCP districts. With technical support from the Union, a pool of master trainers was trained in each district that included programme managers from both the RNTCP and the NTCP. Training tools included a module for medical officers, a module for health workers, printed handouts for TB patients and a tobacco cessation intervention (TCI) card to record information captured during the intervention. The master trainers then trained all medical officers and paramedical staff in the district over a three month period from July to September 2010.

**Discussion:** All TB patients registered in the 4th quarter of 2010 in the districts of Kamrup (Assam) and Vadodara (Gujarat) were routinely asked about their tobacco use at the time of registration of treatment. These patients will be followed up at least on 3 occasions during treatment—end of intensive phase, middle of continuation phase and end of treatment. Patients identified to be tobacco users are asked about the type and duration of their tobacco use and then offered support to quit; patients accepting support are referred to cessation services established in the district by the NTCP.

**Results:** In district Vadodara, 996 TB patients were registered in the 4th quarter 2010. Of this, 369 (37%) were tobacco users—190 (19%) using smoked tobacco and 179 (18%) using smokeless tobacco. 392 tobacco users were provided with a TCI card and will be followed up with support for quitting during the period of their TB treatment.

**Conclusion:** Significant numbers of TB patients use tobacco with important implications for TB control.

### PC-1316-28 Enforcing prohibition of smoking in public places in developing countries: experiences from Chennai

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**Background:** India has comprehensive national legislation that prohibits public smoking, requires prominent display of specific signage, identifies enforcement authority, defines public places and imposes penalties on violations. Data from the Global Adult Tobacco Survey (GATS) 2010 report shows that 21.1% of adults in Tamil Nadu are exposed to secondhand smoke (SHS) in any public place. The DPH employs enforcement squads comprising of a police officer and a health officer which identify violators and imposes a penalty which is usually collected and receipted on the spot. PSI supported this squad with the addition of an interpersonal communicator (IPC) and interactive communication tools to assist the smoker to understand their offence and change behaviour.

**Discussion:** Over a period of 12 months, 12 531 persons were penalised for smoking in public places and were counselled by the PSI IPC. The counselling session included direct interaction, access to printed information and linkage to cessation services through a telephone helpline. The counselling targeted increasing knowledge about the national law and the harmful effect of SHS. Public premises were provided the option to obtain socially marketed signage at cost. Baseline and end line research was conducted using a two stage stratified sampling frame.

**Results:** Knowledge of the national law increased from 37.9% to 82.3% with significant increases in knowledge around specific sections of the law. Increases were most significant in public places where smoking was more likely to occur—bars and pubs when compared to hospitals and schools. Increases were also significant among smokers exposed to communication with IPC versus those who were not.

**Conclusion:** Combining IPC and education with enforcement has significant implications for expanding smoke free public places in developing countries.



## SATURDAY 29 OCTOBER 2011

### ORAL PRESENTATION SESSIONS

#### EXPERIENCES IN MDR-TB MANAGEMENT: AN AROUND- THE-WORLD VIEW

##### OP-436-29 Acquired resistance to second-line anti-tuberculosis drugs during MDR-TB treatment in the PETTS study

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**Setting:** The 'Preserving Effective TB Treatment Study' (PETTS) is a prospective study of 1794 MDR-TB patients enrolled 2005–2008 in Green Light Committee (GLC) approved treatment programs (Estonia, Latvia, Peru, Philippines, Russia) and non-GLC programs (South Africa, South Korea, Thailand, Taiwan).

**Objectives:** To determine the incidence and consequences of acquired resistance to second-line anti-tuberculosis drugs (SLDs). This report presents preliminary results on acquired resistance comparing GLC-approved and non-GLC programs.

**Methods:** Drug susceptibility testing (DST) was performed at CDC by the proportion method on Middlebrook 7H10 agar. For each patient, we compared baseline DST results from sputum collected within 30 days of starting SLDs, and final DST results from the last available culture. Genotyping results are pending.

**Results:** To date, 778 pairs of baseline and final results have been analyzed. Of 411 from GLC sites, 355 were susceptible to fluoroquinolones (FQ: ciprofloxacin, ofloxacin) at baseline; 35/355 (9.9%) acquired FQ resistance. Of 367 from non-GLC sites, 302 were FQ-susceptible at baseline; 63/302 (20.9%) acquired FQ resistance. For second-line injectable drugs (SL-injectables: kanamycin, amikacin, capreomycin), resistance developed in 38/320 (11.9%) patients in GLC sites vs. 33/266 (12.4%) in non-GLC sites. Comparing GLC and non-GLC sites, XDR-TB developed in 32/391 (8.2%) and 57/324 (17.6%) patients, respectively, who did not have XDR-TB at baseline. Of 89 patients who developed XDR-TB during treatment and had definite outcomes, 7/32 (21.9%) from GLC sites and 27/48 (56.3%) from non-GLC sites died during treatment.

**Conclusions:** During treatment of MDR-TB, 10%–

20% of patients acquired resistance to SLDs, with fatal outcomes in many cases, reinforcing the need for complete, reliable DST and effective treatment regimens.

##### OP-464-29 Review of Nepal drug-resistant TB programme on completion of 5 years: lessons learnt and key challenges

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**Background:** Nepal National Tuberculosis Control Programme has implemented a Green Light Committee-approved Drug Resistant TB project since September 2005, using standardized treatment regimens and a predominantly ambulatory approach. The project offers treatment from 12 treatment centres and 54 treatment sub-centres throughout the country. We undertook to review the outcomes from the first 5 years of the program.

**Methods:** Free, standardized treatment (kanamycin, ethionamide, cycloserine, pyrazinamide, levofloxacin) is provided for Category 2 failures and other culture-demonstrated multidrug-resistant cases. Monthly medical reviews include smear and culture testing, and serum monitoring for potassium and creatinine. Outcomes were recorded according to the standard definition.

**Results:** By the end of 2010, 910 patients were enrolled. The largest number of MDR-TB cases registered were failures of CAT 2 (90%), followed by CAT I failures with culture and DST confirmed MDR (5%). Complete outcomes were available for 525 patients who started treatment during 2005–2008 period, with the following results: cure (65%), default (19%), failure (7%), death (9%).

Table Cohort report, 2005–2008

Registration group	Cured	Treatment completed	Died	Failed	De-faulted	Transferred out	Total
New	2				1		3
Relapse		1					1
After default							0
After failure of Category 1 treatment	19		1	3	3		26
After failure of Category 2 treatment	308		44	32	90		474
New extra-pulmonary							0
Other	12		4		5		21
Total	341	1	49	35	99	0	525
%	65.0	0.2	9.3	6.7	18.9	0	

**Conclusion:** Standardized treatment is best option for countries like Nepal where drug sensitivity patterns

are known. Ambulatory Drug Resistant Treatment is key for achieving nationwide programme coverage and improve access. Cure rates for Nepal's Drug Resistant TB programme remain on par with international standards. Default rates have been high, particularly among patients from rural areas, who incur significant travel, living, and indirect expenses to receive treatment. Providing socio economic support may reduce default and improve outcomes for MDR-TB in low-income settings.

### OP-551-29 Progress and plans for nationwide scale-up of programmatic management of MDR-TB in India

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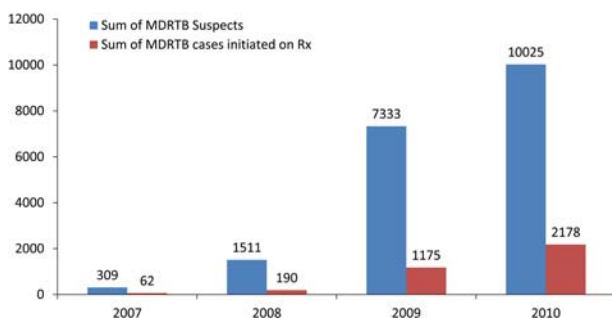
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**Background:** India has the world's highest burden of tuberculosis (TB) and multidrug-resistant tuberculosis (MDR-TB), with an estimated 99000 cases of MDR-TB emerging annually. The programmatic management of MDR-TB (PMDT) in India began in 2007. We sought to document the progress and plans for scaling up PMDT services nationwide.

**Methods:** We reviewed programme records on PMDT service expansion, MDR-TB case-finding, and treatment initiation. Future scale-up planning was conducted by detailed consultations with all 35 states of India, aligning State plans with national resources including second line anti-TB drug supply, laboratory capacity, and realistic timelines for pre-service district appraisals and trainings required.

**Results:** From 2007–2010, PMDT services have expanded to 12 states of India covering 139 districts with 288 million population, 21% and 24% respectively of total national districts and population, and 19 culture labs have been accredited. Cumulatively, 19078 MDR-TB suspects were tested and 3605 MDR-TB cases initiated on MDR-TB treatment, increasing annually (Figure). In 2012, India expects to have achieved complete geographic coverage of basic



**Figure** Total MDR suspects tested and cases initiated on MDR TB treatment, 2007–2010.

PMDT services, to evaluate ~ 97000 sputum positive TB patients, initiate treatment for >15 000 MDR-TB cases, and 250 (40%) districts will offer rapid drug-susceptibility testing (DST) for all sputum-positive previously-treated TB cases at diagnosis.

**Discussion:** India has achieved rapid expansion of PMDT services, and has funded plans for accelerated nationwide scale-up of PMDT services. Crucially, national plans include aligned national plans for laboratory capacity development, drug procurement, and pre-service district training and appraisals. Key threats to the success of the scale-up plan include second-line anti-TB drug supply limitations, escalating drug costs, and delays in implementation of laboratory development including rapid DST.

### OP-581-29 Impact of standardised treatment on the infectiousness of MDR-TB patients in South Africa

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**Setting:** Direct evidence of the impact of effective treatment on MDR-TB transmission is lacking.

**Methods:** We directly quantified MDR-TB transmission by exposing hundreds of sentinel guinea pigs (GPs) to the exhaust air from a 6-bed experimental ward where groups of South African culture positive MDR-TB patients believed to be highly infectious [mostly smear positive, coughing, with lung cavitation, and 70% recently initiated (<24 hrs) on standardized therapy] were admitted. Among those patients, several XDR-TB patients were retrospectively identified using liquid-based culture and genetic second-line drug susceptibility testing.

**Results:** In one study, 74% of 360 GPs were infected over 4 months by exposure to 26 patients. Microbial genotyping among 18 GPs with recoverable isolates revealed that all 18 were infected by just two strains, both of which were likely from two XDR-TB patients on the ward. In another experiment, 54% of 90 GPs were infected over 2 months by exposure to 15 patients, including 3 unsuspected, inadequately treated XDR-TB patients. In a third 3-month experiment, however, in which there were no XDR-TB patients, 27 MDR-TB patients infected just 1 of 90 GPs.

**Conclusions:** As shown by Riley's experiments more than 50 years ago, and more recently by Escombe, TB transmission to GPs exposed to exhaust air from a TB ward predominantly occurs from patients with unsuspected drug resistant isolates who are on inadequate treatment. These observations extend those findings to MDR-TB, showing that patients recently started on the standard South African regimen rarely

infected sentinel GPs. However, patients with unsuspected XDR-TB, who were being treated for MDR-TB, infected large numbers of animals. These preliminary results have policy implications for rapid drug resistance testing, prompt effective treatment initiation, and hospital vs. community-based treatment of MDR-TB.

#### OP-727-29 Impact of a private sector funded programme for MDR-TB management on scale-up in Pakistan

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**Background:** Even though most TB patients in Asian settings are first treated in private clinics, the private sector remains insufficiently engaged in responding to the global drug-resistant TB epidemic. The Indus Hospital in Karachi established an MDR-TB control program providing free treatment within the private sector supported through individual and corporate donations from November 2007 to June 2010.

**Methods:** Culture confirmed cases of MDR-TB were provided free community-based treatment, and monthly consultations, sputum cultures, food baskets and psychological support. A MoU was signed with the National TB Programme (NTP) in November 2008 to share data and experience. Treatment was individualized in accordance with WHO guidelines, but all drugs were purchased off the local market.

**Results:** 199 patients were registered between November 2007 and June 2010. In November 2008, the program was approved by the Green Light Committee although quality-assured drugs only became available in June 2010 through the NTP and the Global Fund. 53 MDR-TB patients (24 males, 29 females) were started on second line treatment in 2008. For patients that had completed 24 months of second line treatment, the treatment success rate was 58%, with 25(47%) patients cured and 6(11%) completed treatment. The Indus Hospital program team worked closely with the NTP to submit a successful Round 9 Global Fund application to scale up MDR-TB treatment to 13 000 patients nationally. Indus Hospital is the sub-recipient for scale-up in Sindh and Balochistan province.

**Conclusion:** The private sector in Asia can positively impact NTPs in supporting the establishment and scale-up of community-based MDR-TB programs.

#### OP-797-29 Epidemiological and clinical characteristics of the XDR-TB epidemic in Peru

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**Background:** Since 2005 to 2009, 215 new XDR-TB cases were diagnosed at the Peruvian National Mycobacteria Reference Laboratory, 91% of these cases come from Lima.

**Objective:** to describe the main epidemiological and clinical characteristics of the XDR-TB cases in Peru.

**Methods:** Information was gathered from clinical charts and from direct interviews to patients or relatives conducted by a field worker. We report here the results of a sample of 67 XDR-TB patients evaluated in Lima.

**Results:** Mean age was 31.7 years (range 11 months to 70 years); 62% were male; 46% were born in Lima; 63% lived in poverty; 10% used illicit drugs; and 16% were heavy drinkers. 52% developed XDR-TB during his first episode of TB, and 8.8% were primary cases of XDR-TB. Before XDR-TB diagnosis, patients took an average of 19 months of anti-TB therapy, and had received 2.7 TB regimens: 71% had taken Cfx, 67% Km, and 47% Cm. 29% had history of defaulting previous treatment regimens. HIV co-infection was evaluated in all cases, 4.6% were positive. Pulmonary TB was reported in 94% and 30% developed consumption. The mean time between the notification of TB and XDR-TB diagnosis was 776 days (range 43 to 2480). All patients received ambulatory therapy. Most frequent drugs prescribed for treatment were Cs, PAS, Mfx, Cm and Eto, nobody received linezolid. 48% developed adverse reactions, and a surgical procedure was performed in 15% only. At the time of data collection 23 (34%) remained on treatment. Of out 44 discharged patients 29.5% were declared cured or completed treatment, 54.5% died and 16% defaulted. Patients were discharged after 3.3 years in average; the survivor time was 3.6 years since TB diagnosis, and 1.3 years since XDR-TB diagnosis.

**Conclusion:** Poor clinical outcomes of Peruvian XDR-TB patients resulted from delaying diagnosis, empiric use of second line drugs, and low performance of surgical treatment. A new approach to properly care for XDR-TB patients must be implemented in Peru.

### OP-1338-29 Preliminary outcomes of a 12-month standardised regimen for the treatment of multidrug-resistant tuberculosis in Cameroon

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**Setting:** The two specialized units for the treatment of MDR-TB patients in Cameroon.

**Objective:** To assess the outcomes of patients with multidrug-resistant tuberculosis with a 12-month standardized regimen.

**Design:** Observational study of patients with confirmed MDR-TB disease put on a 12-month standardized treatment regimen. The treatment regimen consisted of an intensive phase with 4 months of KmGfxPtoHCfzEZ, followed by a continuation phase of 8 months with GfxPtoCfzEZ, given daily. Clinical and bacterial progress was monitored during treatment monthly until completion; follow-up was done clinically and with bacteriological control for up to one year.

**Results:** A total of 54 patients were put on treatment during the study period, 25 (46.3%) being male and 29 (53.7%) being female. The mean age of the patients was 32.52 years (range 17–60). The following anti-TB drug resistance patterns were identified: HR 15 patients; HRE 3 patients and HRS 17 patients, each; HRES 19 patients. None had taken any second-line drug. 12 (22.2%) of the patients were HIV-seropositive. Treatment outcomes were the following: cured 50 (92.5%); died 4 (7.5%); none of the patients defaulted or was referred. The most important treatment side effect was impairment of hearing in 10 patients. During a total of 384 patient-months follow-up no relapse occurred.

**Conclusions:** Preliminary results of our regimen appear to be very promising and underscore the fact that a standardized short-course regimen may be the best pragmatic alternative to the standardized WHO regimen or individualized treatment of MDR-TB in resource poor settings with little exposure to second-line anti-tuberculosis drugs.

### EXPANDING TUBERCULOSIS PROGRAMMES: ISSUES IN SCALING UP

#### OP-305-29 Tuberculosis control in two prisons in Kenya

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**Setting:** Embu and Meru prisons, located in Eastern Province, Kenya hold average 780 and 1300 prisoners respectively. Like other prisons in Kenya, they are associated with rapid transmission of infectious diseases like tuberculosis due to poor living conditions and ineffective health services. Before 2007 the challenges to tuberculosis control in these two prisons were: health posts in the two prisons lacked tuberculosis diagnosis services and therefore tuberculosis suspects had to be transported to the district hospitals for diagnosis, there was no TB screening on prisoner admission leading to delays in TB diagnosis. This fuelled tuberculosis transmission with high case notifications of over 17 000 and 3500 for Embu and Meru prisons respectively before 2007.

**Intervention:** Interventions were put in place from the third quarter of 2007. All the wardens were trained on TB control and five designated as TB coordinators who facilitated referral of TB suspects to the prison health post, regular health education was conducted amongst all the inmates, selected inmates designated as cough monitors and TB microscopy services started at the prison health post. Routine data from the prison facilities' TB treatment registers was reviewed for the period before and after the intervention.

**Results:** (See Table.) Notified cases of TB increased in 2007 when the interventions were put in place. A 200% increase in notified cases was witnessed in 2008 relative to 2006. However, by 2010 incidence rates of cases notified had decreased by 51.9% (Embu) and 71.7% (Meru) compared to the 2006 rates.

	2006	2007	2008	2009	2010
Embu prison, case notification per 100 000 population	17051	20256	33846	13076	8205
Meru prison, case notification per 100 000 population	3538	4000	6692	1538	1000

**Conclusion:** The tuberculosis interventions were effective in controlling transmission of TB and should be considered in other highly endemic prisons.



### OP-339-29 Community volunteers' contribution and challenges to tuberculosis case finding in Nigeria

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**Background:** Community TB care as one of the Stop TB strategy, to increase case detection and management of TB was adapted in Nigeria with development of national guidelines, training modules and training of community volunteers. One of the states to commence implementation was Adamawa state because of its low case detection rate of 27%.

**Objective:** The objective of the paper is to demonstrate the contribution of the CVs and describe challenges faced during implementation.

**Methods:** It was a retrospective study, analyzing the contribution of eighty eight (88) CVs who were trained on identifying and referring TB suspects from 12 of 21 LGAs in the State in 2008, using a standardized National training manual. Data capturing tools (referral forms for CVs, patient record cards at the facilities and registers for the Local Government Supervisors) were made available. Data collection started January 2009, and by end of December 2010, program data from the 12 participating LGAs were analyzed. Two (2) Focused Group Discussions were held with 30 CVs each in 2010.

**Results:** The analysis focused on data collected in 2010. Of the 88 trained CVs, 35 (40%) referred TB suspects to DOTS centers in 2010. The number of CVs per LGA ranged from 2 to 10 with an average of 3 per LGA. A total of 479 TB suspects were referred to DOTS facilities for diagnosis; 114 (24%) were confirmed as TB cases. The total number of TB cases detected in 2010 by the 12 LGAs was 1537; CVs contributed 114 (7.4%). Challenges faced by CVs include; poor incentives, lack of recognition within communities and poor linkage with DOTS health facilities.

**Conclusion:** CVs activities can result in increase case detection where there is a functional TB program.

### OP-467-29 Cost-effectiveness of alternative case finding strategies for prisons with high prevalence of MDR-TB

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**Background:** Prisons of the former Soviet Union (FSU) have some of the highest rates of multidrug-resistant tuberculosis (MDR-TB) ever observed, and are thought to drive rising TB levels in these countries' general populations. Effective case finding in prisons may reduce long-term treatment costs and potentially TB incidence outside prisons.

**Design/methods:** We developed a dynamic state-transition model of TB and drug resistance, with inputs matched to the epidemiology of prisons in the FSU, including primary cost data collected in the Republic of Tajikistan. We evaluated eight alternative case finding strategies combining symptom questionnaires, mass miniature radiography (MMR), sputum smear microscopy, sputum culture and sputum PCR analysis. Over a ten-year time horizon, we projected costs, quality-adjusted life years (QALYs) saved, TB and MDR-TB prevalence. We also examined the effect of overpopulation on MDR-TB prevalence.

**Results:** The current strategy in most FSU prisons—annual MMR screening with smear microscopy for case confirmation—cost more and was less effective than strategies including symptom screening. In addition, annual screening with both symptom questionnaires and MMR cost \$164 per QALY compared with symptom screening alone. Adding PCR confirmation to this strategy cost \$649 per QALY. The cost-effectiveness of these strategies was associated with their capacity to reduce MDR-TB prevalence. Adding overpopulation to our model caused MDR-TB prevalence to increase in all case finding strategies.

**Conclusion and recommendations:** In prisons of the FSU, the current strategy of annual MMR screening should be modified to include symptom screening, which may reduce costs and improve outcomes. More sensitive but resource-intensive case finding methods (including PCR) may be cost-effective in the long-run by interrupting transmission of MDR-TB. The effects of improved disease control may be attenuated by overpopulation of prisons.

### OP-535-29 Piloting airborne infection control in India: baseline assessment and early results in 35 health-care facilities

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**Background:** Airborne infection control (AIC) has not been previously addressed in policy or practice in India. National AIC operational guidelines for health care facilities (HCF) were adopted in 2010, but no information was available on the baseline situation, nor the feasibility and effectiveness of the recommended activities.

**Objectives:** To conduct systematic baseline assessments of AIC administrative, environmental and personal protective measures and practices at 35 selected HCF in 3 States of India, and assess the uptake of AIC measures after 6 months.

**Methods:** Cross-sectional descriptive study: AIC capacity building and standardized HCF risk assessments were conducted in 35 HCF. Recommendations were provided to HCF administrators, and after 6 months uptake of AIC measures was assessed and compared to baseline assessment results.

**Results:** The 35 HCF included 187 distinct clinical departments across 9 medical colleges/tertiary facilities, 11 district hospitals, 8 primary facilities, 10 ART centres, and 4 drug-resistant TB services. Overall infection control (IC) systems were found to be poorly developed, with AIC largely absent. Administrative controls were uncommonly practiced, and about half of departments need minor renovation to achieve minimum environmental standards. AIC capacity building and systems development efforts resulted in promising improvements across all indicators (Table).

Indicator of AIC measure	Baseline (n/N)	6 months (n/N)	Percent change
HCF with IC Committee in place	11/35	17/21	81
IC committee meeting regularly	8/11	14/17	10
Written IC plan available	5/35	12/21	43
Written IC plan includes AIC	0/5	12/12	100
IC focal point in place	7/35	21/21	80
Health care worker surveillance (passive/active)	1/35	9/21	40
Cough hygiene information	6/33	16/20	62
Screening and fast-tracking	0/33	9/20	45
Separation of suspects	0/33	7/20	35

**Discussion:** Across a broad range of health facilities in 3 states, AIC practices at baseline were extremely poorly implemented. A package of capacity building and systems development for HCF based on national guidelines substantially improved uptake of AIC in-

terventions. After revision of national guidelines based on this pilot, India will move towards scale up of the intervention package, with emphasis on integration of AIC into routine health system IC activities.

### OP-868-29 Scaling-up diagnosis and treatment of drug-resistant TB: an integrated, community-based approach

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**Introduction:** There is an urgent need to scale up treatment access for drug resistant TB (DR-TB) globally. Scale up requires new models of care that move away from centralised, specialised programs, towards community-based interventions. Khayelitsha is a large peri-urban township in Cape Town, with high rates of HIV, TB and DR-TB. MDR-TB incidence is estimated at 51/100 000/year.

**Intervention:** From late 2007, a program to decentralise and integrate DR-TB care into the primary health system was initiated. Implementation was incremental, starting with extensive training of existing clinic staff, TB infection control and clinic-based registers. Further inputs include: DR-TB counselling, social assistance and support groups, home visits, clinician support, a local inpatient service, audiometry screening, contact screening and a specialist outreach paediatric DR-TB clinic. Patients are diagnosed and treatment initiated (daily clinic attendance) at their local clinic and only admitted to hospital if required clinically. The DR-TB starting regimen (defined as any rifampicin resistance) has been strengthened to include: moxifloxacin, kanamycin, ethionamide, terizidone, pyrazinamide and ethambutol.

**Results:** Case finding increased from 118 in 2006 to 231 in 2009; 75% HIV infected. Second-line drug susceptibility results were available for 35% in 2007 and 88% in 2009. More than 80% of diagnosed cases start treatment, with 70% of these at clinic level. The time between sputum sampling and treatment initiation has declined from 71 days in 2007 to 34 in 2010; the majority resulting from decreases in the time taken to initiate treatment after the result is received.

**Conclusions:** The Khayelitsha DR-TB program demonstrates how a patient-centred, community-based model of care can improve case detection, get more patients on treatment and improve survival. Ultimately, this approach is likely to reduce further transmission, particularly if new rapid diagnostics can be implemented.

### OP-877-29 The truth about TB: involving communities in the fight against tuberculosis in England

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**Background:** TB has been rising in England for 20 years, with 8286 cases reported in 2009, mostly among non-UK born people living in urban areas. The Department of Health's TB Action Plan calls for local awareness initiatives involving community organisations. TB Alert, with funding from a Department of Health grant, has developed The Truth About TB programme to enable community organisations to integrate TB into their work and partner local health services to better meet community needs.

**Intervention:** TB Alert works alongside health services at national and local levels to encourage and assist them to adopt a social model of health for TB control, by improving understanding of the individual and community-level wider determinants of health and adapting services accordingly. In 2010 and early 2011, TB Alert ran a series of 12 seminars for community leaders, to build understanding of how TB affects their communities, and to explore how they can work with local statutory stakeholders to increase awareness and improve access to services. [thetruthabouttb.org](http://thetruthabouttb.org) website and other awareness resources support this work.

**Results:** Over 400 delegates attended the recent community seminars and most wish their field staff to receive training in TB; this will be launched in 2011. Health sector and local government stakeholders increasingly recognise the value of working with the community through a structured approach. The new London TB Model of Care includes awareness raising and community involvement as integral components.

**Conclusion and key recommendations:** Multi-sector partnerships are necessary to deliver TB services that meet the needs of the most vulnerable communities, from prevention and awareness through to diagnosis and treatment. This should be an integral part of locally developed and commissioned TB services.

### OP-1028-29 Identifying and relieving barriers to accessing TB care in Ghana with a tool to estimate patients costs

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**Background:** As in other African countries, Ghana faces low TB case notification. In spite of TB treatment being free there are other factors such as health systems, community and patients that are barriers to care.

**Design/methods:** TBCAP's Tool to Estimate Patients costs was adapted to Ghana to estimate patients' costs incurred before/during diagnosis and during treatment. New TB patients, older than 15 years, were interviewed.

**Results:** Over 60% of TB patients were in the lowest poverty quintiles earning less than US\$50 per month. 69% of the patients stopped working or going to school as a result of falling ill. Patients (37%) delayed care seeking (4–10 weeks) and borrowed or sold assets to pay for health care costs. On average patients spent 21.5 hours seeking diagnosis. Total direct (out of pocket) costs before and after diagnosis and during treatment were US\$1030. Average indirect costs were US\$424 (median 170). The total cost of US\$1455 (median 270) incurred corresponds to 22% of annual personal income.

**Conclusion and recommendations:** Despite free TB treatment, there are other significant costs to patients to access TB care. Pro-poor strategies are therefore planned to improve access to TB care.

## IMPLEMENTING THE THREE I'S

### OP-786-29 Implementation of tuberculosis infection control measures at HIV CARE and treatment sites in Africa

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**Background:** Nosocomial transmission of tuberculosis (TB) is a major public health concern in resource constrained settings. Instituting infection control (IC) measures is vital to strengthen health systems and reduce TB incidence in countries with high HIV prevalence.

**Methods:** In September 2010, a structured survey was administered in 663 healthcare sites providing HIV care and treatment to over 900 000 patients in 9 TB-affected countries (Cote d'Ivoire, Ethiopia, Kenya, Mozambique, Nigeria, Rwanda, South Africa, Swaziland, and Tanzania). Presence of a TB IC plan, triage practices to identify TB suspects, N95 respirator availability and location of sputum collection were assessed in relation to facility characteristics, including location (urban, rural), facility type (1°, 2°, 3°, private) and provision of TB treatment (yes or no).

**Results:** 47% (range across countries [RAC]: 2%–77%) of the 663 sites had a written TB IC plan, 60% (RAC 5%–93%) practiced triage, 16% (RAC: 2–87%) had N95 respirators available, and of 542 sites with access to microscopy, 83% (RAC: 56%–91%) performed sputum collection outdoors and 13% (RAC: 9%–36%) in ventilated indoor spaces. Written TB IC plans were more common at 2° (57%,  $P = 0.0001$ ) or 3° (75%,  $P < 0.0001$ ) sites compared to 1° sites (40%). Sites providing TB treatment were more likely to have TB IC plans than those without TB services (54% vs. 12%  $P < 0.0001$ ). Sites providing TB treatment were also more likely to have N95 respirators (18% vs. 8%,  $P = 0.0126$ ) and perform sputum collection outdoors or in ventilated areas (99% vs. 78%,  $P = 0.0017$ ) than those without TB services.

**Conclusions:** There is urgent need for further scale up of TB IC practices at HIV care and treatment sites, particularly those that do not also provide TB treatment. Implementation of inexpensive managerial and administrative IC measures is an important step to strengthen health systems and protect health care workers.

#### OP-815-29 Using a quality improvement team approach to scale up provision of TB isoniazid preventive therapy

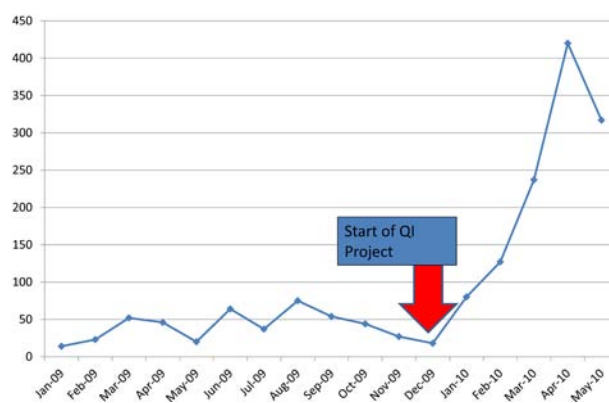
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**Background and challenges to implementation:** Outapi ART Clinic has been implementing the HIVQUAL program for monitoring and improving the quality of HIV care since 2007. Of the 11 quality indicators routinely monitored by the Quality Improvement (QI) Program, Isoniazid Preventive Therapy performance score (22%) was the lowest in the last review period ending December 2009 and IPT scores were generally very low at all previous quality monitoring review periods. WHO and the Namibian Ministry of Health and Social Services recommend the provision of 6 months of IPT to all HIV positive persons where active TB has been ruled out.

**Intervention or response:** A QI Project team was established led by a Medical Officer, Sister-In-Charge, Pharmacist, Data Clerk, Community Counselor, Ex-

pert patient and a registered nurse who was the project secretary. The team did a root-cause analysis and Focus Group Discussions (FGDs) with patients and identified several systemic reasons for the poor IPT coverage. The doctor gave a presentation to all the clinic nurses on screening for IPT eligibility and how to prescribe IPT. A screening tool for TB for IPT was availed for all providers. Data clerk gave a presentation on documentation in the patient's file and the Expert patient provided intensified Health Education to patients on IPT to clear misconceptions on IPT identified in the FGDs.

**Results and lessons learnt:** Over the following 6 months data on IPT coverage was monitored closely and showed remarkable improvement (see Figure).



**Figure** Review of monthly data patients newly commenced on IPT, January 2009 to May 2010 at Outapi ARV clinic.

**Conclusions and key recommendations:** Client involvement can yield positive results in IPT and clinic staff members are more dedicated if they are involved and are constantly updated on progress on quality improvement initiatives.

#### OP-1006-29 TB infection control in OR Tambo District, Eastern Cape Province, South Africa

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**Aim:** At 970 cases per 100 000 in 2009, South Africa had the highest TB incidence in the world. The high incidence of TB is partly attributed to poor infection control in public healthcare facilities. This paper aims to describe infection control measures in place at primary healthcare facilities in a rural district of the Eastern Cape.

**Methods:** A cross-sectional baseline survey was conducted in O.R. Tambo during late 2010. A representative sample of 62 clinics was randomly selected. A



structured questionnaire was developed and data obtained by interviewing either the operational manager or TB nurse. Observations were conducted regarding equipment, environmental and infection control, and the availability of guidelines. Data were coded, captured and analysed using SPSS17. Univariate analysis was performed.

**Results:** 54.8% of clinics produced a written infection control policy; at 41.0% of facilities all windows were open during the visit; 9.8% facilities had TB signs and symptoms questionnaires attached to patient files; 19.4% of facilities had an open window register; all windows were able to open at 88.7% of facilities; N95 respirators available at 29.0% of facilities; and occupational health services available at 22.6% of facilities. Training on infection control was poorly attended by chief/senior professional nurses (32.2%) and professional nurses (38.1%).

**Conclusion:** Infection control procedures were not well implemented in the district, a finding that may be aggravated by the lack of training for nurses on infection control policies and practices.

#### OP-1030-29 Intensified tuberculosis case finding at HIV diagnostic and treatment services in India, 2010

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**Background:** India is highest TB burden country in the world and is also ranked third in terms of absolute number of persons living with HIV/AIDS (PLHIV). With a relatively low population prevalence of HIV, the national TB and HIV programmes have prioritized HIV diagnostic and treatment service locations for intensified TB case finding (ICF) activities, as PLHIV are relatively concentrated in these settings.

**Objective:** To assess status of ICF activities at HIV care settings in India.

**Results:** In 2010, more than 8.4 million clients visited 7976 integrated HIV counseling and testing centers (ICTC), among whom 290 542 (3.5%) were referred for TB diagnostic evaluation. Among those referred 48 598 (16.7%) were diagnosed with TB, and >85% were started on treatment under the national TB control programme. Among diagnosed TB cases referred from ICTCs, 36 553 (75%) were among ICTC clients reported to be HIV-negative; 25% (12 045) diagnosed TB patients were reported among HIV-positive clients. Out of 292 ART centers in the country, only 100 have reported on HIV-TB in 2010. A total of 900 781 patient visits were recorded at these centers in 2010; 36 169 referrals for TB diagnostic evaluation were made, among whom 8134 (23%) were diagnosed with TB.

**Discussion:** Nationwide implementation of ICF at

HIV diagnostic and treatment services is feasible and sustainable at a large scale. ICF at ICTCs has contributed measurably to TB case-finding, offering an opportunity for earlier detection of TB among HIV-infected and uninfected persons alike. ICF at ART centers in India requires substantial strengthening in monitoring, supervision, and reporting; where implemented, nearly 1 in 4 referrals for TB yield a TB diagnosis, and large numbers of TB patients are being diagnosed from relatively few centers with small client loads.

#### OP-1105-29 Strategies for scaling-up TB-HIV collaborative activities at HIV facilities in Mozambique

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**Background:** In Mozambique the Ministry of Health has been promoting the WHO recommended TB-HIV collaborative activities since mid-2006. In order to facilitate and enhance TB active case finding and access to Isoniazid Preventive Therapy (IPT), a TB screening questionnaire was adopted nationally in 2008. The tool aims to regularly screen for TB the patients enrolled in care at HIV facilities. Furthermore, TB-HIV reporting forms were developed to collect and report data on HIV patients screened, patients diagnosed with TB, and patients initiated on IPT.

**Methods:** We evaluated the data on TB screening and IPT progressively implemented at HIV services in the 11 provinces of the country, and reported to the National TB Program from 2008 to 2010.

**Results:** Since the introduction of the TB screening tool there was a progressive increase in the number of patients screened for TB. In 2008 less than 3% (4880/180 364) of HIV patients newly enrolled at HIV services were screened for TB, while the proportion increased to 49% (34 205/69 635) in 2009 and 63% (87 320/138 249) in 2010. Data on patients screened and diagnosed with TB were available only in 2009 and 2010 and showed an increase in TB diagnosis from 11% (3727/34 205) to 16% (14 344/87 320) in the two respective periods. The number of HIV patients initiated on IPT also increased along the 3 years: from 724 in 2008 to 2429 and 13 164 in the following 2 years respectively.

**Conclusions:** Data showed that by including a TB screening questionnaire into routine HIV clinic care, the proportion of HIV patients screened and treated for TB increases, as well as the number of patients initiated on IPT. Better uptake of such tools may improve TB detection and IPT expansion, as well as TB-HIV data recording and reporting. Collaboration between TB and HIV Programs and partners at all levels—from National to service delivery—is important to scale up these activities.

### OP-1142-29 Prevalent tuberculosis at HIV diagnosis in Rio de Janeiro, Brazil: TB-HIV in Rio (THRio) Cohort

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**Background:** Brazil has model HIV care programs, but many patients present to care late, missing opportunities for preventive interventions. We studied the frequency of TB at HIV diagnosis in Rio de Janeiro in order to quantify the missing opportunity to prevent TB.

**Methods:** The THRio cohort includes ~19 000 HIV-infected patients from 29 public HIV clinics in Rio de Janeiro. Patients diagnosed with HIV between 1 September 2005 and 31 August 2009 were included. Prevalent TB was defined as TB diagnosed in the first 90 days after HIV diagnosis or HIV diagnosis during TB standard therapy. Survival was measured from HIV diagnosis. Kaplan-Meier survival plots and Cox regression analyses were conducted.

**Results:** 4548 newly HIV-diagnosed patients were enrolled in the study period, 524 (11.5%) with prevalent TB. Patients with prevalent TB were older, had lower CD4 counts and higher viral loads than those without TB. Prevalent TB cases had a poorer survival (log-rank test,  $P < 0.001$ ) and by Cox regression prevalent TB patients had a greater risk of death [HR = 2.54 (95% CI 2.05–3.15)  $P < 0.001$ ]. In multivariate analysis, prevalent TB [aHR = 1.94 (CI95% 1.42–2.63)] remained significant when controlling for sex, age, CD4 and viral load (Table). The median time to HAART in prevalent TB cases was 101 days (IQR = 58–189) vs. 127 days (IQR = 103–304) in those without TB.

Variable	aHR	95%CI
Prevalent TB	1.94	1.42–2.63
Age	1.02	1.00–1.03
Sex	0.95	0.73–1.24
CD4 count		
<200	1.0	—
200–349	0.58	0.42–0.81
350–499	0.48	0.32–0.72
≥500	0.31	0.19–0.50
Log viral load	1.32	1.20–1.45

**Conclusions:** Almost 12% of newly diagnosed HIV patients in our study present to care with TB and thus, weren't eligible for TB preventive therapy. Earlier diagnosis leading to TB preventive therapy and HAART will reduce morbidity and mortality.

### OP-1191-29 Screening for pulmonary tuberculosis among HIV-infected pregnant women in Western Kenya

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**Objectives:** Among HIV-infected pregnant women participating in a standard pulmonary tuberculosis (PTB) screening program, to determine the prevalence of: latent tuberculosis infection (LTBI) and active PTB.

**Methods:** This was a cross-sectional descriptive study carried out within the USAID-AMPATH program; Western Kenya. All participants eligible at the period of the study underwent: a standardized structured symptom/sign screen, tuberculin skin test (PPD), single view posterior anterior shielded chest radiograph (CXR) on an opt out basis after the first trimester and sputum smear and cultures when cough was present.

**Results:** A total of 190 patients were enrolled. The study participants had a mean age of 27 years and a median (range): parity of 2 (0, 10); gravidity of 3 (1, 11); gestation at enrolment of 26(10, 41) weeks and CD4 counts of 440 (24, 1408) cells/ $\mu$ l. Only 20% of the study respondents had a positive symptom and sign screen. The prevalence of: LTBI as defined by a positive PPD was 40% and of presumptive active TB as defined by suggestive CXR was 5%. There was a notable representation of milliary TB; of the 10 cases with suggestive radiological features of active TB; 3 had a milliary picture. None of the 28 samples of sputum's collected were smear or culture positive.

**Conclusion and recommendations:** LTBI infection is common in this population with a remarkable percentage of CXR suggestive of TB. TB screening should be routine in all PMTCT care programs in high TB and HIV burden areas.

### TB-HIV: EPIDEMIOLOGY AND RESPONSE

#### OP-163-29 Production of modelling on integrated prevention, treatment and care services for HIV-positive drug users

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Azerbaijan proximity to the drug trafficking routes is a major factor struggling with illicit drug usage, HIV and TB infections. Prevalence of HIV is 12%, Hepatitis C 53%, TB 3.5%. HIV is the greatest risk factor for tuberculosis disease; thereby HIV and tuberculosis are significant health problems; TB among prisoners 4.5% and TB among HIV positive patients

are 15.6%, in addition 10% of MDR cases among TB new cases and 40% of MDR are registered among relapsed cases. Only 11% of TB patients are covered by HIV testing and less than 2% of IDUs have access to HIV/AIDS prevention programmes, OST and ARV is not available for TB positive IDUs in direct facilities; it demonstrates absence of evidence-based TB and HIV frameworks aimed at target groups and creates obstacles on integrations of services. Objectives are achieved by harmonization of Programs on HIV/AIDS, TB and Drug Control. Epidemiology analyzes conducted in the 13 districts with highest rate of drug usage, HIV and TB revealed that TB prevalence is outnumbered by 5–6 to 1 in comparison with other districts. Model for integration of TB and HIV is endorsed based on epidemiological finding and national plan on OST expansion.

#### OP-411-29 Routine screening for TB and HIV by health care workers at primary health care clinics

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**Background:** South Africa has a high TB-HIV burden. Provider initiated HIV counselling and testing (HIV CT), and routine TB symptom screening are part of the South African national TB and HIV control strategy.

**Methods:** Exit interviews of 640 adult clients (convenience sample) at 3 primary care clinics in Johannesburg, South Africa were performed to assess the frequency of routine HIV CT and TB symptom and suspect screening by health care workers (HCW).

**Results:** One in three (38.2%) clients self-reported TB symptoms (24% weight loss, 16.3% cough >2 weeks, 15.1% chest pain, 14.9% drenching night sweats and 9.9% fever >2 weeks). Only 24.2% of clients overall and 61.7% of those self-reporting TB symptoms at time of the exit interview had been screened for TB symptoms by their HCW. The proportion screened did not differ by type of self-reported symptom (68.8% for fever >2 weeks, 56.9% for weight loss, 54.4% for cough >2 weeks, and 50.7% for chest pain,  $P = 0.78$ ). Among the 178 clients with TB symptoms identified by a HCW, only 60% were asked to provide a sputum sample, with clients with chest pain or prolonged fever being most likely to have been assessed (77% if chest pain, 73.3% if fever >2 weeks, 62% if weight loss, 50% if night sweats). Regarding HIV testing, 81.7% of all participating clients reported receiving HIV CT at least once in the past. Among those never tested, only 32.5% were offered HIV CT at the current clinic visit. Of those not offered testing,

58.2% were interested in knowing their HIV status and were subsequently referred for HIV CT.

**Conclusion:** TB symptoms were highly prevalent among primary care clinic clients. The lack of routine TB symptom screening and systematic assessment of TB suspects represent an important missed opportunity for TB control. Similarly, routine provider initiated HIV CT of clinic clients unaware of their HIV status has not yet become routine practice, even in a setting with a very high TB-HIV burden.

#### OP-705-29 HIV seroprevalence among tuberculosis suspects in Mandya district, South India, 2010

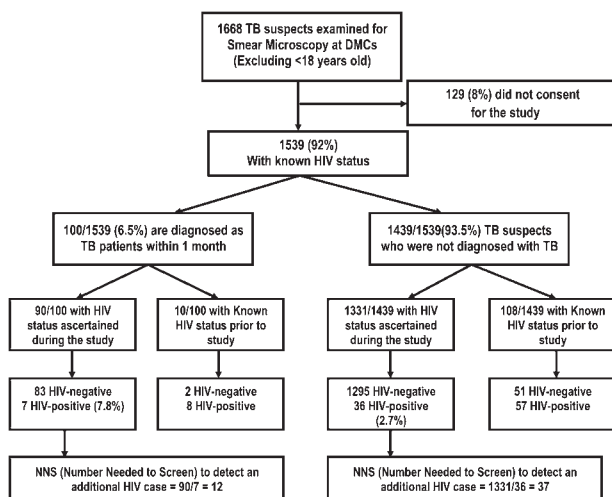
R Balaji Naik,<sup>1</sup> L A L Kumaraswamy,<sup>2</sup> D D Doddamani,<sup>3</sup> K Mohan,<sup>2</sup> VIKAS Inamdar,<sup>3</sup> P K Puneet Dewan,<sup>4</sup> S Srinath,<sup>5</sup> M V Ajay Kumar.<sup>4</sup> <sup>1</sup>WRTAP Consultant SAMS, Bangalore, Karnataka, <sup>2</sup>State TB Officer, Bangalore, Karnataka, <sup>3</sup>Karnataka State AIDS Control Society, Bangalore, Karnataka, <sup>4</sup>WHO India, New Delhi, Delhi, <sup>5</sup>The Union (IUATLD), New Delhi, Delhi, India. e-mail: sathyasaakshi@gmail.com

**Background:** HIV testing of tuberculosis (TB) suspects is recommended by WHO, but is not policy in even high HIV-prevalence areas of India. Limiting HIV testing to persons diagnosed with TB may limit opportunities for early HIV diagnosis and treatment, but the HIV prevalence among TB suspects in India has never been reported. We sought to determine HIV prevalence among TB suspects examined for smear microscopy in Mandya district (population 2 million), a relatively high HIV-prevalence setting in South India, with HIV-positive results reported among 5% in all HIV testing centre clients in 2009.

**Methods:** All adults examined for diagnostics sputum microscopy at 25 microscopy centres in December 2010 were offered, after study consent, voluntary HIV counseling and testing (VCT) as per National AIDS Control Programme guidelines; participants were followed up for a month to assess if they were subsequently diagnosed TB.

**Results:** Among 1668 eligible patients, 1539 (92%) consented to VCT. Among these, 108 (7%) were HIV-positive. HIV seroprevalence was higher in suspects eventually diagnosed with TB (15%) than those with a non-TB diagnosis (6%;  $P = 0.001$ ). To detect a new case of HIV infection (i.e., excluding those persons with previously-known HIV infection), the number needed to screen (NNS) for TB patients was 12; among those not diagnosed as TB, the NNS was 37 (Figure). Among patients with ages 25–44 years, the NNS for a newly-detected instance of HIV infection was 20.

**Conclusion:** Routine HIV testing of TB suspects, though feasible, may not be a high-yield HIV case finding strategy, even in higher-HIV prevalence areas of India, with only 1 newly detected case of HIV infection per 37 persons tested. Testing of TB suspects



**Figure** HIV prevalence among TB suspects in Mandya, South India.

with ages 25–44 years demonstrated higher HIV case-finding yield, and could be considered. Given a highly heterogeneous HIV epidemic in India, broader surveillance is required in other areas before a national policy can be established.

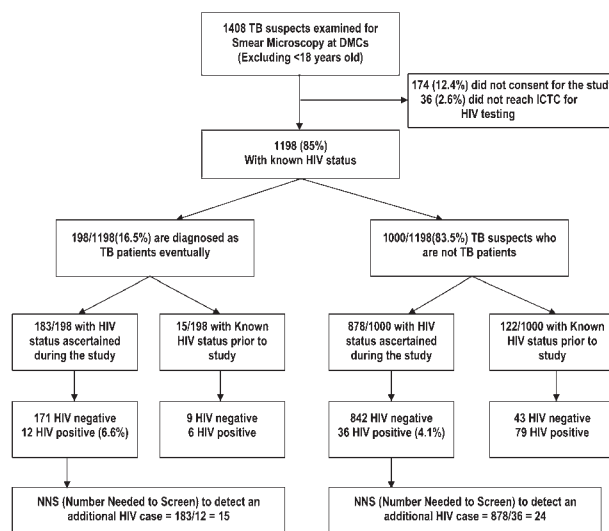
#### OP-714-29 HIV seroprevalence among tuberculosis suspects in Vizianagaram district, South India

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**Background:** HIV testing of tuberculosis (TB) suspects is recommended by WHO, but is not policy in even high HIV-prevalence areas of India. Limiting HIV testing to persons diagnosed with TB may limit opportunities for early HIV diagnosis and treatment, but the HIV prevalence among TB suspects in India has never been reported. We sought to determine HIV prevalence among TB suspects examined for smear microscopy in Vizianagaram district (population 2.5 million), a relatively high HIV-prevalence setting in South India.

**Methods:** All adults examined for diagnostics sputum microscopy at 31 microscopy centres in November 2010 were offered, after study consent, voluntary HIV counseling and testing (VCT) as per National AIDS Control Programme guidelines; participants were followed up for a month to assess if they were subsequently diagnosed TB.

**Results:** Among 1408 eligible patients, 1198 (85%) consented to VCT. Among these, 133 (11%) were HIV-positive. HIV seroprevalence was similar among persons eventually diagnosed with TB (9%) than those with a non-TB diagnosis (11%). To detect a new case



**Figure** HIV prevalence among TB suspects in Vizianagaram, South India.

of HIV infection (i.e., excluding those persons with previously-known HIV infection), the number needed to screen (NNS) for TB patients was 15; among those not diagnosed as TB, the NNS was 24 (Figure).

**Conclusion:** In Vizianagaram district, India, HIV prevalence among persons susceptible of TB was high, and similar to that found among the subset of those diagnosed with TB. This provides strong evidence that routine HIV testing of TB suspects may be an efficient HIV case-finding strategy. Given a highly heterogeneous HIV epidemic in India, broader surveillance is required in other areas before a national policy can be established.

#### OP-731-29 Community engagement in joint TB-HIV activities: lesson learnt from a rural district in South Africa

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**Background:** The project aims were to integrate Community Health Workers (CHWs) and Home Based Carers (HBCs) as one cadre of community care workers (CCWs) and train them in order to enhance TB-HIV collaborative activities including PMTCT at community level.

**Intervention:** The study was conducted in a rural district of KZN. A total of 161 CCWs were trained on health education, TB and STIs case finding, home based VCT, ART adherence and infant feeding counseling. Routine monthly data were collected from March to August 2010.

**Results and lessons learned:** A total of 10 114 households were served by CCWs, out of 29 039 households



members served, 92% were adults and the majority were females (74%). The majority (78%) of household members were educated on TB, STIs and HIV prevention as well PMTCT and 93% of households received condoms. 11 712 (43%) of household members were screened for TB symptoms, 4.5% were suspects and referred to the clinic and 72% went to clinic and diagnosed with TB. Of 6309 adults screened for STIs, 2% were suspects and referred to the clinic and 57% went to the clinic and diagnosed with STIs. A total of 826 people were counseled and tested for HIV in homes, 7% tested HIV+ and were referred to the clinics for HIV care. Of 817 traced, 39% were TB contacts, 26% TB defaulters and 35% were ART defaulters. Of 5360 receiving treatment adherence support, 27% were on TBDOT, 60% on ART and 6% HIV pregnant women on AZT.

**Conclusions and recommendations:** Integrating CHWs and HBCs as one cadre of CCWs is an effective approach to maximise resources and avoid multiple visits at household level. Also training CCWs on TB-HIV integrated care could be seen as one of the avenues to enhance TB-HIV case finding, linkages to care and case holding at community level. This requires policy paradigm shift and task-shifting.

### OP-938-29 Injecting drug use as a risk factor for TB among HIV-infected patients in Indonesia

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**Background:** Injecting drug use (IDU) has previously been identified as a risk factor for TB, but there are very few data from low-resource settings endemic for TB. Indonesia has the fifth largest case-load of TB, and a rapidly growing HIV-epidemic which is largely driven by IDU. We evaluated IDU as a risk factor for TB in a cohort of HIV-patients in an urban setting in West-Java.

**Methods and results:** We selected 780 HIV-infected patients in a HIV-clinic who were ART-naïve and who had information about TB treatment during a median follow-up of 234 days (IQR: 46–541 days). 55.1% of patients reported a history of IDU, 26.6% had a history of TB treatment, and 17.6% were treated for TB during follow-up. TB incidence was higher in patients with a history of IDU than among those with no history of IDU (22.6% vs. 9.8%,  $P < 0.001$ ). Using Cox proportional hazard regression analyses, IDU remained a significant risk factor after adjustment for the baseline CD4 cell count, haemoglobin concentration, and ART during follow-up (time-dependent). The adjusted hazard ratio for a history of IDU was

2.5 (95%CI 1.6–3.9). Gender, age and HCV did not affect the relation between IDU and TB incidence.

**Discussion and conclusion:** The higher incidence of tuberculosis among IDUs might be attributed to higher exposure of IDUs to tuberculosis, even though in Indonesia IDUs often come from a high socio-economic background. Alternatively, heroin may directly impair host defence against tuberculosis. The results of this study could have implications for active screening and preventive therapy for latent TB among (HIV-infected and non-infected) IDUs.

## CHILDHOOD TUBERCULOSIS

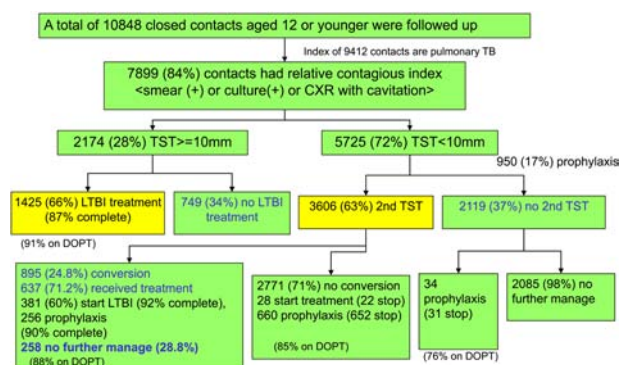
### OP-202-29 The effectiveness of isoniazid preventive therapy in children TB contacts: a population study

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**Purpose:** To evaluate the effectiveness of isoniazid preventive therapy (IPT) provided to children contacts younger than 13 years with latent TB infection (LTBI) country-wide in Taiwan since year 2008.

**Materials and methods:** TB contacts aged younger than 13 years received tuberculin skin test (TST) for contact investigation between April, 2008 and Sep., 2009 were enrolled. LTBI was defined with TST  $\geq 10$  mm in non-HIV contacts in Taiwan. Subsequent development of TB diseases was evaluated and analyzed with stratification of receiving IPT or not. The data were obtained from the National Surveillance Network of Communicable Disease, Centers for Disease Control, Taiwan by Sep. 30, 2010.

**Results:** A total of 7899 contacts with contagious pulmonary TB index cases were target populations for LTBI diagnosis. LTBI was diagnosed in 28% of them and 66% of the LTBI contacts started IPT. Overall,



**Figure** The outcome of contact investigation and LTBI treatment, April 2008–September 2009.

91% of them were cared by directly observed preventive therapy (DOPT) during IPT with a 90% completion rate among the 1431 contacts. During the follow-up, 19 TB cases were confirmed based on bacteriology or image study. The time elapse between diagnosis of index cases and development of TB in contacts was shorter than 3 months for 13 contacts (68%), suggesting delayed diagnosis of index cases or incapability to provide IPT in time. Based on the 6 incident TB cases in contacts diagnosed more than 3 months following index cases, the incidence of developing TB without IPT was up to 812/100 000 which translated to an effectiveness of 96% from IPT (RR: 0.04 [95%CI: 0.002–0.71]).

**Conclusions:** With high coverage of DOPT, effectiveness was very high for IPT in contacts with positive TST using 10 mm as the cutoff point. Earlier detection and diagnosis of index cases is crucial so that IPT could be provided in time.

#### OP-350-29 Pharmacokinetics of isoniazid, rifampicin and pyrazinamide in children younger than two years of age

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**Introduction:** The WHO recently issued revised first-line antituberculosis drug dosage recommendations for children. No pharmacokinetic studies of these revised dosages in children < 2 years are available.

**Aim:** To document the pharmacokinetics of the first-line antituberculosis agents in children < 2 years of age comparing former and revised WHO dosages of isoniazid (INH; 4–6 mg/kg/day vs. 10–15 mg/kg/day), rifampicin (RMP; 8–12 mg/kg/day vs. 10–20 mg/kg/day) and pyrazinamide (PZA; 20–30 mg/kg/day vs. 30–40 mg/kg/day).

**Methods:** Serum levels were prospectively assessed in 20 children aged 0–2 years routinely treated for tuberculosis (regimens with or without RMP). INH, RMP and PZA were administered at the former and, after an adequate washout period, the revised WHO dosages. Serum samples were collected prior to (t<sub>0</sub>), and at 0.5, 1.5, 3 and 5 hours following dosing using high-performance liquid chromatography. Maximum serum concentration (C<sub>max</sub>), time to C<sub>max</sub> (t<sub>max</sub>) and area under the time-concentration curve from 0–5 hours (AUC<sub>0–5</sub>) were calculated.

**Results:** Twenty children were enrolled; 11 children with pulmonary and 9 with extrapulmonary TB. Five children were HIV-infected. Eleven children were on

regimens including RMP and 9 without RMP. The mean C<sub>max</sub> [µg/ml], following former/current dosages, were: INH 3.19/9.85, RMP 6.36/11.69 and PZA 29.94/47.11. The mean AUC(0–5) [µg·h/ml] were: INH 8.09/20.36, RMP 17.78/36.95 and PZA 118.0/175.2. Mean C<sub>max</sub> and AUC(0–5) differed significantly between the dosages. There was no significant difference in the t<sub>max</sub> between the different dosages. **Conclusion:** New WHO doses guidelines result in significantly higher levels of INH, RMP and PZA in children aged 0–2 years compared to former WHO guidelines.

#### OP-383-29 Diagnosis, evaluation and treatment for latent tuberculosis infection among legal Mexican pediatric immigrants

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**Background:** Annual incidence of active tuberculosis (TB) cases among foreign-born persons is growing within the U.S. This has prompted improved screening to detect both active and latent TB infection (LTBI) along the US-Mexican border.

**Objective:** To document and propose an epidemiological model for diagnosis, evaluation, and treatment for LTBI among legal pediatric immigrants from Mexico.

**Methods:** A cross-sectional study was done with three stages designs to: Stage 1, to obtain TBI prevalence; Stage 2, to chose a sample, to determine LTBI rates by two different CDC's approved tests for LTBI (tuberculin skin testing [TST] and Quantiferon) using Sensitivity and Specificity for diagnostic tests; Stage 3, propose an epidemiological model to detect cases and follow them to treatment.

**Results:** Stage 1. Between January 2008 and August 2009, there were 17730 applicants for legal permanent residency ≤15 years old; 52% were male and mean age was 9.4 years + 3.6 years. LTBI prevalence was 24%. Children from south region of Mexico presented higher risk for LTBI (OR 1.38, *P* < 0.0001), compared to the central or northern region; as being under five years of age (OR 6.8, *P* < 0.0001), and not being BCG vaccinated (OR 2.2, *P* = 0.005) were associated to LTBI. Stage 2. LTBI was associated to a smaller age (*F* = 17.8, *P* = 0.004) being twice the risk in preschoolers (OR = 2.2, *P* < 0.0001). Stage 3. An epidemiological model was developed as a guideline to detect and tract TB cases and LTBI to follow them and treatment according to international standards. There was a concordant coefficient of 74% on the TST test and QFT, and a Kappa of 0.67.

**Conclusion:** The prevalence of LTBI is consistent with previous reports. However, the socioeconomic and nutritional factors are important determinants for LTBI. It is suggested the Quantiferon test as the standard test for LTBI in pediatric patients.

### OP-538-29 Impact of isoniazid preventive therapy on mortality among children less than 5 years old

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**Background and objective:** In a cohort of children less than 5 years old exposed to adult intrathoracic tuberculosis (TB) in 1996–1998 we found a 66% increased mortality compared with community controls. In 2005 we implemented isoniazid preventive therapy (IPT) for children exposed to TB at home.

**Setting:** This prospective cohort study was conducted in six suburban areas, included in the demographic surveillance system of the Bandim Health Project (BHP) in an urban area of Guinea-Bissau.

**Participants:** All children < 5 years of age living in the same house as an adult with intrathoracic TB registered for treatment in the study area between 2005 and 2007 were evaluated for inclusion in the IPT programme. A total of 23 289 children < 5 years of age lived in the study area between September 2005 and June 2008. At the same period a total of 474 TB cases were identified living in 433 houses.

**Main outcome measures (end points):** The mortality rate ratio (MRR) between exposed children and unexposed community control children.

**Results:** A total of 1396 children were identified as living in the same houses as 416 adult TB cases, of those 691 were enrolled in the IPT programme. Compared with community controls, the IPT children had a mortality rate ratio (MRR) of 0.30 (95%CI 0.1–1.2). Similar to the exposed children in 1996–1998 the 705 children exposed to TB in 2005–2008 who did not receive IPT due to being absent at inclusion had increased mortality compared with community controls, the MRR being 1.49 (0.8–2.9) from 6 months after exposure. The mortality in IPT children compared with community controls in the 2005–2008 period differed significantly from the mortality of exposed but untreated children in the 1996–1998 cohort (test of interaction,  $P = 0.01$ ).

**Conclusion:** The IPT programme significantly reduced mortality among children exposed to TB at home. Though recommended, IPT is rarely implemented by TB programmes in low-income countries.

### OP-617-29 Opportunities for chemoprophylaxis in children with culture-confirmed tuberculosis

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**Background:** Post-exposure isoniazid chemoprophylaxis (IPT) is an effective strategy to prevent tuberculosis (TB) disease progression in children exposed to an infectious TB source case. Many operational gaps remain in the implementation of IPT in high-burden TB settings. We describe the TB exposure history and disease spectrum in children diagnosed with culture-confirmed TB; missed opportunities for chemoprophylaxis are described.

**Methods:** All children <13 years of age routinely diagnosed with culture-confirmed TB at a tertiary referral hospital, Cape Town, South Africa (March 2003–February 2007) were included. Clinical data were collected through folder review. TB was classified as pulmonary and extra-pulmonary; disseminated disease included miliary disease and TB meningitis.

**Results:** 614 children (327; 53.3% boys, median age 32 months) were diagnosed with culture-confirmed TB. Contact with an infectious adult source case was reported in 333 (54.2%); 237 (71.2%) of these were < 5 years of age and a further 24 (7.2%) were in HIV-infected children 5 years or more. Of those eligible for chemoprophylaxis based on national guidelines, missed opportunities for IPT were identified in 156/221 (70.6%) children. Of these, 127 (81.4%) were < 3 years, 39 (25%) had disseminated TB and 8 (5.1%) had died. The reported TB source case was the mother or father in 74/156 (47.4%) children.

**Discussion:** Opportunities for initiation of post-exposure IPT in young and HIV-infected children are frequently missed in this high-burden TB setting. Healthcare worker and community awareness should be raised regarding the importance of post-exposure IPT in children. Health systems should be strengthened to improve contact tracing and delivery of IPT to vulnerable children in close contact with an infectious TB source case.



### OP-837-29 Impact of age and nutritional status on the pharmacokinetics of anti-tuberculosis drugs in children

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**Background:** Currently recommended dosages of rifampicin (RMP), isoniazid (INH), pyrazinamide (PZA) and ethambutol are extrapolated from pharmacokinetic studies performed in adults and have not been adequately evaluated in children.

**Aim:** To study the impact of age and nutritional status on the pharmacokinetics of RMP, INH and PZA in children with TB.

**Methods:** Eighty three HIV uninfected children aged 1 to 12 years with pulmonary ( $n = 19$ ) or extrapulmonary TB ( $n = 64$ ), on anti-TB treatment for at least 2 weeks were recruited. Nutritional status was assessed using  $z$  scores calculated from child's weight and height. On the study day, serial blood samples were collected after supervised administration of drugs. Plasma RMP, INH and PZA were measured by HPLC and pharmacokinetic parameters calculated.

**Results:** Children aged 1–3 years had significantly lower peak concentration and exposure of RMP, INH and PZA compared to other age groups. The proportion of children with sub-therapeutic RMP, INH and PZA were 90%, 12% and 37% respectively. All children < 3 years had sub-therapeutic RMP which was not significant from those who were aged 3 years and above (100% vs. 88%). However, the proportion of children with sub-therapeutic INH (38% vs. 6%) and PZA (88% & 25%) was significantly higher in those < 3 years than those above 3 years of age. Children with stunting and underweight had significantly lower peak concentration and exposure of RMP and PZA than normally nourished children. Multivariable linear regression analysis showed age to be independently associated with peak concentration and exposure of RMP, INH and PZA.

**Conclusions:** Younger children have lower blood levels of key first-line anti-TB drugs. These findings have important clinical implications and suggest that dose modifications of anti-TB drugs may be needed, especially in young children, in order to achieve optimal blood levels. However, the blood levels have to be correlated with TB treatment outcomes.

### OP-881-29 Paediatric TB care in the private sector: the evolution of a public-private partnership in Pakistan

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**Aim:** To improve suspect referral, management and reporting of childhood TB suspects in an evolving private sector pediatric TB program while building close linkages with the National TB Program (NTP).

**Methods:** Programmatic data were recorded for all children 15 years and under treated at the Indus Hospital between Dec 2007–Feb 2011. These include demographics, history of contact, symptoms, weight, physical findings, chest X-ray findings, mantoux test results and smears at presentation. Additional tests (e.g., CT scans) were conducted as required. Linkages were established with the NTP to report all pediatric cases, starting with older children receiving fixed dose combination pills from NTP.

**Results:** 280 children 15 years and under were enrolled since the inception of the program, 50% of them during 2010. In 2010 (142/727) 19.5% of all TB cases seen at the Indus Hospital were in the pediatric age group. 12% were less than 5 years of age, whereas 64% were 10–15 years of age. 65% (183/280) were female (overall F:M ratio of 1.8:1) and 62% weighed < 5% for age. 45% (62/137) of children with pulmonary TB were smear positive. Just 52% (146/280) of all pediatric cases were registered with NTP till the end of 2010. Linkages were established with private General Practitioners (GP) in the community to refer pediatric suspects and cases to Indus Hospital for screening and management.

**Conclusions:** The evolution of the childhood TB program at the Indus Hospital in partnership with the NTP and local GPs has led to improved case referral and detection with 1 in 5 new cases being children during 2010. We are developing a mechanism of reporting all childhood TB cases to the NTP as children clearly constitute a substantial proportion of the burden in our population.

### OP-1054-29 Childhood tuberculosis and case finding in Germany, 2002–2009

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**Background:** Early diagnosis of childhood tuberculosis (TB) is highly relevant for the management of individual cases and for keeping track on TB transmission in the general population. This stresses the value of active case finding in children.



**Methods:** 2002 to 2009 surveillance data from Germany, electronically reported to the Robert Koch Institute, were pooled and analyzed including univariate logistic regression.

**Results:** From 2002 to 2009, 1762 children < 15 years were notified (sex-ratio 1:1); 69% of them were born in Germany. Of the cases, 74.5% had pulmonary TB and 25.4% extrapulmonary manifestations, of which 29 with meningitis. The treatment success rate remained stable around 97% and was irrespective of the children's sex, age, country of birth, but higher in pulmonary than in extrapulmonary cases (OR 2.30; 95%CI 1.21–4.37;  $P = 0.01$ ). The proportion of active case finding was 50% in children (vs. 13% in adults) and had annually increased by 8% (OR 1.08; 95%CI 1.04–1.13;  $P < 0.001$ ) from 2002 to 2009. Children born in Germany had 73% higher chances of being identified via active case finding than those born abroad (OR 1.73; 95%CI 1.38–2.17;  $P < 0.001$ ). Extrapulmonary TB cases had less frequently been actively identified (OR 0.38; 95%CI 0.29–0.48;  $P < 0.001$ ). Nearly all meningitis cases (20/22) had been detected upon clinical presentation or post-mortem only. Active case finding was associated with higher chances of successful treatment outcome (OR 2.42; 95%CI 1.00–5.32;  $P = 0.03$ ).

**Discussion and conclusions:** Active case finding was found to play an important role for early identifying childhood TB. Foreign-born children seem to be reached less, yet the scope of action remains to be explored. Overall, in line with established guidelines, active case finding should be enhanced with particular focus on children of vulnerable population groups.

## POSTER DISCUSSION SESSIONS

### BUILDING A MULTI-SECTORAL PARTNERSHIP APPROACH TO TB-HIV

#### PC-303-29 Private doctors and TB-HIV collaborative activities in India: a qualitative study from Chennai

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**Background:** 50–80% of tuberculosis (TB) patients seek care in India's private sector. This study investigated the practices, limitations and potential of private doctors for TB-HIV collaborative activities.

**Methods:** Qualitative interviews were conducted with private hospital doctors and other informants involved in TB control ( $n = 17$ ). Hospitals were selected to

represent the range of facilities available to patients. Interviews covered HIV testing; linking HIV-positive TB patients to HIV care; and coordination of care for co-infected patients.

**Results:** Most doctors did not routinely offer HIV tests to TB patients. Testing was more common when a facility guideline mandated testing or a public-private initiative for TB management was in place. Otherwise, testing was based on doctors' judgement, including whether patients would take offence or if a patient was deemed high risk. While wealthy HIV-infected patients could afford private treatment, middle income patients accustomed to private care were reportedly reluctant to shift to public facilities. Most doctors did not report TB or HIV cases and patients choosing not to take up referral were not followed up. A lack of communication between public and private doctors was found to undermine co-management.

**Conclusions:** Private providers' practices are influenced by the social and health systems contexts in which they operate. Educating patients to understand the importance of testing, scaling-up public private partnerships, and encouraging facility managers to mandate HIV testing, should enable more HIV-positive patients to be identified. Current referral and communication mechanisms between private and public sectors require strengthening. The coordination and integration of public and private services represent a huge public health challenge. Only by addressing the local realities influencing private practice can these challenges be overcome.

#### PC-556-29 Las alianzas estrategicas para disminuir la tuberculosis entre las personas que viven con VIH y DM

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**Antecedentes:** Las comorbilidades de la tuberculosis (TB) en México representan una amenaza y un reto serio para la salud pública, por lo que el PNT se ha dado a la tarea de intensificar acciones mediante la integración interprogramática de las Alianzas estratégicas en 7 estados.

**Objetivo:** Fortalecer las Alianzas TB/SIDA y TB/DM para la implementación sistematizada de 12 y 10 acciones respectivamente.

**Metodología:** Estudio observacional, descriptivo y de intervención en salud pública, con medición basal del estatus de las acciones y la situación epidemiológica, más una intervención y una medición al final.

**Acciones:**

- Consolidación de la Alianza interprogramática TB/SIDA y TB/DM
- Sistematización de pruebas de VIH en enfermos de TB, pruebas de TB y TPI para personas con VIH.

- Búsqueda intencionada de casos de TB en centros de salud y grupos de ayuda mutua de DM y VIH
- Capacitación a médicos, enfermeras y líderes que atienden personas con VIH/Sida y diabetes

**Resultados:** Incremento de la capacitación en 100% durante 2010 respecto a 2008. Entre 2008 y 2010 se observó un incremento del 15.6% y 20.4% en los casos coinfectados con TB y VIH-SIDA y en la comorbilidad TB-DM respectivamente.

**Conclusiones:** Las alianzas estratégicas interprogramáticas marcan la diferencia en el control de las comorbilidades y por ende en el impacto que a mediano y largo plazo puedan causar.

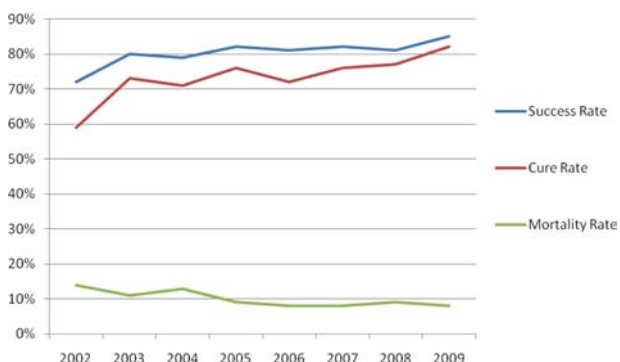
### PC-712-29 Enhanced partnerships improving TB-HIV programme: case for the Eastern Province of Zambia

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**Background:** Zambia has a TB notification rate of 466/100 000 (2006 National TB report). Eastern Province of Zambia has a TB notification rate of 154/100 000 (2010 Provincial TB report). TB case management and weak partnerships in the TB control was a challenge for the Province. In Eastern Province of Zambia, the TB program and the partners have been working together to ensure that the TB program is implemented in line with the national guidelines. Partners were assigned roles by the Provincial Health Office to ensure that all 8 Districts were covered in strengthening the TB program.

**Interventions:** Partners were assigned specific roles in trainings, service delivery and strengthening community participation. The Provincial Health Office took the overall task of coordination, supervision and technical support to all the districts and health facilities.

**Results:** Partnerships led to an improvement in the management of the TB program with cure rate of 82% according to the 2009 cohort from 59% (2002 Cohort), mortality rate reducing from 14% (2002



**Figure** TB outcome for 2002–2009 cohorts.

cohort) to 8% (2009 cohort). Percentage of TB patients tested for HIV increased from 40% in 2006 to 89% in 2010. 202 Health workers, 249 community members and 40 microscopists were trained in 2010. The HIV prevalence in the Province fell from 14% to 10.3% between 2002 and 2007 with HIV positivity in TB patients reducing from 70% in 2007 to 57% in 2010.

**Conclusions:** Enhanced partnerships has been key to the success of the TB program in the Province. There is need to further strengthen these partners for even better outcomes.

### PC-776-29 A multi-country, multi-agency partnership for HIV-TB collaboration in the Caribbean Region

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**Background:** In 2006, an international partnership was formed to address HIV and TB co-infection across parts of the Caribbean where national TB and HIV programs were run separately. Higher reported rates of TB in 2006 compared to 1996 in some countries had signaled the need to re-focus on TB and TB-HIV interaction.

**Intervention:** The US Agency for International Development and the Health Resources and Services Administration provided funding. The Caribbean Epidemiology Centre and the Caribbean HIV/AIDS Regional Training Network (CHART) were project co-leads, partnering with the International Training & Education Center for Health and the Curry International TB Center. Representatives from TB and HIV Programs in nine target countries took part in stakeholder meetings and trainings. Project staff visited selected countries to support implementation of rapid HIV testing and implementation of DOTS. A trans-Caribbean technical working group updated Caribbean TB guidelines, incorporating TB-HIV co-infection. Curricula and job aides were prepared and pilot tested. A TB nurses' network and a TB clinical consultation service have been established.

**Results:** Experience in TB and HIV care and treatment in high burden countries and expertise from international partners were effectively shared. Clinical and laboratory staff teamed up to develop TB-HIV collaborative plans for implementation nationally.

Caribbean TB guidelines were updated, incorporating the International Standards for TB Care and WHO guidelines; these were disseminated throughout the region and are being adapted for national use. Through CHART, practitioners from additional Caribbean countries are continuing to receive training in HIV and TB prevention and care.

**Conclusions:** The partnership led to stronger joint TB and HIV Program planning in the Caribbean region. Interest in TB was revived. Active networks augur well for sustainability. External funding and a consultative approach are reaping success.

### PC-805-29 Increasing tuberculosis awareness in South African schools: Kick TB campaign

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**Background:** South Africa, with the third highest TB incidence in the world, is one of the 22 high burden countries. Raising awareness and knowledge of TB amongst the population is a key intervention in response to TB and HIV in the country.

**Intervention:** The Kick TB campaign is a focused campaign aimed at raising awareness and imparting knowledge among South African learners, contributing to the vision of South Africa's National TB Programme (country free of TB and stigma reduction around TB); specifically, it aims at strengthening the DOTS strategy by increasing awareness and knowledge about TB, dispelling common myths and misconceptions currently contributing to stigmatization, promoting behavioural change required to prevent TB infection, increasing TB case detection by encouraging uptake of services at different levels, increasing TB treatment adherence.

**Methodology:** The National Department of Health and the Desmond Tutu TB Centre developed a campaign on TB linked to the 2010 FIFA World Cup in South Africa. Leading implementing partners include the Centers for Disease Control (CDC), University Research Corporation, LLC. (URC), and the United States Agency for International Development (USAID). Dubbed 'Kick TB', the campaign links the spectacle of soccer, mass mobilization against TB, and linkages with facilities: a tool specifically conceptualized and designed for this campaign, the TB Passport, actively assist the latter with case findings.

**Results:** Number of pupils reached, evaluation of pre- and post-intervention knowledge and awareness of TB and number of new TB cases detected through the TB passport have been evaluated.

**Conclusion:** The Kick TB campaign contributes to improved knowledge and awareness of South African learners; they may take information home, and

contribute to increased disease knowledge and awareness among community members with its consequences of new infections reduced numbers and increased adherence to TB treatment.

### PC-843-29 Engaging women organizations and women volunteers in supporting poor TB and TB-HIV patients in Thailand

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**Background:** Managing TB care in Chiang Rai Provincial Hospital (CRH) is complicated by several factors including caseloads (about 800–900 cases/year) and high rate of treatment interruption, stigma against TB-HIV co-infection and hilltribe minorities and migrants who are not covered by Thai health insurance. A few literatures on the role of women volunteers in TB control are currently available in English. We planned an intervention to explore the extent to which women organizations and individual women with high socio-economic status can be mobilized to support TB care in CRH.

**Intervention:** We organized a series of workshops, gathering leaders, majority with middle or high socio-economic status, from 9 women organizations in Chiang Rai. The first workshop built TB awareness via presenting TB epidemiology in the province and the experiences of Japanese women volunteers.

**Results:** Prior to the first workshop, TB awareness among the participants was low. The experiences of Japan showed practical examples of how women can contribute to TB control. Follow-up workshops were then organized for participants to plan for activities to support TB patients. Participating organizations jointly established a group 'Chiang Rai Women Volunteers to Eradicate TB'. The Table summarizes activities and outcome of the group. Most patients appreciated the financial and psychological supports from the women volunteers.

**Table** Outcomes of women volunteers' activities to support TB and TB-HIV patients in Chiang Rai Hospital (May 2009–December 2010)

Activities	Outcome
1 Fund raising to support poor patients	201 354 Thai Baht (~6700 \$US) 176 poor patients received support for transportation and livelihoods
2 Home visits to patients who are 'extremely poor' and living alone	Provided encouragement and some foods during home visits 24 patients (3 children, 8 men and 13 women)
3 Packaging the daily dose of anti-TB medicine	Prepared 25 230 daily packs of anti-TB medicine



**Conclusion:** Women organizations and individuals with high socio-economic status is a potential source that can be mobilized for TB control. The experience in Chiang Rai should be applicable in other settings.

### PC-929-29 The role of the private health sector in HIV counseling and testing in Ethiopia

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**Background:** Private for-profit health facilities in Ethiopia are flourishing and contributing to improved access to health care in almost all urban areas of the country. The Private Health Sector Program (PHSP), a USAID-funded program implemented by Abt Associates, is working with the Federal Ministry of Health in Ethiopia to integrate and expand clinical services in TB, HIV/AIDS, FP and STIs in the private health sector. Integrated with all these activities is HIV counseling and testing (HCT), a critical and essential component of HIV/AIDS prevention, care, and support programs in Ethiopia.

**Methodology:** A quantitative study was conducted with quarterly reported data from 133 PHSP-supported private health facilities between October 2009 and December 2010. Simple descriptive statistical analyses were performed using EPI-Info 3.3.2.

**Results:** Since October 2009, PHSP has operated in 33 towns in Ethiopia to build capacity in 133 private and workplace facilities to render provider initiated testing and counseling (PITC) and voluntary counseling and testing (VCT) services for HIV. Between October 2009 and December 2010, a total of 165 962 clients were tested for HIV in these facilities; 54.4% (90 412) were females and 9834 (5.9%) tested positive. All clients that tested positive were referred for anti-retroviral therapy (ART).

**Conclusion:** HCT services in private facilities are effective as an entry point for HIV/AIDS prevention, care, and support programs in Ethiopia. Expansion of not only HCT, but also ART services to all private facilities should be pursued to provide clients with more comprehensive, effective, and efficient HIV services.

### PC-1035-29 A quality improvement private public partnership model for improving quality of TB-HIV services

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**Background:** Operationalization of the TB-HIV Collaborative framework has been a challenge for Iringa district situate in the southern highlands of Tanzania, where tuberculosis is a leading cause of morbidity and mortality and TB-HIV co-infection is high. To

address this problem the district adopted a model that combined the adoption of quality improvement tools and a public-private partnership (PPP) that operated in the context of a collaborative framework to improve key indicators.

**Aim:** To improve TB-HIV services through a collaborative PPP utilizing quality improvement tools.

**Design:** This was operational research implemented as intervention linked research within the day to day operations of the health care facilities.

**Methods:** Methods for problem analysis, root cause analysis, intervention design and implementation were derived from the quality improvement tool box. A quality improvement collaborative approach was used to bring together partners (8) with different competencies to improve the quality of TB-HIV (Tuberculosis/Human Immuno Deficiency Virus) services.

**Results:** The district has in the two years of program implementation (2008–2010) improved indicators as follows: TB case detection 56% to 76%; TB patients tested for HIV 45.6% to 91%; TB-HIV registered to Care and Treatment Centers 56.9% to 64%; TB-HIV clients receiving CPT 45% to 100%.

**Conclusion:** The quality improvement PPP model has shown results for Iringa and is poised for replication in other districts.

### PC-1043-29 Leveraging on national partnership to scale up TB-HIV services in Nigeria: lessons from 2006 to 2010

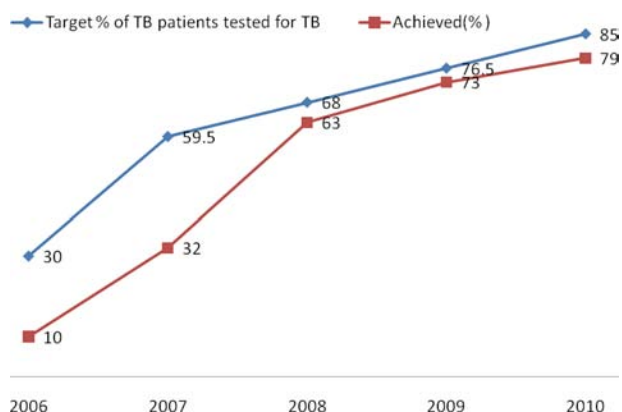
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**Background:** The provision of TB-HIV services in Nigeria was not in existent or rudimentary as at 2006. The lack of collaboration between TB and HIV partners creates barrier to service provision. This study aimed at reviewing the lessons learnt since the establishment of the TB-HIV partnership in 2006.

**Intervention/response:** The FMOH in 2006 established the National TB-HIV Working Group (NTWG) comprising of TB and HIV partners and communities. The minutes of the quarterly meetings of NTWG were reviewed; quarterly TB-HIV collaborative activities reports submitted to FMOH were also analyzed.

**Results and lessons learnt:** This partnership resulted in the development of essential National TB-HIV policy documents and Guidelines. It allowed programmes and partners to discuss their plans thus reducing duplication of services. Facilities providing TB-HIV services increased from 23 in 2006 to 974 in 2010 with concomitant increased in proportion of TB patients tested for HIV from 10% in 2006 to 79% in 2010;





**Figure** HIV testing among regular TB patients in Nigeria: target vs. achieved, 2006–2010.

and also increased in uptake of other TB-HIV services. Such partnership is weak at lower level thus resulting in none involvement of the State and LGA programmes with suboptimal reporting of TB-HIV activities to National. Target setting by funders often result in over-concentration of services in some areas.

**Conclusions and key recommendations:** Effective partnership provides potential for control programme to rapidly scale up TBHIV services. Partnership at National level must be replicated at lower level for effectiveness; funding agencies should involve National programmes in target settings.

### PC-1090-29 Monitoring TB control programme through politicians and media in Uttar Pradesh, India

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**Aim:** Tuberculosis control issues are poorly reported in regional and local language papers in India. While it is an accepted fact that Political Will is an Integral component of any successful national response, ways to measure it. Indian Media Centre for Journalists train media persons & politicians with media workshop to draw the attention of UP state government on monitoring TB issues.

**Methods:** The IMCFJ projects through support of WHO and self finance demonstrated that taking tuberculosis control messages to the grassroots through local language newspapers create widespread awareness, influence local decision makers, and improve implementation of the law and administration of the tuberculosis control programme.

**Results:** Between September 2005 and August 2010 IMCFJ conducted 19 training programmes and trained 687 vernacular media persons, who published nearly 980 articles in their papers. Articles by participants were uploaded in a participant-managed blog.

**Conclusions:** All major regional Hindi (22 papers with a circulation of more than 10 million copies a day) and Urdu papers have reported more on tuberculosis related stories.

### PC-1244-29 Encouraging involvement and participation of different partners in TB-HIV care

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**Introduction:** Since 2004, collaborative TB-HIV activities were implemented in DR Congo in order to reduce HIV burden among TB patients. Several partners were involved as WHO, USAID, CDC, Global Fund, The Union, UNC, NTP, NAP. From pilot studies, NTP is making efforts to scale-up those activities within the country. Currently, an integrated TB-HIV service is expecting to cover 30% of TB clinics.

**Objectives:** The aim of the study was to evaluate outcomes after the rolling-out TB-HIV activities from different pilot projects to national level and to draw lessons for future scaling-up.

**Methods:** We did a retrospective review of all records reported by the all 24 provincial TB coordination (CPLT) in 2010. From cases notification gathered in TB registers, we determine the major outcomes/indicators of the implementation of TB-HIV activities in DR Congo.

**Results:** In 2010, a total of 119 290 TB patients were notified. 44 681 did get access to VCT in 389 TB clinics nationwide. Preliminary data shows that 70% (31 240) have been tested for HIV. Overall 17% (5234) of TB patients tested are being found to be HIV positive. Of 5234 co-infected patients, only 21% (1107) did get access to ARV treatment.

**Conclusion:** Partnership in HIV-TB co infection projects has boosted the implementation of TB-HIV activities nationwide. However services coverage is still limited due to the lack of adequate provisions of supply and funds. Results provide the NTP and NAP with information allowing improvement to the continuation of care for people facing the twin diseases.

## EPIDEMIOLOGY OF TB-HIV AND HIV TESTING

### PC-92-29 Assessment of acceptability of provider initiated testing and counseling for HIV virus

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**Aim:** To assess acceptability of Provider Initiative Testing and Counseling and factors influencing its uptake among tuberculosis patients in PPM-DOTS sites, Amhara Region.

**Methods:** A facility based cross-sectional study, involving 412 TB patients, was conducted in Amhara Region March 2010. Odds ratio with 95% confidence interval and logistic regression analysis were employed to measure the degree of association between factors and identify the factors influencing its uptake PITC.

**Results:** The reported barriers for acceptability of PITC include difficult to pay 58 (56.3%), tested before 68 (66.0%), fear of stigma and discrimination 46 (44.7%), unable to cope with positive result 21 (20.4%) and fear of partners reaction 19 (18.4%) of the study participants. The study population who heard availability of PITC was 4 times more likely to accept the PITC (AOR: 4.01, with 95%CI: 1.63–9.84). Study participants who had knowing someone infected with HIV and/or died of AIDS were almost 2 times more likely to accept PITC (AOR:2.04, with 95%CI: 1.13–3.69).

**Conclusion:** The acceptability of PITC in this study was 66.2%. This holds significant promise for the control, prevention and treatment of TB and HIV/AIDS in private health facilities. Despite high knowledge of TB, HIV/AIDS, still there is misconception about disease transmission which requires intensive health education. The GO and NGOs shall support PITC by providing free HIV test kits so the overall cost reduces for clients.

### PC-144-29 HIV surveillance among TB patients in Regional TB Centre, Pokhara, Western Nepal

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**Aim:** HIV testing is an important aspect in a health care system dealing with dual problem of TB and HIV. We performed HIV surveillance among TB patients screened in Regional TB Centre at Pokhara in Western Nepal.

**Methods:** 197 TB patients who came to the Regional TB Centre, Pokhara between 29/January/2010 to 31/May/2010 were counselled and screened for HIV.

**Results:** Of the total 197 TB patients screened for HIV only 5 (5.1%) showed positive for HIV which

includes 4 male and 1 female. Of the total 197 TB patients screened for HIV, 128 (64.9%) were male and 69 (35%) were female. Most of the TB patients 106 (53.8%) were of the age group 21–40 years, followed by 55 (27.9%) of the age group 41–60 years and 36 (18.2%) of the age group 0–20 years. Among 5 HIV positive tested TB patients 3 were of the age group of 21–40 years and 2 were of the age group of 41–60 years.

**Conclusion:** The dual existence of HIV and TB was noted, so a good coordination is required between the HIV and TB clinics for better screening of HIV in TB patients.

### PC-148-29 Sexual behaviour and HIV/AIDS prevention among adolescent refugees in Oru refugee camp, Nigeria

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**Background:** Adolescents have been considered as vulnerable populations in displaced settings, they begin sexual relations at an earlier age, take sexual risk such as having sexual intercourse without using condom. This study explored the perception, knowledge and attitude of adolescent refugees towards HIV prevention and condom use and we hypothesized that there exist a significant relationship between them.

**Methods:** Adolescent refugees ( $n = 187$ , 13–19 years of age) from simple and stratified sample in Oru Refugee camp completed a self-administered questionnaire and focus group discussion was conducted differently for boys and girls between October and December 2008. We performed the analysis using SPSS and frequency distribution was also used.

**Results:** The study shows that 52.4% of the respondents are female and 47.6% of them are male. 70% of them have had sex while 30% have not had sex.  $\chi^2$  test was used to compare knowledge of HIV prevention and use of condom which shows a significant relationship between them ( $\chi^2 = 10.832$ ,  $DF = 2$ ,  $P = 0.004 < 0.05$ ). Among boys high level of HIV prevention increased use of condoms and among girls with low level of condom use believe it reduces pleasure, does not work, partner will not permit or they have trusted partners and more respondent believe it is a sign of lack of trust towards sexual partner.

**Conclusion:** The result shows misperception of condom use among the adolescent refugees. The focus group discussion revealed that condom use is low among the female adolescent which is one of the factors contributing to high teenage pregnancy in the camp.

Intervention programs aimed at displaced people such program should be part of an effective HIV-prevention strategy. Young people especially the female ones should be empowered about the importance of

protecting their health, knowing their right and condom negotiation skills in order to slow the spread of HIV.

### PC-180-29 HIV testing among tuberculosis patients

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**Setting:** TB is the most common cause of death in people with HIV. In order to determine HIV prevalence among TB patients and reduce the burden of HIV in patients with TB, a city of China HIV testing was done. We assessed the project in order to improve the performance and determine barriers to HIV testing at TB dispensary (TBD).

**Methods:** Voluntary HIV testing and counseling was offered to all TB patients registered for treatment at 14 TBDs between 1 January and 31 December 2010. Trained TB lab technicians were responsible for HIV pre-test counseling and blood collection, and the blood samples were sent to the local HIV counseling and testing center for testing. A log book was used to record information about the barriers to HIV testing during field supervision.

**Results:** There were 3573 patients registered in the 13 TBDs in the city; only one of them had known HIV infection at the time of TB diagnosis. Of the other 3572 TB patients, 1210 individuals (34%) received HIV tests, of whom 1181 (98%) had active pulmonary TB and 29 (2%) had TB pleurisy. None among the 1210 TB patients tested positive for HIV. The health workers from TBDs commented on insufficient funding for running the project and irregularly responded results of HIV testing by local HIV testing centers.

**Conclusion:** The HIV prevalence among TB patients in this area was 0%, but only a third of registered TB patients were tested. We suggest that the local government reinforces a stable financial support for this project to ensure its smooth implementation. Evidence-based approaches need to be developed to improve collaboration between TB and HIV control programmes at local and national level.

### PC-186-29 HIV infection at the KNUST Hospital in Kumasi, Ghana

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**Background:** The early identification of HIV through screening could substantially lengthen the life of the person identified and provides an important public health benefit from reduced HIV transmission. The

aim of this cross sectional study was to find out the sero-prevalence of HIV infection in the patients attending the Infectious Diseases Unit of the KNUST Hospital in Kumasi Ghana.

**Subjects and methods:** This study was conducted between October 2006 to December 2007 involving 858 patients consisting of Voluntary Counselling and Testing (VCT) and the Provider Initiated Testing and Counselling (PITC). Tests were performed by the Rapid Kit (Determine HIV-1/2, Abbott Laboratories) and confirmed by the First Response HIV card Test 1–2.0 (Premier Medical Corporation Ltd, India) and/or Oral Quick Test (Orasure Technologies, Inc, USA). Analysis was by SPSS version 17.

**Results:** Of the 858 subjects tested, 217 (25.3%) were positive of which the majority, 150 (69.1%) were female. The highest prevalence of 159 (73.3%) was in the age group 21–30 years and the lowest of 0.9% in the 71–80 age bracket. The prevalence of HIV among the University staff was 11 (5.1%) and 1 (0.5%) in the students.

**Conclusion:** HIV prevalence remains high among the sexually active age group whilst women continue to be at the receiving end. More emphasis must be placed on Behavioural Change activities.

### PC-259-29 Access to HIV counseling and testing by TB suspects: a comparative analysis of two states in Nigeria

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**Background:** Access of TB suspects and patients to HIV Counseling and Testing (HCT) is an important preventive strategy to identify TB patients co-infected with HIV early enough so that they can benefit from HIV care and support services. The study was carried out to determine access to HCT service among TB suspects in two states of the South West geopolitical Zone, Nigeria.

**Methods:** A comparative cross sectional study was carried out between July 1 and December 31, 2010. The first state (Ogun State) referred as State A has a population of 3.9 million while the second state (Oyo State) referred as State B has a population of 5.8 million. In State A, HCT services was offered to a TB suspects by the laboratory staff when the TB suspects accesses the laboratory for AFB sputum microscopy while in State B, HCT services was offered and testing was done by a General Health care Worker (GHW) in the DOTS clinic.



**Results:** During the study period, a total of 3574 and 9318 TB suspects were reported in state A and B respectively. A statistically significant number of TB suspects were offered HIV counseling in State B compared with state A {9019 (96.8%) vs. 2208 (61.8%)  $P = 0.00001$ }. Of all the TB suspects, 1650 (46.2%) and 8921 (95.7%) were tested for HIV in State A and B respectively. Among the TB suspects who received HIV counseling, 1650 (74.7%) and 8921 (98.9%) were tested for HIV in state A and B respectively. The dropout rate of those who received HIV counseling and refused HIV testing was 558 (25.3%) and 98 (1.1%) in State A and B respectively. The HIV positivity rate among TB suspects who were tested was 197 (11.9%) in State A compared with 487 (5.5%) in State B.

**Conclusion:** The study highlighted that training health care workers at DOTS clinics to perform HCT significantly improved access to HCT services, acceptance of HCT services and reduced dropout rate among TB suspects. There is the need to decentralize HCT services and build the capacity of GHW on HCT.

### PC-326-29 Demographic and clinical-epidemiological characteristics of TB patients with and without HIV, Brazil

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**Background:** Thinking about the care of people with HIV/AIDS means to reflect on the incidence and prevalence of comorbidities such as tuberculosis (TB).

**Aim:** To analyze the demographic, clinical and epidemiological data on TB patients co-infected (HIV-TB) and without co-infected in Ribeirão Preto (RP), Brazil.

**Methods:** This descriptive study from TB cases in RP in 2009, recorded in the information system state of TB (TB-WEB).

**Results:** It was recorded 203 cases of TB, 42 (20.7%) co-infected. For the conditions of no co-infection (NCI) and co-infection (CI), prevalence was male (68.3% and 59.5% respectively) and whites (44.7% and 57.1% respectively). NCI's focus mostly (19.9%) aged 20 to 29 years while the CI from 30 to 39 years (35.7%), which may be related to the late manifestation of aids. Regarding the place of treatment, 87.0% of NCI are treated at TRC (Tuberculosis Reference Centres) while 78.6% of CI in hospitals, since they are more affected due to low immunity. In both conditions, new cases (91.9% between the NCI and 95.2% among CI) and the clinical pulmonary TB are

more incidents (84.5% between the NCI and 52.4% among CI). Regarding the type of treatment, 91.9% of NCI and CI are 88.1% of the observed treatment (DOT), the oversight made by the TRC. NCI and CI had the cure as the main outcome of treatment (87.6% between the NCI and 61.9% among CI).

**Final considerations:** Despite the prevalence of pulmonary TB and cured between CI and NCI, it appears that the condition of HIV/aids contributes to the change in the epidemiology of the disease with the highest number of cases of extrapulmonary TB and not cured cases, urging the need for an integrated action program of aids and TB, with a view to reducing the burden of infectious diseases, early detection, appropriate treatment and regular monitoring of cases.

### PC-412-29 HIV co-infection prevalence among different TB classification types in Northern Uganda

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**Background:** HIV prevalence rate in Northern Uganda is at 8.2%, with male at 7.1% and female at 9%. It is estimated that HIV prevalence among newly registered TB patients is around 50%. However, little is known about any difference in HIV prevalence among sex and across various TB classification types, whose occurrence is also directly influenced by HIV co-infection.

**Intervention:** Data for 2010 were collected from all the 11 reporting districts in the region and reviewed. The overall number of cases was broken down by sex and TB classification as main variables of interest. Results were tested for any statistical significance.

**Results:** Of the 6368 cases registered in 2010 in the region who were offered an HIV test, 5584 (87.7%) accepted being tested, with no significant difference between male (87.2%) and female (88.5%) patients. Overall, the proportion of HIV-positive TB patients was 50.3% (male 48% and female 54.3%). Female were more likely to be found HIV-positive, with an odd ratio of 1.29 (1.15–1.43,  $P < 0.0001$ ). Smear-positive pulmonary TB patients were found co-infected

Classification type	Tested for HIV <i>n</i>	Tested HIV-positive <i>n</i>	HIV prevalence %
New smear-positive TB cases	2738	1286	47.0 (OR = 1.0)
New smear-negative TB cases	2284	1227	53.7 (OR = 1.31, $P < 0.0001$ )
New extra-pulmonary TB cases	320	143	55.3 (OR = 1.40, $P < 0.005$ )
Other types of TB	242	117	48.3 (OR = 1.05, $P = 0.68$ )
Total	5584	2807	50.3



with HIV in 47% of cases; while smear-negative pulmonary and extra-pulmonary cases were found HIV-positive in 53.7% and 55.3% respectively. The odds ratio of being found HIV-positive was 1.31 (1.17–1.46,  $P < 0.0001$ ) for smear-negative and 1.40 (1.10–1.76,  $P < 0.005$ ) for extra-pulmonary cases.

**Conclusions:** HIV testing acceptance is high among TB patients in Northern Uganda. The HIV prevalence among them is not homogeneous across different disease classification types and is higher in females than in males. This information could help in ensuring all TB cases receive HIV counseling and testing, especially those whose disease type is more likely to be associated with HIV co-infection.

#### PC-446-29 The impact of HIV on the evolving epidemiology of smear-positive tuberculosis in three high-burden provinces of Kenya

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**Background and challenges to implementation:** Interest in epidemiology of tuberculosis has recently been activated worldwide by its re-emergence since the mid-1990s especially in SSA where HIV and poverty have created a lethal combination that propagates TB transmission. The three high HIV provinces of Kenya contribute 60% of all the TB cases notified in Kenya.

**Interventions:** Kenya introduced HIV testing for TB patients in 3rd quarter of 2005 as an entry to comprehensive care. Smear positive notification and HIV testing data was abstracted from 2002 to 2009 and subjected to analysis.

**Results and lessons learnt:** The highest case notification rates were reported in 2004 in all the provinces. There has been a gradual decline since 2005 but the highest decline was reported in Nairobi which fell to below 200/100 000 population. HIV testing increased from 35% in 2005 to 90% in 2009 with the HIV prevalence amongst the TB patients declining from 60% (2005) to 38% (2009). Treatment outcomes in 2008 were better in HIV negative (TSR 88%, died 2.3%) patients as compared to HIV positive (TSR 82%, died 6.3%) and the worst outcomes were in patients with unknown HIV status (TSR 80%, died 3.7%).

**Conclusion and key recommendations:** The overall trend of smear positive TB cases notified is on the decline and if control efforts are sustained, the decline can be accelerated especially if lessons from Nairobi are adopted. Efforts should be made to identify and address barriers to HIV testing and causes of high death rate in HIV positive patients.

#### PC-548-29 HIV testing among tuberculosis patients in Denmark increased through the period from 2007 to 2009

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**Background:** It is generally accepted that any individual diagnosed with tuberculosis (TB) should undergo testing for human immunodeficiency virus (HIV) to rule out co-infection. TB disease as well as HIV infection is notifiable in Denmark. All TB cases are registered in the Danish national TB registry but information on HIV co-infection is in-constant and direct linking with the national HIV registry is not possible. We examined whether patients notified with TB in Denmark were tested for co-infection with HIV during a 3 year period from 2007 to 2009.

**Interventions:** We used the Danish national TB registry to identify patients diagnosed with TB and locate the relevant clinical departments in charge of treatment. We contacted the departments and requested the results of HIV testing in all TB patients.

**Results:** A total of 1085 persons were diagnosed with TB in Denmark during the three year period from 2007 to 2009. We were able to obtain HIV test status for 95%. The percentage of patients examined for HIV infection, increased from 43% in 2007, to 50% in 2008, and 63% in 2009.

HIV infection prevalence was 3% among the total number of TB patients, and it was 6% in the 521 patients tested for HIV co-infection.

**Conclusions:** HIV prevalence among tested TB patients in Denmark is much higher than the estimated 0.1% in the average population. The true prevalence of HIV infection in all TB patients in Denmark is likely to be 3–4%. It seems there is an increasing awareness in Denmark towards testing TB cases for HIV co-infection.

#### PC-561-29 Tuberculosis: clinical and epidemiological impact of HIV infection, Ribeirão Preto, Brazil, 1999–2009

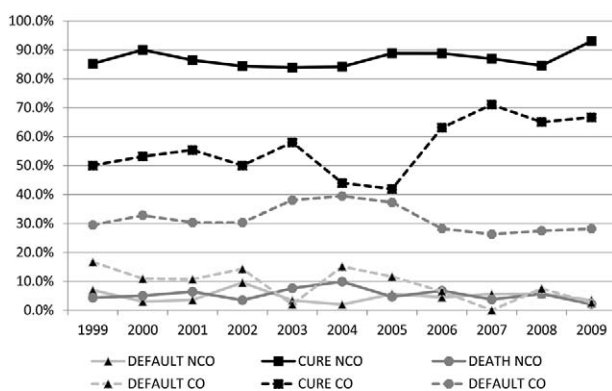
A Monroe,<sup>1</sup> R L P Andrade,<sup>1</sup> M A Z Ponce,<sup>1</sup> M E F Brunello,<sup>1</sup> G T Magnabosco,<sup>1</sup> L M Lopes,<sup>1</sup> A Ruffino-Netto,<sup>2</sup> T C S Villa.<sup>1</sup> <sup>1</sup>Department Maternal Infant and Public Health of College of Nursing of Ribeirão Preto–University of São Paulo, Ribeirão Preto, SP, <sup>2</sup>Department Social Medicine of College of Medicine of Ribeirão Preto–University of São Paulo, Ribeirão Preto, SP, Brazil. Fax: (+55) 16 3602-0518. e-mail: amonroe@eerp.usp.br

**Background:** HIV/AIDS infection not only contributes to the increased number of tuberculosis cases, but also promotes an impact on mortality rates among co-infected individuals.

**Aim:** To analyze clinical presentations and treatment outcomes for tuberculosis (TB), according to HIV/AIDS co-infection in the Ribeirão Preto from 1999 to 2009.

**Methods:** A descriptive study was conducted with TB cases register in Ribeirão Preto recorded in the period from 1999 to 2009 at the state surveillance information system (TB-WEB).

**Results:** Of 1834 TB cases notified, 576 (31.4%) presented TB-HIV co-infection. Among those not co-infected, 83.2% had pulmonary tuberculosis, 12.2% were extrapulmonary cases, 4.5% had pulmonary/extrapulmonary and 0.1% disseminated. Among those co-infected, 55.2% had pulmonary TB, 26.2% extrapulmonary, 14.4% had both forms and 4.2% disseminated TB. Relating to the outcome of TB treatment, there was an increase in cure rate and subsequent lower rates of death and default among co-infected since 2006 (as seen at the chart), a period that corresponds to the decentralization of the TB Directly Observed Therapy from the tertiary sector (hospitals/outpatient clinics) for regionalized TB reference centers. In 2009 rates of 66.7% cure, 2.6% dropout and 28.2% mortality were reached.



**Figure** Distribution of cases of tuberculosis according co-infected TB-HIV and outcomes of treatment, 1999–2009.

**Conclusions:** Despite efforts, there is a high morbidity and mortality due to TB among people living with HIV/aids, avoiding the achievement of nationally and internationally established goals of control. This situation poses challenges to the health system to develop actions and interventions that enable the delineation and classification of a risk profile of patients, as well as the elaboration and implementation of protocols which systematize the care provided to people living with aids in Ribeirão Preto, in order to adequate prevention and clinical management of TB in this vulnerable group.

### PC-672-29 Factors associated with low level HIV testing among TB patients in one district, West Bengal, India

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**Background:** Though national policy recommends voluntary HIV testing of all diagnosed TB patients it was seen that uptake of HIV testing among TB patients was <30% in West Bengal, a low HIV-prevalent state.

**Objective:** We assessed patient and provider related factors associated with low uptake of HIV testing among TB patients.

**Methods:** We conducted cross-sectional analysis of HIV testing status of TB patients registered in July–September 2010 in South 24 Parganas district (population 7.7 million), West Bengal, followed by interview of 10% random sample TB patients and qualitative review of Health Institutions using uniform checklist, key informant interview (KII) and focus group discussions (FGD) among providers. We sourced data on HIV status from TB and HIV program records.

**Results:** Of 1651 TB patients registered 497 (30%) patients tested for HIV, out of whom 435 (88%) tested in first 2 months of treatment. Within district 65 TB diagnostic microscopy sites were available, 15 of which had HIV testing services; patients diagnosed of TB at centers with co-located HIV services were more likely to get HIV tested than those at sites without (RR = 2, 95%CI: 1.7–2.3). Patient interview revealed only 44% were referred of whom 82% underwent testing, education level and financial status not being significantly associated with successful testing. Provider KII and FGD revealed reasons for low testing like partial information about the national policy among providers, shortage of HIV testing kits and staff, suboptimal understanding of recording and reporting process and non use of referral forms.

**Discussion:** In South 24 Parganas, low HIV testing of TB patients was associated with lack of locally available HIV testing services further complicated by HIV test kit supply disruptions. Referral by all providers, decentralization of HIV testing to all microscopy sites and improved HIV test kit supply chain management may increase number of TB patients with known HIV status.

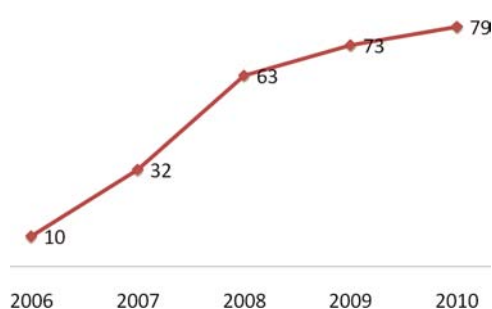
### PC-896-29 HCT among TB suspects registered in 2010: lessons from the three highest HIV prevalence states in Nigeria

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**Background:** Nigeria has the highest TB and HIV burden in Africa. The HIV sero-prevalence rate among TB patients increased from 2.1% in 1991 to 19.1% in 2001 and is now 25% with little information on HCT among TB suspects. The objectives of this study is to analyze records of HCT among registered TB suspects in 2010 from 3 states with highest HIV prevalence in Nigeria with the aim of providing evidence-based information for policy change on HCT for this group.

**Methods:** A retrospective study of cohort of registered TB suspects offered HCT between April to June 2010 from 3 states. Trained Staff at DOTS centers provides the HIV counseling and in some cases the testing. Information on HCT for TB suspects was recorded in the TB suspect and laboratory registers and were analysed.

**Results:** A total of 7556 TB suspects were registered during the period out of which 2117 have TB. 28.4% (2147) of the TB suspects were tested for HIV, out of which 39.5% (849) of them were HIV-positive. 75.3% of the TB patients were also tested for HIV out of which 51% of them were HIV-positive.



**Figure** Trend in % of regular TB patients tested for HIV in Nigeria, 2006–2010.

**Conclusion/recommendations:** Efforts to provide HCT at DOTS centers are mostly focused on TB patients and not TB suspects in spite of the huge number of TB suspects seen in such centers. HCT provision for TB suspects has a higher potential of accelerating universal access target for National HCT programme and therefore NTBLCP and NASCP should review the HCT policy to cover TB suspects at DOTS centers.

### PC-1334-29 Evaluation of health service response to TB and HIV in Manicaland Province, Zimbabwe

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**Aim:** In April, 2010 visits to the seven districts in Manicaland found performance of the TB-HIV and DOTS programs in the province to be poor. Our objective was to further evaluate TB-HIV collaborative activities in the province in order to develop a strategy for improvement.

**Methods:** A cross sectional descriptive study of the performance of the TB-HIV program from 03–12 December 2010 was undertaken using a structured questionnaire derived from the WHO-IUATLD DOTS and DOTS Plus strategies documents.

**Results:** Notification rates for the seven districts ranged from 144–694/100 000/year. Sputum cases smear positive (SS+) ranged from 8% to 76%. The proportion of TB patients who had an HIV test ranged from 65% to 92% and between 40% and 78% of those tested were HIV positive. Reported treatment success rates ranged from 69% to 95% and cure rates from 15% to 63%. There was little evidence of register data being used to performance manage the TB-HIV services. While some clinics had no TB suspect registers. Laboratory services were very poor in some districts. Lack of vehicles or fuel, meant sputum transport, contact tracing and support were difficult. Facilities for radiology were variable and there was minimal access to sputum culture, whilst its reporting took up to 30 days.

**Conclusion:** Performance of the TB-HIV program in the districts of Manicaland Province was highly variable. There was clear evidence of good performance on which to build. Initial support should focus on improved identification of SS+ TB and improved data management and interpretation.

### DIAGNOSIS, TREATMENT AND CLINICAL MANAGEMENT OF TB-HIV

#### PC-145-29 Factors associated with reduced anti-tuberculous serum drug levels in patients with HIV-TB co-infection

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**Background:** To identify correlates of reduced anti-tuberculous serum drug levels (SDL) in HIV patients receiving treatment for active TB.

**Methods:** Cross-sectional analysis of all individuals diagnosed with both HIV and active TB in Northern Alberta, Canada from 1998–2009 was performed. Data was collected by retrospective chart review. Correlates of low SDL (Cmax) were assessed using  $\chi^2$  and Fisher's Exact test (for categorical outcomes) and Students *t*-test (two-tailed) for continuous outcomes. Regression analysis was used for multivariate analysis.

**Results:** 30 cases of HIV-TB co-infection were identified. 27 patients underwent measurement of SDL. Rates of low SDL were 9/26 (34%) for INH, and 16/25 (64%) for rifamycins. A low SDL for at least one drug was documented in 20/27 (74%). A trend was found between low SDL and CD4 < 200 cell/mm<sup>3</sup> and/or lack of antiretrovirals, although this did not reach statistical significance. Weight > 70 kg and BMI > 18 were significantly correlated with low SDL and for the rifamycins, despite the small number of patients in this group ( $P < 0.05$ ).

**Conclusions:** Inadequate absorption of first-line TB drugs, including INH and rifamycins, is common in patients with HIV-TB co-infection. A novel finding of this study is weight > 70 kg significantly correlated with low SDL. Thus conventional dosing may be too low for HIV-TB patients and consideration should be given to increasing the maximum weight-based starting doses. Further study is needed to confirm that higher dosing would achieve adequate SDL, that relapse and acquired drug resistance would be reduced, and that higher rates of drug toxicity would not result.

#### PC-154-29 Factors associated with increased risk of TB among HIV-infected patients in Sudan

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**Setting:** TB screening among HIV infected patients is one of the approaches for TB/HIV co-infection control. But this approach is challenging due to lacking of traditional TB symptoms among HIV-infected patients.

**Objectives:** This research was designed to study risks of TB among HIV-infected patients. Main objectives are: (1) to study associations of TB risk factors: personal characteristics, baseline CD4, WHO clinical stage and use of HAART and (2) to study the sensitivity and specificity of traditional TB symptoms among HIV patients in order to generate strong evidence for IPT.

**Methodology:** Case control study was conducted in Khartoum State during the period January–October 2010. Cases and controls were selected by SRS in 1:2 ratios according to specific selection criteria. Data was collected using structured questionnaires, patient registries and screening results records. 97 (33%) cases and 193 (67%) controls were enrolled in the study.

**Results:** Past history of TB was found to be associ-

ated with high risk of TB (adjusted OR 8.8). Poor adherence to HAART had nearly double risk (OR 1.8). Low baseline CD4 count (OR 4.4) and WHO stage 4 (OR 2.6) were found to be absolute risks for TB. Fever and cough together had a sensitivity of 0.76 and specificity of 0.89.

**Conclusion:** TB clinical screening should be conducted regularly for all patients on HIV chronic care regardless of their risk factors. Two approaches should be encouraged: TB active case finding in VCT centers and provision of IPT to HIV patients under chronic HIV care.

#### PC-217-29 Problem of TB-HIV co-infection in Donetsk oblast, Ukraine

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Population of Donetsk oblast counts 10% of all Ukrainian population, and this oblast bears the main burden of TB in Ukraine since 1995. TB-HIV co-infection rate patients among new TB patients increased from 11% to 24.7%, among died TB patients—from 14.8% to 36% for the last 5 years. 783 new cases of TB-HIV and 533 cases of death from co-infection were registered in Donetsk oblast in 2010; total number of patients with co-infection came to 1254 by the end of the year. This data evidences of substantial scale and special significance of the problem of TB-HIV co-infection for Donetsk oblast. 55% of new HIV-positive TB patients were previously registered as HIV infected, but they did not receive chemoprophylaxis of TB. 94% of TB-HIV co-infected patients had pulmonary TB. In half of cases TB was detected based on clinical symptoms, i.e., in previously registered HIV+ persons, despite the majority of them (75%) underwent a radiography examination for the last 12 months. Low level of treatment efficacy of TB-HIV patients in comparison with HIV-negative TB patients (43% and 65% accordingly), high lethality rate before treatment completion (39% among HIV-positive and 5.3% among HIV-negative TB patients) are caused by insufficient availability of anti-retroviral therapy (ARVT)—only 35% out of patients in need of ARVT received it; main cause is lack of ARVT drugs that are procured centrally in Ukraine. Primary multidrug resistance results in treatment failure in TB-HIV co-infected cases rather rarely (in 5% of cases) because of high early lethality rate among these patients.

Our analysis confirms the necessity to join resources of the National TB Programme and HIV/AIDS Programme in the form of the separate sub-programme.



### PC-312-29 Risk factors of drug-induced hepatitis among TB-HIV patients in Iran

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**Objectives:** Treatment of TB-HIV is challenging. Drug-induced hepatitis (DIH) is a major problem. In this study we evaluate risk factors of DIH in TB-HIV patients.

**Materials and methods:** This study has been performed during 2004–2009 in national referral center in Tehran. All patients with TB-HIV were included in the study. DIH was determined based on ATS criteria. Antiretroviral therapy (ART) and anti-tuberculosis treatment was based on national guidelines.

**Results:** 151 patients were included in study. Majority of patients were male (97.4%). Mean age was  $40 \pm 9.38$ . History of smoking was present in 147 (97.5%) and majority of them were opium addicted (92.7%). During treatment 45 (29.8%) of patients developed DIH. Rehepatitis occurred in 24 (9.3%) of patients. HBS antigen and anti-HCV were positive in 9 (6.3%) and 63 (41.7%) respectively. According to treatment outcome, cure, death and failure occurred in 102 (67.5%), 42 (27.8%) and 7 (4.6%) respectively. ART was initiated for 90 (59.6%) of patients. DIH was not associated with ART, HBS Ag, anti HCV, sex, age or weight. In logistic regression the only factor associated with DIH was CD4 count  $< 100$  ( $P \leq 0.001$ ). DIH was not associated with bad treatment outcome.

**Conclusion:** DIH had high prevalence in this study. The only factor associated with DIH was severe immunosuppression (CD4 count  $< 100$ ).

### PC-394-29 Performance of TST and T-SPOT.TB tests for latent tuberculosis in HIV-infected persons

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**Objectives:** Bacillus Calmette-Guérin (BCG) vaccination will increase the false-positive rate of tuberculin skin test (TST) in diagnosis LTBI. Taiwan had high BCG coverage rate which is over 95% and reduce the specificity of TST. This study is to compare the performance TST and IFN- $\gamma$  Release Assay (T-SPOT.TB) of LTBI diagnosis in HIV-infected persons.

**Methods:** Both tuberculin skin test (TST with RT23 2TU PPD) and T-SPOT.TB were provided to HIV-infected individuals who were capable to sign informed

consent. BCG vaccination record was confirmed through scar inspection.

**Results:** A total of 1005 subjects were enrolled from 2008 to 2010 and 883 subjects had valid both test results. The mean age was 36.3 years (range 20.0–81.7) and 88% were males. The positive rate of TST and T-SPOT.TB was 24.6% and 14.3% respectively. Only 75 participants had both tests positive and the overall double positivity rate is 8.5%. There were 5.6% of the participants without BCG scar and the TST positive rate was 24%, the same with one BCG scar (e.g. BCG in infancy). In subjects with two BCG scar, the TST positive rate increased to 27%. T-SPOT.TB positive rate among the participants by increasing BCG scar number was 29%, 15% and 13% respectively. The kappa statistic of the two tests is 0.32 and the agreement is around median only. The proportion of positive TST was significantly related to increased CD4 counts, the other two tests didn't show such correlation. The proportion of positive T-SPOT.TB and double positive rate was significantly related to increased age, but TST didn't show the same correlation.

**Conclusion:** Serial testing which use TST screening first then confirmed by T-SPOT.TB is more cost-effective for HIV-infected individuals in highly BCG-vaccinated country. As to some high risk groups such as CD4 lymphocyte count less than 200 cells/mm<sup>3</sup>, we recommend direct use T-SPOT.TB screening to achieve the best protection.

### PC-656-29 Incidence and risk factors of tuberculosis in HIV-infected patients while on HAART in Cambodia

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**Background:** Very limited data are available on the incidence and determinants of TB in patients on anti-retroviral treatment (HAART) from South-east-Asia, and how this evolves over time on treatment. The aim of this study was to determine the incidence and risk factors of early ( $< 6$  months of HAART) and late ( $> 6$  months of HAART) incident TB in Cambodia.

**Methods:** We conducted a retrospective analysis of all patients initiating HAART at a tertiary hospital in Phnom Penh between March 2003 and December 2010. Since the program onset, patient data were prospectively captured. TB diagnosis was performed in line with WHO algorithms. A risk factor analysis was performed using multivariate Cox regression modelling.

**Results:** Overall, 2984 patients initiated HAART, with a median baseline CD4 count of 89 (IQR 25–209) and median age of 34 (IQR 29–40) years. Fifty-three percent were female, mean follow-up time on HAART

was three years. Besides the 926 (31.0%) patients on TB treatment at ART initiation ('prevalent TB'), 313 (10.5%) developed incident TB, with an overall incidence rate of 3.4/100 patient-years. Cumulative 1-year incidence decreased from 12.7% in 2004 to 5.9% in 2009. 168 (5.6%) patients were diagnosed with early TB and 145 (4.9%) with late TB, corresponding with a rate of 12.3 and 1.8/100 py respectively. Risk factors for early TB included low baseline CD4 count and low baseline BMI (Table). Older age and low baseline haemoglobin were identified as risk factors for late TB.

**Table** Adjusted hazard ratios (95%CI) for early and late incident TB in patients receiving HAART

Covariates	Incident TB category	
	Early incident TB	Late incident TB
Demographic characteristic		
History of TB treatment	0.83 (0.44–1.54)	1.51 (0.93–2.47)
Female gender	0.88 (0.63–1.23)	0.84 (0.59–1.20)
Age > 40 years	1.21 (0.85–1.74)	1.48 (1.03–2.13)
Baseline haemoglobin		
<8 g/dL	1.25 (0.71–2.21)	2.29 (1.37–3.83)
8–10 g/dL	1.29 (0.89–1.88)	1.16 (0.76–1.78)
>10 g/dL	1	1
Body mass index		
≤18.5 kg/m <sup>2</sup>	1.59 (1.12–2.24)	1.27 (0.88–1.83)
>18.5 kg/m <sup>2</sup>	1	1
CD4 count		
<50 cells/μL	3.32 (1.89–5.83)	1.59 (0.94–2.70)
51–200 cells/μL	1.86 (1.04–3.32)	1.15 (0.67–1.97)
>200 cells/μL	1	1

**Conclusion:** The incidence of early TB was high, and mainly associated with markers of advanced HIV progression. A pronounced decline in incidence of TB was seen after longer time on HAART. These findings reinforce the need of early HAART initiation and better screening strategies before treatment initiation.

### PC-715-29 HIV and ARVs increase risk of adverse events in patients treated for drug-resistant TB in Namibia

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**Background:** In Namibia, the proportion of TB patients with HIV is 59%. We sought to examine and describe risk-factors associated with occurrence of adverse events (AEs) in HIV co-infected TB patients treated for drug-resistant (DR) TB.

**Design and methods:** Retrospective analysis of records of patients treated DR-TB in a district hospital

from 01-Jan-2008 to 24-Feb-2010. Data on patient and treatment characteristics and the occurrence of AEs were collected using a structured data collection form. Hazard ratios (HR, 95%CI) from Cox proportional hazard analysis were used to assess the association between possible risk factors and (specific) adverse events.

**Results:** Of the 59 DR-TB patients in the study, 31 (53%) were HIV+, 28 of whom reported a total of 79/136 (58%) AEs (2.82 per person). The risk of 3 or more AEs was highest in HIV co-infected patients (HR 3.02; 95%CI 1.06–8.65). In these patients, kanamycin was associated with AEs lasting ≥3 months (HR 5.53; 95%CI 1.20–25.56) during the intensive phase of treatment (HR 3.41; 95%CI 1.33–8.79). AZT-based regimens were associated with AEs lasting < 1 month (HR 7.26; 95%CI 1.38–38.23), notably nausea (HR 7.50; 95%CI 1.10–51.51). Joint pains were associated with cycloserine (HR 5.68; 95%CI 1.13–28.44).

**Conclusion and recommendations:** HIV disease increased the risk of experiencing 3 or more AEs. AZT increased the risk of short-lived AEs particularly nausea. Clinicians should intensify prevention and management of AEs in DR-TB-HIV+ patients on second line medications especially among those using ARVs.

### PC-741-29 Capacity building with teleradiology in a district level hospital, Malawi

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**Background:** Malawi has a high burden of tuberculosis (TB) and HIV, yet about half of TB cases go undiagnosed. Chest X-ray (CXR) presentations of TB in HIV patients are well characterized, but as clinicians have little training in interpretation of radiographs, there is risk of misdiagnosis & incorrect treatment. The National TB Programme recommends that 3 clinicians review a CXR. Additional expert interpretation is often useful to confirm the clinical diagnosis.

**Methods:** Médecins Sans Frontières (MSF) supports the Ministry of Health by sending radiographic images from complicated clinical cases seen at Thyolo District Hospital electronically through the MSF Diagnostic Network to a radiologist in the United States. Radiographs are digitized using a camera, tripod, light-box, computer & internet connection. The digital image is sent with a clinical history report form. The radiologist sends back a report, free-of-charge, that aims to reach the clinician within 48–72 hours.

**Results:** Between October 2010 and end February

2011, 50 images (10 paediatric, 1 lumbar) were reviewed, including 32 from HIV-positive patients. The teleradiologist's diagnosis confirmed the provisional clinical diagnosis in 36 of 50 cases (72%). Of the 48 interpretable images, 16 of 31 TB suspects were confirmed to have TB; 3 of the 5 suspected cases of pulmonary Kaposi Sarcoma (KS) were confirmed; and KS was diagnosed in a patient who was initially diagnosed with TB. The radiologist diagnosed 9 cases of pneumonia, of which 3 were not suspected by the clinicians. Despite a 7-hour time difference, 2 out of 3 urgent requests were reviewed within 24 hours.

**Conclusions:** Experience in Thyolo to date has shown teleradiology to be a promising tool. It benefits patients by facilitating rapid confirmation or correction of the clinicians' diagnosis. In addition, radiology reports act as a low-cost training tool for clinicians. Patients medical outcomes to be assessed at a later date.

#### PC-753-29 Interferon-gamma release assays for diagnosing TB in HIV-infected adults: a systematic review

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**Background:** Interferon- $\gamma$  release assays (IGRAs) are being increasingly used for the diagnosis of tuberculosis (TB) and TB infection. However, the helpfulness of IGRAs in HIV-infected patients is unclear.

**Methods:** We searched MEDLINE, Cochrane, and Biomedicine (IME) databases for articles on the commercial IGRAs (QuantiFERON-TB<sup>®</sup> Gold In-Tube [QFT-IT] and T-SPOT.TB<sup>®</sup>) in HIV-infected people, published between January 2005 and January 2011. Sensitivity, specificity, indeterminate results, effect of immunosuppression, and development of tuberculosis were assessed. We calculated pooled estimates by using random effects models.

**Results:** The search yielded 34 articles. The pooled sensitivity for active TB was 64% (95%CI 54–74) for QFT-IT and 62% (95%CI 50–74) for T-SPOT.TB; and the pooled specificity was 88% (95%CI 70–100) for QFT-IT, and 71% (95%CI 51–86) for T-SPOT.TB. Indeterminate rates were higher with  $<200$  CD4<sup>+</sup> cell/ $\mu$ L: pooled rates for QFT-IT were 13.5% (95%CI 7.8–19.3) for CD4<sup>+</sup>  $< 200$ , and 2.4% (95%CI 1.4–3.5) for CD4<sup>+</sup>  $\geq 200$  (OR 5.6 [95%CI 2.6–12.1];  $P < 0.0001$ ). Correspondent figures for T-SPOT.TB were 18.2% (95%CI 9.0–27.4) for CD4<sup>+</sup>  $< 200$ , and 6.6% (95%CI 2.6–10.7) for CD4<sup>+</sup>  $\geq 200$  (OR 1.9 [95%CI 1.0–3.5];  $P = 0.04$ ). Available data showed that a negative QFT-IT the risk of developing active TB was very low during the followed two years if a QFT-IT test was negative.

**Conclusion:** Sensitivity and specificity of commercial IGRAs in HIV-infected adults are suboptimal to rule out TB or to differentiate active disease from latent

infection. Although it needs further confirmation, a negative QFT-IT in HIV-infected adults implies a low risk of developing active TB.

#### PC-844-29 Predictors of tuberculosis immune reconstitution inflammatory syndrome in TB-HIV patients

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**Aim:** To determine the clinical spectrum, predictors and outcomes of tuberculosis-immune reconstitution inflammatory syndrome (TB-IRIS) in a resource-limited setting.

**Methods:** In a prospective study using the International Network for Studies against HIV associated IRIS (INSHI) definition we studied 254 patients with TB-HIV co-infection starting antiretroviral therapy (ART). INSHI major criteria were used to describe the frequency (pulmonary or extrapulmonary) of TB-IRIS manifestations.

**Results:** We identified 53 (21%) patients with TB-IRIS. ART was started a median 44 days (IQR, 28–64 days) after TB treatment initiation and the median time to TB-IRIS was two weeks (IQR, 12–22 days) after ART initiation. Majority of the patients with TB-IRIS had extrapulmonary manifestations 38/53 (72%). In a multiple logistic regression model baseline haemoglobin less than 100 g/L (OR 2.23 (1.08–4.60);  $P = 0.021$ ) and baseline CD4 lymphocyte count  $< 50$  cells  $\mu$ L (OR 4.27, IQR 1.72–7.94;  $P = 0.001$ ) were significant predictors of IRIS. TB-IRIS was not identified as a cause of mortality in any of the patients.

**Conclusion:** The majority of the patients from this Ugandan cohort with TB-IRIS manifested as extrapulmonary disease. Advanced immunosuppression with CD4 lymphocyte counts less than 50 cells/ $\mu$ L and anaemia were independent predictors of TB-IRIS in patients with HIV-TB co-infection commencing ART. And, in spite of the associated morbidity, TB-IRIS is not a cause of mortality in TB-HIV co-infected patients.



### PC-1004-29 Urinary lipoarabinomannan as predictor for tuberculosis immune reconstitution inflammatory syndrome

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**Setting and objective:** Upon initiation of highly active antiretroviral therapy (HAART), about 15% of tuberculosis (TB)-HIV co-infected individuals experience paradoxical worsening of their clinical status with exuberant inflammation consistent with Immune Reconstitution Inflammatory Syndrome (IRIS). Predictive diagnostic test for IRIS have not been yet identified. We investigated whether positive urinary TB lipoarabinomannan (LAM) antigen ELISA detection prior starting HAART was associated with development of TB IRIS.

**Methods:** In a prospective observational cohort, we compared pre-HAART urinary LAM concentration in HIV-infected patients on treatment for active TB disease starting HAART in Mulago Hospital, Kampala, Uganda. The median follow up period was 332 days (IQR:168–361). Cases were patients who developed TB IRIS during the first 3 months of HAART (definition from the International Network for the Study of HIV-associated IRIS (INSHI)), controls were patients who remained TB IRIS free during the follow up period.

**Results:** Twenty-six IRIS cases and 66 controls were included in the analysis. The median time to develop IRIS was 14 days (IQR:11–14). Eighty-one percent of the cases ( $n = 21$ ) had a positive LAM test compared to 48% ( $n = 31$ ) among the controls. Univariate analysis showed that a positive urinary LAM test pre-HAART (OR:4.5 [95%CI:1.5–13.3],  $P = 0.007$ ) and a baseline CD4 cell T-cell count  $< 50$  cells/ml (OR:21 [95%CI:2.6–168.8],  $P = 0.004$ ) were both associated with an increased risk of TB IRIS. However, multivariate analysis revealed that only baseline CD4 T-cell count was predictive of IRIS ( $P < 0.001$ ). Sensitivity and specificity (95%CI) of a positive LAM-ELISA test to diagnose IRIS was 80.8% (60.6–93.4) and 51.6% (38.7–64.2).

**Conclusion:** A positive LAM test was associated with TB IRIS. In the absence of CD4 T-cell count, LAM detection in a point-of-care format could be useful to detect patients at high risk of TB IRIS. Further testing with lateral flow point-of-care format is warranted.

### PC-1222-29 Gender differences in lung cancer presentation and survival among HIV-positive and HIV-negative individuals

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**Background:** Lung cancer (LC) is the leading cause of cancer-related death among people living with HIV (PLWH). In the general population, adenocarcinoma is more common in women with LC, while squamous cell carcinoma is more common in men. We explored potential gender-related differences in lung cancer presentation and survival in HIV+ and HIV- patients.

**Methods:** A retrospective review of the hospital cancer registry from 2000–2010 was performed. HIV status of identified lung cancer patients was assessed. Demographics, stage of cancer, and outcome were recorded for HIV+ and HIV- patients. Data were analyzed using SAS 9.1.

**Results:** Over the 10-year period, 1250 lung cancer cases were identified (75 HIV+, 205 HIV-, and 970 unknown HIV status). There were 20 women (W+) and 55 men (M+) with HIV, and 85 women (W-) and 120 men (M-) who are HIV-. There were significantly more men tested for HIV at cancer diagnosis than women ( $P = 0.0001$ ). The distribution of lung cancer type is similar among the HIV+ and HIV- individuals. Median age at cancer diagnosis is not significantly different among W+ (50 years old), W- (55), M+ (55) and M- (58). Prevalence of stage IIIB or IV occurred in 69% of W+, 67% W-, 68% M+ and 73% M-. There is no difference of median CD4+ cell counts (W+ = 233, M+ = 159,  $P = 0.1$ ) or HAART use at cancer diagnosis among M+ (53%) or W+ (63%), ( $P = 0.4$ ). The median survival time for W+ (386 days), M+ (192 days), W- (475 days) and M- (247 days). There is a trend for longer survival for W+ vs. M+ (log rank  $P = 0.07$ ), as well as W- vs. M- (log rank  $P = 0.06$ ), but no difference for W+ vs. W- (LR  $P = 0.7$ ) or M+ vs. M- (LR  $P = 0.8$ ).

**Conclusion:** The experience in our hospital reveals that in the combined antiretroviral therapy (cART) era, there does not seem to be a difference in lung cancer presentation among HIV+ or HIV- patients, but there is a trend for better survival among any women compared to men, whether HIV+ or HIV-.



### PC-1293-29 The clinical utility of sputum induction in different patient settings within a high HIV prevalence

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**Background:** In HIV prevalent resource-limited settings sputum induction (SI) is advocated for sample acquisition in sputum scarce (SS) and smear-negative (SN) TB suspects. Few studies have evaluated the impact of SI as part of routine care in adults. The objective of our study was to evaluate the clinical utility of SI in high HIV prevalence outpatient and inpatient hospital settings.

**Methods:** SS or SN inpatients and outpatients with suspected TB were referred for SI at the respiratory clinic of a tertiary South African hospital. SI was performed using ultrasonic nebulisation with 5% hypertonic saline. Mycobacterial liquid culture served as a reference standard.

**Results:** 715 SS/SNTB TB suspects underwent SI. SI failed in 15% (106/715) of patients and <2% (14/715) of patients developed side-effects. Culture-positive TB was diagnosed in 12% of both SS (19/161) and SN (6/49) outpatient SI samples and 26% (61/237) and 15% (14/91) of SS and SN inpatient SI samples. SS inpatients had a significantly higher culture-positive rate than outpatients (26% vs. 12%;  $P = 0.04$ ). Single smear microscopy sensitivity in outpatients was 42% (2/6) and 33% (8/12) for SS and SNTB respectively, while in inpatients it was 67% (41/61) and 76% (11/14). There was no added benefit in performing more than a single SI. No significant difference in SI performance between HIV-positive and HIV-negative patients was found.

**Conclusions:** Under routine hospital conditions SI was a safe and clinically useful method of sample acquisition for TB diagnosis in a high HIV prevalence resource-limited setting. SI offers greatest benefit in inpatient TB suspects unable to produce sputum. SI performance is unaffected by HIV positivity and there is no added benefit in performing more than a single SI. The impact of sputum induction in primary care outpatient settings and the utility of novel rapid diagnostics applied to SI samples now require urgent evaluation.

### ADULT LUNG HEALTH/ TUBERCULOSIS MISCELLANEOUS

#### PC-47-29 Adjutant ciprofloxacin therapy in pulmonary tuberculosis

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Pulmonary tuberculosis is primarily a disease of poor and therefore is a major health problem in the third world. It is estimated that 1700 million people harbor the pathogen at a given time, out of which 8 million people develop clinical disease every year and 2 million died annually. Following aspects therefore need to be taken into consideration while planning therapeutic regimen: (a) efficiency (b) minimum side effects (c) to meet the exigency of drug resistance and (d) cost effectiveness. We decided to assess the effect of ciprofloxacin on liver in patients receiving different anti-tubercular drug combinations. In patients receiving isoniazid, ethambutol, the serum alanine transaminase levels were  $37 \pm 7.1$ ,  $54 \pm 2.5$  and  $66 \pm 4.8$  units/ml on day 1, 15 and 30 respectively, whereas in other group receiving isoniazid, ethambutol and ciprofloxacin the levels were  $36 \pm 16$ ,  $41 \pm 14.8$  and  $44 \pm 19$  units/ml on corresponding days. Both on day 15 and 30 serum alanine transaminase levels were significantly lower in test group. On the other hand, lactate dehydrogenase levels were raised on day 1 and 15 but returned to normal on day 30. Similarly ciprofloxacin addition to the patients receiving isoniazid, ethambutol, rifampin (HER) and isoniazid, ethambutol, rifampin and pyrazinamide (HERZ) fluctuating trend were observed. The overall trend indicates that though ciprofloxacin may initially causes a non significant mild upset of the liver but the latter quickly adapts to itself.

#### PC-322-29 Low pulmonary function in patients with tuberculosis sequelae

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**Background:** Pulmonary sequelae of tuberculosis are characterized by bronchovascular distortion, bronchiectasis, emphysematous changes, and fibrotic bands. Little is known of effects of treated pulmonary tuberculosis on lung function. The aim of the study was to evaluate the prevalence of low pulmonary function (a condition determined to be present if forced expiratory volume in 1 second was less than 80% of predicted value) in patients who had been treated for pulmonary tuberculosis.

**Methods:** Pulmonary function tests were performed in consecutive 224 patients (between the ages of 20 and 82 years) who were observed at the local dispensary.

**Results:** Pulmonary impairment was present in 105 (46.9%) patients including 81 (36.2%) patients with airway obstruction ( $FEV_1/FVC < 0.7$ ) and 24 (10.7%) patients with restrictive pattern ( $FEV_1/FVC \geq 0.7$  and  $FVC$  or  $FEV_1 < 80\%$  predicted). Of 224 patients, 79 (35.3%) had  $FEV_1 < 80\%$  predicted. According to ATS/ERS criteria we classified 10.3% of subjects as having mild impairment, 15.6% of subjects as having moderate impairment, and 9.4% of subjects as having severe impairment. The prevalence of low pulmonary function in patients aged 40 and older and in younger patients was 40.6% and 13.3% respectively ( $P < 0.01$ ). In patients with culture-positive pulmonary tuberculosis in the past the prevalence of low pulmonary function was 44.4% and in patients with culture-negative pulmonary tuberculosis the prevalence of low pulmonary function was 19.3% ( $P < 0.01$ ). In patients who had two or more episodes of tuberculosis the prevalence of low pulmonary function was 63.3% and in patients with one episode the prevalence of low pulmonary function was 30.9% ( $P < 0.01$ ).

**Conclusions:** Tuberculosis is associated with frequent pulmonary impairment which was variable, ranging from mild to severe. This supports performance of pulmonary function tests in the course of treatment and after a cure.

### PC-335-29 Assessment of health-related quality of life in patients cured for pulmonary tuberculosis

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**Background:** Tuberculosis remains a public health problem with significant impacts on morbidity and mortality. With effective treatment, the focus of tuberculosis management has shifted from the prevention of mortality to the avoidance of morbidity. Pulmonary tuberculosis can result in anatomic and functional changes. The aim of this work was to assess the validity and reliability of the St. George respiratory questionnaire (SGRQ) in patients with a history of tuberculosis and then to examine the impact of the treated pulmonary tuberculosis on quality of life (QoL).

**Methods:** In consecutive fashion, QoL was studied in 219 persons at the age of 20–82 who were observed at the local dispensary. SGRQ was used for assessment of QoL.

**Results:** The SGRQ scores correlated with forced expiratory volume in 1 second in predicted value

( $FEV_1\%$ ); Pearson correlation coefficient ranged from  $-0.53$  to  $-0.58$  (all  $P < 0.01$ ). Test-retest correlation ranged from 0.94 to 0.99 (all  $P < 0.01$ ). Cronbach's Alpha was 0.94 ( $P < 0.01$ ). All the SGRQ components for participants with treated pulmonary tuberculosis were worse in comparison with healthy subjects. In 219 persons symptoms score was  $26.3 \pm 24.7\%$ ; activity score was  $28.1 \pm 23.7\%$ ; impact score was  $16.7 \pm 20.3\%$ ; and total score was  $21.6 \pm 20.6\%$ . All the SGRQ components for patients with pulmonary impairment ( $FEV_1 < 80\%$  predicted) were worse than in patients with normal spirometry results (all  $P < 0.01$ ).

**Conclusions:** The SGRQ scores were valid and reliable. Quality of life in patients treated for pulmonary tuberculosis remained lowered even after treatment was completed. The main factor influencing quality of life was impaired pulmonary function.

### PC-417-29 Tuberculosis in a rural population in Russia

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**Setting:** The problems of TB detection and treatment are taking on special significance in rural territories since social conditions here are worse, contacts are closer and the place of residence is remote from a medical station and that retards medical aid.

**Aim:** Assessment of TB detection, clinical course and treatment effectiveness in rural population.

**Methods:** Incidence statistical data in urban and rural population and individual records of 800 newly detected patients were analyzed.

**Results:** The study of TB incidence of urban and rural population showed that TB incidence in rural population is higher than in urban. In 2009 TB incidence in urban population totaled 78.9 per 100 000 of population and TB incidence in rural population—92.4 per 100 000 of population. Disseminated TB was detected two times more often in rural patients and destructive forms of TB by 10% more frequent as compared to urban population. TB incidence in children (from 0–14 years old), in adolescents (15–17) and pulmonary TB incidence in people older than 65 proved to be two times higher in rural patients. It takes more time to make a diagnosis in rural area than in urban one. Evaluation of treatment results showed that treatment effectiveness in urban and rural areas is high enough. According to treatment results the difference between urban and rural area was not revealed, though treatment effectiveness of rural patients is a bit lower.

**Conclusion:** It is necessary to put in order the work of mobile medical teams to make fluorography examination of patients in order to provide early diagnosis of TB among rural population.

**PC-426-29 Burden of tuberculosis in diabetes clinics in western Kenya**N K Kirui,<sup>1</sup> S Cheng,<sup>2</sup> A Gardner,<sup>3</sup> E J Carter,<sup>3</sup> S Pastakia,<sup>1,2,4</sup><sup>1</sup>Moi Teaching and Referral Hospital, Eldoret, Kenya; <sup>2</sup>Purdue University College of Pharmacy, West Lafayette, IN; <sup>3</sup>Alpert Medical School at Brown University, Providence, RI, USA;<sup>4</sup>Moi University School of Medicine, Eldoret, Kenya.

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**Background:** In 2003, an estimated 7 million people in Africa had diabetes mellitus (DM) and that number is likely to increase to 15 million by 2025. Africa is also facing the worst tuberculosis (TB) epidemic since the advent of the antibiotic era driven by a generalized HIV epidemic and compounded by weak health care systems, inadequate laboratories and conditions that promote transmission. DM is a known risk factor for reactivation of latent TB but currently there are no policy guidelines on how to tackle this emerging health problem. This study aims to characterize the extent of the problem in three DM clinics in western Kenya.

**Design/methods:** Retrospective review of the clinical database in three specialist DM clinics in Western Kenya. Data was collected using an Access database and patients were classified based on the prior history of TB at time of enrollment into the DM clinic based on self-report.

**Results:** 1375 patient records were extracted. Data of 143 patients was excluded due to missing data. 68 (4.95%) patients had a history of TB at enrollment into DM care. The mean duration of DM in patients with a history of TB was 9.07 years vs. 6.94 years in those reporting no prior history of TB ( $P < 0.05$ ). Of those with a history of TB, 32 (47.1%) patients were on oral hypoglycemic agents only and 36 (52.9%) had a history of insulin therapy. 6 (8.8%) were HIV positive, 32 (47.1%) were HIV negative and 30 (44.1%) reported unknown HIV status.

**Conclusion:** History of TB is common among patients attending diabetes clinics in western Kenya. Targeted TB case finding activities in diabetes clinics could be useful in TB control. Further study is necessary.

**PC-657-29 Macronutrient intake and body composition in patients with pulmonary TB in Tbilisi, Georgia**E Sanikidze,<sup>1</sup> J Frediani,<sup>2</sup> M Gegechkori,<sup>1</sup> N Tukvadze,<sup>2</sup> R Kempker,<sup>2</sup> I Kalandadze,<sup>1</sup> H Blumberg,<sup>2</sup> T Ziegler.<sup>2</sup><sup>1</sup>National Center for Tuberculosis and Lung Disease, Tbilisi, Georgia; <sup>2</sup>Emory University, Atlanta, GA, USA.

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**Aim:** Malnutrition is common in tuberculosis (TB), yet little information is available on habitual dietary intake of macronutrients and links with body composition in TB patients.

**Methods:** Dietary intake was obtained from patients within 7 days of pulmonary TB diagnosis using a tool developed for a low literacy population that captures

specific foods common in Georgian culture. Intake of each specific food item consumed during the previous 3 days was determined via one-on-one interviews. Quantitated food intake data was entered into a state-of-the-art software program and mean daily intake of macronutrients determined. Body composition was determined by calculation of body mass index (BMI; kg/m<sup>2</sup>) and bioelectrical impedance analysis (BIA; for % body fat and % lean body mass). Descriptive statistics, unpaired t-tests and linear regression methods were used.

**Results:** In the total of 123 subjects (mean age 33 y; 60% male and 40% female), BMI averaged  $20.7 \pm 3.6$  (SD) kg/m<sup>2</sup>; fat mass was  $22 \pm 10\%$  and lean body mass  $78 \pm 10\%$  of body weight, respectively. Total energy intake averaged  $51 \pm 20$  kcal/kg/day (32% fat, 56% carbohydrate and 12% protein). Protein intake averaged  $1.46 \pm 0.69$  g/kg/day (54% as animal-derived and 46% as vegetable-derived protein, respectively). Underweight subjects (BMI  $\leq 18.5$  kg/m<sup>2</sup>;  $n = 27$ ) compared to those with BMI  $> 18.5$  kg/m<sup>2</sup>, ( $n = 96$ ) consumed more total energy ( $64 \pm 23$  vs.  $47 \pm 18$  kcal/kg/d;  $P = 0.001$ ), protein ( $1.95 \pm 0.80$  vs.  $1.32 \pm 0.59$ ;  $P = 0.005$ ) and fat ( $2.42 \pm 1.04$  vs.  $1.74$  g/kg/d;  $P = 0.0008$ ). BMI negatively correlated with caloric, fat and protein intake, respectively ( $P = 0.001$ ).

**Conclusions:** This cohort of newly diagnosed TB patients in Tbilisi, Georgia exhibited a low-normal BMI, were generally lean and 22% were frankly underweight. Overall, subjects consumed a high-kcal, high-protein diet from mixed nutrient food sources. Underweight patients (BMI  $\leq 18.5$  kg/m<sup>2</sup>) consumed significantly higher amounts of dietary macronutrients than non-underweight patients.

**PC-749-29 Dietary vitamin and mineral intake in patients with pulmonary TB in Tbilisi, Georgia**M Gegechkori,<sup>1</sup> J Frediani,<sup>2</sup> E Sanikidze,<sup>1</sup> N Tukvadze,<sup>1</sup> R Kempker,<sup>2</sup> V Mirtskhulava,<sup>1</sup> I Kalandadze,<sup>1</sup> T Ziegler.<sup>2</sup><sup>1</sup>National Center for Tuberculosis and Lung Disease, Tbilisi, Georgia; <sup>2</sup>Emory University, Atlanta, GA, USA.

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**Aim:** Specific vitamins and minerals are critical for optimal immune function but little information is available on habitual dietary intake of micronutrients in TB patients.

**Methods:** Micronutrient intake was documented from adult patients within 7 days of pulmonary TB diagnosis. A food/nutrient intake tool was developed for a low literacy population that captures composition of specific foods and meal patterns common in Georgian culture. Intake of all foods consumed during the previous 3 days was determined via one-on-one interviews with a trained study coordinator. Quantitated food intake data was entered into a software program



(Nutrient Database System for Research, NDS-R) and mean daily intake of specific vitamins and minerals determined. Descriptive statistics and intake of micronutrients compared to the United States Dietary Reference Intake (US DRI) guidelines for adults were evaluated.

**Results:** A total of 123 subjects were studied (mean age 33 y; 60% male and 40% female). No subject consumed specific vitamin or mineral supplements. Mean daily dietary intake of micronutrients most closely linked to immune function were: vitamin D  $147 \pm 176$  (SD) IU/day (24% of US DRI); retinol (vitamin A)  $620 \pm 558$  mcg/day (76% of US DRI), vitamin E  $16 \pm 8$  IU/day (72% of US DRI); vitamin C  $130 \pm 85$  mg/day (156% of US DRI); copper  $2.10 \pm 0.92$  mg/day (233% of US DRI), selenium  $134 \pm 60$  mcg/day (243% of US DRI) and zinc  $11.0 \pm 4.8$  mg/day (113% of US DRI). In addition, dietary intake of both thiamine (vitamin B1) and riboflavin (vitamin B2) was adequate at  $2.25 \pm 0.84$  mg/day (193% of US DRI) and  $2.53 \pm 1.02$  (206% of US DRI), respectively.

**Conclusions:** Micronutrient dietary intake data from these Georgian TB patients revealed adequate intake of vitamin C, thiamine, riboflavin, and specific minerals linked to immune function (copper, selenium and zinc). In contrast, dietary intake of several vitamins closely linked to human immune function (vitamin D, retinol and vitamin E) was inadequate.

### PC-994-29 Use of peak expiratory flow rate in monitoring effective response to TB treatment

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**Background:** Existing work suggests many TB survivors have a residual deficit in pulmonary function, although an improvement in spirometric parameters with successful treatment has been described in a subset.

**Aim:** To determine whether serial measurements of peak expiratory flow rate (PEFR) vary during the intensive phase of TB treatment, and whether these are associated with radiological disease extent or clinical outcome.

**Methods:** 85 patients with smear positive or smear negative PTB. PEFR was measured at baseline, then on days 0, 3, 7, 28 and 56 of TB treatment. Mycobacterial culture was performed as part of a larger parallel study.

**Results:** 54% of patients had microbiological confirmation of PTB; these had a mean PEFR of 316 l/min (95%CI 285–348) on day 0 of TB treatment, increasing to 328 (95%CI 304–351) by day 7 ( $P = 0.02$ ), to

350 (95%CI 321–380) by day 28 ( $P = 0.002$ ) and to 357 (95%CI 331–384) by day 56 ( $P = 0.0009$ ) (One-way ANOVA with Bonferonni post-test). In patients without microbiological confirmation of disease, the mean PEFR on day 0 was 332 l/min (95%CI 288–375) with no significant changes during the 56 day follow-up. Low PEFR was not associated with baseline disease extent or risk of clinical deterioration during the study period.

**Conclusion:** Serial measurement of PEFR in patients undergoing treatment for pulmonary tuberculosis revealed a significant increase in PEFR amongst patients with a microbiologically confirmed diagnosis of TB compared to patients in whom the diagnosis was not confirmed. Other causes of chronic lung disease should be considered in the latter group.

### PC-1161-29 T-cell interferon-gamma response to RD1 antigens among leprosy patients in India

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**Aim:** To investigate the performance of RD1 *M. tuberculosis* specific RD1 antigens (primarily ESAT-6 and CFP-10) based interferon gamma release assay (Quantiferon-TB Gold in tube assay) in leprosy patients.

**Methods:** Blood samples obtained from leprosy patients, tuberculosis patients and healthy individuals were evaluated employing Quantiferon-TB Gold in tube assay kit.

**Results:** In the tuberculosis group the positivity was found to be 50/64 (78.1%). The positivity with leprosy patients was 69/162 (42.6%) which was similar ( $P > 0.05$ ) to that in healthy group 71/160 (44.4%). The positivity with TB patients differed significantly ( $P < 0.05$ ) from that with healthy and leprosy groups.

**Conclusions:** It appears that *M. leprae* infection does not influence the specificity of the RD1 antigen based interferon gamma release assay. In a setting where both TB and leprosy are endemic, the performance of T-cell IFN- $\gamma$  response to RD1 antigens as seen by Quantiferon assay appears to be significantly different between TB patients and leprosy patients.



## CHILDHOOD TUBERCULOSIS

### PC-123-29 The role of a tuberculosis scoring system in screening and diagnosing child tuberculosis

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**Background:** Diagnosis of tuberculosis (TB) in children remains a challenge. Scoring systems are often used, but most are poorly validated and their role and performance in children actively screened for TB is unclear. We evaluated the Indonesian scoring system as a screening and diagnostic tool for children living with a sputum smear positive TB case and also evaluated the recently WHO recommended symptom based screening (SBS) approach, designed for screening of child case contacts.

**Methods/design:** Children were screened by symptoms and tuberculin skin test (TST). Chest X-rays (CXR) were conducted in TST positive children. The scoring system was completed by the study doctor. Active disease was determined by CXR evaluated by two WHO paediatricians. Performance of the scoring system and SBS approach was calculated.

**Results:** 318 children were recruited to the study and 159 (50%) were TST positive. 126 (79%) had CXR successfully read and 9 (7%) were diagnosed with active TB, including 8 with uncomplicated hilar adenopathy. The scoring system was 100% sensitive and 15% specific for a diagnosis of active TB. Reduced specificity arose from high point allocation for case contacts and TST positives. When screened with the scoring system TB would be considered for 159/318 (50%) children. Using SBS 115/318 (36%) would require further assessment to exclude active TB. For case detection SBS was 33% sensitive and 56% specific. However 83% of CXR positive, asymptomatic children, in whom a positive diagnosis would have been missed using SBS, presented with hilar adenopathy only.

**Conclusion:** The current Indonesian developed scoring system has low specificity for diagnosis of TB in child case contacts and leads to significant overtreatment. SBS shows promise as a screening tool, especially if uncomplicated hilar adenopathy is not part of the case definition. This requires further investigation.

### PC-257-29 Incidence of child tuberculosis among household contacts of newly diagnosed TB patients

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**Background:** TB remains a major cause of death and disability across the globe. Pakistan is the 6th high TB burden country in the world. Worldwide over 250 000 children develop TB and 100 000 children continue to die each year from TB. Data about number of childhood TB cases within household contacts of TB patients is required for developing effective measures for controlling childhood disease in Pakistan.

**Methodology:** A three years (2008–2010) data analysis was done for all newly TB patients diagnosed by Marie Adelaide Leprosy Centre in Karachi. All immediate household contacts under the age of 14 years were examined at least twice (at the time of registration and discharge) for the cardinal signs and symptoms of the disease.

**Results:** See table.

Description	2008 <i>n</i>	2009 <i>n</i>	2010 <i>n</i>
New TB patients	552	737	705
Pulmonary smear positive	302	404	383
Pulmonary smear negative	163	220	202
Extra pulmonary tuberculosis	87	113	120
Household contacts examined	3720	5251	4542
Children ( $\leq 14$ years) diagnosed with tuberculosis amongst household contacts	31	44	46
Male children	7	12	13
Female children	24	32	33

**Conclusion:** Our data suggests considerable transmission of tuberculosis within children of tuberculosis patients, with a greater risk to the female child. There is a need to focus on childhood tuberculosis in Pakistan with particular emphasis on prevention of disease in female children.

### PC-310-29 Childhood tuberculosis in Stockholm, 2000–2009

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**Background:** During the last decades, globalisation has led to an increasing incidence of tuberculosis (TB) in low-burden countries. There are few recent reports of epidemiology and clinical manifestations in children.

**Methods:** We prospectively entered children (0–17 yr) with a diagnosis of TB into a database, which was verified with notification and clinical microbiology data. Population data, by country of birth of children and parents, were obtained from Statistics Sweden.

**Results:** We identified 139 TB cases, 55 Swedish-born and 84 foreign-born. 128 were diagnosed in Stockholm. The incidence varied between 450/100 000 person-years (py) in Somali-born children, and 50–100/100 000 py in those born in other high-incidence (>100/100 000) countries. Among Swedish-born children to parents from high-incidence countries, it was 10/100 000 py. Stratified by age, the incidence was highest among 6–17-year-old, foreign-born children. We considered 43 Swedish-born and 33 foreign-born children to have primary disease. Both adult-type pulmonary ( $n = 32$ ) and cervical lymph node TB ( $n = 19$ ) was found mainly in the foreign-born. Two children were HIV infected. Material for culture was obtained from 113 children and *M. tuberculosis* was isolated from 69 (61%). Any antimicrobial resistance was found in 26 (38%). Ten INH-resistant isolates belonged to one previously reported cluster. Four isolates were multidrug-resistant.

**Conclusions:** In Stockholm, the TB incidence among migrant children born in high-incidence countries remains high, but already in the first Swedish-born generation it is reduced by 80–95%. Early, mild disease is typical. The rate of antimicrobial resistance is disturbing.

### PC-338-29 Partnering with parents and communities: childhood tuberculosis, United States, 2009

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**Background:** The United States National Tuberculosis Surveillance System in 2009 includes previously unreported data to help identify children at risk for tuberculosis (TB).

**Methods:** We analyzed all incident TB cases among children < 15 years reported in the United States. We calculated frequencies of child's country of birth and newly added variables on guardian country of birth, country lived outside United States, and characteristics of TB cases epidemiologically linked to child TB cases.

**Results:** Of 646 TB cases reported among children < 15 years in the United States in 2009, 22% (142) were foreign-born; top countries of birth were Mexico (25), Philippines (17), Ethiopia (15), Burma/Myanmar (9), Somalia (7), and Kenya (6). No data on new variables were available for 14 reporting areas (35% of pediatric TB cases). Among those with data, 82% (75 of 92) of foreign-born and 69% (156 of 225) of U.S.-born children with TB had at least one foreign-born guardian. Foreign-born pediatric patients with foreign-born guardians were older (mean 7 years) than foreign-born patients with U.S.-born guardians and than U.S.-born patients (mean 3 years for both). Top guardian countries of birth were United States (85), Mexico (69), India (15), Guatemala (14),

and Philippines (12). For U.S.-born children with TB who lived outside U.S., top countries were Mexico (6) and India (6). Of 67 pediatric cases linked to another case, 75% (50) were evaluated because they were a contact to a known TB case, 15% (10) because of TB symptoms, 6% (4) because of incidental abnormal chest X-ray, and 4% (3) because of targeted tuberculin skin testing.

**Conclusions:** New data indicate a high proportion of U.S.-born children with TB have foreign-born guardians or history of having lived in areas with increased TB risk. Partnering with parents and communities with family-based approaches to TB prevention and education are needed to achieve the goal of TB elimination among children in the United States.

### PC-470-29 Implementing TB screening in a preventing mother to child transmission clinic in western Kenya

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**Background:** Tuberculosis (TB) during pregnancy presents a challenge since two individuals are at risk—mother and baby. Furthermore, HIV infection increases both the risk of TB infection and risk of TB disease in infected patients. The preventing mother to child transmission (PMTCT) clinic at AMPATH provides pregnant HIV-infected mothers with antenatal care and antiretrovirals to decrease HIV transmission. Efforts to protect the mother and newborn from TB disease include chest X-rays and isoniazid preventive therapy, but intensified case finding (ICF) has not yet been performed in this population. The TB project office at AMPATH has conducted ICF using a cough monitor (CM) model for the past 6 years. >70 000 symptomatic individuals have been screened with sputum smears finding 14% with smear positive TB. **Intervention:** A CM (lay individual trained in TB sensitization and screening) was assigned to the PMTCT clinic. The CM was instructed to screen every pregnant woman using a six-question questionnaire. All patients with a positive questionnaire were instructed to provide a spot sputum (S1) following questionnaire completion and were asked to bring a morning sample (M1) the next morning or at a subsequent visit.

**Results:** After 19 weeks, 335 women in PMTCT were screened by a cough monitor. 58 (17%) had positive questionnaires. Out of the women with positive questionnaires, 22 (38%) had TB previously. 25 (43%) complained of a cough lasting > 2 weeks. Only 17 (29%) and 5 (9%) women were able to provide S1 and M1, respectively. No smear positive cases were found.

**Conclusion:** In the PMTCT setting, conducting ICF

posed significant challenges. Less than 10% of symptomatic patients completed screening and no cases of smear positive TB were found. Barriers to screening included lack of transportation, family responsibilities, financial constraints, and 'forgetfulness.' Improved strategies for screening this particularly vulnerable population are urgently required.

### PC-566-29 Cure of XDR-TB in an HIV-negative 11-month-old infant in Lima, Peru

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**Background:** Tuberculosis in infants is always a primary infection from an adult source. Scarce information about XDR-TB in infants has been reported.

**Case report:** An 11-month-old infant from a poor shantytown in Lima was ambulatorily evaluated for a two week history of a cough. His mother had had TB without treatment during her pregnancy and the mother's brother died from MDR-TB two years ago. The mother died of TB when the patient was 1 year and 4 months old with her last drug susceptibility test (DST) showing an XDR-TB pattern (resistant to: R, low doses of H, S, Cfx, Km and Cm). At admission, the infant's PPD was 15 mm, he had not received the BCG vaccine, and his CT showed mediastinal enlargement with adenopathies and consolidation in the lingular lobule. His HIV test was negative. A culture of a gastric aspirate sample with a Bactec 460 system was positive and the DST result was the same as his mother. He started a regimen with H (10 mg/kg) Z, Mfx, Amk (for 7 months), Cs, PAS (suspended at third month for intolerance) and Eto. The patient completed 24 months of treatment without adverse reactions and with negative cultures since the first month of treatment. The clinical, radiological and microbiological outcomes were favorable and the patient was discharged as cured. In the subsequent visits, his growth in weight and stature was normal.

**Conclusions:** XDR-TB can transmit directly from mother to child. The treatment of primary cases in infant patients likely has a better outcome and is better tolerated than secondary cases or older individuals.

### PC-816-29 Multidrug-resistant tuberculosis of the spine in children

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**Background:** Multidrug-resistant (MDR) spinal tuberculosis (TB) in children can be a debilitating disease with the potential for long-term neurological sequelae. Treatment involves a combination of surgical and medical care and long courses of drug therapy are required.

**Methods:** Hospital records at Brooklyn Chest Hospital were analysed from January 2004 until December 2010 searching for any patient started on treatment for MDR spinal TB. In addition laboratory records were consulted to identify any MDR-TB samples that were associated with spinal TB. Children were treated according to WHO guidelines. Regular monitoring of response included radiology, growth and clinical assessment; the monitoring of adverse effects included clinical examination, audiology and blood tests.

**Results:** Eleven children were identified. Four children were excluded: one who had MDR-TB confirmed only from gastric samples, two who were treated only presumptively for MDR-TB and one who although initially treated for MDR-TB, biopsy samples subsequently demonstrated drug-susceptible TB. Of the seven children, five were boys and the median age was 8 years (range 1.5 to 14). The median delay from start of MDR-TB episode to initiation of appropriate therapy was 36 weeks (range 7 to 76 weeks). One child died, five have completed treatment and one is still on therapy. The medications were well tolerated and although two of the surviving children had severe spinal deformity, none had any significant neurological deficit.

**Conclusion:** The diagnosis of spinal MDR-TB is frequently delayed in children frequently leading to advanced disease and severe vertebral damage. In spite of this, however, children tolerate therapy well and once identified it is a condition that can be treated successfully.

### PC-863-29 The pharmacokinetics and pharmacodynamics of pyrazinamide in adults and children

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Pyrazinamide (PZA) an essential sterilizing drug, with rifampicin makes possible six month short-course antituberculosis chemotherapy. Despite routine use for nearly forty years uncertainty remains regarding the appropriate PZA dosage for children. The literature since 1952 relating to the efficacy and pharmacokinetics of PZA in 1, children treated for tuberculosis, in 2, adult volunteers and 3, patients was reviewed. Using PZA maximum concentration (C<sub>max</sub>) following various PZA dosages in the different groups straight line regression of concentration on dosage was fitted through the origin by least squares, weighted for the numbers of subjects. The fitted line offers an approximation of the likely PZA C<sub>max</sub> that would result from a particular dosage. The slopes of C<sub>max</sub>/dosage of the fitted lines are 1.32 (SE 0.099) for paediatric patients, 1.36 (SE 0.051) for adult volunteers and 1.35 (SE 0.037) for adult patients; there is little difference between the C<sub>max</sub> concentrations achieved in children and adults, whether patients or healthy volunteers, following various mg/kg body weight dosages, suggesting that children and adults receiving the same mg/kg body weight PZA dosage will reach a similar C<sub>max</sub>. Children can receive the same mg/kg body weight PZA dosage as adults.

### PC-921-29 A proposed comprehensive classification for tuberculosis disease spectrum and severity in children

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**Background:** Tuberculosis (TB) in children has conventionally been classified as pulmonary (PTB) and extrapulmonary (EPTB) disease, including disseminated TB (TB meningitis and miliary disease). There is no existing approach that comprehensively characterizes the spectrum and severity of paediatric disease. **Aims:** To develop a classification of paediatric TB disease which comprehensively reflects the spectrum and severity of clinical disease.

**Methods:** We propose a disease classification system based on available scientific evidence including bacteriological, histopathological, radiological (chest radiograph, computerised tomography), clinical and bronchoscopy data and assumed disease pathogenesis.

Based on the extent and the presence of complications, each disease entity was classified as severe or non-severe. The findings from the proposed classification were compared to the conventional system in a cohort of 160 infants with well-characterized, bacteriologically confirmed TB disease (21% HIV-infected).

**Results:** Of the infants 99 (62%) had PTB, 61 (38%) EPTB. In contrast, 124 (77.5%) had severe and 36 (22.5%) nonsevere disease based on the proposed classification. Amongst HIV-infected infants 14 (30%) had EPTB, 33 (70%) PTB; 33 (70%) had severe and 14 (30%) nonsevere disease. Of HIV-uninfected children, 47 (42%) had EPTB, 66 (58%) PTB; compared to 91 (81%) with severe and 22 (19%) nonsevere TB. Agreement between the conventional and comprehensive system was poor in both HIV-infected and uninfected groups (Kappa statistics 0.159 ( $P = 0.0651$ ) and 0.197 ( $P = 0.0015$ ), respectively).

**Conclusions:** The proposed disease classification system may reflect the clinical disease spectrum more accurately and is relevant to clinical management, diagnostic and preventive TB studies. Prospective studies are required to assess the value of this approach in representative paediatric populations, correlating TB disease severity with diagnostic yield and outcome.

### PC-1001-29 Persistent positive culture from glandular tissue at enucleation of tuberculous lymph glands

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**Background:** In children, lympho-bronchial tuberculosis (TB) may in cases be complicated by airway obstruction. Refractory obstruction can be managed by surgical gland enucleation. Our aim was to determine the number of cases remaining culture positive on samples obtained at surgical glandular enucleation performed after at least one month of TB treatment.

**Design/methods:** Data from children referred to Tygerberg Children's Hospital between January 2004 and December 2010 for complicated intra-thoracic glandular TB were collected prospectively. Children showing poor response to standard TB treatment with added oral prednisone were evaluated by fibre-optic bronchoscopy. Those demonstrating >75% airway obstruction were referred for glandular enucleation. Broncho-alveolar lavage (BAL) and glandular tissue samples obtained at bronchoscopy and surgery respectively were cultured and drug susceptibility testing (DST) performed.

**Results:** Of 84 children aged 1.5–106 months (mean 17 months) who underwent surgical gland enucleation, 44 (52%) had had  $\geq 1$  month of TB treatment.



In the 44 cases, mean duration of TB treatment prior to surgery was 41 days (range 30–291 days). Eight children (18%) were HIV infected. TB culture was positive in 33 of 44 cases (75%): gastric lavage ( $n = 25$ ), BAL ( $n = 6$ ) and tissue culture ( $n = 17$ ). Tissue was the only source of positive culture in 4 (12%) cases. Of 26 specimens undergoing DST, 6 (23%) were drug-resistant, of which 4 were multidrug-resistant.

**Conclusion:** A significant proportion of young children with complicated lympho-bronchial TB had evidence of viable organisms after  $\geq 1$  month of treatment. Drug resistance was involved in a minority of cases. The immuno-pathological basis for mycobacterial persistence requires investigation, and may have implications for diagnostics and treatment duration in this patient population.

#### PC-1025-29 Role of source TB case characteristics in transmission of MDR-TB to children in Georgia

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**Background:** Tuberculosis (TB) in young children is an indicator of ongoing community transmission. Having a TB contact is a major risk-factor for children to get TB. MDR-TB transmission to children is somewhat novel process that needs extensive contact investigation in Georgia.

**Objectives:** To evaluate the characteristics of TB source cases of MDR-TB children contacts in Georgia.

**Design/methods:** A retrospective observational study was conducted at the National Center for Tuberculosis and Lung Diseases, Tbilisi, Georgia. Social, demographic and disease specific information was obtained for every pediatric MDR-TB case registered during 2008–2010 in Georgia and on their relevant TB source.

**Results:** Total of 45 pediatric MDR-TB patients were evaluated during the study. 28 (62%) were male and 17 (28%) female, mean age—10 years. Pediatric MDR-TB contact cases had: had unsatisfactory living conditions in 49%, household number of more than 5 members among 16%, drug susceptibility testing (DST) results available for 21 (46%), information on potential TB source known for 31 pediatric patients. Data analysis on 31 TB source cases showed that source cases: are sputum smear positive in 87% of cases, have MDR-TB in 83%, are family members in 87% of cases, are father or uncle in 72% of cases, are males in 74% of cases and aged 15–35 in 76% of cases.

**Conclusion:** The study showed that the majority of TB source cases are smear positive, have MDR-TB, are predominantly males, are family members and are

15 to 35 years old. The study results emphasize the importance of extension of TB patient education especially of males and young adults, in order to prevent disease transmission.

#### PC-1048-29 Childhood MDR-TB in Georgia

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**Background:** Despite recent developments the childhood TB is still remains problem. Experience of any National TB Programs will be critical for improving management of paediatric TB, especially MDR-TB.

**Aim:** To evaluate existing results of childhood MDR-TB management in Georgia for promoting of new interventions.

**Methods:** Program-based operational study was conducted since August 2008. Data were collected from '0–18' age group DR-TB patients who were treated under DOTS+ strategy. Statistical analysis was performed using Epi Info version 3.5.1.

**Results:** Out of 41 (100%) DR-TB infant and children patients 26 (63.4%) were male and 15 (36.6%) female. 8 (19.5%) were from '0–3' and 13 (31.7%) from '15–18' age groups. In 37 (90.2%) cases the reason of illness was DR-TB contact. Pulmonary TB was diagnosed in 17 (41.5%) cases. From 24 (58.5%) Extra-pulmonary TB cases lymphadenopathy was diagnosed in 15 (62.5%), meningitis in 4 (16.7%), pleuritis in 5 (20.8%) cases. In all 9 (22%) AFB (+) cases examination was performed on sputum specimen. In 19 (46.3%) culture (+) cases examination materials were biopsy specimen [2 (11%)], cerebrospinal fluid [2 (11%)], pleural effusion [1 (4%)] and sputum [14 (74%)]. In these 19 (46.3%) culture (+) cases treatment was provided according own DST, in 22 (53.7%) culture (–) cases—according contact DST. In patients with known DST 16 (84.2%) were MDR-TB, 2 (10.5%) PDR-TB and 1 (5.3%) XDR-TB. In 14 (34%) cases the side effects of TB drugs were fixed, in 4 (9.8%) cases caused drugs were stopped. In 12 patients culture conversion was fixed in first 2 months of treatment. Out of 18 cases with known treatment outcome 5 were defaulted and 2 died.

**Conclusions:** Prevention of DR-TB transmission in contact groups, rapid implementation of new diagnostic methods for AFB(–) and extra-pulmonary childhood MDR-TB and ongoing studies for evidence based recommendations are urgently needed.

## MDR-TB MANAGEMENT II

### PC-604-29 Experience of MDR-TB treatment in a context of high levels of drug resistance and co-morbidity

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**Background:** Multidrug resistance tuberculosis (MDR-TB) is a serious public health concern in Armenia. Médecins Sans Frontières supports the treatment of drug resistant TB since 2005 in Yerevan using individualized drug regimen following WHO guidelines. We present 3 years experience of treating MDR-TB in a high burden and limited resource country.

**Methods:** Retrospective cohort study of MDR-TB patients initiating treatment in Yerevan from September 2005 to June 2008. Patients' characteristics and treatment outcomes are described. Univariate and multivariate analysis are used to identify patients' (age, sex, number of drugs patient was resistant to, past TB drugs history, co-morbidity, body mass index (BMI), year of inclusion) and treatment (number and duration of interruption of at least one drug) characteristics associated with death or failure after exclusion of defaulters.

**Results:** Hundred MDR-TB patients were enrolled: 79% male, median age 39 years, 38% with history of 2nd line drugs, median BMI 20.3 kg/m<sup>2</sup>, 41% with bilateral cavities, 39% presenting at least one co-morbidity and median number of resistant drugs 4 (interquartile range, IQR 4–5).

87% of patients had at least one drug interruption during treatment, respectively. The median number and maximum duration of interruption was 8 (IQR 4–14) and 16 days (IQR 6–42), respectively. Among 87 patients with drug interruption, 56% and 31% had at least one interruption due to side-effect and co-morbidity, respectively. Treatment success, death, failure and defaulter rates were 49%, 7%, 18% and 26%, respectively. Co-morbidity, number of resistant drugs and duration of drug interruption were independently associated with an unsuccessful treatment outcome.

**Conclusion:** The high level of drug resistance, the frequency of co-morbidities and the problem of drug interruption, often due to side-effect, could explain the poor MDR-TB treatment outcomes in Yerevan. New TB drugs are urgently needed.

### PC-674-29 MDR-TB treatment in International Nepal Fellowship, Mid-Western Region, Nepal: an insight analysis

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**Background:** Multidrug-resistant tuberculosis (MDR-TB) has been an area of growing concern and is posing a threat to control of tuberculosis because of the reduced response to standard short course chemotherapy with first line drugs, leading to higher mortality and treatment failure rates and increased periods of transmission. The latest estimate of MDR-TB is 2.9% among new sputum smear positive TB patients in Nepal. MDR-TB management programme started in September 2005 in Nepal. NTP offers fully supervised standard regimen for the treatment of MDR-TB. Nepalgunj TB Referral Centre (NTRC) run by International Nepal Fellowship (INF) in the Mid-Western Region of Nepal is one of the MDR-TB treatments Centre under NTP in Nepal. NTRC runs a 20 bed hostel and provides socio-economic rehabilitation support to MDR-TB patients.

**Objective:** To analysis the outcome of MDR-TB being enrolled and treated in NTRC, Banke, Nepal.

**Methods:** To review the MDR-TB treatment in the Mid-Western Region of Nepal.

**Results:** From December 2005 until February 2011, 84 MDR-TB patients were registered in NTRC. 54 MDR-TB patients enrolled from December 2005 to June 2009 followed up their treatment outcomes until December 2010, 45 (83%) got cured, 4 (7%) died, 4 (7%) defaulted and 1 (2%) transferred out.

**Conclusion:** NTRC provides a 20 beds hostel and socio-economic rehabilitation support to MDR-TB patients. It has better cure rate of MDR-TB than has been reported elsewhere in Nepal.

### PC-704-29 Treatment outcomes of MDR-TB patients in Mongolia, 2006–2008

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**Background:** The emergence of drug-resistant tuberculosis hampers TB control. Since June 2006, second-line anti-tuberculosis agents have been regularly available in Mongolia for the treatment of MDR-TB using 24 month's regimen. In 2003–2010, the National Reference TB Laboratory detected 776 MDR-TB cases through survey conducted among re-treatment cases segregated into return after default, failure and relapse.

**Methods:** Since June 28, 2006 to December 25, 2008, 179 MDR-TB patients has been enrolled SLD. All bacteriological investigations including smear, culture, identification and susceptibility testing was carried out

in the NRTBL, Mongolia. Patients diagnosed with MDR-TB based on DST results. Patients were monitored by every month cultures and smears.

**Results:** In this study, 179 patients with MDR-TB, average age 31.2 years (range 14–69) were treated; of these 107 (59.8%) were male and 72 (40.2%) were female. Of the 179 patients, who had 55 (30.7%) were failure Cat-I, 120 (67.0%) were failure cat-II, 2 (1.1%) were relapse and non converted cases. 132 (73.8%) had successful outcomes: 110 (61.5%) were cured and 22 (12.3%) completed treatment; 33 (18.5%) had a poor outcome: treatment resulted in failure in 15 (8.4%), died in 18 (10.1%) cases and another 14 (7.8%) patients defaulted (Figure). See the figure 2 for comparison of treatment outcome by category in enrolled SLD.

**Conclusion:** Good treatment success rate of MDR-TB treatment are feasible, however necessary to improve the management of patients with failure under program DOTS-PLUS. Patients who do not show sign improvement after four months of treatment are at risk for treatment failure. Such patients should be reviewed the treatment regimen and the bacteriological data.

#### PC-740-29 Programmatic management of drug-resistant tuberculosis: 2 years experience in a tertiary TB hospital

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Rajan Babu Institute of Pulmonary Medicine and Tuberculosis (RBIPMT) is 1155 bed institute in Delhi catering predominantly to TB. MDR-TB was diagnosed at accredited intermediate referral centres and standardized treatment regimens (STR) is given. The total population covered is 5.3 million. Nine chest clinics refer the patients after their sputum DST reports indicate drug resistance.

STR strategy of management of MDR-TB cases was started under the national programme from April 2009. In 2009, 68 patients (male 41, female 27) and 124 patients (male 76, female 48) in 2010 were put on treatment. Till date 11 patients registered in 2009 and 4 patients registered in 2010 have defaulted and 4 deaths in 2009 and 3 deaths in 2010 were also been reported. An in depth study of resistance pattern was done in patients registered in 2009 and 2010. Though the resistance to primary line of anti-TB drugs has

Drugs	Number of resistant cases in 2009	Number of resistant cases in 2010
HR	22	29
HRS	35	40
HRE	0	7
HRES	11	44
R	0	4
Total	68	124

been seen in all categories but polydrug resistance to HRES has shown a sharp rise in 2010 as compared to 2009.

**Conclusion:** The number of MDR-TB detected and put on treatment have shown an increase and the default rate and deaths have shown a decline but resistant pattern is gradually indicating resistance to more and more anti TB drugs. The poly drug resistance to HRES has more than doubled in those registered in 2010 as compared to 2009. This is an indicator to watch for in future.

#### PC-765-29 A successful model for MDR-TB treatment and scale-up in Ethiopia with a community-based programme

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**Background:** Ethiopia ranks seventh among the world's 22 high-burden TB countries and has a large burden of MDR-TB with an estimated 6000 new cases/year. Since February 2009, the Global Health Committee (GHC), in partnership with the Ethiopian Ministry of Health (MOH), has delivered and scaled up MDR-TB treatment using a community-based model, adapted from the GHC's prior program implementation of MDR-TB care in Cambodia. This was the only mechanism for MDR-TB treatment for the entire country which provided second-line drugs while Ethiopia awaited for commitments from the GLC/GDF to be received.

**Methods:** Retrospective analysis of early outcomes for patients enrolled in the Ethiopian GHC-MOH MDR-TB treatment program between February 1, 2009 and March 4, 2011. As of August 2010, the program in Addis Ababa has expanded to include an additional enrollment site in Gondar (northern Ethiopia).

**Results:** One hundred and ninety-nine (199) patients were enrolled in the cohort during this time frame: 51% male, 49% female, with a median age of 28 years. All patients were tested for HIV, and 23% were noted to be co-infected. Two patients have completed treatment and are cured; 180 patients are currently in treatment; 1 patient has interrupted treatment and 16 patients have died. Updated outcomes will be presented at the time of the conference (October 2011).

**Conclusions:** Successful treatment implementation and scale-up of MDR-TB care can be achieved with south-to-south transfer of a community-based program such as the GHC-MOH partnership model outlined above.



### PC-784-29 Overview of MDR-TB treatment outcome in central Taiwan

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**Background:** The central Taiwan DOTs program car term has been established since May 2007. Medication was delivered twice daily to individual patients in order to ensure their compliance and control the transmission of multiple drug resistant tuberculosis (MDR-TB).

**Methods:** Subjects included were MDR-TB patients (defined as resistant to isoniazid and rifampin from drug sensitivity test) with their diagnosis confirmed by Reference Laboratory of Mycobacteriology in central Taiwan. All subjects were supervised under our car team medical staff of DOTs-plus program for taking medication and observe any adverse reactions.

**Main findings:** From May 2007 to November 2010, a total of 174 MDR-TB subjects were included in the program. The subjects were mainly males (127/174, 73.0%) with an average age of 52.6 years old. Subjects were categorized into new TB cases (40.8%, 71/74), reactivated (26.4%, 46/174), treatment after defaulted (4.6%, 8/174), and retreatment (28.2%, 49/174). The number of new TB cases represented a large percentage of our study group which indicated the presence of contagious tuberculin in the community. Fifty three subjects were still in treatment, 76 (68.5%) subjects were successfully treated, 10 (9.0%) failed, 4 (3.6%) died from TB, 20 (18.0%) died from non-TB and 1 (0.9%) defaulted.

	New TB case	Reactive	Default	Re-treatment	Total
Amended diagnosis	1	0	0	0	1
Transferred to other hospital	3	5	1	0	9
Still in treatment	25	10	2	16	53
Defaulted	0	1	0	0	1
Died not from TB	12	3	0	5	20
Died from TB	0	2	0	2	4
Failed	0	1	2	7	10
Cured	30	24	3	19	76
Total	71	46	8	49	174

**Conclusion and suggestions:** The number of MDR-TB in the program gradually declines each year and the success rate for treatment is around 68.5%. The new TB cases represented 40.8% of our study population and implies the presence of contagious tuberculin in the community. Future study can focus on the close contacts and treatment for latent tuberculosis infection.

### PC-813-29 Side effects during the intensive phase of MDR-TB therapy in West Bengal, India

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**Background:** Community-based treatment program based on National Guidelines for patients with multidrug-resistant tuberculosis (MDR-TB) at DOTS Plus site in a resource poor setting of Jalpaiguri, a small town in northern part of West Bengal, India catering three adjacent difficult hilly and tribal districts of Darjeeling, Coochbehar and Jalpaiguri.

The objective is to find out the frequency of treatment adverse effects associated with intensive phase of MDR-TB therapy in DOTS Plus site.

**Design:** Retrospective record review of 96 patients who had either completed or, are on standardized Intensive Phase of MDR-TB therapy: 6 (9) Kanamycin, Ofloxacin (Levofloxacin), Ethionamide, Cycloserine, Pyrazinamide, Ethambutol/18 Ofloxacin (Levofloxacin), Ethionamide, Cycloserine, Ethambutol (from 1st Oct. '09 till Feb '11.)

**Results:** Adverse effects were common. Commonly reported side effects are gastritis (100%), dermatological effects (1.04%), depression (4.1%), anxiety (2.08%), psychosis (5.2%), tinnitus/ear problems (4.1%) and body ache/general malaise (2.8%). None of the patients had to discontinue treatment due to side effects.

**Conclusion:** In, Intensive phase of MDR therapy there was no life-threatening adverse effects for any patients in the study. Common side effects can be managed easily by outpatient basis in resource-poor health care settings.

### PC-920-29 Treatment outcomes in multidrug-resistant TB patients in Uzbekistan

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**Aim:** To describe patients enrolled for treatment in a large multidrug-resistant TB (MDR-TB) program in Karakalpakstan, Uzbekistan between 2003 and 2010. To evaluate treatment outcomes of patients enrolled between 2003 and 2008 and compare outcomes in new and previously treated patients.

**Methods:** MDR-TB treatment has been provided since 2003 in Nukus and Chimbay districts in Karakalpakstan, Uzbekistan. Laboratory confirmed patients were treated with individualized treatment



regimens according to WHO guidelines. Data was collected and entered into the project database for monitoring and evaluation purposes.

**Results:** 1140 MDR-TB patients were enrolled in treatment between 2003 and 2010. Between 2003 and 2005 most patients had previously failed category II treatment, whereas from 2006 drug sensitivity testing expanded to include any smear positive patient. By 2010 the profile of enrolled patients changed, with most being new, relapsed or other. Patients were resistant to an average of 4.3 drugs. Outcomes are reported for patients enrolled between 2003 and 2008 ( $n = 709$ ). The overall rate of success was 62%, with the yearly cohort rate lowest in 2003 (47.6%), but then stable between 58–67%. Failure rates decreased from 20% in the 2005 cohort to 6% in 2008. Rates of death have remained stable below 8% since 2005 (range 5–8% per yearly cohort). Defaulter rates were 12% in 2005 and increased to 25% in 2008. Treatment outcomes differed in new patients and those who were previously treated, with higher success rates in new patients (74%) compared to previously treated (60%).

**Conclusion and recommendations:** In this program acceptable success rates for MDR-TB care were achieved. During scale up of MDR-TB treatment failure rates decreased but default rates increased. Programs scaling up activities must address factors that may result in default. More operational research into models of DR TB care is needed.

#### PC-995-29 Zero defaulter rate in Lesotho

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**Background and challenges:** Partners In Health (PIHL) has been implementing a community based MDR-TB-HIV programme since 2007, Lesotho is one of the countries with a highest rates of TB and HIV. The programme was designed to address drug resistant TB. The country has mountainous terrain. With sparsely populated MDR-TB-HIV patients, harsh weather conditions, with an average walking distance to nearest health facility of 4–6 hours, with high migration among males.

**Intervention and response:** PIHL implemented a strong community based program where trained supervised and monitored community health workers are used, with involvement of the families and community structures in management of patient. DOT twice a day, clear follow-up structures, referral procedures, addressing social problems use of different transportation and communication modes led for good case holding.

**Result and lessons learnt:** Community based approach is a good for treatment of MDR-TB-HIV in resource-limited setting, 2008 cohort had a 65% treatment success with no defaulters.

**Conclusions and key recommendations:** Accompaniment is a good strategy for management of drug resistant TB to achieve good outcomes and prevent defaulting.

#### PC-1116-29 Adverse drug reactions among drug resistant tuberculosis patients in a rural area

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**Background:** Management of drug resistant tuberculosis remains a problem in resource limited countries, and programs are increasingly looking at community based treatment models, as numbers needing treatment exceeds existing bed capacity. There remains a paucity of data looking at adverse drug reactions within these settings.

**Intervention:** All patients treated for DR-TB during 2010 in the Northern Cape Province, South Africa were either admitted to the DR-TB facility for the initiation of treatment or, more commonly, initiated in the community. Patients in the community were followed up monthly at the outpatient clinic once treatment was initiated. ADR's were graded according to severity [grade 0 = none; grade 1–2 = mild to moderate and grade 3–5 = severe (drug stopped, life-threatening or death)].

**Results:** Of the 197 patients treated 14.72% (29/197) experienced 35 side effects and of these 27.6% (8/29) were HIV-infected. Adverse side effects among the various DR-TB categories: mono/poly resistance 4.6% (2/43), MDR-TB 11.3% (11/97), pre XDR 24% (6/25), XDR 31.2% (10/32). The different grades of ADRs experienced: Grade 1: 22.8% (8/35), 2: 65.71% (23/35), 3: 5.71% (2/35), 4: none, and grade 5: 5.71% (2/35). ADR's experienced in the community versus those in hospital [44.82% (13/29 vs. 55.17% (16/29)]. All of the patients experiencing an ADR in the community were successfully managed without needing hospitalisation. Both deaths occurred in hospitalised patients of renal and hepatic complications.

**Conclusion and recommendation:** This study shows that adverse drug reactions, with close monitoring, daily observed treatment and rigorous training of health care workers at clinic level, can be successfully managed in patients treated in the community.

### PC-1288-29 MDR-TB resistance to injectable drugs in KwaZulu Natal and Eastern Cape Provinces, South Africa

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**Background:** From 2000, the primary injectable second-line drugs (ISLDs) in Eastern Cape (EC) and KwaZulu Natal (KZN) provinces were amikacin (AMK) and kanamycin (KAN), respectively. CAP was used in both provinces to treat XDR-TB starting in 2006.

**Objectives:** To compare baseline resistance to ISLDs among patients starting treatment with any SLDs in EC and KZN provinces, 2005–2008.

**Methods:** Consecutive, consenting adults with new, pulmonary MDR-TB were enrolled in different periods from 2005–2008. Sputum specimens were cultured at the start of SLD treatment. Isolates were shipped to the CDC for drug susceptibility tests (DST) by the proportion method on Middlebrook 7H10 agar.

**Results:** Of 131 MDR-TB isolates from EC, 66 (50.4%) were resistant to at least one ISLD and 65 (49.6%) were resistant to all 3 tested. Of 104 MDR-TB isolates from KZN, 11 (10.6%) were resistant to at least one and 8 (7.7%) were resistant to all 3 tested (both  $P < 0.0001$ ). In EC, the proportion of isolates with resistance to all ISLD increased over time: 10/34 (29.4%) in 2005, to 3/10 (30%) in 2006, 20/38 (52.6%) in 2007, and 32/49 (65.3%) in 2008 (test for trend  $P < 0.001$ ).

**Conclusions:** The difference in ISLD resistance among patients with new MDR-TB from 2005–2008 mirrors the primary ISLDs used in these provinces. Its impact on acquired drug resistance and patient outcomes is being assessed.

### PC-1312-29 MDR-TB management and treatment outcome in Macedonia

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Multidrug-resistant tuberculosis is one of the most challenging problems for clinician treating TB patients. The aim of this study was to evaluate the profile and treatment outcome of the patients with MDR-TB who were registered in the National MDR-TB Register in Macedonia between 2001–2010 year. We did a retrospective analysis in which 31 patients were included. Patients follow-up ended when an outcome was recorded or, in December 2010 for those still on treatment. 20 patients (71.42%) were male and 8 (28.58%) were female. In the National MDR-TB

Register 23 patients are registered only once, 3 patients are registered twice, 1 patient is registered 3 times, and another one 4 times. The most of the patients were hospitalized during the initial phase of the treatment in the Institute for Lung Diseases and Tuberculosis. 26 patients (92.85%) had acquired resistance and only 2 patients (7.14%) had primary MDR resistance. The patients were treated with individual regimens with second line anti TB drugs according to the findings of the susceptibility tests. The results of treatment outcome are: 8 patients were cured (28.57%), 10 patients (35.71%) died, 2 patients interrupted the treatment (7.14%) and 8 patients (28.57%) are still on treatment. To improve management and treatment results of MDR-TB patients in Macedonia, we need more efforts in providing necessary medications, clinical conditions and treatment under direct control.

## CLINICAL TUBERCULOSIS II

### PC-46-29 Mycobacterial peritonitis: from *Mycobacterium tuberculosis* to nontuberculous mycobacteria

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**Rationale:** Unlike tuberculous peritonitis, the clinical manifestation of peritonitis due to nontuberculous mycobacteria (NTM) is unclear. The impact of different causative pathogens on peritonitis is also unknown.

**Methods:** This retrospective study was conducted from 2000 to 2008 in a medical center in Taiwan. Patients with mycobacteria isolated from ascites were identified and compared according to causative pathogens (*Mycobacterium tuberculosis* or NTM). Those with NTM isolates were further classified into probable and possible NTM peritonitis based on the diagnostic evidence.

**Results:** Twenty-five patients with NTM peritonitis and 65 with tuberculous peritonitis were reviewed. *M. avium* complex was the most common NTM pathogen (52%). There was no obvious difference between probable and possible NTM peritonitis regarding age and laboratory data. Patients with NTM peritonitis and tuberculous peritonitis had no differences in age, gender but varied in symptomatology and serum laboratory data. However, NTM peritonitis was 100% associated with underlying comorbidities and had lower proportions of lymphocytes and albumin level in ascites. Twelve (48%) NTM peritonitis and 21 (32%) tuberculous peritonitis patients died in the six-month follow-up. Anti-mycobacterial treatment, not mycobacterial species, correlated with better six-month survival.

**Conclusion:** In Taiwan, NTM is responsible for 28% of mycobacterial peritonitis cases, which had poor prognosis if untreated. There are some different clinical manifestations between NTM and tuberculous peritonitis. NTM peritonitis should be kept in mind for patients with peritonitis but no causative microorganism other than NTM identified.

### PC-81-29 Linear associations between the global financial crisis and severity of tuberculosis in Osaka City

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**Background:** The unemployment rate rose again from 5.3% in 2008 to 6.6% in 2009 after gradual reduction for the past six years in Osaka prefecture, due to the global financial crisis.

**Aim:** To investigate how the recession affected the severity of tuberculosis detected in examinations in Osaka City, the capital city of Osaka.

**Methods:** This is an analytical cross-sectional study, evaluating registered pulmonary tuberculosis patients found from 2006 to 2009. Data was collected from patients' records including their socioeconomic status, respiratory symptoms and sputum smear tests.

**Results:** There were 4646 pulmonary tuberculosis patients. Five hundred fourteen of these patients (11.1%) were detected in examinations. Seventy-five (83.3%) of the 90 were male, 25 (27.8%) were unemployed, and 28 (31.1%) were not covered by medical insurance. The median age was 53 years old (range 15–77). There was a steady increase in the rate of respiratory symptoms with sputum smear positive patients among employed medical insurance subscribers; 6 (8.1%), 8 (11.9%), 21 (25.3%), respectively from 2007 to 2009 (linear-by-linear association test,  $P < 0.05$ ). On the other hand, the rate showed a sharp decline among the unemployed without medical insurance; 3 (60.0%), 7 (41.2%), 6 (9.2%), respectively from 2007 to 2009 (linear-by-linear association test,  $P < 0.05$ ).

**Conclusion:** The severity of tuberculosis correlated with the socioeconomic status during the recession. Tuberculosis examinations conducted by the government or employers are free, whereas co-payments are required when consulting doctors under the Japanese medical insurance system. Therefore employees chose examinations rather than visiting health facilities, which resulted in delayed detection. On the contrary, the recession motivated the jobless to come spontaneously to examinations, which resulted in earlier detection. It was because welfare apartments were offered only after they were proved not to have contagious diseases.

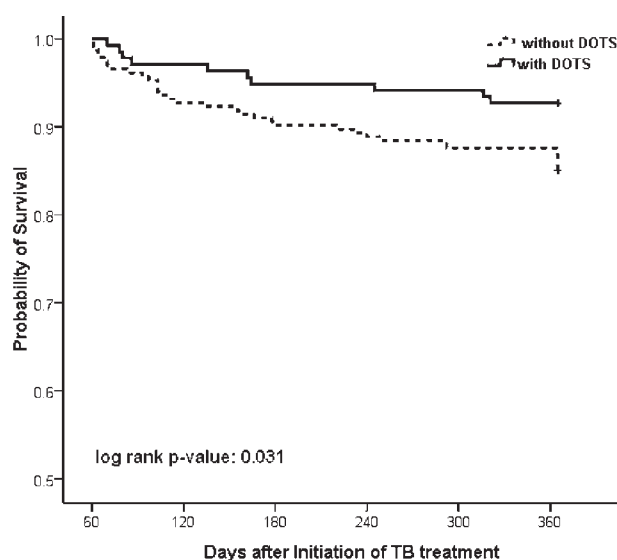
### PC-158-29 Implementation of the DOTS strategy reduces pulmonary tuberculosis mortality

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**Background:** The DOTS strategy is recommended by WHO as a pivotal measure in TB control. Taiwan started DOTS programs since 2006. The impact of DOTS implementation in PTB mortality deserves further clarification.

**Methods:** This prospective study included culture-proven pulmonary tuberculosis (PTB) patients at six hospitals in Taiwan. Patients who joined the DOTS program immediately after diagnosis and without interruption throughout the treatment course for the initial two months were defined as adhering to the DOTS strategy. At least two sets of sputum were collected at the completion of eight weeks and 24 weeks of TB treatment to evaluate sputum conversion. The information of in-treatment mortality was determined according to the records in the CDC database, Taiwan.

**Results:** A total of 371 patients were enrolled for analysis from January 2006 to December 2008. Of these patients, 137 (36.9%) adhered the DOTS program and 234 (63.1%) did not. The patients who were with DOTS program have higher positive sputum smear rate before initiation of anti-TB treatment (69.3% vs. 49.1%,  $P < 0.001$ ). Other demographic



characteristics, including underlying comorbidities, radiographic presentations, drug susceptibility profiles, and genotypes of *M. tuberculosis* isolates, were comparable between patients with or without DOTS program. In treatment outcome evaluation, patients with DOTS program had higher two months sputum smear conversion rate (79.6% vs. 63.7%,  $P = 0.001$ ), higher two months sputum culture conversion rate (83.9% vs. 67.5%,  $P = 0.001$ ), higher six months sputum culture conversion rate (97.6% vs. 85.4%,  $P < 0.001$ ), and lower in-treatment mortality (7.3% vs. 15.0%,  $P = 0.029$ ).

**Conclusion:** PTB patients adhered to DOTS program had lower in-treatment mortality and higher sputum conversion rate, as compared with those did not adhere to DOTS program. Implementation of DOTS strategy is helpful to improve treatment outcome of PTB patients.

#### PC-187-29 Neurological tuberculosis: a series of 20 cases

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**Background:** Central nervous system involvement is serious complication of tuberculosis and is caused by the hematogenous spread of *Mycobacterium tuberculosis*. It occurs essentially in infants and immune depressed patients but can also complicate the course of immune competent patients, especially in the site of miliary tuberculosis.

**Objective:** To outline characteristics and outcome of neurological tuberculosis in a low incidence country.

**Methods:** Charts of neurological tuberculosis patients, hospitalized in the Israeli Referral Tuberculosis Center from year 2000 to 2010, were retrospectively reviewed. All the relevant data were summarized.

**Results:** 20 patients were identified with a median age of 42 and female preponderance. 65% of them were African refugees. HIV co-infection was diagnosed in 50% of the patients and was concomitant to the tuberculosis diagnosis in half of them. In most of the patients (80%), the neurological involvement was the presenting symptom (in two patients, it appears during the first months of treatment, and in one patient after treatment completion). Fever was more frequent than coma and seizures (75% vs. 20%). CSF finding was compatible with lymphocytic meningitis in all but 2 patients with a positive culture for *M. tuberculosis* in 30% of the cases. 40% of the brain CT revealed tuberculoma and hydrocephalus was found in 15% of the cases. Only three patients had miliary infiltrate on chest X-ray. Treatment was individual, based on drug susceptibility pattern. All the patients received adjunctive steroid therapy. No HIV infected patients were on HAART therapy at diagnosis time. 35% of the patients died after the first

year and the mortality was strongly associated with HIV co-infection (85%) and hydrocephalus (66%).

**Conclusion:** This study emphasizes the poor prognosis of neurological tuberculosis especially in HIV co-infected patients. Effort should be focused on earlier diagnosis and treatment in this vulnerable population.

#### PC-213-29 Assessment of TB treatment efficiency in the settings of high prevalence of TB-HIV and MDR-TB

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Donetsk oblast was the first one in Ukraine to have implemented DOTS-strategy in 2001–2003 with the support of WHO. Stable trend to decrease of TB notification and TB mortality rate (excluding TB-HIV cases) for 5% annually is observed since 2006. Main indicators for TB case detection recommended by WHO and National TB Programme are achieved:

- TB case detection rate—more than 70% of estimated number;
- detection of new pulmonary TB cases by sputum smear microscopy (SSM) in general health care facilities increased to 62.4%, case detection by SSM in 1st level laboratories is fluctuating from 3 to 8%.

At the same time TB control programme implementation in Donetsk oblast is carried out against the background of high prevalence of HIV infection (by 01.01.2011 prevalence of HIV among pregnant women is 0.8%) and high rate of multidrug resistance (MDR) among new pulmonary TB cases (13.9% in 2009). At that number of TB-HIV deaths increases annually.

These factors considerably influence treatment efficacy rate that according to the cohort analysis results (data for 2009) came to 55.6% (whereas WHO recommended indicator is 85%, and this indicator is calculated for the TB programmes with HIV and MDR-TB prevalence of no more than 5% among new TB cases, in Donetsk oblast these indicators came to 24.7% and 13.9% accordingly). Low treatment efficacy rate may cast the doubt TB programme efficacy and effectiveness of investments that may result in reduction of funds. In our opinion it is reasonable to conduct the calculation of WHO recommended indicators (case detection rate and treatment efficacy rate) taking into account real situation in the region and in accordance with SMART criteria and principles.



### PC-225-29 Treatment outcomes among tuberculosis patients with isoniazid/streptomycin resistance

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**Background:** Different treatment approaches are recommended for patients with isoniazid (INH) or isoniazid/streptomycin (INH/SM) resistance. The most commonly used regimen is rifampin, ethambutol and pirazianmide (REZ) given daily for 9 months. However, there is unclear clinical evidence to support one treatment strategy for these forms of TB.

**Aims:** The study objectives were to assess treatment outcomes among patients with INH and INH/SM resistance and to determine if previous treatment history is associated with poor treatment outcomes. The definition of poor treatment outcomes included death, failure and default.

**Methods:** A retrospective cohort study was conducted between 2007 and 2009. Patients with both INH and with INH/SM resistance were included. All patients were treated with 9 REZ regimen. Drug susceptibility testing was performed by Georgian reference laboratory using absolute concentration method. External quality control was provided by the Supranational Reference Lab in Antwerp, Belgium.

**Results:** 902 INH and INH/SM resistant TB patients were enrolled. 78% (704) were male and 22% (198) female. Mean age was 28. New cases were 72% (651) and previously treated—28% (251). An overall, successful treatment outcome among new patients was higher than among previously treated cases (80.5% comparing to 67.1% in 2007; 66.5% comparing to 46.7% in 2008 and 57.9% comparing to 42.5%).

**Conclusions:** The percentage of successful outcomes had decreased in both groups from 2007 till 2009. Previously treated cases had lower rates of poor treatment outcomes compared with new patients, suggesting a different treatment approach is necessary among patients with INH or INH/SM resistance with prior treatment. Further research is needed to recommend the optimal treatment regimens for patients with previous treatment history, especially in a setting of high background rates of drug-resistant TB.

### PC-319-29 Extensively drug-resistant tuberculosis at a tuberculosis specialised hospital in Shanghai, China

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**Objectives:** Extensively drug-resistant tuberculosis (XDR-TB) has recently emerged as a global public health problem. To investigate the clinical characteristics, management, and outcomes of patients with XDR-TB and HIV-negative at a tuberculosis specialized hospital in Shanghai, China.

**Methods:** We analyzed TB patients with culture-proven MDR-TB from January 2007 to June 2009 at a tuberculosis specialized hospital in Shanghai.

**Results:** Among 1156 TB cases with culture-positive for *M. tuberculosis* complex, 785 cases (67.9%) were drug resistant (DR), 494 cases (42.7%) were classified as having MDR-TB, accounting for 62.9% of DR-TB. 126 cases (10.9%) were XDR-TB, accounting for 16.1% of DR-TB, 25.5% of MDR-TB. The percentage of female from XDR group was 42.1%, significantly higher in comparison with that from other MDR group ( $\chi^2 = 7.560$ ,  $P = 0.006$ ). Median ages in XDR and other MDR groups were 46 (33.8, 58.0) and 41 (31.3, 51.0) years, respectively. 22.2% of drug resistance belonged to newly diagnosed patients. At least three lung fields were involved in 90.5% of XDR patients and in 80.7% of other MDR patients ( $P = 0.008$ ). 40.5% of XDR patients were complicated by diabetes, lung disease, liver disease. The resistance rates of all drugs except isoniazid and rifampicin were significantly higher in patients with XDR-TB than in other MDR patients ( $P < 0.001$ ). Treatment failure was more common in patients with XDR-TB than in those with other MDR-TB (72.3% vs. 36.0%,  $P < 0.001$ ). Cure or treatment completion was more common in other patients with MDR-TB than in patients with XDR-TB (53.1% vs. 14.9%;  $P < 0.001$ ), whereas the mortality and default rates did not differ significantly.

**Conclusion:** The prevalence of XDR-TB is serious in some areas in China. Because of its seriousness and shortage of our options, patients with XDR-TB are more likely to show no response to therapy and their clinical treatment outcome is usually very poor.

### PC-567-29 Demographics and clinical manifestations of uveitis due to tuberculosis: a 26-year experience in Peru

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**Background:** Tuberculosis has a multiplicity of clinical presentations. Uveal involvement caused by tuberculosis remains poorly recognized in areas where tuberculosis is endemic.

**Objective:** To investigate the demographics and clinical characteristics of patients with tuberculous uveitis (TU), as this can aid primary health physicians and clinicians to identify patients at risk, and prevent common and severe complications.

**Material and methods:** A prospective study was performed to evaluate patients seen at Alexander von Humboldt Tropical Medicine Institute, Cayetano Heredia National Hospital-Peru, and at the National Institute of Ophthalmology-Peru, from 1985 through 2010. The diagnoses of TU were made on the basis of ocular involvement in one of the follow situations: a) pulmonary and/or extrapulmonary lesion, with positive direct smear (+BK) in sputum, fluid or other specimen; b) +BK and/or positive 'C' reactive protein in aqueous or vitreous humor; c) pulmonary and/or extrapulmonary lesion, with negative BK, but positive mantoux test (+PPD); or d) no pulmonary and/or extrapulmonary lesion, with +PPD.

**Results:** 135 cases of TU were diagnosed during a period of 26 years. The patients were most commonly female, aged  $38.84 \pm 13.9$  years; with neither past medical history nor risk factors for tuberculosis. The clinical course lasted  $17.5 \pm 35.9$  months. The ocular involvement was 48.9% unilateral and 45.2% bilateral (unknown in 5.9%). The most common ocular symptom reported was blurry vision. Posterior uveitis was the most frequent uveal syndrome. 40.8% of patients were legally blind at the time of the presentation. 20% had associated cataracts, the most commonly seen complication in this series.

**Conclusion:** Tuberculosis may involve the uvea and can lead to serious intraocular complications. In patients with tuberculosis, early ophthalmologic evaluation can lead to prompt treatment and might prevent blindness from severe ocular damage.

### PC-619-29 The outcome of reintroduction of first-line anti-tuberculosis drugs after drug-induced hepatitis

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**Background:** Drug-induced hepatotoxicity (DIH) is the most common problem leading to interruption of anti-tuberculosis(TB) treatment.

**Methods:** Retrospective observation study.

**Results:** A total of 77 patients with a diagnosis of anti-TB DIH were analyzed. After resolution of hepatitis, 31 (40%) patients were reintroduced with isoniazid (INH), rifampicin (RMP) sequentially (HR group), while 46 patients received RMP, INH sequentially (RH group). There are similar incidence of reintroduction associated adverse reactions (16% vs. 22%,  $P = 0.77$ ) and recurrence of DIH (6% vs. 4%,  $P = 1.00$ ) between HR group and RH group (Table 1). INH and RMP were reintroduced with gradually increasing dosages method (to full dosages within 3–5 days) in 30 (39%) and 38 (49%) patients, while others with full dosage throughout method (full dosage since day 1). The incidence of reintroduction associated adverse reactions, including recurrence of DIH, was not significantly different between two methods (Table 2). However, reintroducing RMP tended to associate with higher rate of adverse reactions than INH (17% vs. 6%,  $P = 0.08$ ) but lower rate of recurrence of hepatitis (0% vs. 5%,  $P = 0.08$ ). Among 13 patients experiencing adverse effects during RMP reintroduction, rifabutin was given to replace RMP in 4 (100%) patients without adverse effects. In contrast, pyrazinamide (PZA, 25 mg/kg) was reintroduced to 9 (12%) patients and associated with high recurrent rate of DIH (75%) if both RMP and INH had been reintroduced before PZA (Table 3). Using multivariate Cox proportional hazards model, successfully introducing RMP or rifabutin was an independent factor associated with earlier achieving completing anti-TB treatment (Hazard ratio = 5.06 (1.8–17.8),  $P < 0.01$ , Table 4).

**Conclusions:** The incidence of reintroduction associated adverse effects, including recurrence of DIH, was similar between different reintroduction regimens. A successful introduction RMP or rifabutin was an independent factor associated with better outcome.

### PC-722-29 Impact of food on the pharmacokinetics of anti-tuberculosis drugs in Taiwanese tuberculosis patients

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**Aim:** To evaluate the effects of food on the pharmacokinetics of first-line anti-TB drugs in Taiwanese TB patients.

**Methods:** An open-label, randomized, cross-over design study to evaluate the effects of food on the pharmacokinetic profile of first line anti-TB drugs in newly-diagnosed Taiwanese TB patients between January 2010 and February 2011 was carried out at Taipei Medical University–Wan Fang Hospital. Rifater (fixed dose combination formulation of isoniazid (INH), rifampin (RIF) and pyrazinamide (PZA) and ethambutol (EMB) were given according to the national TB guidelines. Blood samples were collected before and 1, 2, 4, 6 and 10 hours after dosing under fasting conditions or with food. Plasma concentrations of drugs were measured with a high-performance liquid chromatography coupled with tandem mass method (LC-MS/MS). Pharmacokinetic parameters of the maximum plasma concentrations (C<sub>max</sub>), the time to C<sub>max</sub> (T<sub>max</sub>) and area under the plasma concentration time curve (AUC<sub>0-10</sub>) were evaluated.

**Results:** Sixteen TB patients were included in this study. The overall effects showed that food reduced the mean C<sub>max</sub> (INH: 40.6%, RIF: 40.2%, EMB: 34.4%, PZA: 24.4%) and mean AUC<sub>0-10</sub> (INH: 21.3%, RIF: 26.4%, EMB: 12.2%, PZA: 12.0%). Meanwhile, food also increased the mean T<sub>max</sub> (INH: 78.1%, RIF: 151.3%, EMB: 41.4%, PZA: 148.9%).

**Conclusion:** From a pharmacokinetic point of view, the impact of random anti-TB drugs taking instead of taking before meals due to the DOTS program should be carefully evaluated in Taiwan.

### PC-899-29 High adherence levels among patients remaining on tuberculosis treatment

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**Background:** In urban settings in sub-Saharan Africa defaulting levels tend to be high. In Kampala these were shown to be associated with alcohol abuse and

change of residence. There are concerns that treatment interruptions may result in treatment failure and drug resistance.

**Design/methods:** An observational study among adult, TB patients receiving care at three urban primary care clinics in Kampala, Uganda. We measured adherence during scheduled treatment visits at 1, 2, 5 and 8 months into treatment by interviewing about any missed doses during the preceding 2 days. Determinants of adherence were assessed by repeated measurement analysis using mixed effects modeling.

**Results:** Between April 2007 and December 2009, 270 patients  $\geq$  15 years were included. Median age was 30 years (range 16–83), 160 (59%) were male, and 236 (87%) had treatment supporters. Fifty-four patients (20%) defaulted. We had 890 measurements for 257 patients; missed doses were reported for 121 measurements (13.6%, adjusted 95%CI: 11.0–16.1) relating to 88 patients. Thirty patients (11.1%) reported missing doses on more one measurement. Female patients were thrice more likely to miss doses than males adjusted OR 3.0 (95%CI: 1.5–5.8). Missed doses were not associated with change of residence, distance to the health center, transport costs or changed marital status since the last visit, sex, age, still having a treatment supporter and daily consumption alcohol.

**Conclusion and recommendations:** Patients not defaulting from treatment, have high levels of self-reported adherence. Increasing adherence counseling for female patients during scheduled clinic visits may improve on adherence.

### PC-1100-29 Plasma inhibitory assay for estimation of isoniazid and rifampin drug levels

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**Background:** Treatment outcomes in resource-limited settings are poor, in part due to low plasma drug levels. Since drug levels are expensive and performed in specialized centers, we developed a plasma inhibitory assay (PIA) of a patient's TB drug regimen against their TB isolate.

**Methods:** PIA compares time-to-positivity (TTP) of an inoculum of patient's TB in BACTEC MGIT tubes, to that inoculum after 72 hours of culture with autologous plasma (TTP hours plasma/TTP hours of control). We chose plasma drawn 2 hours after drug administration as an estimate of peak circulating concentration (C<sub>2hr</sub>). HIV(–) adults with smear(+) TB were enrolled from Kibong'oto National TB Hospital in Tanzania, and plasma obtained 2 weeks after

treatment with isoniazid (INH), rifampin (RIF), ethambutol and pyrazinamide. PIA was compared to healthy volunteer plasma spiked with low levels of INH and RIF.

**Results:** Sixteen patients were enrolled with mean age 38 years (SE 3.0); 13 (81%) were male. All patients' TB isolates were susceptible to INH and RIF. Mean PIA was 1.9 (SE 0.14). Five (31%) patients had  $PIA \leq 1.5$ , equivalent to spiked plasma values of RIF at 8  $\mu\text{g/ml}$  (expected range 8–24) and INH at 3  $\mu\text{g/ml}$  (3–5). Multidrug-resistant (MDR)-TB isolates were tested against patient's plasma revealing a mean PIA of 0.92 (SE 0.01) which differed significantly from PIA against their own TB isolate, PIA 2.1 (SE 0.15) [ $P < 0.001$ ]. Among those with  $PIA \leq 1.5$ , 2 (40%) remained smear(+) at 2 months of treatment, compared with 1 (9%) with  $PIA > 1.5$  [ $P = 0.17$ ]; while 3 (60%) of those with  $PIA \leq 1.5$  remained symptomatic at 2 months, compared with 1 (9%) with  $PIA > 1.5$  [ $P = 0.05$ ].

**Conclusions:** PIA values suggest the majority of patients in this cohort have low C2hr levels of RIF and INH. Extremely low PIA may predict MDR-TB. PIA can be performed in settings capable of liquid culture and future studies may demonstrate the assay as an alternative indicator of outcome in patients at risk of poor response.

#### **PC-1305-29 Marcadores de adhesión al tratamiento de la tuberculosis: resultados preliminares**

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Comprender la adhesión al tratamiento de tuberculosis como resultado de la interacción de diferentes determinantes sociales, no apenas la tomada del medicamento, se presenta como potencial para mejorar la monitorización del tratamiento.

**Objetivo:** Identificar las necesidades de intervención, según los determinantes sociales de adhesión, de pacientes en tratamiento de tuberculosis, en Atención Básica de Salud, en la región Centro-Oeste, ciudad de Sao Paulo, Brasil.

**Metodología:** Estudio descriptivo, que tuvo como referencial teórico la determinación social del proceso salud-enfermedad. El instrumento utilizado, en fase de validación, captó 28 marcadores, con scores de 1–3, siendo que el score 1 evidencia mayor potencial de abandono del tratamiento. Los datos se colectaron entre setiembre 2010 a febrero 2011, con pacientes en el primer mes de tratamiento.

**Resultados:** El instrumento fue aplicado a 22 pacientes, la mayoría: sexo masculino, educación primaria y renta familiar entre insuficiente y poco suficiente. Los marcadores con score 1, más presentes en esta

población fueron: fumar todos los días; desconocer la causa de la enfermedad; reacción negativa ante el diagnóstico; historia de tratamiento anterior; condiciones de vida e de trabajo; acceso a los servicios de salud y percepción del proceso salud-enfermedad.

**Conclusión:** Existe necesidad de cambios en las intervenciones de salud, de forma a planear acciones intersectoriales e interdisciplinarias para mejorar la adhesión al tratamiento de tuberculosis en esta población.

## **TUBERCULOSIS TREATMENT ADHERENCE/CASE MANAGEMENT II**

### **PC-178-29 Operation ASHA: using biometrics to prevent MDR-TB**

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Our biometric based attendance system has been developed by a collaboration between Microsoft Research and Innovators in Health (IIH). It consists of off-the-shelf components like a simple netbook computer, a commodity fingerprint reader and a low cost mobile phone. When a patient comes in to take her medication, her fingerprint is scanned and patient identification is performed on the computer itself. The visit is logged and at the end of the day, a complete log is sent via SMS to a central server in the cloud. It is then downloaded by our programme managers via the Internet and uploaded to an EMR where it can be visualised. If a patient fails to come in when expected, our counselors get text messages from the system. They can then go and track the patient in her home and give her the medication. This system has been deployed in 13 DOTS centers so far and 675 patients have been registered with it. There has been 0.5% default in the centers in which it is deployed.

### **PC-251-29 Initial default common in tertiary care hospitals: descriptive study, Rawalpindi district, Pakistan**

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Pakistan ranks 8th amongst the high burden TB countries in the world and harbor 63% of tuberculosis burden in EMRO WHO. The health care system hierarchy may lead to higher initial default at various level of health delivery system. A descriptive study was conducted to determine the true rates of initial default at primary and tertiary level. The data of patients of 2009 cohort from lab register were compared with patient registered in the TB register. The data was collected from 16 peripheral diagnostic centers



**Table** Association of initial default in tertiary care hospitals with peripheral health centers

Type of health facility	Defaults	On treatment	Total
Tertiary care hospital	86	756	842
Peripheral diagnostic centre	15	841	856
Total	101	1597	1698

RR 5.83 at 95%CI,  $P = 0.0000000$ .

and five tertiary care hospitals. The total number of suspects screened in tertiary care hospital were 9711, in peripheral diagnostic centre 6434. The smear positive cases diagnosed out of these TB suspects were 842 out of 9711 (9%) in tertiary care hospitals and 856 out of 6434 (13%). The initial default of smear positive patients before registration on the TB register was 10% in tertiary care hospitals, i.e., 86 out of 842 smear positive patients were not registered, in peripheral diagnostic centres 2% default were seen, i.e., 15 out of 856 smear positive patients defaulted. The difference of initial default of smear positive patients between tertiary care hospitals and peripheral diagnostic centres was found to be significant with  $P = 0.0000$  at 5% significance level with RR 5.83. The association of default with gender and age was not significant. The study was never done before and will open a wider area of research to enable policies to strengthen tertiary care hospital patients adherence.

### PC-642-29 Devenir des malades atteints de tuberculose pulmonaire traités par le régime de Catégorie II

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**Introduction :** Le régime de catégorie II (2RHEZ/1RHEZ/5RHE) est recommandé par l'OMS et l'UNION pour le traitement des rechutes, des échecs au régime de catégorie I (2RHEZ/4RH) et des reprises de traitement. L'objectif de cette étude est de comparer le devenir des malades dans ces trois catégories.

**Patients et méthodes :** Etude rétrospective portant sur les registres de tuberculose, allant de janvier 2000 à décembre 2009 et réalisée au centre de diagnostic et de traitement de la tuberculose (CDT) de l'hôpital Jamot de Yaoundé.

**Résultats :** Neuf cent soixante quatre patients ont été enregistrés et traités par le régime de catégorie II. Ils représentaient 5,4% de l'ensemble des cas de tuberculose. Il s'agissait de 632 hommes (65,6%) et 332 femmes (34,4%), l'âge moyen était de  $36,73 \pm 12,5$  ans (extrêmes 13–81). Cinq cent quatre vint quatorze patients (61,7%) étaient des rechutes, 289

(30%) des reprises de traitement et 80 patients (8,3%) des échecs. Des 964 patients enregistrés, 536 (55,6%) ont eu un succès thérapeutique, 21(2,2%) un échec de retraitement, 313 (32,5%) ont abandonné le traitement, 58 (5,8%) décédés et 38 (3,9%) ont été transférés dans un autre centre de diagnostic et de traitement de la tuberculose. Le taux de succès thérapeutique était de 61% en cas de rechute et de 57% dans le groupe des défailants contre seulement 38,4% dans le groupe des échecs ( $P < 0,006$ ). Le taux d'échec du retraitement était plus important dans le groupe des échecs au régime de catégorie I (11,5%) que dans les groupes de rechute (1,6%) et de reprise de traitement (1%)( $P < 0,001$ ). Aucune différence significative n'a été retrouvée entre les différents groupes quant aux taux de perdus de vue et de décès.

**Conclusion :** Le faible taux de succès thérapeutique et le taux élevé d'échec de retraitement retrouvés dans le groupe d'échec au régime de catégorie I constituent des arguments pour une reconsidération du régime thérapeutique chez ces patients.

### PC-668-29 A study on pulmonary tuberculosis treatment and follow-up practices in the private health sector

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**Background:** To determine the treatment and follow-up practices among private practitioners.

**Methods:** A cross-sectional study was conducted in rural and urban areas of Udupi taluk. The study population included all general practitioners and the specialists practicing internal medicine, chest medicine, and pediatrics. The non-response rate was 8%. The total number of practitioners interviewed was 116. Data was analyzed using Statistical Package for Social Sciences (SPSS) version 11.5.

**Results:** In our study, observations on various regimens used for tuberculosis treatment by practitioners indicate that as many as 23 different regimens were used by doctors. Majority (64.0%) of specialists preferred to ask change in color of urine to assess compliance to treatment. Most of the practitioners (70.7%) preferred chest X-ray at the end of treatment to declare patient as cured.

**Conclusion and recommendations:** Continuing medical education program should be conducted to update the knowledge of private practitioners regarding standard tuberculosis treatment and follow-up guidelines.

### PC-710-29 Factors associated with unsuccessful tuberculosis treatment in an urban setting in Java, Indonesia

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**Background:** We evaluated the treatment outcome for new smear-positive pulmonary tuberculosis (TB) cases and risk factors associated with unsuccessful treatment in urban TB clinic in Java, Indonesia.

**Methods:** From 2000 to 2005, we included 932 consecutive patients over 15 years old with new smear-positive pulmonary TB. Treatment outcome was assessed at the end of treatment. By logistic regression analysis, we examined what factors were associated with unsuccessful treatment (including dropouts, treatment failures, and deaths).

**Results:** Unsuccessful treatment (16.6%) was associated with sputum positivity after 2 months of treatment. Study dropout (7.7%) was associated with treatment delay  $\geq 60$  days, human immunodeficiency virus (HIV) infection, and smoking. Treatment failure (8.2%) was associated with an initial 3+ sputum smear grading and with a positive sputum smear after 2 months of treatment. Death (0.7%) was not significantly associated with any factor.

**Conclusions:** Total treatment success rate (83.4%) approached the WHO target (85%) for smear positive TB cases. Success could be increased by improving care for patients with severe disease, i.e., those with high smear gradings or low response to treatment during the intensive phase; reducing the time between symptom onset and starting treatment; integrating TB-HIV services; and adding a smoking cessation program.

### PC-734-29 Feasibility of bringing in default patients for retreatment within the DOTS programme in Chennai, India

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**Study setting:** Default TB patients registered in government clinics under DOTS (Direct Observed Treatment, Short course) program in Chennai city catering to 4.34 million population.

**Objectives:** To find out feasibility of bringing in default patients for re-treatment within DOTS program by providing necessary social support services.

**Methods:** An interventional study on TB patients registered as default from April 09 to June 10 in the

urban DOTS program of Chennai city. Components of study included an initial assessment of treatment cards of defaulters, personal interview of defaulters and their referral to Microscopy Centers for sputum status and bringing them back to treatment by providing necessary social support.

**Results:** Profile of defaulters included 88% males, 54% who had defaulted during first 2 months of starting treatment and 75% who were pulmonary positive. Of 234 default patients, 37% could not be interviewed for following reasons: 20% had died, 16% had shifted residence. Of 67% interviewed, 27% were referred for sputum test, 21% were started on DOTS, 6% were not willing for treatment, 7% had already completed treatment. Social support needed for bringing defaulters back to treatment included intense patient and family counseling, nutritional and medical support, counseling for alcoholism, alcoholic de-addiction support.

**Conclusion:** The present study has highlighted mechanisms and social support needed for ensuring successful treatment completion by default patients. Default patients are a potentially important group as they have had some form of anti-TB treatment and contribute to the pool of patients spreading the disease in community.

### PC-788-29 High default rates in an urban district in Lima, Peru

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**Background:** Patients defaulting TB treatment are at risk of chronic disease and acquiring multi drug resistance (MDR). Identifying factors associated with default may help TB control programs in reducing the burden of MDR-TB.

**Methods:** From March to July 2010, new smear-positive adult TB patients were enrolled from 34 health services in an urban district with high TB and MDR-TB rates. A structured questionnaire was applied. Patients were followed up for six months; outcomes were cross-checked with TB registers. Risk factors for treatment completion and default were analyzed.

**Results:** We enrolled 315 patients of which 30 were still on treatment during the follow up. After excluding the latter, 10.9% (95% confidence interval [CI] 7.5–15.1; 31/285) defaulted; 84.6% (95% CI 79.8–88.6; 241/285) completed treatment; 2.1% (95% CI 0.8–4.5; 6/285) died, and 2.5% (95% CI 1.0–5.0; 7/285) were transferred outside the district. After excluding deaths and transfers, the final model to predict default included substance abuse, educational status, previous imprisonment, HIV status and

sex. In multivariable analysis, substance abuse was associated to default (OR 4.2 95%CI 1.3–13.2) as well as not finishing high school (OR 3.2, 95%CI 1.1–9.3). Of the 315 enrolled, 20 had primary MDR. After six months of starting treatment: 14 were still on it, 3 had died and 3 had defaulted.

**Conclusions:** We found a very high defaulter rate in a high MDR-TB prevalence area. Interventions to reduce default in our setting should be implemented addressing the identified risk factors, in particular the social conditions of these groups of patients.

### PC-795-29 High risk of airborne TB transmission in prefabricated homes donated to families with TB and MDR-TB

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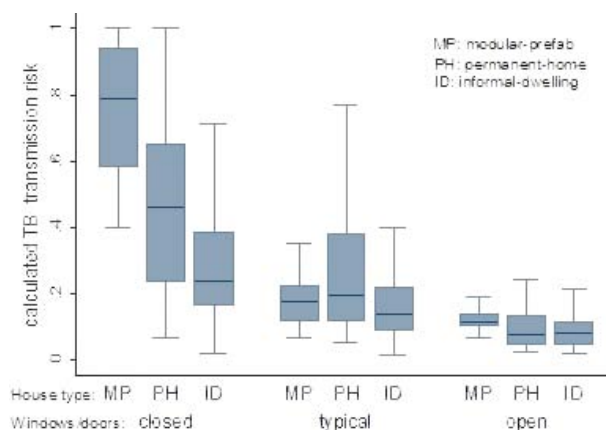
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**Background:** Ventilation is a key determinant of the risk of airborne TB transmission from patients to their contacts. We measured ventilation and calculated risk of TB transmission in homes in Peruvian shantytowns.

**Methods:** We studied 69 homes in Lima, 60 of which housed a smear-positive TB patient and his or her co-habitants. Homes were categorized as: (1) informal-dwellings made of wood, adobe, plastic and straw ( $n = 35$ ); (2) permanent-homes made of cement, bricks, and mortar ( $n = 20$ ); and (3) modular-prefabs, prefabricated homes donated to or subsidised for poor, TB- and/or MDR-TB-affected households by non-governmental organizations ( $n = 14$ ). Using a CO<sub>2</sub> gas tracer technique the ventilation of each home was measured with the doors/windows fully-closed, in their typical state and fully-open. The TB transmission risk (with 95% confidence intervals) adjusted for wind speed was calculated using the Wells-Riley model for two-week exposure to a smear-positive patient.

**Results:** Multiple regression analysis demonstrated that modular-prefabs were at 1.7-times (1.3–2.2) greater risk of TB transmission than informal-dwellings. Permanent-dwellings had intermediate calculated risk. Compared to the typical state, closing windows and doors caused a 2.1-fold (1.8–2.4) increase in calculated TB transmission risk while opening windows and doors resulted in a 1.9-fold (1.7–2.2) decrease in risk of TB transmission.

**Conclusion:** The risk of airborne TB transmission was reduced by opening windows in all house types. The worst quality shack-like informal-dwellings were best ventilated and had the lowest risk of TB transmission, whereas high quality prefabricated-homes



donated to poor TB- and MDR-TB-affected families were poorly ventilated, thus having the highest risk of TB transmission. These paradoxical findings should influence the design of housing modifications donated to TB-affected families to ensure that improvements in housing quality do not increase TB and MDR-TB transmission.

### PC-858-29 Clinical economic model of social support efficiency in tuberculosis patients

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**Aim:** To determine economic efficiency of social support (SS) in tuberculosis (TB) patients.

**Design/methods:** Clinical economic model of chemotherapy outcomes and costs in TB patients, receiving SS, was performed. The source of the data had been the study of chemotherapy outcomes in 1910 newly detected pulmonary TB patients from 7 regions of Russia. Information on SS cost was obtained from the Russian Red Cross (data of 2009). Anti-tuberculosis drugs cost was estimated in 2009 prices.

**Results:** Average cost of medicines for newly detected TB patient treatment was US\$98.5. Average cost of SS was US\$89.8, including food kits for TB patients, transport expenses reimbursement for visits to the doctor, salary of the personnel. The frequency of chemotherapy regimen administration in TB patients, receiving repeated treatment, was estimated. Model of repeated treatment courses administration in 100 newly detected pulmonary TB patients was made. Medical efficiency of treatment in patients receiving SS (excluding died ones) was 94.4%, and in patients without SS, 68.4% [Bogorodskaya E.M., 2009]. Under condition of SS presence 6 TB patients would receive repeated treatment courses (4 patients, according to the 2nd chemotherapy regimen; 2 patients, multidrug-resistant TB treatment regimen). Without SS 32 TB patients would receive such courses

(24 patients, the 2nd regimen; 8 patients, multidrug-resistant TB treatment regimen). Additional expenses for SS in the model group were US\$8979.90. Due to reduced number of repeated chemotherapy courses in the group of patients it allowed to get economic advantage equal to US\$66765.30. Efficiency rate was 7.4.

**Conclusion:** The SS in TB patients allows to save direct expenditures on chemotherapy at the expense of reduction number of repeated treatment courses.

### PC-948-29 The development of drug resistance among new cases with drug-susceptible tuberculosis

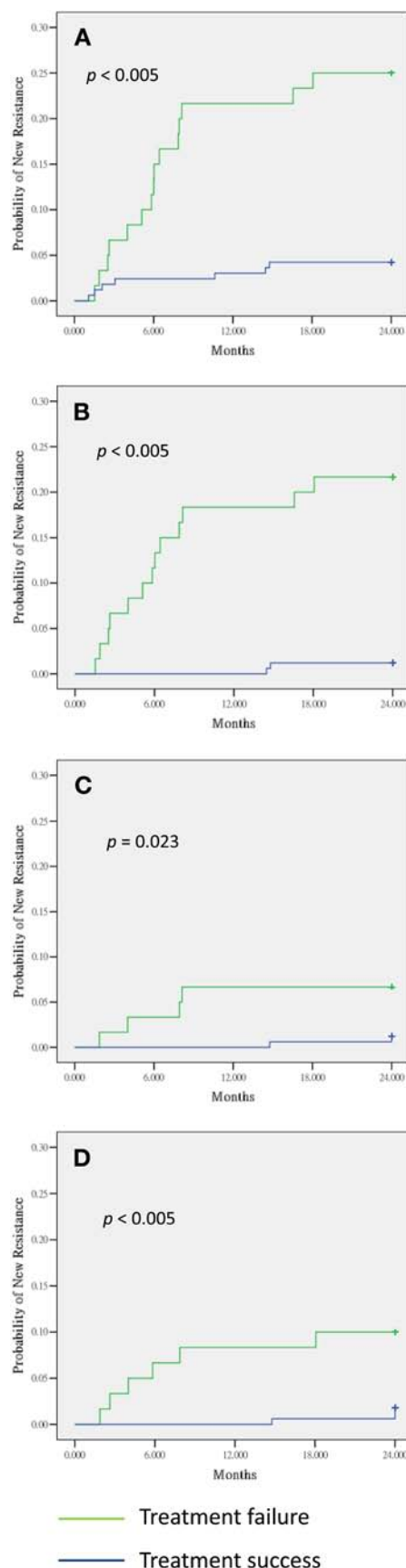
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**Aim:** To investigate the development of drug resistance in new cases of pulmonary tuberculosis (TB) whose strains were sensitive to all first-line antituberculosis agents at beginning of treatment.

**Methods:** Retrospectively, all new cases of pulmonary TB whose initial sputum culture showed *M. tuberculosis* and the drug susceptibility testing (DST) to first-line drugs showed all sensitive were enrolled. Every case was followed for 2 years. Cases who had the subsequent DST within 2 years were analyzed for the development of drug resistance.

**Results:** Total 1815 new cases were enrolled. They all received standard short-course anti-TB treatment. Of them, 243 cases had the second DST for the subsequent positive sputum tuberculosis culture. The incidence of acquired new resistance to INH, RMP, EMB and SM were 6.1, 3.9, 1.7 and 3.3 (every 1000 cases) within the first 6 months of treatment, and 12.7, 8.8, 3.3 and 5.5 (every 1000 cases) within 2 years of follow-up. To classify the 243 patients by treatment outcome, 165 (67.9%) cases were treatment success, 60 (24.7%) were treatment failure, 2 (0.8%) were defaulter and 16 (6.6%) died within the first 6 months. The Kaplan-Meier time-to-event analyses (Figure) showed the incidence of new resistance to INH, RMP, EMB and SM were significantly higher in treatment failure group than in success group within the 2 years of follow-up (Log-Rank  $P < 0.005$ ,  $P < 0.005$ ,  $P = 0.023$  and  $P < 0.005$ , respectively). At the end of 6-months treatment, the cumulative incidence of new resistance to INH and RMP were significantly higher in treatment failure group than in treatment success group (11.7% vs. 2.4%,  $P = 0.009$ ; 11.7% vs. 0%,  $P < 0.005$ ; respectively).

**Conclusion:** Even under DOTS strategy, the development of new resistance to INH and RMP could occur very early after initiation of treatment and is associated with treatment failure. Early detection of the emergence of drug resistance strain is crucial in the TB-control program.



**Figure** Kaplan-Meier cumulative-incidence plots and log-rank  $P$  values for development of new resistance to INH (A), RMP (B), EMB (C) and SM (D) within 24 months after anti-TB treatment, according to different clinical outcomes.



### PC-1078-29 Using brief counseling interventions to address AUD among patients with tuberculosis, Tomsk, Russia

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**Background:** Alcohol use disorders (AUD) contribute to poor TB outcomes. We investigated the feasibility of delivering BCI to patients with AUDs as part of TB treatment in Tomsk, Russia within a NIAAA-funded randomized controlled trial IMPACT (Integrated Management of Physician-delivered Alcohol Care to TB patients). Integrating BCI interventions into TB services could improve adherence and treatment success.

**Intervention:** An adaptation of the NIAAA's Clinician's Guide, BCI is a menu of skills and tools that doctors utilized during monthly consultations for 6 months. BCI training was developed and implemented with TB staff of the Tomsk regional TB hospital. Didactics and one-on-one role play were used to train TB physicians, who were required to demonstrate proficiency in BCI prior to delivering the intervention. Monitoring and fidelity assessment minimized protocol deviation and improved proficiency. Audiotapes of behavioral interventions were reviewed monthly by Russian speaking raters and scored for adherence with an instrument developed for the study.

**Results:** Of 16 physicians who participated in initial training, all were certified in BCI. They achieved a high standard of BCI skills after approximately 12 months of ongoing supervision and refresher training. Of 200 TB patients enrolled in the study, 98 were randomized to receive BCI group. During the first three months, 67% of scheduled BCI encounters were completed; in the last three months, BCI adherence decreased to 36%. Exit interviews revealed that 70% of patients interviewed found the sessions positively affected patient-doctor relationship and 86% would recommend them to others.

**Conclusion:** Ongoing supervision and training are crucial to supporting BCI fidelity. Program completion rates were associated with period of hospital stay. We conclude that use of BCI skills is feasible and potentially effective within a hospital setting, but further effort is needed for adoption at ambulatory sites.

### PC-1169-29 Treating TB patients with no entitlement to social support

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In the UK, TB medication is free but access to additional resources necessary for treatment completion is conditional. Patients with no recourse to public funds (NRPF), including undocumented and some European Economic Area migrants, have no rights to benefits, public housing or social care. The International Union Against Tuberculosis and Lung Disease (The Union) recommends that undocumented migrants with TB should receive free treatment and not be deported until completion of treatment.

**Methods:** We reviewed clinical, social circumstances and treatment outcomes for 75 NRPF patients with active TB referred from September 2007 to February 2011 to Find & Treat, a pan-London multi-disciplinary project developed to strengthen TB control in hard-to-reach groups.

**Results:** Lack of access to public funds severely compromises treatment access, completion and cure. Patients are unable to pay for transport to attend clinic appointments, buy food or access accommodation. Many (43/75) were sleeping rough. Just under a half (20/44) had resistant forms of TB, including 10 with multidrug resistance (MDR) and 1 extremely drug resistance (XDR). 35 patients were lost to follow-up, of which 9 have never been found. Consequences included unsupervised medication, street homelessness, hospital admission and treatment interruption and default.

**Conclusion:** Though ensuring access to free treatment, current guidance does not address the wider determinants of health in tuberculosis. This results in severe inequity of care, and poor treatment outcomes with potentially serious public health implications. Political commitment to provide for basic social needs as well as free medication for all patients is required to effectively control TB.

## TUBERCULOSIS IN SPECIAL POPULATIONS

### PC-99-29 Re-setting TB incidence in rural Taiwan with a novel intensive TB elimination programme: 10 years later

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**Objective:** To document the effect of a novel and brief intensive tuberculosis (TB) elimination program (beyond standard WHO recommended DOTS), incorporating latent TB infection treatment, in an aboriginal township village area ( $n = 1785$ ) in eastern Taiwan with a very high tuberculosis burden.

**Study design:** Prospective.

**Methods:** All study interventions were in accordance with standard medical practice and with the consent of the patient. TB case reports were collected as they were made available by the official local Taiwan agency. The number of TB cases occurring post-intervention; both in initial and late four-year periods, were compared to the number of cases in the four-year baseline period using the McNemar test.

**Results:** In the initial post-intervention period, total TB cases decreased from 81 to 53 ( $P = 0.016$ ). The decline persisted during the final four-year period with 56 cases ( $P = 0.033$ ) representing a 31% lasting decrease at ten years. One village's decrease persisted at 59% ( $P = 0.041$ ).

**Conclusions:** Although far shy of elimination goals, the significant and lasting benefit of a brief intensive TB program utilizing LTBI treatment is apparent.

#### PC-194-29 Programme implications of genomic epidemiologic analysis of tuberculosis transmission patterns

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**Background:** Canadian Aboriginal populations experience TB rates 5–30 times higher than the general population. Socioeconomic determinants, mobility, and barriers to health services play key roles in this inequity. Genome sequencing yields valuable insights with implications for TB control strategies.

**Methods:** Data from epidemiologic investigation of a large TB outbreak (contact tracing and social network analysis) were complemented with genome sequencing of 32 *M. tuberculosis* outbreak isolates and four historic isolates from the same area with matching genotype. Epidemiological and genomic data were integrated empirically. Findings were reviewed in the context of improvements to current TB investigation and control tools and policy.

**Results:** Genome sequencing helped identify the following:

- 1 The organism was not significantly different from other circulating strains and the factors leading to the outbreak were host behavioral, social and environmental factors;
- 2 Identification of lineages and transmission events beyond the resolution of RFLP/MIRU-VNTR can inform the development of next-generation outbreak investigation tools and accurate correlates of transmission;
- 3 Combinations of traditional contact tracing, social network analysis, genotyping and genome sequencing provide layers of information useful for cross-validation;

4 Proactive identification of high transmission potential communities, social groups and locations is possible.

**Conclusion:** Genome sequencing of TB outbreaks yields additional insights into transmission dynamics and patterns which will improve contact tracing and social network analysis. Genomic data may confirm, disprove or identify transmission relationships. Real time sequencing can be a useful outbreak investigation tool if cost issues are overcome.

#### PC-490-29 Utilisation of HIV and TB services among health workers in Uganda

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**Background:** To assess utilization of HIV and TB services among health workers in the Uganda. Occupational TB can lead to the loss of health workers.

**Methods:** A cross-sectional study conducted among 544 health workers in Mukono and Wakiso districts in Uganda from October 2010 to January 2011. Mukono has had TB infection control training in all health facilities and Wakiso has not. HIV prevalence in both districts is 9%. Data was collected on HIV testing among health workers, where the testing was done and where they would prefer to be treated for HIV/AIDS and history of TB.

**Results:** Knowledge about TB transmission in outpatient department was low; with 53% from Wakiso and 50% from Mukono ( $P = 0.457$ ). Health workers are not provided with special HIV and TB services. 35% from Mukono compared to 50% Wakiso felt HIV testing services in their workplaces are not confidential ( $P = 0.005$ ). Over 90% of the respondents in both districts reported having ever had an HIV test. Of those who had ever tested, 75% from Mukono and 63% from Wakiso had the test at their workplace ( $P = 0.009$ ) and more than a half did the test themselves (Mukono = 55% and Wakiso = 58%). 50% of respondents from Mukono and 55% from Wakiso said they would not like disclosing their HIV status to their colleagues ( $P = 0.339$ ). 5% of health care workers admitted being treated for TB in the past 5 years. Over 90% of the health workers from both districts are willing to be screened for TB.

**Conclusions and recommendations:** HIV testing is high, with self testing being common. Willingness to disclose one's positive HIV status to colleagues is difficult. TB disease is common among health workers. There is a need for provision of confidential HIV testing, care and treatment and TB services for health workers and training in TB infection control.

### PC-1007-29 Tuberculosis control in migrants, St Petersburg, Russian Federation

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**Introduction:** Last years migrants in the Russian Federation (RF) are presented mainly by foreign citizens arriving to the RF from former Soviet republics visa-free with the aim of temporary labour activity. These persons may remain in the RF for only 90 days; they can move freely within the RF, most of them have no health insurance. For a longer stay temporary residence permits or work permits is needed. By law, TB is the basis for the refusal or cancellation of temporary residence permits or work permits to foreigners in RF.

**Objective:** To investigate adherence of migrants to TB treatment and reasons for defaulting.

**Methods:** A prospective study among migrants-TB-patients diagnosed in Admiralteisky District, St. Petersburg, Russian Federation, between January 1 2008 and July 1 2010. Examinations and treatment were free for patients. All patients were interviewed.

**Results:** A total of 126 persons with symptoms of tuberculosis or casual radiological findings were examined. Active TB was diagnosed in 70 persons, 28 patients did not complete examination. Tax-free treatment was offered to all TB-patients (70). 22 patients (31%) refused treatment wishing to return home. Of the 48 patients who started treatment, 21 did not complete treatment. Thus, only 27 patients (39%) completed treatment, the fate of 43 patients (61%) is unknown. Their places of residence were not established. Reasons for defaulting was wishing to return home. Some of the patients remained in Russia illegally to work, because they need to earn a living or take care of their families.

**Conclusions:** In the absence of registration at the place of actual residence, health care staff cannot locate the patient and ensure completion of treatment. If treatment cannot be completed in the country of temporary stay, a patient transfer to their home country is required.

### PC-1036-29 TB screening for health care workers in Botswana

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**Background:** Health care workers (HCW) in Africa have higher rates of TB than the general population. No consensus exists on the best approach to screen

African HCW for TB. Cost, confidentiality and operational challenges impact program design and implementation.

**Intervention:** We conducted TB screening as part of a Workplace Wellness Program (WWP) for HCW employed in clinical departments in six public hospitals in Botswana. After TB infection control training HCW were invited to attend the WWP, where they were offered TB screening, rapid HIV testing and a general medical evaluation. We screened HCW not on TB treatment for symptoms lasting  $\geq 2$  weeks: cough, fever, night sweats, lymphadenopathy, and weight loss. If symptoms were present, we ordered 3 sputum samples for AFB smear and culture and/or chest X-ray. All tests were done using diagnostic services available in the Botswana public health system. Review of facility TB registers at least 6 months after the WWP identified any missed cases in HCW who screened negative at the time of the WWP appointment.

**Results:** Of 1877 HCW who received care from the WWP between April 2009 and May 2010, 5 were on TB treatment at the time of their appointment and 164 (9%) had a prior history of TB. We screened 1869 of the remaining 1872 HCW for TB: 80 (4%) had one or more TB symptoms. Three sputum samples were ordered for 78 HCW: 42 had at least one smear and culture result available, 28 had two results and 20 HCW had all three results. Only one result was smear negative, culture positive for drug-sensitive TB. Chest X-rays were done on 6 HCW and all were normal. One smear and culture negative TB case was subsequently diagnosed in a HCW who screened negative at the WWP. We estimated a 20% HIV prevalence rate among participants.

**Conclusions:** Voluntary symptom-based TB screening for HCW is not an efficient method of case finding under operational conditions in Botswana.

### PC-1084-29 Tuberculosis in homeless population: actions in the shelters

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**Background and challenges to implementation:** The municipality of Rio de Janeiro has been developing actions to decrease the cases of tuberculosis (TB) among the homeless population. It's estimated that this population of high vulnerability has sixty times more chances to develop TB. A study on the prevalence of TB among this population was conducted in Rio de Janeiro and was important for the implementation of the current work in shelters of search for respiratory symptoms.

**Intervention or response:**

- Shelters' staff qualification in order to provide them with the proper qualification to identify respiratory symptoms.

- Workshop for the shelter and the Primary Care Unit in order to create a flow to follow up the cases of TB.
- Systematic supervision of the actions above mentioned.
- Information lessons about TB-HIV to the shelter's population.

After these actions, the respiratory symptomatic people were identified and registered in the tuberculosis control registry system.

**Results and lessons learnt:** The routine search of respiratory symptomatic was implanted in six shelters, the diagnosis and treatment remain in the Primary Care Unit. We observed that a more efficient integration between the shelters is necessary to support this frequently migrating population.

**Conclusions and key recommendations:** IT showed how important these institutions are for the TB control in such population. The success of this program was due to the previous identification of TB cases in the shelters. This experience provides sufficient elements to implement treatment in the shelters.

#### PC-1101-29 Empowering the Somali migrant community on TB awareness, care and treatment in a South African township

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**Background:** Officially, South Africa hosts 21 300 documented Somali migrants (source: UNHCR), living in South African townships. In close collaboration with the provincial and district tuberculosis (TB) management program, University Research Corporation, LLC. (URC), through the United States Agency for International Development (USAID) TB project, provides technical assistance in tuberculosis (TB) activities in selected districts and facilities. In Port Elizabeth, one of the USAID TB project supported facility, Schauderville clinic is attended by the Somali community. During support visits, the project and clinic staff identified an increase in the number of defaulters (6) and treatment interrupters (14), all belonging to the Somali community.

**Interventions:** In collaboration with the district team and the South African Somali Association (SASA), the USAID TB project conducted a root cause analysis of treatment interruptions; a workshop was held with members of the local Somali community to impart knowledge on TB, TB transmission, TB treatment and importance of adherence.

**Results and lessons learnt:** The language used by health workers for health education and adherence support, was identified as the main reason for inter-

ruption. Following the workshop, attendees' mobilized to trace the defaulters/interrupters, and after 4 days of this activity, 18 out of 20 (90%) of the defaulters/interrupters were put back into TB treatment. To date, all the returnees are still on treatment and outcomes will be further analyzed. One of the workshop attendees is now working in the clinic for translation, and regular adherence support to the attending Somali community, while SASA is involved in social mobilization activities around TB and TBHIV.

**Conclusions:** This success story shows that collaborative interventions targeted at and involving specific communities are key to achieving better TB control in a replicable and sustainable way.

#### PC-1204-29 Active tuberculosis surveillance in health care workers: a literature update of country surveys

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**Background and objective:** Recent systematic reviews on occupational risk for tuberculosis (TB) disease among health care workers (HCWs) have recently reported active TB incidence rates as being substantially higher than those observed among the general population. However, according to 2009 country notification data reported to the World Health Organization (WHO), most countries have no system for collecting data on active TB among HCWs. We performed a systematic review on countries' experiences and the current notification system available at country level for the surveillance of TB disease in HCWs.

**Methods:** A literature search for the period Feb. 2006–Jan. 2011 retrieved 429 documents. Thirty-two surveys from 18 different countries were selected. We extracted data from 7 population-based surveys, 10 hospital-based retrospective analysis of clinical records of patients, and 15 local or multicentric hospital screening surveys.

**Findings:** The majority of these surveys were local (28, 87.5%), and often based on a single center (20, 62.5%). Twenty-five surveys reported a median incidence of TB in HCWs of 723.3/100 000 (IQR 99.8–1472.7). Standard diagnostic tools included clinical evaluation, 1- or 2-step tuberculin skin test, Interferon Gamma Release Assay (IGRA) testing for TB, and chest radiography. Occupational groups analyzed were mostly HCWs in general (25, 78.1%), but sometimes focused specifically on nurses (2 surveys), laboratory personnel (1), community based/home based caregivers (3) or health researchers (1). Transmission control measures were implemented only in a few settings.

**Conclusions:** A wide heterogeneity between surveys,



in terms of study design, sampling method and study populations, was reflected in the variety of risk assessment tools and surveillance methods used. These findings reinforce the need to develop a consensual, simple and efficient surveillance system to assess TB among HCW at country level.

### PC-1282-29 Tuberculosis among the Canadian First Nations populations: a widening gap

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Tuberculosis (TB), has been a constant burden of First Nations (FN), the original inhabitants of the Land now called Canada, since the arrival of European settlers. This burden peaked in the 1930s and 1940s with up to 700 TB deaths per 100 000 people. TB rates on-reserve improved over the course of the 1990s but have not changed since 2000. Despite continuing decreases in some regions, the overall rates remain higher than among the general Canadian population. The current and new strategies being implemented are aimed at a TB Canadian target rate of 3.6 per 100 000 people by 2015, which supports the target set in the Global Plan to Stop TB 2006–2015 to reduce the burden of TB by 50 percent of the 1990 rate. The impact of TB among First Nations continues to be exacerbated by conditions such as overcrowding, malnutrition and lack of immunity. All, Social Determinants of Health that need to be addressed in order to improve TB incidence. Even though the total number of cases has been reduced overall, the gap on the incidence of the disease between First Nations and the Canadian General Population has widened, from 27.7 times more cases in FN in 1992 to 32.7 times more cases in 2008. The AFN is actively involved in several different initiatives working with national and international partners to augment awareness of TB issues on FN populations, lobby for increased funding for TB prevention, detection and treatment programs and actively involved in the modernization of National TB initiatives aimed at decreasing the existing gap.

**Conclusion:** TB mirrors society. What is revealed are inequities for FN peoples. We must strengthen our efforts to address FN people's needs or the vision of TB-free world by 2050 will fail.

### PC-1313-29 Tuberculosis in migrants, St Petersburg, Russian Federation

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**Setting:** TB services in Russian Federation (RF) has traditionally focused on the local population. Last

years, the incidence of tuberculosis (TB) in St. Petersburg remains high. Number of labour migrants arriving to the RF from former Soviet republics with high burden of TB also remains high. There is a perception that TB-patients from these countries will be arriving in the RF for treatment if the treatment will be free.

**Objective:** To evaluate the dynamics of the number of new TB-cases in migrants and to determine the time since entry into the RF to develop TB disease.

**Methods:** All the migrants who addressed the TB dispensary during 2008–2010 were examined. The causes for examination were symptoms of tuberculosis or casual radiological findings. Examinations and treatment were free for patients.

**Results:** The increase of the cases of active pulmonary TB (PTB) in migrants was not considerably (35, 31, 37). Among migrants the number of cases of sputum-negative PTB has increased (18, 15, 24), the number of cases of latent TB has also increased (10, 16, 34), the number of cases of sputum-positive PTB has decreased (17, 16, 13), the number of cases of cavitary PTB has decreased (20, 15, 10), the number of TB-cases in children has decreased (7, 5, 4). Among the local population: the number of active TB-cases has decreased (80, 72, 54), the number of sputum-positive PTB-cases has decreased (43, 33, 19), the number of TB-cases in children has decreased (6, 4, 0). The total number of TB-cases (migrants and local population) has decreased (115, 103, 91). Time since entry into the RF was 4.5 years on average every year. Only one TB-patient was diagnosed soon after the arrival in RF.

**Conclusions:** In most cases TB developed after the arrival in RF. The number of patients is not increased. However, since 2011 free TB-screening and free TB-treatment for labor migrants is not available in RF. Revision of the guidelines in TB-services for migrants is needed.

## PUBLIC-PRIVATE MIX II

### PC-114-29 RRNTCP PPM: role of NGOs

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DOTS is the heart of RNTCP; and effective implementation of DOTS only will give us the desired results aimed at as per the MDG, thanks to GFATM for funding various NGOs in the RNTCP by way of PPM—public private mix. IMA (Indian Medical Association), the largest NGO of qualified medical practitioners in India, has been approached by GOI and MOU was signed in 2004.

Other NGOs like LEPRO India, World Vision, TB Alert, PATH, are also now partners in the DOTS implementation programme in a big way.

Private medical colleges involvement is another positive step for increasing the new cases detection and also for effective implementation of DOTS.

During 2007 under IMA RNTCP GFATM PPM Project 5 states and 1 Union territory were selected—A.p; Maharastra; Up; Punjab; Chandigarh and Haryana. a national working group was formed; state units were created and technical consultants were appointed and trained. By organising local branch CMEs and district level modular training programmes IMA members (PPS) were sensitised reg RNTCP, and are made to involve in the national programme.

During 2010 the GFATM has expanded the activity of IMA by adding 10 more states for the project; and now under the IMA RNTCP GFATM PPM RCC project 16 states and one UT were involved in the programme. PPS are involving themselves as referral doctors referring chest symptomatics for sputum microscopy; many clinics and hospitals identified as DOT centres and even DMCS are also established under the PPM schemes. A directory of DOT service providers and DMCS was published by IMA in Dec 2009 documenting our involvement and commitment.

By the involvement of NGOS in a big way, the revised objective of 90/90 can be achieved and a combined effort will give us the result.

Our own NGO by name SMLS Trust (member of the Union) is involved in the RNTCP programme in ACSM activities in an agency area since Oct 2009.

### PC-370-29 Public-private partnership in TB control in Bangladesh: factors affecting scale-up

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**Background:** Based on the experiences from pilot implementation, the PPP model approach has been scaled up in Chittagong and Sylhet since 2007. The scale up followed a similar systematic process and steps as applied in the pilot implementation. Tools and guidelines that were developed earlier have been used. The research was conducted jointly by the NTP, BRAC and University of Leeds, UK.

**Objective:** To identify factors facilitating and hindering scale-up of the PPP.

**Methods:** Action research. Both quantitative and qualitative data were collected from 3 areas in Chittagong and 2 areas in Sylhet.

**Results:** Facilitators included:

- Use of a systematic process and steps.
- An implementation plan, jointly prepared by all partners under NTP leadership.

- Use of participatory approaches to introduce tools, protocols and ACSM materials.
- Operational guidelines that were detailed enough to enable local health officials to move forward, but with enough flexibility to permit modifications according to local context.
- A champion who helped to mobilise political support and stakeholders' engagement, and facilitated the implementation process.
- A strong policy environment and regular supervision and monitoring.

Barriers included:

- Limited capacity of local authorities for networking and coordination.
- Health worker shortages and inadequate infrastructure.
- Initial resistance by local authorities and private sector providers.
- Continued mistrust between local government officials and private sector partners.

**Conclusions:** Explicit plans to build on facilitating factors and minimise barriers may help development of other PPPs.

### PC-483-29 Understanding TB management behavior of private providers, towards their partnership with the NTP

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**Background:** Cough persisting for more than two weeks is a symptom of active TB. Little information is available on the management practices of pulmonary TB suspects by private health care providers (PHCP) catering to urban slum populations. The USAID funded, market-based partnerships for health (MBPH) project intends to understand PHCP behavior with the vision of enabling their inclusion in the National TB Control Program (NTP) in India.

**Methods:** The profile of PHCP catering to urban slum residents was collected by trained workers by December 2010 using a semi-structured interview schedule. Self-reported practices on management of TB were recorded.

**Results:** 1408 PHCP (888 in Uttar Pradesh and 520 in Karnataka) were interviewed, including 521 practitioners of modern medicine, 524 practitioners of Indian systems of medicine and homeopathy and 363 less-than-fully qualified providers. Knowledge on DOTS strategy was poor among all type of providers. X-rays and blood tests were the main investigations sought; less than 50% stated recommendation of sputum microscopy. Around 30% practitioners of modern medicine and 21% of the less-than-fully qualified providers referred TB patients for DOTS.

**Implications for TB control:** There is need to in-

crease the saliency of sputum microscopy for diagnosis of TB, without discouraging X-rays and blood tests, and for effective capacity building of PHCP on DOTS. The study highlights the necessity to involve all type of PHCP as partners in the national TB program. MBPH intends to facilitate behavioural change among PHCP to bridge gaps in the NTP.

**PC-633-29 Afghanistan NTP: strengthening and establishment of partnership with public private health providers**

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**Aim:** To assess the achievements of NTP and its partners on strengthening and establishment of partnership to improve TB program.

**Methods:** Review of minutes of TB task force, STP, TB IC, CB-DOTS group, ACSM working group, Urban DOTS task force meetings and interview with involved people.

**Results:** NTP and its partners established Partnership with Afghanistan Tuberculosis and Lung Doctors Society (ATLDS), Afghan Private Hospitals Association (APHA), Quality Control Task force and participated in 19 coordination meetings. Seven meetings were held with planning, design and construction department of MoPH. Thirteen Provincial TB IC Committees established in 13 provinces and nine coordination meeting was conducted. Twenty-three Coordination meeting were held at provincial level. Regular monthly health committee meeting conducted at the health facility level of 13 provinces. In addition, one national Stop TB Partnership and five sub nationals STP (Stop TB Partnership) and national ACSM Committee established. Quarterly Provincial, sub national and annual review meetings supported by NTP partners. NTP and TB CAP participated in seven PCH Meetings, 5 NGO partner meetings, 17 USAID partners Meeting and 11 HMIS Task Force Meetings.

**Conclusion:** The Afghanistan NTP and its partner's strengths and established partnership with public private health provider, health providers, civil society, donors, governmental and nongovernmental organizations to coordinate and support the TB Program in Afghanistan.

**PC-708-29 Can subsidised private TB care serve the poor? Evidence from Myanmar**

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**Aim:** To address the concern that privately-delivered care only benefits the wealthy. Sun Quality Health (SQH) is a franchise network of private doctors in Myanmar that has operated since 2001 with the support of Population Services International (PSI). Since 2004, SQH has provided TB care through this network. The members use DOTS protocols and medicines supplied by the Government of Myanmar, packaged and rebranded by PSI.

**Design:** This study tests the extent to which the private SQH network is pro-poor. Data for the study is drawn from the first ever nationally representative TB prevalence study and from exit surveys of TB patients treated in SQH provider clinics. Both surveys were conducted in 2010 and data cleaned in early 2011. We compare asset ownership in the two samples as a proxy for wealth. Simple descriptive analysis of both data-sets (generation of frequencies and percentages) has been conducted.

**Preliminary results:** SQH patients are better educated than the general population (4.5% illiterate vs. 10.9% nationally). Ownership of key assets common to both urban and rural Myanmar (bicycle, TV, motorcylce) show no significant difference between SQH patients and the overall population.

**Conclusion:** Despite being a private-provider network, early results indicate that SQH practitioners serve a cross section of patients that are equivalent to the general population in asset ownership. Further, more comprehensive, analysis of these datasets is continuing and will investigate whether SQH is providing equitable access to care across multiple SES variables, also comparing SQH TB patients and government TB patients.

**PC-800-29 Impact on TB care and control in India through civil society engagement in ACSM**

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**Background:** The project was implemented in 80 districts in India through first ever civil society engagement in TB care and control funded by USAID. The objective was to contribute to RNTCP's efforts in increasing case detection in India.

**Methods:** The evaluation of the project was conducted to evaluate efficiency, benefits, sustainability

and challenges of ACSM project in India and strengthen the quality of ongoing GF R9 TB project using Rapid Assessment Methodology. Three stages stratified random sampling, 8 randomly selected states and 16 randomly selected district. Field activities were related to semi-structured interviews (122 respondents) and focus group discussions (33 groups).

**Results:** Visible changes were evident in the community and also amongst the State and District TB Officers on the role of civil society. Treatment seeking behaviors of the community changed and 103 171 TB suspects were identified due to intensified ACSM activities. 67 328 (65%) reached Designated Microscopy Centre and subjected themselves for sputum analysis. Median CDR has increased from 61% to 65%. This was possible due to referrals from the rural health care providers, community leaders and cured TB patients.

**Recommendation:** Impact assessment (varying degrees of programming success across states) recommends the convergence of programme. Capacity building intervention of partners on interpersonal skills and technical component of TB. This would be taken in R9 TB Project.

**Lessons learned:** Shelf life of project is short and hence difficult to assess RNTCP outcome indicators.

**Challenges:** A recurring challenge that demands pertains to delivering messages clearly and in culturally appropriate ways to various target groups and key stakeholders on TB.

**Conclusion:** Project need to focus effectively on strengthening the capacity and performance of counterpart organizations, instead of giving priority to the achievement of short-term project and programme results.

### PC-803-29 Civil society TB partnership in India: how and why?

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The National Partnership for TB care and control in India evolved from a meeting involving 44 civil society organisations held in New Delhi in November 2008 with the agenda of working closely to support the government's efforts in controlling TB. The Partnership was instrumental in facilitating concerted efforts from various partners to finalize and submit the India Global Fund Round 9 TB proposal. Civil society partnership today promotes collaborative efforts in the field through various activities strengthening India's national programme. National and sub-national consultative meetings are being organised to ensure wide stakeholder participation involving the government, partners (for profit and non-profit), WHO and technical agencies to find solutions to

address TB, and synergise in identifying solutions. The working groups developed a white paper providing recommendations and solutions targeting 3 key focal areas—service delivery, ACSM and PPM, from the civil society perspective to contribute towards RNTCP Phase III planning. This process involved structured dialogue to obtain larger consensus from all partners and external stakeholders. Challenges faced during the formation and functioning of the Partnership included getting the different mind sets of a variety of partners and from diverse sectors to agree on a common/shared goal; defining roles and responsibilities of the partnership acceptable to all stakeholders; and defining a governance system maintaining equal representation. With the shift to universal access of TB care, the role of CSOs will become more critical in terms of consolidating and scaling up key community linkages with the essential services. Hence partnership forums are the way forward in achieving a unified response against tuberculosis.

### PC-826-29 Capturing the missing cases of TB: the magnitude of non-NTP care providers in the Philippines

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**Background:** The Philippine National Tuberculosis Program (NTP) has been implementing the public-private mix (PPM) DOTS strategy since 2004 primarily to engage the private physicians in DOTS implementation. PPM has contributed 6% to national case detection rate (CDR) in 2008. However, according to the 2007 National TB Prevalence Survey, only 27% of TB symptomatics who sought care consulted DOTS facilities. The rest who visited providers from private and public hospitals and other non-NTP care providers may not be receiving proper care and are most likely the unreported cases missing in the CDR of the NTP. From the initial engagement of private physicians, scaling up the scope of PPM should now involve all providers in the care and control of TB. Thus, identifying the magnitude of non-NTP care providers in the country is needed.

**Design/methods:** Surveys were conducted in 44 provinces in 2009 and in 2010. A self-administered questionnaire was developed to gather data on the non-NTP providers, where provincial NTP coordinators, municipal health officers and public health nurses served as data collectors. Identified non-NTP care providers, both from the public and private sectors, were enumerated.

**Results:** A total of 19 517 non-NTP care providers were identified in the 44 provinces which include private physicians (47%), public physicians (9%), school nurses (9%), company nurses (3%), traditional healers (26%) and other care providers (6%).



**Conclusion and recommendations:** Engaging all relevant health care providers in TB care and control through PPM approach is an essential component of the Philippine Plan of Action to Control Tuberculosis (PhilPACT). Opportunities for their participation in the NTP should be explored to capture the missing cases of TB. Their engagement in TB care and control requires interventions such as trainings and advocacy.

### PC-836-29 Public-private partnership in tuberculosis control in Bangladesh

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**Introduction:** Partnership between government and NGOs has proved as a driving force in tuberculosis control programme to achieve its highest success in Bangladesh. It is now providing a strong technical platform to generate political support to fight TB. NGOs came forward to support National Tuberculosis Control Programme (NTP) efforts to reduce TB burden in early 1990s. BRAC and other 43 NGOs are collaborating NTP in providing TB services.

**Objective:** Implement an unified effort to achieve universal DOTS coverage in Bangladesh.

**Strategy:** NTP adopted DOTS strategy in 1993 to keep pace with WHO's international effort to check tuberculosis. NGOs participated this national effort in 1994 in rural and in 2002 in urban areas following an MoU. The partnership between NTP and NGOs was further scaled-up with the sustained financial assistance from GFATM since 2004. This facilitates the expansion of TB diagnostic facilities and treatment services throughout the country.

**Results:** NTP now covers all administrative units in Bangladesh with the partnership of NGOs. In 2010, case detection rate was 78%. In 2009, treatment success rate was 93%. 1050 health facilities involved with DOTS in 2010. Between July 2009 and June 2010, total 580 health managers, medical doctors, health workers and 4131 Shasthya Shebikas were trained. During this period 22 794 people were reached through district level advocacy meetings and 7791 opinion leaders were reached to aware about DOTS services and strengthen it.

**Conclusion:** Resources mobilization, capacity building and human resources are crucial to maintain the achieved success in TB control programme in Bangladesh.

### PC-1050-29 Preparedness of DOTS centers in engaging all care providers in 44 provinces in the Philippines

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**Background:** The public-private mix (PPM) DOTS in the Philippines is embarking on expanding the scope of TB control initiative by engaging all care providers outside the purview of the National TB Program (NTP). Engaging the non-NTP providers in standard TB care and control requires that the enabling factors within the NTP are in place. PPM can be successfully carried out if trained human resources are sufficient and functional equipment are available to deal with the additional case load from referrals. These should also be supported by an existing system of laboratory quality assurance and mechanism of diagnosing smear-negative cases. Assessing the DOTS centers' preparedness before engaging the non-NTP care providers is needed.

**Design/methods:** DOTS facilities in 44 provinces were surveyed in 2009 and in 2010 using a self-administered questionnaire. Data on trained staff, availability of functional microscope, access to provincial TB diagnostic committee (TBDC) and status of the provincial laboratory external quality assurance (EQA) were gathered. Percentages were determined for each province and the mean percentages for the 44 provinces were computed.

**Results:** Among the 44 provinces, the average percent of DOTS centers with trained physicians is 78%; with trained nurses, 85%; with trained medical technologists, 88%; with functional microscope, 86%; with access to provincial TBDC, 71%; and with access to provincial laboratory EQA, 76%.

**Conclusion and recommendations:** There is variability in the current preparedness of DOTS centers to implement PPM in the provinces. Efforts should be directed in strengthening DOTS preparedness through staff training, technical assistance and resource mobilization. Advocacy to the local government for support is recommended.

### PC-1080-29 Cross referral between National TB Programme and non-state health service providers in Nepal

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**Setting:** Pokhara Municipality/Nepal. The National TB Programme started to engage all public, voluntary, corporate and private providers and implemented PPM approach in urban setting.

**Objectives:** To establish cross referral mechanism between National TB Programme and non-NTP

providers for effective implementation of public private mix (PPM).

**Methods:** In close coordination with municipality and district public health office, formation of PPM working group, series of meetings and sensitization/re-activation of PPM members, mobilization and training of NTP and non-NTP providers during implementation were done. Record analysis and in-depth interviews the methods for monitoring and assessment.

**Findings:** Case finding rate was increased by 10 percent from 73 percent and cure rate increased by 4 percent from 83 percent than before. Out of 116 referred cases to TB service centres, 30 cases (nearly 26%) were referred by private sectors.

**Conclusion:** PPM is a feasible way to improve TB case detection, treatment success thus contribute to national TB targets. This study also contributed to policy makers to scale up the program to other urban areas in the country along with exploration, orientation/training and streamlining private institution under the NTP umbrella.

Acknowledgements: NTP; Non-state health service providers; people with TB; GFATM for funding

#### PC-1093-29 Study on public private partnership in RNTCP-DOTS in Delhi: a 5 year follow-up

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**Objective:** A) To study improvement in private sector involvement in various services provided under RNTCP in Delhi. B) To identify the constraints and difficulties encountered by private providers.

**Setting:** Delhi Study design: descriptive study.

**Study duration:** January-February 2011.

**Background:** India is one of the 20 high burden country in the world where 40% of population is infected with TB. RNTCP DOTS was started in 1997 and produced encouraging results with cure rate of more than 85%.

**Major study findings:** There are 24 chest clinics in Delhi and about 600 DOTS centers and 200 microscopy centers for population of about 15 million. There are 365 private providers of which 95 (25%) are NGOs and 270 (75%) are private providers. The total case contribution of NGOs and PPs is about 15%. In last 5 years NGOs involved have increased from 42 to 95 that is increase of (122% approximate). Private providers have increased from 174 to 270. 8 microscopy centers, 65 DOTS centers are exclusively run by private partners and others are providing referral services along with health education. No. of patients put on treatment have increased from 45 647 in 2005 to 50 476 in 2010. The success rate have remained almost at 86-87%. Death rate have

Indicator	2005	2010
No. of patients put on treatment	45 647	50 476
Death rate, %	2.3	3
Failure rate, %	4.5	4
Defaulter rate, %	5.3	4.3
NGOs involved	42	95
PPs involved	174	270
Contribution of cases, %	Not known	15
Treatment units run by NGOs	1	2

increased from 2.3% to 3%, but failure rate have decreased from 4.5% to 4% and defaulter rate from 5.3% to 4.3%. The incentive provided to private providers is Rs. 250 (about US\$5). Most providers are getting anti-TB drugs, IEC material and stationery and training from public sector. There is no apprehension among private providers and about 90% of PPs are satisfied with the attitude of government staff. The PPs expect more financial support increase in facilities and better support from public sector.

**Policy implications:** Increase support to private providers is needed further to decrease the default rate. Induction training of PPs; reorientation sessions, counseling sessions, regular supportive supervisions are needed.

#### PC-1296-29 Microfinance as socioeconomic support for patients and families affected by MDR-TB and HIV

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**Background and challenges to implementation:** In Peru, as in many parts of the world, tuberculosis, multidrug-resistant tuberculosis (MDR-TB), and HIV are diseases that disproportionately affect the poor. Incidence of TB in low income persons per 10 000 is 147 higher than low-medium income persons. The side effects of TB treatment render most patients unable to work, and thus out of work when they finish treatment. People in this disease-poverty cycle in Lima, Peru, are the focus of our program. Since 2007, we have given interest-free loans to 193 different patients, ex-patients, and patients' family members to start small businesses and thus evade conditions of extreme poverty.

**Intervention and response:** All beneficiaries are identified as candidates by socioeconomic support field workers. We select cases based on program budget and patient details. All participants are provided three group trainings to learn about businesses and one-on-one meetings to develop a business plan. The loans, which are on average \$530 over 12 months, are spent with the accompaniment of field workers. These same field workers continue to make personal visits to participants at least once a month to monitor and support the participants.

**Results and lessons learned:** To date, the program's beneficiaries' household incomes increased from their

baseline levels by an average of \$162 with a median of \$75. To put these amounts in perspective, the average and median family expenditures in the baseline data are \$188 and \$175 respectively. This significant increase in monthly income helps keep participant's households economically stable, well-nourished, and healthy.

**Conclusions and recommendations:** We have found our program to be an effective socioeconomic intervention to help patients out of the poverty-disease cycle. As opposed to socioeconomic programs that are finite, such as nutritional support programs, the benefits of a steady income support patients' families over a long period of time.

## TUBERCULOSIS IN HIGH-BURDEN COUNTRIES III

### PC-115-29 Tuberculosis in penitentiary facilities of Russia

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Socially significant infectious diseases, including tuberculosis (TB), have always been a relevant issue in penitentiary facilities of Russia. For the last ten years, the efforts jointly made by penitentiary medicine, international non-governmental organizations, reforming of the correctional system allowed for improving TB epidemiological rates. The number of active TB patients has declined two times. TB incidence rate has decreased from 2783 in 2001 to 1302 in 2010, TB mortality—from 135 to 92 per 100 000 inmates. However, multidrug-resistant tuberculosis (MDR-TB) has become a priority issue. A portion of drug resistant TB patients among all active TB patients is about 30%, of them MDR-TB is more than 17%. Taking into account the current situation and high concentration of drug resistant TB patients it is required to provide timely and rapid detection of bacillary patients and conduct drug susceptibility testing to first and second line TB drugs. Nowadays, 90 bacteriological laboratories operate in Russia where TB is diagnosed. In 2010, 98% of TB patients were covered by bacteriological examination. Properly organized bacteriological service allowed for timely adjustment of chemotherapy in drug resistant TB patients and providing treatment with second line TB drugs. Now hospital TB mortality rate in penitentiary health care facilities is about 2%. Timely treatment start allows to not only prevent the spread of drug resistant tuberculosis among inmates, but to stabilize TB epidemiological situation among the population in Russia.

### PC-119-29 Identifying the magnitude of pulmonary TB among internally displaced populations in Afghanistan

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**Background:** Internal displaced persons (IDPs) are one of vulnerable groups for tuberculosis (TB). There is no such investigation to identify TB burden among them in Afghanistan and current national TB control program (NTP) recording and reporting surveillance system does not capture this information. This assessment was designed to identify the magnitude of TB among IDPs.

**Methodology:** A cross sectional study conducted in IDPs camps in three provinces (Nengarhar, Paktia and Khost) of Afghanistan. Study subjects were male and female with age > 15 years. Sample size ( $n = 1565$ ) was calculated considering CI = 95%, precision of 14% and proportion of NSS+ incidence of 0.076 (76/100 000) population. Structured questionnaire and TB recording forms for suspect registration, lab register and case detection used as data collection tool. Three sputum samples were collected from TB suspects, and AFB examination done by provincial TB laboratories.

**Results:** 1565 individuals participated to study, (441 (26.5%) female & 1445 (73%) male), 78 of them identified as TB-suspects (female 61 (78%) and male 17 (22%) the female/male ratio was 3.6 ( $\chi^2 = 1.015$ , Df = 1, OR = 10.5,  $P = 0.0001$ ). 4 persons diagnosed as pulmonary new sputum smear positive (NSS+) TB. The incidence for NSS+ was 256/100 000 ( $P = 0.026$ , 95% CI,  $\chi^2 = 6.192$ ).

**Conclusion:** This study confirmed higher incidence of TB among IDPs compared to general population (256/100 000 vs. 76/100 000), and also the high predominance of symptomatic TB among female then male.

### PC-127-29 Enhanced TB identification through one month follow-up of smear-negative TB suspects

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**Setting:** Bandim Health Project, Bissau, Guinea-Bissau. **Objective:** To conduct a TB screening among former TB suspects in whom TB had been ruled out at the initial consultation, hence assumed to be TB negative (aTBneg).

**Design:** A cohort follow-up study. aTBneg suspects were screened for symptoms from one month after the initial negative sputum smear examination.

Symptomatic individuals were referred to clinical re-examination and HIV testing.

**Results:** Among 428 TB suspects presenting during a 10 month period in 2007, 80% (343) were smear negative. Of these, 21 were subsequently diagnosed with smear negative TB. Among the remaining 322 aTBneg patients, 212 were followed up and symptoms examined one month or more after initial examination. Among patients with follow-up, 89 (42%) were still symptomatic and five of these were diagnosed with TB on the basis of repeated sputum smears and chest X-ray. Of the symptomatic patients 39% (17/44) were HIV infected. Thirteen (4.0%) of the 322 aTBneg suspects had died before follow-up.

**Conclusion:** A large proportion of aTBneg suspects remained symptomatic after one month. Several TB cases had initially not been diagnosed and HIV infection was highly prevalent. aTBneg suspects had high mortality and need increased attention from TB and HIV programs.

### PC-336-29 Seguimiento para recaídas y reinfecciones a casos pos-tratamiento de tuberculosis

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**Objetivo:** Establecer si los casos que fueron tratados contra tuberculosis en Amor-ProTB han presentado alguna recaída o reinfección entre seis meses y tres años después del término de tratamiento.

**Material y métodos:** Se estudiaron 40 casos residentes de cualquier Estado del país con 6 a 36 meses post-tratamiento recibido en Amor-ProTB en Juárez Chihuahua, que terminaron con cultivo negativo. El 90% había recibido tratamiento para tuberculosis susceptible, 2.5% para tuberculosis mono-resistente, 5% para tuberculosis poli-resistente y 2.5% para tuberculosis multifarmacoresistente. Al término del tratamiento 25% de los casos presentaba alguna enfermedad concomitante. La recolección de datos fue a través del expediente clínico, de la base de datos epidemiológica y de un cuestionario aplicado vía telefónica para conocer si fueron revisados médicamente entre 6 y 36 meses después de terminar su tratamiento para tuberculosis.

**Resultados:** Se aplico el cuestionario de manera directa a 45% de los casos; 40% a algún familiar directo y 15% no se localizo. 70% de los casos tuvo seguimiento médico pos-tratamiento y no presento recaídas ni reinfecciones por tuberculosis; 15% no tuvo ningún seguimiento médico pos tratamiento y niega sintomatología aunque carece de impresión médica diagnóstica y 15% no se localizo.

60% refirió continuar sin enfermedades concomi-

tantes, 25% mantiene las enfermedades que tenía al término de su tratamiento, 5% además, refiere cursar con algún tipo de cáncer y 15% se ignora. 95% obtuvo su residencia estadounidense, 5% aún están en proceso.

**Conclusiones y recomendaciones:** Es necesario dar un seguimiento médico a los casos para detectar recaídas o reinfecciones, ésto permite validar el tratamiento recibido; se requiere confirmar los datos domiciliarios periódicamente. Se recomienda la ampliación de este estudio de manera prospectiva de manera semestral con los casos tratados y egresados por al menos dos años consecutivos.

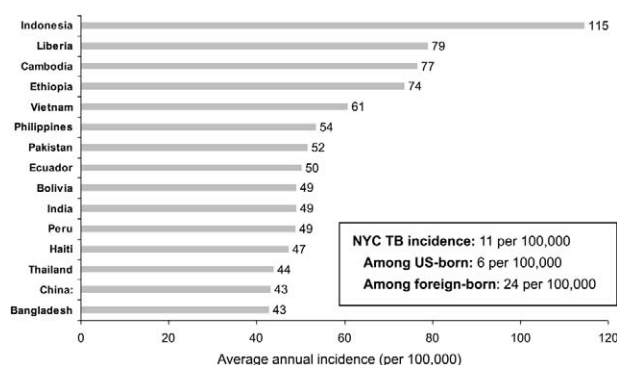
### PC-364-29 Differential incidence and patient characteristics of tuberculosis by country of birth in New York

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**Background:** The decline in TB rates in the United States (US) has taken place disproportionately among the US-born, resulting in a dramatic increase in the proportion of non-US born cases over the same time period. While numerous studies have presented differences in patient characteristics between US-born and non-US born TB patients, few have evaluated these differences by country of birth.

**Methods:** Retrospective population-based cohort analysis of incident TB cases diagnosed in NYC from 2001–2008. Socio-demographic and clinical characteristics were abstracted from NYC TB case registry. Average annual incidence rates were calculated by country of birth using population estimates from the US Census American Community Survey.

**Results:** The 8171 TB cases diagnosed during the study period hailed from 143 countries, with 20 countries of birth representing 80% of cases. Countries



**Figure** Countries of birth with highest New York City (NYC) tuberculosis (TB) incidence, 2001–2008.



with the highest NYC incidence rates (Indonesia, Liberia, Cambodia, Ethiopia) were not necessarily those with the largest populations in NYC (Dominican Republic, China, Jamaica, Guyana; Figure). Among 5688 non-US born cases, 82% were born in a high TB incidence country, 13% in a medium incidence country and 5% in a low incidence country. Patient characteristics differed dramatically by country. Non-US born patients overall had lower proportions of HIV infection, homelessness and substance use compared to US-born patients.

**Conclusion:** While non-US-born TB patients in NYC share certain characteristics, our data show that they are largely a heterogeneous group. With the proportion of non-US-born TB cases increasing nationwide, analysis of population-based data by country of birth can help focus interventions to reduce TB incidence.

### PC-365-29 Contribution of country of birth to the transmission of *Mycobacterium tuberculosis* in New York City

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**Background:** Despite declining tuberculosis (TB) incidence in the United States (US), the proportion of non-US born TB cases is increasing. Clustering of TB isolates is used as a proxy for recent transmission. Many studies show that clustering is more common in native populations; however, risk factors for clustering of non-US born TB cases are unknown.

**Methods:** We conducted a retrospective population-based cohort analysis of culture-positive TB cases with known genotype (RFLP and spoligotype) in New York City (NYC) from 2001–2008. Socio-demographic, clinical and genotyping characteristics were abstracted from NYC TB program databases. Factors associated with having a clustered genotype were analyzed using log binomial regression with generalized estimating equations to estimate adjusted relative risk and 95% confidence intervals.

**Results:** There were 5840 culture-positive TB cases with known genotype diagnosed in NYC from 2001–2008; 4071 were non-US born, of whom 34% were clustered. Proportion of isolates clustered varied by country of birth from 12% among Bangladesh-born cases to 68% among Guyana-born cases. Characteristics independently associated with increased risk of clustering among non-US born cases were younger age, male sex, residence in a low income neighborhood and history of homelessness or drugs and alcohol use (Table). Cases that arrived in the US more recently had lower risk of clustering, as did cases from

**Table** Factors associated with clustering among culture-positive foreign-born TB cases ( $n = 4071$ )

Patient characteristic	Adjusted relative risk (95% CI)
Age	
<18 years	2.47 (1.68-3.62)
18-44 years	2.04 (1.66-2.50)
45-64 years	1.79 (1.45-2.20)
65+ years	1.0
Male sex	1.14 (1.03-1.25)
TB incidence in country of origin	
Low	1.0
Medium	0.83 (0.67-1.03)
High	0.67 (0.53-0.77)
Years in the US	
<2 years	0.87 (0.77-0.99)
2-5 years	0.83 (0.72-0.96)
>5 years	1.0
Neighborhood poverty level	
Low income	1.26 (1.10-1.44)
Medium income	1.11 (0.97-1.28)
High income	1.0
Homeless history	1.23 (1.02-1.48)
Substance use history	1.22 (1.01-1.47)
Employed or a student	1.08 (0.98-1.19)

a high TB incidence country compared to those from a low incidence country (Table).

**Conclusion:** Although recent transmission is more common in the US-born population, our data demonstrate that it is also occurring among the non-US born in NYC. Clustering varied widely by country of birth indicating a need to focus on individual countries to better understand transmission dynamics in non-US born populations.

### PC-382-29 Pulmonary tuberculosis epidemiology among legal immigrant population

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**Background:** Foreign-born persons make up the majority of tuberculosis (TB) cases in the United States.

**Objective:** To determine rates of TB among persons who are processed for immigration to United States.

**Methods:** A retrospective cross-sectional study from 2007–2010, of medical examinations among Mexican applicants applying for migration to the United States. All TB suspect cases based on chest X-ray findings, were screened with sputum smear, cultures and DNA probes.

**Results:** From 2007 through 2010, a total of 184 367 applicants were seen and 2115 (1.14%) of these were suspect TB cases. Of these, 86 cases were found to be cultures positive for *Mycobacterium tuberculosis* complex (a prevalence of 46.7 per 100 000), but only 14 were positive by sputum smears (16.2% or 7.5/100 000). 64.5% were male with mean age 61.2 years. 64 patients completed directly observed therapy in our treatment center DOTMANIA in

Juárez, Mexico. There was a 100% cure at the completion of therapy. Two patients (2.3%) had drug resistance to INH and RIF. Fourteen (16%) patients had type 2 diabetes mellitus and none had HIV infection. Using DNA probe as the gold standard, there was a 96% sensitivity and 93% specificity for the sputum cultures and 22% sensitivity for acid-fast bacilli smears.

Year	Applicants	Suspect for pulmonary TB	TB cases diagnosed by culture	Rate per 100 000
2007	36 588	362	16	43.7
2008	57 335	863	26	45.3
2009	45 674	426	21	45.9
2010	44 770	635	23	51.3
Total	184 367	2115	86	46.7

**Conclusion:** Compared with the 2008 World Health Organization reported TB prevalence of 9.1/100 000 (range 3.1–19/100 000), the TB rate among treated applicants for U.S. immigration is more than two times higher, but equal to the rate by using smear results alone. This difference is probably because in Mexico cultures have not been instituted as standard policy for diagnosis and treatment. With this current policy, three in four cases of TB are remaining undiagnosed and have the potential of transmitting TB in Mexico.

#### PC-406-29 The strategies to improve community participation in a TB disease prevalence survey: descriptive study

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Pakistan ranks 8th among high burden countries for TB and contributes highest to EMRO burden. The prevalence of TB in Pakistan is based upon WHO estimates. The last prevalence survey was done in 1987, it was decided by WHO task force to conduct a disease prevalence survey based on symptom screening and chest X-rays. The main objective is to estimate the prevalence of bacteriological confirmed pulmonary tuberculosis among the adult population ( $\geq 15$  years) 2010–11. The secondary objective is to estimate the prevalence of sputum smear positive pulmonary TB and culture positive pulmonary TB. The survey suspect definition is Having cough of more than two weeks, Individuals with any chest X-ray abnormality, Individuals having cough of any duration who did not have chest X-ray or chest X-ray results are not interpretable and Individuals who on TB treatment. The sample size of the survey is 133 000 adults, cluster size is 1400 adults. The first pilot of the project began in Aug 2009 in the UC Kalyam Awan of Punjab. The pilot had a low participation of 61% 1155/1400. The pilot had to be repeated in another cluster,

**Table** Comparison of key findings of two pilots disease prevalence survey, Pakistan, 2010

Participation percentage	Suspect percentage	Estimated prevalence ss+ve and culture positive/100 000
61	14.9	173
82	14.8	1041

specific strategies to improve participation were done such as improved communication skills, social mobilization event in the cluster, provision of basic medicines, engaging community leaders, religious leaders, school teachers. The participation increased to 81%. A descriptive study was done to compare the findings of first and second pilot. The finding of this study is useful for all the countries planning for the disease prevalence survey.

#### PC-534-29 Prevalence of tuberculosis in a penitentiary in southern Brazil

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**Background:** Tuberculosis (TB) in prisons is a huge public health issue. According to estimates its rates in these settings are many times higher than in general population. Penitenciária Estadual do Jacuí is located in Rio do Grande do Sul State and shelters approximately 1900 prisoners. The aim of this work is to carry out a survey to estimate the prevalence of TB, perform susceptibility testing and genotype isolates of *Mycobacterium tuberculosis* in order to understand the transmission of the bacilli among the inmates.

**Design/methods:** A screening questionnaire was applied to the inmates to identify respiratory symptomatic (RS). Those presenting cough for longer than two weeks were enrolled in the study, signed an informed consent and provided sputum samples for microscopic analysis, culture and susceptibility testing (ST). The isolates of *M. tuberculosis* were fingerprinted by spoligotyping.

**Results:** Among 1900 inmates, 20.6% RS were identified. Seventy-two (3.8%) patients were positive for TB, corresponding incidence of 3789 cases per 100 000 people. Paucibacillary samples accounted for 27.8% of all samples analyzed. ST was performed for 60 isolates and 15% presented resistance at least to one drug. Eight (89%) isolates were resistant to isoniazid (INH) either alone or combined to other drugs and two were multidrug-resistant (MDR). Genotyping using spoligotyping was applied to 63 isolates and 18 different shared international types (SIT) were identified. SITs most frequently found 729 (27%).

**Conclusion and recommendations:** Active search for

RS and culture of samples allowed an early diagnosis in 26.4% of the patients. ST identified of resistance 15% to any drug and MDR 3.4%. Spoligotyping analysis showed that transmission of resistant isolates among the inmates is not very likely because genotypes of resistant isolates were different from each other, except in two isolates presenting isolated resistance to INH and SIT 729.

### PC-587-29 Patients' characteristic and treatment outcomes of labor migrants and Israeli citizens in Tel Aviv

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**Introduction:** Most labor migrants (LM) in Israel originate in developing countries endemic for TB, and the majority live in Tel-Aviv upon arrival. LM are usually not medically insured but can use the free TB service, which is covered by the Ministry of Health. The purpose of this retrospective study is to compare treatment outcomes, patient and system delay of TB patients between LM and Israeli citizens.

**Methods:** A sample of all patients treated in the Tel-Aviv TB clinic between 1998 and 2008 was divided into LM and citizens and reviewed. Treatment outcome was defined as success if patients completed therapy or were cured.

**Results:** Of the 487 patients sampled, 222 (45.6%) were LM and 265 (54.4%) were Israeli citizens. Demographic: LM were younger than Israelis and male:female ratio was lower. A greater proportion of LM lost their jobs due to their illness, while greater proportion of Israelis used substances. Clinical: A greater proportion of extra-PTB was detected among LM than in Israelis. More LM had smear positive samples and had lung cavitations than Israelis, and their hospitalization periods were longer. No significant difference was found in HIV diagnosis or in MDR-TB between LM and Israelis. Treatment outcome: PTB Israelis achieved higher rate of success than LM (94% vs. 84%, respectively,  $P = 0.005$ ), while no difference was found in success rate in extra-PTB (84% vs. 82%, respectively,  $P = 0.8$ ). Patient delay was longer among LM ( $33 \pm 53$  days vs.  $17 \pm 45$ , respectively,  $P < 0.01$ ), while system delay was longer among Israelis ( $105 \pm 178$  days vs.  $49 \pm 77$ , respectively,  $P < 0.01$ ).

**Conclusion:** The long patient delay among LM was associated with the more severe findings found in chest radiography and the higher rate of smear positive cases. Inferior treatment outcome among LM may be related to deportation of LM prior to treat-

ment completion and to their difficulties in complying with the follow-up due to stressing financial difficulties and the need to hold their jobs.

### PC-622-29 Tuberculosis control: political commitment of the municipal management of health, São Paulo, Brazil

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**Aim:** To analyze the political commitment of the municipal management of health with measures to control tuberculosis (TB) in nine priority municipalities of São Paulo, Brazil, from the perspective of the coordinators of the disease control program (TCP).

**Methods:** A qualitative approach study which data were collected in 2005 through semi-structured interviews and analyzed through the technique of content analysis, thematic modality. The testimonials were encoded in the Thematic Unit 'Tuberculosis control in municipal health agenda: a policy priority?'

**Results:** Identified the lack of interest policies and strategies to control TB, the disagreement with the practice of directly observed treatment; the presence of other health priorities facing the care of acute conditions (emergency, and acute infectious diseases such as dengue fever) and focused on deployment and expansion of family health teams by city management without their concern with the guarantee of human resources sufficient and qualified for the management of TB. These factors hinder the recovery of TB on the health agenda and consequently influence the provision and maintenance of resources essential to control the disease.

**Conclusions:** The TCP trajectory reveals the poor integration into social and political spaces, giving poor visibility and relevance to the control of the disease at the municipal level. Management capacity tied to party political convenience, autonomy in decision making, health awareness about the TB epidemiological situation and the mechanism of transfer of health policy at the federal level to the city associated with the transfer of resources and financial incentives-shape as elements that affect the degree of commitment to a municipal health system with the implementation and sustainability of local strategies for effective disease control.

### PC-796-29 Survey on the use of serological tests for the diagnosis of tuberculosis in 22 high-burden countries

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**Background:** Amidst excitement about new diagnostic tests for TB is concern about abuse of inaccurate tests. The WHO has recently announced a policy against the use of serological (antibody-detection) tests. Our objective was to survey 22 high TB burden countries, determine whether serological tests are in use, gauge the volume, type of usage, and settings in which tests are used.

**Methods:** An online questionnaire was created to assess diagnostic practices related to TB. At least 2 TB experts in each country were invited to provide information regarding diagnostic practices in their countries.

**Results:** Respondents from 14 out of 22 countries (Afghanistan, Bangladesh, Brazil, Cambodia, China, India, Kenya, Myanmar, Nigeria, Pakistan, Russia, South Africa, Thailand and Viet Nam) acknowledged the use of serological tests for TB, chiefly in the private sector. Respondents from 11 countries affirmed that the results of serological tests were used to initiate TB treatment. A majority of the serological tests used were imported, possibly eased by weak regulatory agencies (as reported by 9 countries). Although volume of usage data was limited, India alone reported use of more than 1.5 million tests annually, at an expense exceeding US\$15 million and two other countries, China and Thailand, reported a volume of use of greater than 10 000 tests annually.

**Conclusion:** Suboptimal TB diagnostics are used in over half of all high TB burden countries. Widespread abuse of inappropriate tests can impede the use of good diagnostics, and this is a major challenge for implementation of new diagnostics that are now available and WHO-approved.

### PC-1057-29 Effectiveness of entry screening for tuberculosis among immigrants in the Netherlands, 2005–2009

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**Objective:** To determine time trends in the prevalence of tuberculosis and the yield of tuberculosis entry screening among immigrants from non-Western countries.

**Methods:** Data from the Monitoring Screening of Immigrants (MSI) system, a national database with results of TB entry and follow-up screening of documented immigrants, were used from cohorts entering

from 2005 to 2009. To identify passively detected patients the database is linked with the national tuberculosis register. All patients diagnosed within 5 months after entry screening are considered to be prevalent cases. The yield of screening is calculated as number of cases detected by screening divided by number of persons screened. Data were analyzed stratified according to estimated WHO-incidence in the country of origin in 2008 and defined as low: <100, middle: 100–200 and high incidence: >200 per 100 000 population.

**Results:** The average proportion of persons screened from low, middle and high incidence countries was 52%, 30% and 18% among immigrants ( $n = 112\,491$ ). The average yield of entry screening for TB was 39, 118, 168 per 100 000 among immigrants. The proportion of cases from low, middle and high incidence countries was 23%, 41% and 35%. The average yield of entry screening for TB of immigrants increased from 2005 to 2009. The yield of entry screening for TB among immigrants from low incidence areas was more or less stable over time. The trend in middle and high incidence countries seems to increase over time but differences are not significant due to small numbers of detected cases. Data on prevalence and percentage of cases detected by screening will be analyzed and presented in the final presentation.

**Conclusions:** The yield of screening for TB in migrant groups from low incidence areas is lower than the threshold for TB risk groups in the Netherlands of 50 per 100 000. The screening of immigrants from countries with an estimated incidence of <100/100 000 should be reconsidered.

### PC-1149-29 Measuring the annual risk of tuberculous infection in the 3rd Nationwide TB Prevalence Survey

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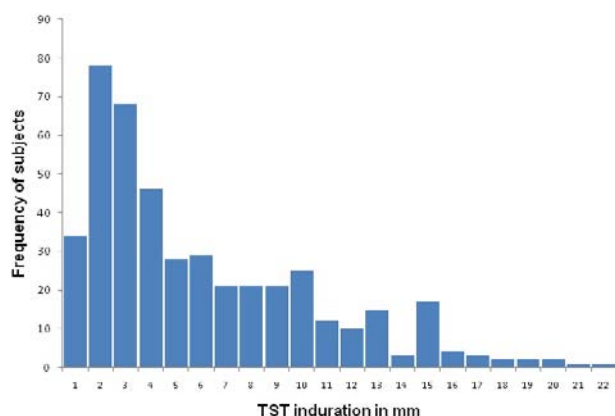
**Background and setting:** The annual risk of tuberculous infection (ARTI) is used to assess the extent of transmission of tuberculosis (TB) infection in a community. The determination of the ARTI has been incorporated in the nationwide TB prevalence survey (NTPS) in the Philippines since the first done in 1981–3.

**Objective:** To determine the ARTI in the 2007 NTPS and compare findings with the previous NTPS done in the country.

**Methodology:** Tuberculin skin test (TST) readers were trained by well-experienced readers to standardized results of the survey. The study population for the determination of ARTI comprised of 1091 bacillus Calmette-Guerin (BCG) unvaccinated children aged 5 to 9 years.

**Results:** The distribution of TST indurations showed





**Figure** Distribution of TST induration of children 5-9 years old without BCG.

no clear antimode to indicate a cut-off for defining TB infection (see Figure). Using the mirror-image technique, the prevalence of TB infection was 15.5%, resulting to an ARTI of 2.2% (95%CI: 1.9-2.6).

**Discussion:** A comparison of the ARTI in the past three NTPS done in the Philippines showed essentially similar rates. This result is in contrast to the findings based on the bacteriologically confirmed PTB in 2007 which showed a significant decline of 31% compared to 1997.

**Conclusion:** ARTI as an indirect measure of TB burden is not as compelling as the direct evidence provided by the prevalence of bacteriologically confirmed PTB in the survey.

## DOTS EXPANSION I

### PC-332-29 Impact of Urban DOTS implementation in Kabul City, 2008-2010

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**Aim:** Kabul City has five-million inhabitants and suffers from population density, overcrowding, poor sanitary facilities. In 2009, TB CAP Urban-DOTS approached closing gaps by engaging public-private-facilities in DOTS, training health-care providers, renovating facilities, improving coordination among stakeholders and supervision-monitoring. We assessed the impact of Urban DOTS implementation in Kabul City.

**Methods:** In January 2011, 2010 data from 53 health facilities' were reviewed and compared with 2008-2009 by NTP/TB CAP team using standard NTP recording-reporting tools. 123 supervisory visits conducted thus improving the TB reporting-recording system; motivating staff members; regulating TB drugs and lab reagent supplies; engaging hospitals in

TB control; and conducting Urban-DOTS task force meeting.

**Results:** In 2008, 78 public and private HFs existed in Kabul, only 20 implemented DOTS without a system for public health interventions. The technical-financial support with case-notification rate was 38%, conversion-rate was 53%, and cure-rate was 54%. In 2010, 53 (48%) public-private health facilities involved in TB-services covered 70% of Kabul population with access to free TB-services. 12 150 TB suspects identified; TB sputum smear-positive cases increased to 1045 compared with 797 in 2008 (31% increase); the conversion-rate reached 65.5% in 2010 (12.5% rise); and cure rate rose to 66% in 2009 (54%, 2008).

**Table** Urban DOTS health facilities performance, 2008-2010

	2008	2009	2010
HFs, <i>n</i>	78	111	111
HFs covered by DOTS, <i>n</i> (%)	20 (26)	22 (20)	53 (48)
TB suspects identified/ examined, <i>n</i>	1220	2856	12 150
New TB SS+ cases notified, <i>n</i>	797	843	1045
TB sputum smear conversion rate, %	53	43.40	65.50
New TB SS+ cure rate, %	54	66	N/A

**Conclusion:** Improving infrastructure, public-private partnerships, and training health-care-providers are beneficial in improving TB-services. Over a two-year-period, health-facilities covered by DOTS have increased, as has the number of identified TB suspects and TB sputum smear-positive cases notified. Thus, we would recommend the scale-up Urban-DOTS to other urban settings.

### PC-564-29 Problem solving for better TB programmes

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**Background:** Indonesia presently is the 5th country among the 22 high burden countries. It was 3rd in 2009. The number of TB cases in Indonesia is 5.8% of the total number of global cases. The annual number of cases is 528 063 with an annual mortality rate of 91 368. Indonesia has a national TB program coordinated by the Ministry of Health through the NTP. Many challenges are faced by the TB program and a need for effective and efficient approaches are needed.

**Response and counter action:** The problem solving approach to overcome TB program problems and improve service quality has proved to be successful. The PSB-TBP approach is to empower health service staff and communities, solve persistent problems with new

ideas and approaches, and sustain successful interventions. The PSB-TBP approach is evidence base.

PSB-TBP was implemented in 4 provinces in Indonesia to initiate community participation, improve services in health centers, hospitals, and district health offices. Interventions of PSB-TBP has 1) improved staff motivation through empowerment, 2) increased CDR, 3) decreased drop outs, 4) improved services in health centers, 5) improved laboratory services, 6) involved private practitioners in the program, 7) improved the information system, 8) DOTS in hospitals, 9) TB program promotion, etc.

**Conclusions:** Indonesia needs effective and efficient approaches to improve the TB program. PSB-TBP is one of these approaches. The challenge is to sustain the success stories achieved. Increased motivation and commitments of the health staff are needed for program sustainability.

### PC-576-29 Strengthening surveillance through quarterly meetings at various levels: a successful experience

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**Setting:** Pakistan is located in South Asia and ranks 6th among high burden TB Countries. Around 420 000 new TB cases occur each year. In order to facilitate the receipt of timely and validated DOTS DATA from the periphery up to the central level, NTP holds quarterly surveillance meetings at district, province and national level.

**Intra-district meetings:** Intra district meeting is arranged at district level within 20 days of the end of each quarter and BMU staff (doctor, paramedic and laboratory technician) attends this meeting. Along with the quarterly reports (TB 07, TB 08, TB 09), they bring the TB register (TB03) and laboratory register (TB 04) for data validation and compilation. The BMU data is validated, collected, compiled and analyzed at district level and reports are generated with the technical assistance of National Program Officers. Private sector data is also incorporated in public sector data here.

**Inter-district meetings:** The inter-district meetings held at provincial level within 30 days of the end of each quarter and are meant to consolidate provincial data and evaluate the performance of the district.

**Inter-provincial meeting:** The inter-provincial meeting held at Central level 45 days of the end of each quarter and is designed primarily to compile and analyze national data and evaluate the overall performance of the program. All provincial program, NTP staff and representative of partners attend this meeting.

**Discussion:** These quarterly meeting are being conducted since 2003 and never missed at any level, although delayed some time due to unforeseen incidents.

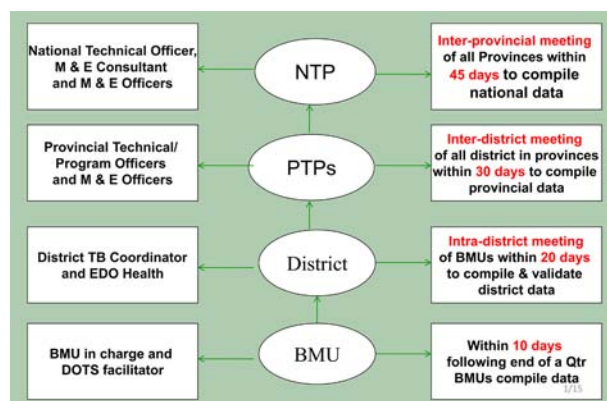


Figure M & E and surveillance.

The meeting contributed significantly in timely validated data collection, compilation and analysis, particularly at the district levels. Afghanistan recently adopted this model and the results are good so far. The model of these meetings may be tested in other high burden TB countries.

### PC-679-29 Evaluation of a DOTS programme in a Himalayan District in Nepal

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**Background:** The NTP introduced the DOTS strategy in 1996 and since then the number of deaths from tuberculosis has been reduced, but still 5000 to 7000 people die due to tuberculosis in Nepal every year. Jumla is one of the hard-to-reach Himalayan districts in western Nepal. It covers 2531 sq. kilo meters area and is situated 7000 feet above sea level. Total estimated population of the district is 100 000 in 2010 and there is a seasonal motor road for about 6 months of the year. Many people migrate to Terai (flat land) of the country and India for work during winter.

**Objectives:** To assess the performance of the DOTS programme in Jumla, Nepal.

**Methods:** A combined approach, using both quantitative and qualitative data analysis was applied.

**Results:** Despite poor infrastructure, long distance to health facilities, poverty and other constraints, TB case finding in the DOTS centre at district health office (DHO) in Jumla was over 70% (26 sputum smear positive cases) and treatment outcomes of new sputum smear positive patients showed 91% success in 2009/10. DHO staffs are committed to the DOTS programme. The laboratory is functioning very well. All TB medicines are stored properly. There are some problems in recording and reporting, as in some patient's cards the address, type of TB, follow up of sputum smear were not recorded properly. Most of the patients were on daily DOTS, but some patients who

live far from any DOTS centre take medicines for a week at a time and family members supervise their treatment.

**Conclusion:** DOTS programme is running well in a Himalaya district Jumla in Nepal.

### PC-821-29 Scaling of community-based DOTS services in Bangladesh: BRAC experience

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**Introduction:** Female community health volunteers known as 'Shasthya Shebika' plays an important role in BRAC TB control program to empower people at community. This model was gradually expanded with the support of national TB control programme to two-thirds of Bangladesh.

**Objective:** Scale-up and strengthen community based DOTS activities throughout the country to enhance TB case detection and treatment success.

**Methods:** BRAC designed an essential health care package including TB services for its beneficiaries in mid 1970s. Shebikas are selected from BRAC's village microcredit program following certain criteria. They received 3 weeks basic training before starting work and one-day refresher training every month. Each Shebika provides essential health care services to an average of 250 households. During household visit they educate community, identify of TB symptomatic and refer them for tests, help in organizing sputum collection and smearing centers in remote areas, provide DOT, continuous follow-up and refer complicated patients.

**Results:** Currently about 85 000 Shebikas are working throughout the country. Number of Shebika increased rapidly when BRAC's community based TB control model was expanded with the support of NTP and GFATM in mid 1990s. In 2010, a total of 95 124 patients were diagnosed, among them 45 441 (48%) were referred by Shebika. Case detection rate was 78% in 2010 and treatment success rate was 93% in 2009 among NSP patients.

**Conclusion:** Shebikas are effectively reaching out the community to identify TB case and treating them successfully with supervision. Community based approach showed better treatment adherence and enhance TB case detection and outcome.

### PC-822-29 Cost of accessing TB treatment in a cosmopolitan city: experiences of TB patients in Abuja Hospital

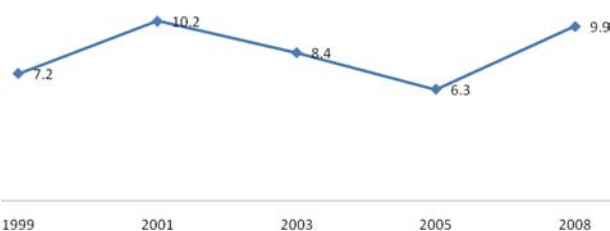
A F Omoniyi,<sup>1</sup> M Kabir,<sup>2</sup> A O Awe,<sup>1</sup> T O Odusote,<sup>1,3</sup> E van der Grinten,<sup>4</sup> E Ubochioma,<sup>2</sup> S Abdurrahman,<sup>5</sup> E Oyama.<sup>1</sup> <sup>1</sup>World Health Organization, Abuja, FCT, <sup>2</sup>National TBL Control Programme, Abuja, FCT, <sup>3</sup>USAID, Abuja, FCT, <sup>4</sup>TB CARE, Abuja, FCT, <sup>5</sup>FCT TBL Control Programme, Abuja, FCT, Nigeria. e-mail: omoniyifadare@yahoo.com

**Background:** TB is a major public health problem in Nigeria compounded by high HIV prevalence. DOTS implementation started in Abuja in 2003 in selected facilities. Diagnosis of TB by smear microscopy and anti-TB drugs are provided free of charge. The objective of this study is to determine the cost incurred by smear-positive TB patients accessing TB treatment in Asokoro District Hospital, Abuja and the effect on treatment outcomes.

**Methods:** The new smear positive TB patients registered in 2009 were selected for this study, in-depth interview were conducted, detail addresses of the patients were imputed into the NTP formats. Patients living far away from the clinic received their drugs weekly and monthly during the intensive and continuation phase respectively. Average number of visits and cost of transportation were calculated for each patient. The patient's treatment outcomes were also evaluated.

**Results:** 32 new-smear positive patients were registered in 2009, 5 of these lives close to the clinic. The average cost spent by the patient on transportation during the course of treatment is N11, 118; 00 (\$72). 66% of the patients completed treatment; 22% defaulted; 9% were transferred out and 3% failed.

**Conclusion/recommendations:** Additional cost are incurred by patients in accessing TB treatment, this cost is high in cosmopolitan setting which often lead to high defaulter rate and poor treatment outcomes. NTP in resource limited settings should introduce the concept of patient centered DOT to reduce the number of visits to hospital and cost to patients. Faster diagnostic tools should be introduced to reduce this cost.



**Figure** Trend of HIV Prev(%) in FCT, 1999–2008.

### PC-856-29 Partnerships in PMDT: lesson learnt from Indonesia

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**Background:** Many health services involved in TB control program in Indonesia belong or under jurisdiction to other institution within/outside MoH. Without strong collaboration and partnerships, implemented PMDT were impossible because of its complexity and multi dimensional problems.

**Methods:** NTP Indonesia working with partners: KNCV, WHO, GF, USAID, professional organization, health institution, laboratory, local government. NTP as regulator and coordinator. WHO/KNCV provide technical assistance. USAID/KNCV/GF support in funding. Professional organization: IMA/Pulmonologist support clinical aspect. Health services and facilities provide resources to establish services. All process need collaboration and harmonization through a National PMDT working group.

**Results:** In public health aspect, limited access and almost 15% of confirmed cases refused treatment. Many patients faced psychological and socio-economic problems during treatment (family and community, loss income and financial problem). Side effect management and co morbid disease were major challenges in clinical aspect, 75% of default cases caused by side effect problems. Limited access and laboratory delays were problem in diagnostic procedures; NTP and partners develop partnership and support mechanism. To give access for MDR-TB cases from remote area, local government NTP has developed mechanism for expansion and planned to develop dormitory system. To solve FHI support to solve Psychosocial problem trough develop methods in counselling and social support based on their experience. Schemes for patient support (income generation) were developed using funds from local government and donor agency. Professional organization and partners assist NTP to develop guidance in side effect management and support.

**Table** Members of National MDR TB Working Group

Unit	Agency	Position
Managerial and technical unit	NTP partners and experts	KNCV
		Technical officer PMDT
		Technical officer logistic
		Technical officer laboratory
Secretariat	MoH	WHO
		Medical Officer (TB)
		National Consultant (Drug-Resistant TB)
		Professional Organizations: PDPI, FARKLIN, PAMKI
		FHI
		DG of Medical Services NTP

**Conclusion:** PMDT has many challenges and involved various aspects. Coordination, communication and harmonization were critical point should address by NTP since beginning.

### PC-1175-29 Effectiveness of data quality audits in recording and reporting of TB-HIV collaboration

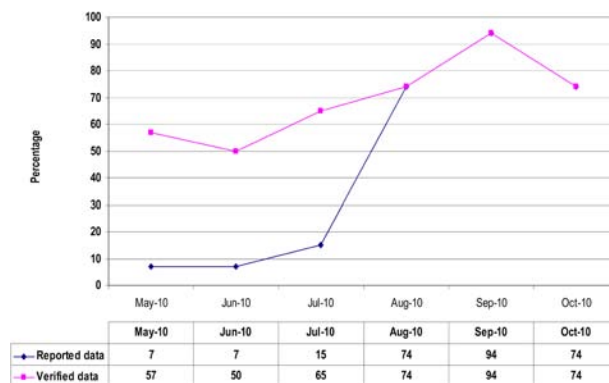
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**Background:** The burden of tuberculosis (TB) and HIV in South Africa remains high, especially in Nelson Mandela Bay Metro district where HIV prevalence in pregnant women was 30.7% in 2009. Wide variations in the quality of data on Cotrimoxazole Preventive Therapy (CPT) uptake in coinfecting patients were noted in 2 facilities supported by the United States Agency for International Development (USAID) TB project in the district for the period of October 2009 to August 2010.

**Intervention:** The two facilities were visited for data quality audit for the period of October 2009 to August 2010. The following steps were taken:

- 1 The source registers (HCT, TB, IPT, CPT and case identification registers) for the month October 2010 were reviewed for validity, reliability and completeness.
- 2 A template that compares the submitted data with the audit figure was used to collect data from source registers that were used by the USAID TB Program coordinator.
- 3 Face to face interviews with the administrators of the registers were conducted by the team.
- 4 All the discrepancies in data were noted and investigated.
- 5 The audit team gave feedback to the implementers of the TB and HIV programs, clinic management and project coordinator.

**Results:** After on site mentoring on TBHIV indicators the uptake of CPT in the 2 facilities went up from 28%



**Figure** CPT uptake in NMBM. Data quality audit results, before and after picture (May 2009–October 2010).



before the data quality audit to 54% for the audit period from October 2009 to August 2010.

**Conclusion:** Data quality audits are an indispensable tool in management of TB HIV services.

Data quality visits and on the job training can be used to identify challenges in reporting and recording, ultimately improving the quality of TBHIV data that informs decision making.

### PC-1202-29 Using NGOs to implement community-based TB care in Namibia

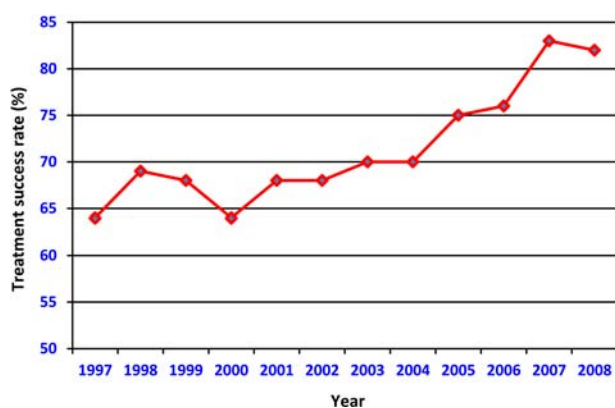
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**Background:** Namibia has a low population density of 2.5/km<sup>2</sup>. The country notified 13 332 TB cases in 2009, (CNR 634/100 000). Provision of health care is complicated by the long distances, contributing to a low treatment success rate (TSR) of 70% for the 2003 cohort (cure rate 54%). The combined default and transfer-out (D&T/O) rate was 21%.

**Intervention:** Since 1999, the country started implementing community TB care (CBTBC) using a non-governmental organisation (NGO) in Omaheke region. This model increased the TSR in this region from less than 30% prior to 1999 (with a default rate of >50%) to 91% (and a D&T/O rate of 2%) in the 2003 cohort. This model was then replicated in other regions starting in 2002. Implementation approaches varied from using mobile lay 'field promoters' to provide DOT, patient support and patient retrieval in sparsely populated rural areas to establishing community DOT points in the more densely populated urban areas. Funding from the Global Fund, USAID, CIDA, The Union, and the Italian government supported these interventions. The average cost of providing CB-DOT per patient is USD\$220. Currently 7 NGOs are assisting with CTBC in the country.

**Results:** The number of districts implementing CBTBC increased from 1 in 1999 to 27 in 2010. National TSR increased from 69% for the 2003 cohort to 82%



**Figure** Trend in treatment success rate for new smear positive cases, Namibia 1997–2008.

in the 2008 cohort (see Figure). This was accompanied by a decrease in the combined default and transfer-out rate from 21% to 9% during the same period. While the treatment success rate has increased; there are still significant fluctuations in the proportion of patients with a cured outcome; suggesting the need to strengthen patient follow-up and data management.

**Conclusions:** NGOs using lay persons can be successfully employed to provide CBTBC if adequate funding can be mobilised. These initiatives should however be coupled with community empowerment and social mobilisation to ensure sustainability and benefit to other disease areas.

### PC-1238-29 Improving tuberculosis notification and reporting in Kenya using personal digital assistants

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**Background:** Tuberculosis recording and reporting in Kenya is a through a manual process. Typically, the District Tuberculosis and Leprosy Coordinator (DTLC) abstracts the reported cases from the facility register into the district register. During reporting the DTLC manually tallies the data from all facilities on the parameters to be reported on. The process is long and could be associated with transcription errors and delays in reporting.

**Methods:** We developed a PDA based data collection system for notifying TB patients in Kenya with an automated reporting system. The cases reported from the facilities are recorded into the PDA system and uploaded into the TB Information System. Once the data is uploaded into the system, reports can be generated and used for decision making in a timely manner at all levels.

**Results:** The new TB information system has been introduced in 50% (6/12) TB control regions with remarkable success. Case based TB data is now available at all levels and in-depth analysis of the data is now possible, the reports are generated easily and tracking of indicators of interest has now been made easy and timely monitoring has been made possible.

**Discussion:** Reporting has been greatly improved since most of the indicators being monitored have been automated. The system can be improved by use of the GSM enabled PDAs that can use the available networks in Kenya to transmit the data directly to the national servers on real time basis and improve data access both at the province and national level.

### PC-1335-29 From DOTS to STOP TB strategy in Nigeria: contribution of WHO Nigeria

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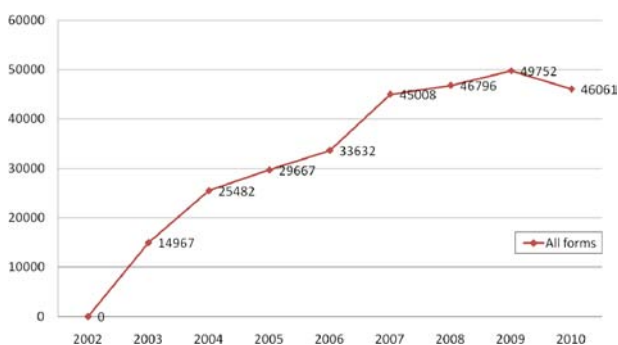
<sup>1</sup>World Health Organization, Abuja, FCT, <sup>2</sup>National TB Control Programme, Abuja, FCT, <sup>3</sup>USAID, Abuja, FCT, Nigeria. e-mail: omoniyifadare@yahoo.com

**Background:** WHO supported the NTBLCP through accelerated DOTS expansion in the 17 USAID supported states. The objective of the study is to assess the impact of WHO support to the NTBLCP from 2002 to 2009.

**Methodology:** The WHO system in Nigeria supported the NTBLCP in the implementation of the DOTS and STOP TB strategies. The support has been in the areas of (a) development of policy and strategic documents; (b) support for the Global fund application for Round 5 and 9 which is currently being implemented; (c) advocacy and resource mobilization for accelerated DOTS expansion through CIDA and USAID from 2003–2010; (d) coordination of TB activities by the establishment of the 6 zonal structures for direct technical and supervisory support to the states; (e) human resource development through development of training modules and capacities; (f) facilitating the procurement and port clearance of anti-TB drugs and consumables; (g) support the establishment of the Nigerian STOP TB partnership forum and (h) the establishment of a mechanism for programme monitoring and evaluation such as the annual joint international monitoring missions.

**Results:** In 2002 before the WHO/USAID intervention there were 10 DOTS facilities which has increased to 920 by 2009; AFB microscopy centers increased from 12 in 2002 to 385 in 2009. The total number of TB cases notified in the 17 states increased from 0 in 2002 to 49752 in 2009. The 17 states contributed about 55% of total cases notified in the country.

**Challenges:** This include frequent changes of programme managers (4 in 5 years), human resource issues at all level, challenged procurement supply and distribution system, coordination of multiple partners.



**Figure** Trend of TB case notification from 17 USAID supported states, 2002–2010.

**Conclusion/recommendation:** WHO/USAID Nigeria has supported the NTBLCP in the attainment of national and global target. In spite of the contextual challenges, the current partnership if sustained will ultimately lead to the attainment of national and global targets.

### THE USE OF RADIOLOGY, MICROSCOPY AND IGRA IN TUBERCULOSIS DETECTION

#### PC-32-29 Mobile chest X-ray screening for pulmonary TB in entrance examination for military service in Taiwan

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**Background:** This study aimed to evaluate the case finding rate of pulmonary tuberculosis (TB) in the entrance examination for military service persons in the National Health Insurance (NHI) era in Taiwan. NHI has launched in Taiwan since 1995. Due to convenience of hospital visit, the importance of active case finding for pulmonary TB in the NHI era seemed becoming less. However, the policy to do entrance examination for military service persons is still not changed now.

**Design/methods:** 4780 persons in the entrance examination for military service received chest X-ray examinations via mobile radiographic devices from January 1, 2009 to December 31, 2009. All received 14×14 inches traditional films or digital chest X-ray check. All films were reviewed by chest specialists and further check was advised if abnormal lung lesion was detected on the X-ray films. Identification card number was used to check the TB status in national TB registration computer database.

**Results:** Further evaluation was advised in 241 persons. In these 241 persons, 5 newly diagnosed pulmonary TB patients were eventually found and confirmed via this screening and further workup. In these 5 newly diagnosed TB patients, positive sputum TB culture was noted in 4 patients. The average case finding rate was 104.60 in 100 000. In the mean time period, the average TB incidence rate in age group 18–25 years old in Taiwan was less than 30.36 in 100 000. The TB incidence rate in Taiwan in 2009 was 57.8 in 100 000.

**Conclusion:** A high case finding rate for pulmonary TB was associated in the entrance examination for military service persons. The chest X-ray examination for these persons, who were from diverse backgrounds and communities and will be housed in close proximity for varying periods, was still valuable, even in the NHI era in Taiwan. Population-based chest radiographic screening with mobile devices on high-risk populations with close contact, remains necessary.

### PC-48-29 Improved case detection and cure rate in a slum area in Nairobi

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**Setting:** An informal settlement in Nairobi with an estimated population of 120 000 people served by one tuberculosis (TB) treatment facility without TB diagnostic services. TB suspects are referred to other facilities for sputum examination which may delay the diagnosis due to increased costs in hospital fee, time and transportation costs.

**Objective:** To determine whether setting up of sputum collection site at the point of care within the slum community leads to improved TB case detection and case holding.

**Methods:** Self referred patients attending Mukuru Ruben Medical Center beginning March 2008 with symptoms suggestive of Tuberculosis were requested to provide 3 sputum specimens (spot, morning, spot) that were then transported to the nearest AFB microscopy center for examination. Results were brought back within 36–48 hours and those found to be positive put on the 6-month treatment regimen for tuberculosis. Follow up sputum samples were also collected by the laboratory technologist and taken for examination. The case detection and cure rate for the first 6 months between 1st April to 31st September 2008 were compared with that of the same period in 2007 when tuberculosis suspects and follow up patients were being referred elsewhere for sputum microscopy services.

**Results:** During the period under review 63 new smear positive pulmonary tuberculosis patients were registered for treatment with a cure rate of 79% compared to 28 patients registered with a cure rate of 57% during the same period in 2007.

**Conclusion:** Setting up of sputum collection sites at the point of care for purposes of AFB microscopy increases case detection and cure rates thereby reducing TB transmission.

### PC-410-29 Cost-effectiveness analysis of mass radiography for tuberculosis detection in Taiwan

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While the utilisation and accessibility of health care services have greatly improved since National Health Insurance programme implemented in 1995, pulmonary tuberculosis (TB) remains prevalent in Taiwan. Hualien County is the highest TB incidence county

around Taiwan, which contains 109 persons per 100 000 population in 2009. Mass radiography expected to actively detect TB patients in Hualien County, which focused on those who older than 12 year-old residents with high risk to develop TB such as TB contacts, residents living at high incidence townships or villages, defaulters, never to receive a chest X-ray examination. The aim of the study was to evaluate the cost effectiveness analysis of mass radiography for TB detection. A retrospective observation study and a decision making model with one way sensitivity analysis were conducted from a societal perspective. 142 community sites for mass radiography took place and 20 659 persons received chest X-ray examinations. Fifty four TB cases, 33 male and 21 female, were confirmed after sputum examinations. Among them, 43 were new cases and 11 were relapse cases. TB detection rate was 261 persons per 100 000 population higher than incident rate 109 persons per 100 000 population in 2009. However, TB detection rate was variable from 0 to 569 persons per 100 000 population among different townships. The cost contained operating cost, TB diagnosis and treatment expenses, transmission cost for delay TB diagnosis, and cost of TB diagnosed and treated at health-care institution without mass radiography (9.1USD, 1135.7USD, 535.3USD, and 1617.7USD). The effect defined as 1 while TB was diagnosed and treated. A decision making model with one way sensitivity analysis implied that mass radiography programme displayed cost effective while TB detection rate above 435 persons per 100 000 population. Mass radiography programme on residents with high risk to develop TB seemed cost effective at high TB incidence townships.

### PC-570-29 Second nationwide external quality assessment of chest radiography at a district hospital, Cambodia

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**Background:** Radiological chest exam has been re-valued recently in diagnosis for smear negative pulmonary TB, but the quality of its image is questioned in developing countries. We assessed the quality of chest radiography at district hospitals in the whole country to strengthen its quality assurance in Cambodia.

**Methods:** We conducted external quality assessment (EQA) of a set of three films collected from each public hospital in 2010 by using 'Handbook for district hospitals in resource constrained settings on quality assurance of chest radiography' developed by the TBCTA. The assessment was made by an experienced radiologist.



**Results:** A total of 168 films from 58 public hospitals rated: Excellent in 8 (5%) films, Good in 60 (36%), Fair in 63 (38%), and Poor in 37 (22%) in overall assessment. Twelve (21%) out of 58 hospitals got Excellent or Good in overall assessment of all the three films submitted. Regarding the 6 factors of the Handbook (ID marking, Positioning, Density, Contrast, Sharpness and Artifacts), 94 (56%) films rated Good in ID marking and 109 (65%) in Artifact, while the majority (70–94%) of them rated Fair or Poor in Positioning, Density, Contrast and Sharpness. We compared the overall results in 2010 with those in 2004 of a total of 174 films collected from 58 hospitals. The percentage (40%) of the films rating Excellent or Good in 2010 was significantly increased compared with that (17%) in 2004 ( $P < 0.01$ ), and the percentage (21%) of the hospitals of which all of the three films rated Excellent or Good was significantly increased compared with that (7%) in 2004 ( $P < 0.05$ ).

**Conclusion:** The 2nd nationwide EQA results showed a considerable improvement in the quality of chest radiography, probably due to training of technicians, strengthening of supervision to hospital and replacement of equipment. For further improvement, quality assurance system of chest radiography needs to be introduced by well-organized efforts.

#### PC-1066-29 Contribution to national case detection by designated microscopy centres in a faith-based organization

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**Introduction:** The Revised National TB Control Programme (RNTCP) in India had sought the involvement of the private sector by officially involving the faith based organization CBCI Coalition for AIDS and Related Diseases (CBCI CARD) from April 2008. With Global Fund aid, it was envisaged that the mostly rural based Catholic Health Facilities (CHFs) would practice the principles of RNTCP wholeheartedly.

**Objective:** To quantify the contribution of Designated Microscopy Centres (DMCs) in CHFs identified and accepted into the programme through an MoU between the district authorities and the CHFs subsequent to quality assurance protocol.

**Methodology:** Each DMC reports an Annexure 'M', which is a consolidation of activities by month. The numbers obtained for the period April 2008 to September 2010 depict the contribution made by these CHFs to the state and the national level programme.

**Results:** The number of sputum positive cases diagnosed and compared with state and national data, shows a significant contribution by the CHFs in case detection. For the identified period there has been an increasing trend in case detection as newer DMCs are added to the count. Many CHFs were participating

as DMCs prior to 2008 ensuring standards of the highest quality. Data sourced from the records of 41 DMCs in 9 states shows more than 60 300 TB suspects examined for sputum microscopy of which 6784 were found to be positive. This data is equivalent to the output from government run gold standard DMCs established almost a decade earlier.

**Conclusion:** The need to involve the private sector, especially the faith based sector, vindicates the stand of the government to reach out to the masses that normally seek healthcare at such well established and reputed facilities. Their commitment and zeal are second to none.

#### PC-1259-29 Interferon-gamma release assays piloted as a TB screening tool in federal Canadian inmates

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**Background:** The prevalence of latent tuberculosis (TB) infection is disproportionately high in prison populations compared to the general public. In 1997, Correctional Services Canada established a Tuberculosis Tracking System (CSC TBTS) to offer comprehensive screening and monitoring services to control TB in the federal prison system. Screening has relied on the tuberculin skin test (TST), which is limited in part by false positive results. IGRA tests are more specific than TST and may increase the efficiency of comprehensive TB screening programs.

**Intervention/response:** To ascertain whether this new tool could effectively be incorporated into the CSC TBTS screening process, 92 inmates with a positive ( $\geq 10$  mm induration) TST agreed to submit blood for testing with the Quantiferon®-TB Gold (QFT-G) IGRA assay from April to October 2010. In addition, sputum cultures and chest X-rays were done to rule out active TB.

**Results:** 92 inmates had a history of being TST positive, of which 26 (28.3%) were QFT-G positive (concordant with their TST results). Outside of having a history of incarceration, most appeared to be low risk reactors. Active TB was excluded in all. Region of birth and BCG vaccination did not appear to affect the chance of having a positive IGRA. For Canadian born inmates (7/26, 26.9%) were positive by IGRA compared to (18/65, 27.7%) among foreign born inmates. History of BCG vaccine did not appear to influence rate of concordance. At the time of testing, no patients were known to be HIV positive. Treatment for latent TB infection for LTBI infection was offered



to the 26 who were positive by IGRA, with preliminary data suggesting good uptake of this treatment recommendation.

**Conclusion:** Our results indicate that IGRA testing could be integrated effectively into TB screening programs in prison, and may reduce unnecessary treatment for presumed latent TB infection.

## RAPID METHODS OF TUBERCULOSIS DIAGNOSIS II

### PC-246-29 Actual technologies in etiologic diagnostics of tuberculous spondylitis

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**Materials and methods:** 86 patients with diagnosis of tuberculous spondylitis (TS) being verified by means of histopathological examination of the surgical material (SM). In 95% cases TS complicated by paravertebral abscesses. SM: pus, granulation tissue were simultaneously examined with the help of molecular genetic RT-PCR, TB-BIOCHIP (TBCh) and inoculation on Löwenstein-Jensen's medium (LJ) for *Mycobacterium tuberculosis* drug resistance (DR) evaluation. TBCh identifies mutations in four MBT genes associated with DR to rifampin (R): *rpoB* and to isoniazid (H): *katG*, *inhA*, *ahpC*.

**Results:** In SM from 57 (66%) patients the culture of *M. tuberculosis* was isolated. DNA of *M. tuberculosis* was obtained in 86 (100%) specimens of SM ( $P = 0.0052$ ). When the results of DR detection by means of LJ and TBCh were compared, 100% agreement was achieved. DR to H was revealed in 35 (61%) patients, to R 32 (56%); MDR was detected in 28 (49%) cases. DR to H was presented by gene *katG* mutations in codon 315 (50.0%). DR to R was determined by gene *rpoB* mutations in codons 531 (42%), 526, 516. In 29 cases with negative results of SM LJ study, RT-PCR made it possible to reveal DNA of *M. tuberculosis*. Mutations associated with DR to H were detected in 15 (51.7%) cases, to R—10 (34.4%) and MDR was revealed in 8 (27.5%). Undeniable strength of gene diagnostics is quickness of result obtainment from 3 hours. Relatively low test-sensitivity rates of LJ methods 66% aggravate diagnostics and they respectively do not provide the means of examination DR of *M. tuberculosis*. Results of TBCh enabled early correction of therapy in postoperative period in patients with DR, which includes those 36 (41.8%) having MDR of *M. tuberculosis*.

**Conclusion:** The results offer the possibility to recommend two-stage use of genetic methods. Initial

examination of SM to reveal DNA of *M. tuberculosis* should be carried out by means of RT-PCR in order to establish or confirm the diagnosis of TS. In case of positive result DNA should be examined with the help of TBCh system to reveal mutations associated with H and R DR.

### PC-300-29 Proficiency of molecular diagnosis of mycobacteria in Taiwan

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**Aim:** To evaluate quality and accuracy of the molecular diagnosis of mycobacteria in clinical services, we conducted a multi-center proficiency testing in 2010.

**Methods:** We prepared a panel of 25 samples including five *Mycobacterium tuberculosis* complex (one *M. africanum*, one *M. microti*, one *M. bovis*-BCG and two *M. tuberculosis*), 16 non-tuberculous mycobacteria (NTM), and four mixtures of *M. tuberculosis* and NTM. Two concentrations,  $5 \times 10^5$  cfu/ml and  $5 \times 10^6$  cfu/ml of *M. tuberculosis* samples were used to assess detection limit of methods adopted in clinical laboratories. Accuracy of 95% was used to define a competent laboratory.

**Results:** Of the 27 clinical laboratories participated, 10 laboratories used the Roche COBAS TaqMan MTB (Roche COBAS) test, six used the BD ProbeTecTM ET, one used Asia Gene, one used the Roche Amplicor, eight used in-house PCR, and one used in-house PCR and the Roche COBAS test. One laboratory failed to return the report by on time. Of the

**Table** Proficiency testing results of molecular diagnosis conducted by 26 participating laboratories in 2010

Species of mycobacteria	No. of correct results
<i>M. avium</i>	26
<i>M. africanum</i> TMC 5122[Rist 3414]	22
<i>M. abscessus</i> CDC T-2366-6[PS 308]	26
<i>M. bovis</i> TMC1011 [BCG Pasteur]	26
<i>M. chelonae</i> TMC 1544 [Friedmann]	26
<i>M. flavescens</i> D-25[TMC 1541]	26
<i>M. fortuitum</i> [TMC 1529]	26
<i>M. gordonae</i> TMC 1325[Kowal]	26
<i>M. haemophilum</i> 29543	26
<i>M. intracellulare</i> TMC 1411[P-54; Wilson]	26
<i>M. kansasii</i> TMC 1201	26
<i>M. malmoeense</i> Mo 816 [CIP 105775; TMC 802]	26
<i>M. marinum</i> Aronson [TMC 1218]	26
<i>M. simiae</i> 3055[N14]	26
<i>M. smegmatis</i> NCTC 8159 [Cornell 3]	26
<i>M. triviale</i> (V Subgroup of Runyon Group III)	26
<i>M. xenopi</i> TMC 1482	25
<i>M. peregrinum</i> 700686	26
<i>M. microti</i> 35782	26
H37Ra 25177	25
H37Ra 25177	25
H37Ra 25177/ <i>M. abscessus</i> CDC T-2366-6[PS 308]	26
H37Ra 25177/ <i>M. gordonae</i> TMC 1325[Kowal]	26
H37Ra 25177/ <i>M. kansasii</i> TMC 1201	26
H37Ra 25177/ <i>M. marinum</i> Aronson [TMC 1218]	26

26 competent laboratories, 19 and 7 had accuracy of 100% and 96%, respectively. Of the seven laboratories, each had one incorrect result. Among them, three and four laboratories used in-house PCR and Roche COBAS test, respectively. In-house PCR showed false negative results of *M. africanum* and high concentration of *M. tuberculosis*, and false positive result of *M. xenopi*, while Roche COBAS test showed false negative results of *M. africanum* in three laboratories and low concentration of *M. tuberculosis* in one laboratory. All participating laboratories correctly detected *M. tuberculosis* in four mixtures. In addition, five laboratories were capable of performing NTM speciation.

**Conclusion:** In-house PCR and commercial tests performed equally well. Clinical laboratories were competent in using molecular assays for identification of *M. tuberculosis* and differentiation of NTM species.

#### PC-584-29 Optimisation of extra-pulmonary samples for detection of *M. tuberculosis* by GeneXpert® MTB/RIF

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**Background:** The rapid and accurate laboratory diagnosis of extrapulmonary TB continues to be a challenge. We determined the extent of PCR inhibition with the GeneXpert® MTB/RIF assay in various types of extrapulmonary specimens and investigated several methods for concentrating the bacilli.

**Methods:** Aliquots of saline and uninfected clinical specimens (17 stools, 9 CSF, 8 tissues, 13 gastric aspirates) were spiked with increasing numbers of single cell, viable, *M. tuberculosis* (H37Ra) to evaluate the extent of PCR inhibition in each specimen type. CSF and gastric aspirates were assayed directly. Stool and tissue specimens were first homogenized in saline, filtered (stool only), and debris allowed to sediment before samples were spiked and tested. For the GeneXpert® MTB/RIF assay, 0.5 mL of sample was added to 1.5 mL of sample reagent according to manufacturer's instructions for sputum testing. Serial dilutions of H37Ra were plated on Middlebrook 7H11 agar to determine bacterial counts. For flotation studies, spiked specimens were reconstituted in 36% NaCl and 28% sucrose and decanted into 15 mL Falcon tubes and left to settle for 1 h. One mL aliquots from the top and bottom were tested and the respective threshold cycles were compared.

**Results:** The spiking studies showed that the lower limit of detection was similar in saline and CSF. Inhibition was observed in gastric aspirates (2 fold;  $P > 0.5$ ), tissue (16 fold;  $P > 0.5$ ), and stool (102 fold;  $P < 0.5$ ) samples. Flotation studies show that 28%

sucrose but not lower sucrose concentrations or any NaCl concentration concentrated bacilli in stool by over 3 fold.

**Conclusions:** Minimum or no PCR inhibition was observed in CSF and gastric aspirates with the GeneXpert® assay. Stool samples showed a significant amount of PCR inhibition. Sucrose flotation may be useful for overcoming inhibition in stool. Further experiments are needed to determine effect of centrifugation.

#### PC-602-29 Added value of rapid culture for diagnosis of smear-negative tuberculosis suspects?

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**Background:** The WHO recommends using rapid mycobacterial culture for diagnosis of smear-negative tuberculosis (TB) in high HIV prevalence countries. In 2007, Thin Layer Agar (TLA) culture was introduced at the Homa Bay district hospital in Nyanza province of Kenya. We compared the performance of a smear-negative diagnostic algorithm without and with TLA, using Löwenstein-Jensen (LJ) culture, as reference standard.

**Methods:** Prospective cohort study of smear-negative TB suspects. Clinical examination, chest X-ray, TLA and LJ cultures were performed at first consultation. Patients not started on TB treatment received a 5 days amoxicillin course and were re-assessed clinically and microscopically. Non TB-treated patients with positive culture were traced to be started on treatment. Because TLA required 15 days to be positive, sensitivity, specificity and predictive values of the algorithm without and with TLA were measured in same patients. Factors associated with inadequate treatment were assessed for the algorithm without TLA.

**Results:** 311 patients were included: median age 34 years, 62.4% women, 6.7% with past TB history, and 68.2% (202/296) HIV positive. LJ culture was positive in 41/276 patients (14.9%). 98/307 (31.9%) and 110/303 (36.3%) patients were started on treatment without and with TLA, respectively ( $P < 0.001$ ). In 13/110 (11.8%) patients, treatment was started based on TLA results. Median time to a positive TLA was 16 days. With TLA, sensitivity was increased from 60.5% (23/38) to 80.5% (33/41),  $P = 0.016$ . Specificity was 71.8% (168/234) and 70.5% (165/234) and positive predictive value (PPV) 25.8% (23/89) and 32.3% (33/102), without and with TLA, respectively. TB history, HIV infection and number of symptoms were independently associated with inadequate treatment decision.

**Conclusion:** Using rapid TB culture significantly increased the number of confirmed TB patients treated but didn't reduce the number of non confirmed treated cases.

### PC-725-29 Development of a molecular assay to fully characterise *M. tuberculosis* isolates

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Current TB control measures rely on multiple tests. Due to the high work load and costs *M. tuberculosis* (TB) strains are seldom fully genetically characterised except retrospectively. We aim to develop a single multiplex molecular assay to fully characterise *M. tuberculosis* isolates. In the assay, dispersed genetic TB markers are targeted chosen on the basis of whole genome comparative data. These include antibiotic resistance markers, markers for species identification and phylogenetic markers. The proposed assay uses multiplex ligation-dependent probe amplification (MLPA) in combination with a magnetic bead liquid array. KIT-BR will develop the assay in collaboration with national and international partners. Evaluation and validation studies will take place in the TB reference laboratories in Sophia, Bulgaria and Tbilisi, Georgia. Using DNA from cultures and an experimental 6-plex assay as a proof of concept array, we have shown that previously sequenced strains can be correctly characterised. Based on fluorescence intensity values, we are able to classify strains as either target-positive or negative. A larger series of 45 informative targets along with controls will be combined in a fully 50-plex bead assay. Challenges are the validation of each target and the definition of thresholds for positive and negative calls for every target. Testing of additional characterised mycobacterial isolates will let us define thresholds based on ROC values. The proposed assay exploits the multiplexing capacity of the MLPA and benefits from the robustness and versatility of the latest liquid bead array-based technology. The potential of this type of multiplex assay for implementation in district hospitals and TB reference labs that are otherwise unable to fully characterise their isolates will be modelled as well as the use of extended genetic testing to support near patient molecular assays such as the GeneXpert.

### PC-744-29 Performance of the MODS assay for diagnosing TB and MDR-TB in a free public health service in Peru

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**Background:** The MODS assay performance in controlled conditions has shown good results. However, there is scarce information of its performance under operational conditions.

**Objective:** To determine the diagnostic performance of MODS for TB and MDR-TB in a public service in Lima, Peru.

**Methods:** The diagnostic performance of MODS compared to i) culture in Löwenstein-Jensen (LJ) and ii) drug susceptibility in the proportion method in LJ medium, was evaluated at the Regional Laboratory of Public Health in Arequipa. All samples collected during September 2008 to June 2010, were analyzed for TB diagnosis. For MDR-TB diagnosis a sample size of at least 500 hundred samples was estimated as representative considering previous reports of MODS performance and a prevalence of MDR-TB of 8.3% in all TB cases in Arequipa). The time around time and contamination rate were evaluated as well.

**Results:** A total of 1344 samples were evaluated for TB detection. The contamination of MODS was 1.9% (25 samples) and the mean time around time for MODS was shorter than for LJ: 12.8 (IQR 9) and 33.7 (IQR 18) days in positive results, respectively ( $P < 0.001$ ); 507 samples had valid results by MODS and conventional DST; the prevalence of MDR-TB was 8.7%. The MODS performance is shown in the table below.

Item	TB diagnosis	RIF-resistance	INH-resistance	MDR-TB diagnosis
Sensitivity	97.11	98.15	94.44	90.91
Specificity	97.01	100.00	99.77	99.78
+ Predictive value	99.40	100.00	98.55	91.62
- Predictive value	87.10	99.80	99.10	98.2
+ Likelihood ratio	32.53	—	408.00	59.28
- Likelihood ratio	0.03	0.02	0.06	0.04

**Conclusion:** Diagnostic performance of MODS under routine conditions, as a free public health service in Arequipa, is similar than reported under controlled conditions. This study provides further support for implementing MODS in developing countries under routine public health services.



### PC-785-29 Evaluation of the Xpert MTB/RIF® test in HIV-positive patients with suspected pulmonary tuberculosis

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**Background:** Rapid tuberculosis (TB) diagnostic tools are needed for HIV-positive patients. Xpert MTB/RIF® detects TB and rifampicin resistance in sputum, within 120 minutes. We assessed Xpert MTB/RIF performance in HIV-positive patients, in a setting of high TB and MDR-TB rates.

**Methods:** From April 2010–January 2011, HIV-positive TB suspects were enrolled from two referral hospitals in Lima, Peru. A TB suspect was defined as an adult coughing  $\geq 10$  days with an abnormal chest X-ray plus at least one of the following: fever, hemoptysis, pleuritic chest pain, night sweats or weight loss. Two sputum samples were obtained, observed under microscopy with Ziehl-Neelsen staining and cultured in Löwenstein-Jensen (LJ) and MGIT media. Drug susceptibility was tested using the proportion method on LJ. Xpert MTB/RIF was performed on and compared with the second sputum sample.

**Results:** Out of 130 patients enrolled, 107 (82.3%) were included of which 39 (36.44%) were culture-positive. Median age was 35 years (IQR: 29–42), 72% were men and the median CD4 cell count was 160 (IQR: 38.7–342.5). Xpert MTB/RIF identified 23.1% (9/39) smear-negative, culture-positive patients. Xpert MTB/RIF sensitivity for detecting TB was 97.4%, the specificity was 98.5% and the positive predictive value was 97.4%. Drug susceptibility tests were available for 76.9% patients. Xpert MTB/RIF sensitivity for detecting rifampicin resistance was 100% and specificity 91.7%.

**Conclusions:** Xpert MTB/RIF has a high diagnostic yield in HIV patients in our setting. Fast diagnosis of TB and MDR-TB allows rapid initiation of treatment which may lead to improved prognosis and decreased transmission.

### PC-964-29 Evaluation of Xpert MTB/RIF® assay (Xpert) to monitor treatment in pulmonary tuberculosis

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**Background:** Early and effective treatment is considered to be a crucial cornerstone of TB-control. Treatment failure and relapse occur in 1–4% and 7%, respectively, of non-resistant TB cases. Currently, smear

microscopy and culture are used to monitor anti-TB treatment, accepting the relevant shortcomings in both methods. A validated, rapidly assessable biomarker to monitor treatment and predict outcome would be extremely helpful to individualize therapy and simplify outcome measurement in clinical trials for evaluation of new anti-TB drugs.

**Methods:** Clinical and microbiological outcome of 50 smear-positive patients under TB-treatment within a clinical trial was monitored. Sputum samples were collected at week 0, 1, 2, 3, 4, 5, 6, 7, 8, 12, 17, 22 and month 6, 9, 12, 15 and 18 after initiation of treatment for evaluation in smear microscopy, culture and Xpert.

**Results:** All successfully treated patients showed sustained conversion in smear microscopy, culture and Xpert. Smear-conversion preceded culture conversion. PCR-conversion was slightly delayed compared to culture, but occurred reliably between week 12 and week 22 after treatment initiation. Four patients who had relapse three months after completion of treatment remained Xpert-positive, but showed conversion of culture and smear microscopy to negative during treatment phase.

**Conclusion:** Xpert MTB/RIF® assay is a robust, sensitive and rapid method to monitor TB-treatment. Our data indicate that failure to convert to negative in Xpert might be associated with a higher risk for relapse. Assessment of a higher number of relapse-cases is required to elucidate this question.

### PC-1027-29 Evaluation of the Xpert MTB/RIF® assay (Xpert) as new diagnostic tool for tuberculosis in children

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**Background:** TB in children can cause severe disease and estimates show that children under 15 years can carry up to 20% of the disease burden in poorly controlled settings. As a measure of TB control, early detection and treatment of childhood TB is necessary. However, diagnosis in children remains challenging due to the paucibacillary nature of the disease and low bacterial yield of the samples. We evaluated the Xpert MTB/RIF® assay (Cepheid, USA), a cartridge-based real-time PCR assay, automating sample processing, amplification and detection of *M. tuberculosis* and resistance to rifampicin.

**Methods:** 180 consecutively enrolled TB suspected children between 6 weeks and 14 years were classified into four diagnostic groups, according to microbiological and clinical results at recruitment and



during follow up of 1 year. Diagnostic performance of the Xpert was compared to smear and culture results in three different sputum collected at baseline.

**Results:** 21 (78%) of 27 culture positive TB cases were detected by Xpert (95%CI = 58% to 91%). In smear-positive children sensitivity of Xpert was 100%, compared to sensitivity in positive culture on LJ and in MGIT of 91% and 81%, respectively. No rifampicin resistance was detected by Xpert which was confirmed by susceptibility testing in liquid culture. Additionally, Xpert detected 4 TB culture negative patients which had been classified as highly probable TB-cases. In 17 of the 25 Xpert positive cases, time to treatment initiation could have been shortened by 1 to 3 months, due to rapidly available test results.

**Conclusion:** We demonstrated that the use of the Xpert in children can significantly increase the number of microbiologically confirmed TB-cases, compared to microscopy, the only diagnostic tool in many developing countries. With easy-to-use technology and rapidly available results, Xpert has marked advantages over culturing methods and the potential to play a major role in improving TB diagnosis in children.

#### PC-1062-29 A rapid immunochromatographic assay for identification of tuberculosis in blood cultures

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**Background:** The Mycobacteriology Referral Laboratory in Johannesburg receives an average of 15 000 specimens for mycobacterial culture monthly, of which approximately 10% are blood cultures. We evaluated a rapid chromatographic immunoassay, the MGIT TBc Identification test (Becton Dickinson), for the identification of *Mycobacterium tuberculosis* complex (MTBC) using blood cultured in Bactec Myco/F lytic medium (Becton Dickinson). The assay detects MPT64 antigen unique to MTBC.

**Methods:** Fifty positive blood culture specimens were tested using the MGIT TBc Identification test as per the manufacturer's instructions. Twenty-six specimens cultured MTBC and 24 specimens cultured *M. avium* complex, as identified by the Accuprobe *M. tuberculosis* complex and Accuprobe *M. avium* complex culture identification tests. In addition, 4 control strains were used, two *M. tuberculosis* complex strains (ATCC25177), one *M. kansasii* strain (ATCC25291) and one *M. avium* strain (ATCC12478).

**Results:** The MGIT TBc Identification test identified all MTBC isolates and all *M. avium* isolates correctly, giving an estimated analytical sensitivity and specificity of 100%.

**Discussion:** We have integrated the MGIT TBc Identification test into our identification algorithm for acid-fast bacilli cultured from Myco/F Lytic blood culture bottles. The test is rapid to perform and easy to interpret enabling improved turn-around-times. Zeehl-Nielson staining of the positive blood cultures is used to screen for infections that may contain both *M. tuberculosis* complex and non-tuberculous mycobacteria. MTBC strains that do not produce MPT64 antigen have been reported in the literature. All positive blood-cultures that are negative by the BD MGIT TBc Identification test undergo further molecular identification.

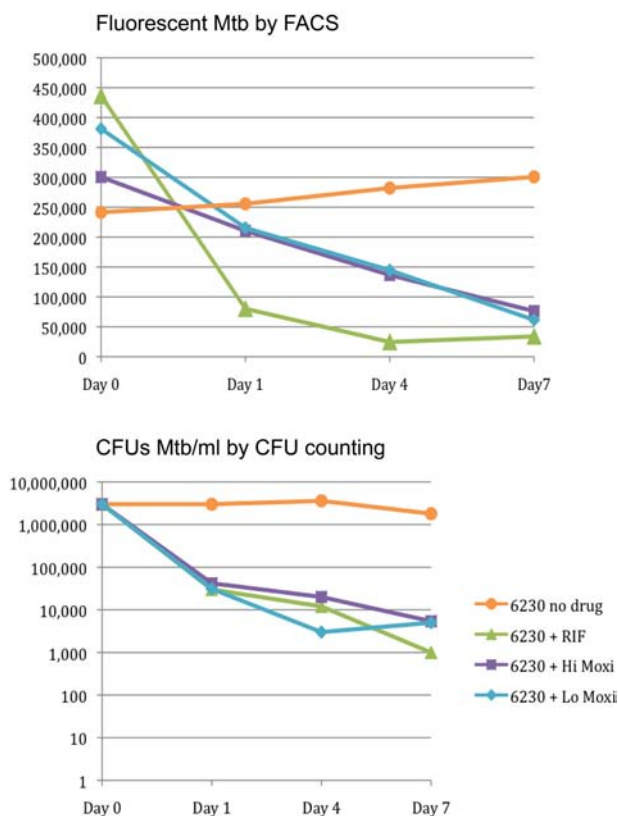
#### PC-1250-29 A novel fluoromycobacteriophage assay rapidly measures treatment response for *Mycobacterium tuberculosis*

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**Background:** An important obstacle to improving treatment for TB, particularly drug-resistant TB, is the lack of a rapid biomarker for treatment response. Molecular diagnostics are endorsed by the WHO, but are unlikely to predict treatment response due to the inability to distinguish viable from non-viable mycobacteria. A rapid prognostic biomarker for treatment response is therefore a critical research gap. Using a fluromycobacteriophage we have shown rapid identification of metabolically active *Mycobacterium tuberculosis* by enumerating fluorescent mycobacteria using conventional fluorescent microscopy or flow cytometry.

**Methods:** Mycobacterial reporter phage phAE466 expressing *gfp* under the PLeft promoter of L5 phage was constructed using the temperature sensitive derivative of TM4. PhAE466 infects and expresses *gfp* reporter but does not lyse cells at 37°C. *M. tuberculosis* (mc26230) was grown in liquid culture, incubated with drug at baseline and with phage at various time points. 24 hours after phage was added the samples were simultaneously plated for colony forming units (CFUs) and underwent flow cytometry (FACS) to enumerate fluorescent *M. tuberculosis*.

**Results:** Baseline estimates of bacillary burden were similar by both CFUs and fluorescent *M. tuberculosis* by FACS. *M. tuberculosis* unexposed to drug did not show numerical decline either by CFUs or FACS. On the other hand, *M. tuberculosis* exposed to either rifampicin, high dose or low dose moxifloxacin showed similar dynamic decline by either CFUs or FACS. While CFUs took 3 weeks, FACS was available within 24 hours.



**Figure** Fluoromycobacteriophage measures dynamic killing of *M. tuberculosis* in the presence of antimycobacterial agents comparable to colony-forming unit counts done in parallel. Attenuated drug-susceptible Mtb (6230) was inoculated with Rifampin (Rif), Moxifloxacin (Moxi) or no drug. FMP was added 16 hours prior to each time point and the number of fluorescent Mtb was measured by flow cytometry (FACS) and by counting CFUs 4 weeks after inoculation. The data show that untreated Mtb remained viable in substantial numbers through day 7 by both FACS and CFU while drug-susceptible Mtb treated with Moxi or Rif decreased markedly. Serial CFUs performed simultaneously showed similar kill-kinetics compared to counts of fluorescent Mtb by FACS.

**Conclusion:** This phenotypic assay has exciting potential as a surrogate for clinical trials in pulmonary tuberculosis or in EBA studies and as a clinical biomarker for clinicians, particularly in the treatment of drug-resistant TB.

### PC-1270-29 Comparison of TB diagnosis with the MDR-/XDR-TB colour test and MODS

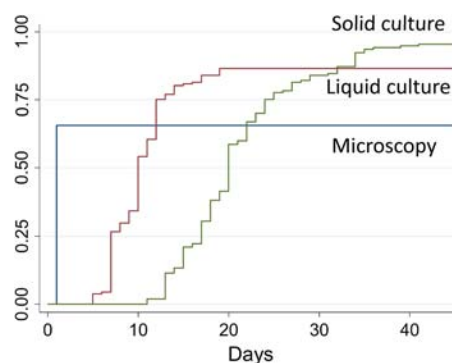
M A Tovar,<sup>1,2</sup> S G Schumacher,<sup>1,2</sup> C Osorio,<sup>1,2</sup> E Ramos,<sup>1,2,3</sup> M Llacza,<sup>1,2,3</sup> T Valencia,<sup>1,2</sup> B Herrera,<sup>1,2</sup> C A Evans.<sup>1,2,4</sup>  
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**Background:** The diagnosis of microscopy-negative TB and MDR-TB may be achieved by non-commercial solid or liquid-culture techniques that we compared in Peru.

**Methods:** Adults ( $n = 544$ ) with suspected TB provided sputum that was split between:

- 1 unconcentrated Ziehl-Neelsen sputum smear microscopy;
- 2 solid culture: the MDR/XDRTB Colour Test with disinfection in the sputum pot, the contents of which were applied directly to thin-layer agar that was sealed, incubated and changed colour if microorganisms grew; and
- 3 liquid culture: the MODS technique that decontaminated sputum with NaOH and centrifugation, re-suspended in broth, incubated and screened microscopically for TB growth.

**Results:** Fewer solid than liquid-cultures failed due to indeterminate or contaminated results (6/544, 1.1% vs. 77/544, 14%,  $P < 0.0001$ ). Of 168 culture-positive samples with fully interpretable results, 156 (93%) were positive by solid-culture vs. 164 (98%) by liquid-culture ( $P = 0.08$ ). Of 189 culture-positive samples, 173 (92%) were positive in solid-culture vs. 165 (87%) in liquid-culture ( $P = 0.2$ ). Microscopy detected 125 (66%) of the culture-positive samples, less than either culture technique ( $P < 0.0001$ ). Microscopy was most rapid; positive liquid-cultures were detected in median 10 days, faster than 20 days for solid-cultures ( $P < 0.0001$ ). Solid and liquid culture MDR-TB-testing had 97% agreement. A technician working full-time managed ~60 microscopies/day, ~30 solid-cultures or ~10 liquid-cultures. Costs were lowest for microscopy, higher for solid-culture and highest for liquid-culture.



**Conclusions:** Smear microscopy is rapid, inexpensive but insensitive and cannot test for MDR-TB. Solid culture was simple, quick to perform and had greater biosafety than liquid culture, which required greater resources. Liquid-culture provided results more rapidly but failed more often; sensitivities were similar. These results inform the selection of appropriate diagnostic techniques for different settings.

## BACTERIOLOGY: CLINICAL TRIALS

### PC-149-29 Microbiological and molecular genetic characterization of multidrug resistance against *M. tuberculosis*

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**Setting:** In recent years there has been an unfortunate trend to increase the number of patients with tuberculosis (TB), infected with multiresistant strains of *M. tuberculosis*. Of particular concern are tuberculosis, caused by *M. tuberculosis*, resistant simultaneously to isoniazid (H) and rifampicin (R) and in combination with other drugs (MDR).

**Aim:** To study the spread of MDR strains of *M. tuberculosis* among patients with chronic forms of tuberculosis, which are observed and treated more than three years.

**Methods:** We examined 354 patients with chronic active pulmonary tuberculosis. Determination of drug resistance (DR) was conducted by microbiological methods (absolute concentration by sowing on solid culture medium and by accelerated method using BACTEC MGIT 960). Of these, at 139 patients definition DR additionally was performed by method of biological microchips.

**Results:** The MDR is established at 248 (70.1%) patients, including resistance to H+R 7 (2.8%), in combination with one antimicrobial drugs in 48 (19.4%), in combination with two drugs in 54 (21.8%), in combination with three or more drugs in 139 (56.1%) patients. Method of biological microchips showed dominance among MDR strains mutations in gene *katG* ser 315 (66.7%) and gene *rpoB* ser 531 (48.2%), compared with patients with isolated resistance to H (37.5%) and R (40%), respectively, indicating a significant level of drug resistance in *M. tuberculosis*.

**Conclusions:** Among patients with active pulmonary tuberculosis with chronic course of process, detected high levels of MDR strains of *M. tuberculosis*. Among *M. tuberculosis* with MDR is dominated by multidrug-resistant strains that are resistant simultaneously from 5 to 9 antibacterial drugs.

### PC-197-29 Genetic characteristics of ethambutol resistance in *Mycobacterium tuberculosis*

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**Background:** Ethambutol (EMB) is a bacteriostatic agent that acts on growing bacilli and has no effect on non-replicating bacilli. In *Mycobacterium tuberculosis*, *embB* is organized into an *embCAB* operon with *embA* and *embC*. The *embB* codon 306 mutation is

the most frequently observed mutation in clinical isolates that are resistant to EMB. However, approximately 35% of EMB-resistant isolates lack *embB* mutations, and mutations in the *embCAB* operon were suggested to be involved.

**Methods:** We analyzed 234 *M. tuberculosis* isolates. The agar proportion method on Middlebrook 7H10 was used for drug susceptibility testing. The critical drug concentrations for EMB were 5.0 µg/ml for EMB. In addition, *embA*, *embB*, *embC* and *embR* genes were analyzed with PCR and sequencing, and the sequence data were assembled and edited using the Sequencing Analysis 5.2.0 software.

**Results:** Of the 234 isolates, of which 162 were EMB-resistant and 72 were EMB-susceptible, the concordance between the phenotypic and the sequencing for EMB resistance was 92.3% (216/234). Among those 71 isolates had no mutation at codon 306 in *embB*, other mutations were found (Table). Nevertheless, 15 EMB-resistant isolates (9.3%, 15/162) still exhibited a wild-type pattern with sequencing. However, among the 72 EMB-susceptible isolates, three isolates each had mutations at codons S297A (TCG→GCG), D328Y (GAT→TAT), or D328G (GAT→GGT) in the *embB* gene.

**Table** Gene mutations in 162 EMB-resistant *Mycobacterium tuberculosis* isolates based on sequencing of *embA*, *embB*, *embC*, *embR* genes

Mutation(s) or codon(s) analyzed	Isolates n (%)
<i>embA</i> C-11A	2 (1.2)
<i>embA</i> G-43C	1 (0.6)
<i>embA</i> G-43C, <i>embB</i> Q497R (CAG→CCG)	1 (0.6)
<i>embA</i> C-16A	1 (0.6)
<i>embA</i> C-16G	1 (0.6)
<i>embA</i> del-3C, <i>embB</i> Q497K (CAG→AAG)	1 (0.6)
<i>embB</i> M306V (ATG→GTG)	54 (33.3)
<i>embB</i> M306I (ATG→ATA)	18 (11.1)
<i>embB</i> M306I (ATG→ATC)	9 (5.6)
<i>embB</i> M306I (ATG→ATT)	4 (2.5)
<i>embB</i> M306L (ATG→CTG)	6 (3.7)
<i>embB</i> Y319C (TAT→TGT)	7 (4.3)
<i>embB</i> Y319D (TAT→GAT)	2 (1.2)
<i>embB</i> P404S (CCG→TCG)	2 (1.2)
<i>embB</i> G406A (GGC→GCC)	3 (1.9)
<i>embB</i> Q497K (CAG→AAG)	5 (3.1)
<i>embB</i> Q497P (CAG→CCG)	9 (5.6)
<i>embB</i> Q497R (CAG→CCG)	13 (8.0)
<i>embB</i> Q497R (CAG→CCG), <i>embB</i> S565G (AGC→GGC)	1 (0.6)
<i>embB</i> Q497R (CAG→CCG), <i>embB</i> N624D (AAC→GAC)	1 (0.6)
<i>embB</i> Q497R (CAG→CCG), <i>embB</i> S565G (AGC→CGC)	1 (0.6)
<i>embB</i> E504D (GAA→GAC)	1 (0.6)
<i>embB</i> A505V (GCC→GTC)	1 (0.6)
<i>embB</i> V602A (GTA→GCA)	1 (0.6)
<i>embC</i> V451I (GTC→ATC)	1 (0.6)
<i>embR</i> G245D (CCG→CTG)	1 (0.6)
WT	15 (9.3)

**Conclusion:** DNA sequencing of EMB resistance associated genes is feasible to rapidly detect EMB resistance in clinical routines.



### PC-387-29 Streptomycin and selection of isoniazid-resistant mutants in nude mice infected with *M. tuberculosis*

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**Rationale:** In a previous study, the treatment of *M. tuberculosis*-infected athymic nu/nu (nude) mice with the bactericidal drug isoniazid (H) combined with the two sterilizing drugs, rifampicin (R) and pyrazinamide (Z) failed and selected H-resistant mutants. We investigated whether the combination of H with the bactericidal drug, streptomycin (S) would be able to prevent that selection.

**Methods:** A total of 80 nude mice were aerosol infected with  $3.67 \pm 0.13 \log_{10}$  of *M. tuberculosis* H37Rv. Two weeks later, at treatment initiation, mice were randomized in the following subgroups: untreated and treated with RZH + ethambutol (E) as controls; treated with SH or RH, as tests, treatment was given five days/week for 12 weeks. Drug doses (mg/kg) were 10 for R and H, 150 for Z and 100 for S and E. Lung CFU counts were done the day after infection, on treatment initiation, and after 4, 8 and 12 weeks of treatment on plain and H 0.2 µg/ml-containing 7H11 selective plates.

**Results:** Lung CFU counts were  $7.40 \pm 0.28 \log_{10}$  on treatment initiation. After 4, 8 and 12 weeks of treatment, they were  $5.82 \pm 0.35$ ,  $4.05 \pm 0.55$  and  $2.30 \pm 0.25$ , respectively for RHZE;  $5.00 \pm 0.09$ ,  $5.32 \pm 0.6$  and  $6.57 \pm 0.29$ , respectively for SH; and  $6.00 \pm 0.39$ ,  $6.24 \pm 0.28$ ,  $7.68 \pm 0.49$ , respectively for RH. H resistance was prevented in RHZE treated mice but not in SH and RH treated mice.

**Conclusion:** Despite its bactericidal activity, S alone cannot prevent selection of H-resistant mutants in nude mice.

### PC-492-29 High ethionamide resistance in *Mycobacterium tuberculosis* strains isolated in Kenya

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**Background:** Increasing development of tuberculosis (TB) resistance to the currently available drugs including second-line anti-tuberculosis drugs that are being used for treatment of multidrug-resistant TB (MDR-TB) patients has frustrated efforts to control TB worldwide. Ethionamide (ETH) is one of the drugs used in the regimen for treatment of these patients.

**Objective:** To determine level of ethionamide resistance among second-line anti-tuberculosis drugs in *Mycobacterium tuberculosis* strains isolated in Kenya.

**Design:** A retrospective lab-based study involving

archived strains from previous studies carried out at the Centre for Respiratory Diseases Research (CRDR), Kenya Medical Research Institute (KEMRI) from 2002 to 2007.

**Setting:** CRDR, KEMRI.

**Methods:** A total of 216 *M. tuberculosis* strains with pre-determined first-line drug susceptibility testing (DST) results were used including 78 first-line resistant to individual and combined drugs, and 138 susceptible to streptomycin, rifampicin, isoniazid and ethambutol. The strains were subjected to DST to ETH among other second-line drugs.

**Results:** Thirty two [32/216 (14.8%)] strains showed resistance to second-line drugs. Resistance to ETH was the highest [18/32 (56.3%)] including co-resistance with isoniazid [8/18 (44.4%)]. Nine [9/18 (50%)] strains were fully resistant and 9 [9/18 (50%)] were intermediate resistant to ETH.

**Conclusion:** High levels of ETH resistance is a cause for concern. This will impact negatively on the outcome of management of MDR-TB especially in Kenya where the use of this drug is almost mandatory. Close monitoring of ETH before initiating individual patient management may be necessary.

### PC-493-29 Fluoroquinolone resistance in *Mycobacterium tuberculosis* strains isolated in Kenya

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**Background:** Fluoroquinolones are key second-line anti-tuberculosis drugs usually used in the treatment of patients with multidrug-resistant tuberculosis (MDR-TB). Anti-TB fluoroquinolones include ciprofloxacin (CIP), moxifloxacin (MXF), gatifloxacin (Gat), ofloxacin (Ofi) and levofloxacin (Lev). Resistance to one fluoroquinolone usually translates to resistance to the others in the group.

**Objective:** To determine whether there is fluoroquinolone resistance in *Mycobacterium tuberculosis* strains isolated in Kenya.

**Design:** A retrospective lab-based study involving archived strains from previous studies carried out at the Centre for Respiratory Diseases Research (CRDR), Kenya Medical Research Institute (KEMRI) from 2002 to 2007.

**Setting:** CRDR, KEMRI.

**Methods:** A total of 216 first-line drug susceptibility testing (DST) pre-tested *M. tuberculosis* strains were used including 78 resistant to one or more drugs, and randomly selected 138 susceptible to all four drugs. The strains were subjected to drug susceptibility testing to gatifloxacin (Gat) among other second-line drugs.

**Results:** Of the 216 strains tested, 32 [32/216 (14.8%)]



showed resistance to second-line drugs. Of these 7 [7/32 (21.9%)] were fully resistant to Gat of which 6 [6/7 (85.7%)] were mono-resistant strains and one [1/7 (14.3%)] with combined resistance strain to ethionamide. Four [4/25 (16%)] MDR-TB strains showed mono-resistance to Gat.

**Conclusion:** Presence of Gat resistance especially in MDR-TB patients may significantly contribute to extensively drug-resistant TB, a more difficult to treat strain than MDR-TB. Therefore strict drug adherence among MDR-TB patients and proper and appropriate use of fluoroquinolones should be implemented.

### PC-518-29 Genotyping of *Mycobacterium tuberculosis* XDR by MIRU-VNTR in Peru

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**Background:** Peru is a high burden MDR/XDR-TB country, but there is little information about the genotypes of these resistant forms.

**Objective:** To determine the genotypes of *Mycobacterium tuberculosis* isolates with extended drug resistant (XDR-TB) collected from 2007 to 2009 at the National Institute of Health from Peru.

**Methods:** One hundred strains of XDR-TB detected by Proportion Agar Plate method were reactivated in 2.5 mL of 7H9 liquid medium and cultured for 10 days at 37°C. DNA was extracted using the CTAB-NaCl method from an aliquot of 1.5 mL and stored at -20°C until use. PCR was performed to determine the genotypes of XDR-TB by MIRU-VNTR using 15 markers already reported. The sizes of PCR products were calculated using Quantity One software (BioRad) and genotypes were determined using the program MIRU-VNTRplus available on-line ([www.miru-vntrplus.org](http://www.miru-vntrplus.org)).

**Results:** From all strains tested, 86% came from Lima, 8% from Callao and the rest from other provinces of Peru. The genotypes found in this study correspond to Haarlem (16%), Beijing (6%) and the remaining 78% had not similarity with any known genotype. By analyzing the phylogenetic relations of all these strains, we found strong evidence that 17 Peruvian strains belong to a new cluster.

**Conclusions:** We are reporting by first time both the Haarlem genotype and a new cluster found among XDR-TB strains in Peru. The Beijing genotype was less frequent in this study. The genotyping of XDR-TB by spoligotyping is being assessed to complement the information of genotypes obtained and evaluate this new cluster.

### PC-524-29 Genotypic diversity and drug susceptibility pattern among *M. tuberculosis* complex isolates from Ghana

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**Objective:** To establish molecular typing techniques at a tertiary laboratory in a TB endemic country and to use them to study the population structure of *M. tuberculosis* complex (MTBC) isolates.

**Methods:** Isolates included were identified using standard biochemical procedures, IS6110 PCR, and large sequence polymorphisms. Isolates were further typed using spoligotyping, and the phenotypic drug susceptibility patterns were determined by the proportion method.

**Results:** One hundred and sixty-two isolates were characterised by LSP typing. Of these, 130 (80.25%) were identified as *Mycobacterium tuberculosis* sensu stricto (MTBss), with the Cameroon sub-lineage being dominant ( $N = 59/130$ , 45.38%). Thirty-two (19.75%) isolates were classified as *M. africanum* type 1, and of these 26 (81.25%) were identified as West-Africa I, and 6 (18.75%) as West-Africa II. Spoligotyping sub-lineages identified among the MTBss included Haarlem ( $N = 15$ , 11.53%), Ghana ( $N = 22$ , 16.92%), Beijing (4, 3.08%), EAI (4, 3.08%), Uganda I (4, 3.08%), LAM (2, 1.54%), X ( $N = 1$ , 0.77%) and S (2, 1.54%). 9 isolates had SIT numbers with no identified sub-lineages while 17 had no SIT numbers. We observed no statistical difference in the proportion of isolates resistant to the first-line anti-TB drugs when comparing MTBss and *M. africanum*.

**Conclusion:** This first in-country study demonstrated that overall 36.4% of TB in South-Western Ghana is caused by the Cameroon sub-lineage of MTBC and 20% by *M. africanum* type 1, including both the West-Africa 1 and West-Africa 2 lineages. The diversity of MTBC in Ghana should be considered when evaluating new TB vaccines.

### PC-671-29 Probable mutation and genotypes of phenotypic multidrug-resistant *Mycobacterium tuberculosis* strains

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**Setting:** Tuberculosis Laboratory of the International Centre for Diarrhoeal Disease Research, Bangladesh.

**Objectives:** To elucidate molecular mechanisms gene mutation associated with multidrug-resistant (MDR) strains of *M. tuberculosis* isolated from the TB patients

of Bangladesh and to investigate the prevalence of their genotypic patterns.

**Methods:** Proportion susceptibility testing method was followed to test susceptibility of *M. tuberculosis* to anti-tuberculosis drugs. A collection of 68 phenotypic MDR strains was included in this study. Sequencing of DNA was performed to detect specific mutation at *rpoB* and *katG* genes. Standard spoligo-typing technique was followed to genotype MDR strains. Spoligo patterns were matched with Spoligo data base to ascertain clade designation.

**Results:** Both single and double mutations were detected at *rpoB* and *katG* genes. Of 68 MDR strains, *rpoB* mutation was detected in 88.0% of strains. The most common *rpoB* mutation was at C1349T ( $n = 28$ ) followed by A1334G ( $n = 6$ ), C1333G ( $n = 5$ ) and A1304T ( $n = 4$ ). *katG* mutation was detected in 85.0% strains. Most common *katG* mutation was detected at G944C ( $n = 54$ ) followed by G944A ( $n = 2$ ) and A823C ( $n = 1$ ). These strains were genotyped into different frequencies of Principle Genetic Group (PGG) 1 and PGG 2 & 3.

**Conclusion:** *rpoB* and *katG* gene mutation of the MDR strains of Bangladesh differs from data of other Asian countries. Spoligo pattern of MDR strains of Bangladesh was heterogeneous.

#### PC-706-29 Genotyping of multidrug-resistant *M. tuberculosis* strains isolated in Kazakhstan

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**Setting:** The major TB problem in the world and in Kazakhstan is *M. tuberculosis* drug resistance, especially multidrug resistance tuberculosis (MDR-TB). Genotyping of *M. tuberculosis* based on 24 MIRU-VNTR (mycobacterial interspersed repeat units-variable number of tandem repeats) loci allows make rapid analysis of genotyping results and compare with data obtained in other laboratories around the world by database MIRU-VNTR.

**Aim:** To genotype multidrug-resistant *M. tuberculosis* strains isolated in different regions of Kazakhstan.

**Design:** MIRU-VNTR analysis of 81 MDR *M. tuberculosis* isolates from different regions of Kazakhstan was carried out by using 24 MIRU-VNTR locus. All clinical isolates collected in reference laboratory of National Center for Tuberculosis Problems from 7 regions of Kazakhstan.

**Results:** 43 different genotypes were detected, 35 (43.2%) of them were unique. 46 (56.8%) isolates of *M. tuberculosis* were clustered at 8 clusters, including 2–27 isolates in a cluster. The main two clusters had 27 (33.3%) and 6 (7.4%) strains of *M. tuberculosis*. One cluster included 3 (3.7%) isolates, and the re-

maining 5 clusters included 2 (2.4%) isolates of *M. tuberculosis*. Analysis of allelic polymorphism for each of the 24 loci individually showed different variability in the number of repeats in one or another locus. The most polymorphic loci was VNTR 21, Qub26, MIRU-26 and Qub11b. 82.7% of all *M. tuberculosis* isolates were identified as Beijing strains. It is showing that isolates of this family are prevalent in Kazakhstan, as well as in other East Asian countries.

**Conclusion:** According to the genotyping results by MIRU-VNTR we noted the predominance of two genotypes among *M. tuberculosis* strains isolated in Kazakhstan, representing 41.1% of the total clinical isolates. 82.7% of all *M. tuberculosis* isolates were assigned to Beijing family. Distribution of Beijing family strains have important role in the spread of MDR-TB in Kazakhstan.

#### PC-721-29 Variable number tandem repeat typing of *Mycobacterium tuberculosis* isolates from Havana, Cuba

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**Background:** Recently, mycobacterial interspersed repetitive units (MIRU)-variable number of tandem repeats (VNTR) typing has become the new gold standard for typing of *Mycobacterium tuberculosis* complex strains.

**Objective:** To provide information about the genetic diversity and prevalent genotypes of *M. tuberculosis* circulating in Havana, Cuba.

**Methods:** PCR-agarose gel electrophoresis-based VNTR typing (15 loci) was used to characterize 89 *M. tuberculosis* isolates collected from different cases diagnosed in Havana in 2009. Genetic relationship and clustering analyses were performed by MVSP software and MIRU-VNTR<sup>plus</sup> website. Clusters of isolates with identical genotyping profiles were determined as an indicator for the rate of recent transmission.

**Results:** From the 89 isolates analyzed by MIRU-VNTR, 45 showed unique patterns and the remaining 44 (49%) belonged to five clusters, including two major groups related to institutional outbreaks. Molecular typing did not completely coincide with the results of contact investigations. The discriminatory index in five (MIRU10 and 40; VNTR 1955, QUB11b and QUB-26) of the 15 loci was high (Hunter-Gaston diversity index > 0.6).

**Conclusion:** The high clustering rate suggests that recent transmission plays an appreciable role in the dynamics of the disease in this setting. VNTR typing can be a useful first-line screening tool for studying genetic diversity and molecular epidemiology of *M. tuberculosis* isolates in Havana, Cuba.

**PC-862-29 Correlation between phenotypic pyrazinamide resistance and pncA mutations *M. tuberculosis* isolates**

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**Aim:** This study was designed to evaluate a DNA sequencing-based kit to detect a mutations either in pncA or upstream of the gene correlated with pyrazinamide (PZA) resistance of *M. tuberculosis*. We aimed to determine the occurrence of PZA-resistant strains with pncA mutations among PZA-resistant and -susceptible *M. tuberculosis* strains isolated in Russia.

**Methods:** A total of 92 *M. tuberculosis* clinical isolates from sputum specimens with variable drug resistance from collection of Central TB Research Institute of RAMS, were randomly selected. Cultures of *M. tuberculosis* were grown on liquid medium. The PZA susceptibility testing was performed by BACTEC MGIT 960 System according to the manufacturers' instructions. The sequences of pncA gene of *M. tuberculosis* were identified by the diagnostic sequencing-based kit, which has been developed in Central Research Institute of Epidemiology previously by automated sequencer 3100 Genetic Analyzer (Applied Biosystems).

**Results:** We analyzed pncA and the upstream putative regulatory region sequences of 92 *M. tuberculosis* isolates from Russia. All the 54 (58.7%) PZA-resistant isolates had a mutations either in pncA or upstream of the gene. The resistance in these isolates was correlated with mutations leading to amino acid substitutions (66.7%), large deletions (16.7%), frame-shifts (12.9%) by single nucleotide insertion or deletion, or promoter mutations (3.7%). Ten of the 43 different mutations were detected during this study had not been described earlier. Of the 92 isolates 38 (41.3%) were PZA susceptible; they all had identical wild-type pncA sequences.

**Conclusion:** Due to the full correlation between pncA genotype and culture method results have been shown for the clinical isolates, the next step is to demonstrate the same for clinical specimens for possible implementation of this DNA sequencing-based kit to clinical practice in the future.

**PC-974-29 Antimycobacterial activity of new derivatives of the lichen metabolite, (+)-usnic acid**

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**Background:** Due to the rising incidence of tuberculosis (TB) worldwide and the emergence of multidrug-resistant (MDR) strains, the development of new anti-tuberculous drugs to reduce the duration of the treatment and fight MDR-TB is urgently needed. The aim of this study is to evaluate the antimycobacterial activity of natural products recently isolated from lichens, based on the scaffold of usnic acid, which is reported to have antimycobacterial properties in vitro on susceptible and resistant strains, but because of its rapid metabolism and toxicity prevents further exploitation.

**Methods:** 31 lichen compounds were screened for antimycobacterial activity. Stock solutions were prepared in dimethyl sulfoxide and the final testing concentrations ranged from 64 to 0.25 µg/ml. Minimal inhibitory concentrations (MICs) were evaluated by the microplate Alamar blue assay (MABA) on *M. tuberculosis* H37Rv, isoniazid resistant (INH-R) and susceptible (INH-S) clinical isolates, all confirmed by genotypic and phenotypic tests. Isoniazid was used as control and the experiments were performed in duplicate.

**Results:** The potential of new derivatives at the triketone moiety of usnic acid, the portion that causes toxicity, was evaluated. Out of the 31 compounds, 11 with a MIC ≤ 32 µg/ml were selected: usnic acid (MIC 32 µg/ml) and 10 of its derivatives. 3 derivatives showed MICs between 8 and 16 µg/ml, 2 of them MIC 8 µg/ml stable in H37Rv, INH-R and INH-S clinical isolates. The most active compounds (PS14, PS18 and PS19) bear an heterocyclic portion, linked as enamine or hydrazone to the benzofuran-dione scaffold.

**Conclusion:** Two compounds seem to be active against *M. tuberculosis* H37Rv, INH-R and INH-S isolates. These results show that usnic acid derivatives have a higher activity than usnic acid itself, which is an active compound, but toxic. Further studies must be done against rifampicin resistant strains to evaluate the real significance of such compounds for MDR-TB.



## TOWARDS ADHERENCE TO TUBERCULOSIS TREATMENT I

### PC-40-29 Providing inclusive TB care: voices from slum populations in India

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**Background:** Despite the successful implementation of a national program based on DOTS strategy, morbidity and mortality due to tuberculosis continue to prevail at unacceptable levels in India. This has primarily been due to the operational challenges faced by the program in reaching marginalized and vulnerable population groups, such as the slums. In this regard, understanding the context and reasons for underutilization of TB care by this group has become important, especially as the program plans to scale-up interventions in its third implementation phase.

**Objective:** To provide evidence-based recommendations for effective scale up of services for urban slum populations.

#### Specific objectives:

- 1 To understand health seeking behavior of the slum populations within their socio-cultural context;
- 2 To identify factors associated with utilization of services for TB;
- 3 To review the current intervention strategies under RNTCP, assess its performance and identify gaps, (if any); and
- 4 To develop recommendations on improving strategies for better outreach of services for slum populations.

**Methodology:** Four states were chosen, one from each zone in India, for better geographical representativeness. Based on the urban slum population, two districts were selected in each state. In each districts two Municipal Corporations recognized urban slum were randomly selected. Key informants were used to identify study participants who were TB suspects (defined as cough for >2 weeks), enrolled TB case, treatment defaulters, etc.

**Data collection:** A total of 40 in-depth interviews are being conducted across the country. The main themes covered in the interviews are socio-demographics, access to care, shopping for care, etc.

**Findings:** Data collection is in process and results from the study are expected by August 2011.

**Expected outcome:** The study should provide the required insight for evidence-based scale-up of the program to cater the burgeoning slum population in India.

### PC-50-29 Tuberculosis treatment interruption in Nairobi

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**Setting:** Nairobi, the capital city of Kenya with an estimated population of 3 100 000 people in an area of 696 sq. k. *M. tuberculosis* (TB) diagnosis and treatment is provided in accordance with the DOTS strategy.

**Objective:** To document reasons for interruption of treatment by TB patients.

**Methods:** This was a cross-sectional descriptive study. Tuberculosis patients registered for treatment in 119 public TB treatment sites between 1st October 2008 and 31st March 2009 were eligible for study. The patients collected medicines at weekly appointment clinics during the intensive phase and two-weekly during the continuation phase. If a patient missed two consecutive drug collection clinics, the health worker traced the patient to find out the reason for the patients failure to collect medicines. Structured questionnaires were used to collect data. The questionnaires were later serialized and captured into the electronic database using MS Access.

**Results:** Sixty-eight percent (68%) of the patients interrupted treatment during the intensive phase (i.e., within two months after commencing treatment). Of the 397 patients whose treatment supporters were traced, reasons for interruption included; travelling out of Nairobi (30%), referral around and out of Nairobi (15.4%), dead (8.3%), drug side effects (6.5%), assumed cure (6.5%), hospitalization (6.3%), too ill (5.8%), work related (4%), imprisonment (3%), drug abuse (2.2%), and other reasons (12%).

**Conclusion:** TB patients mostly interrupt medication during the intensive phase and frequent movement (travelling out of Nairobi) is the main cause of interruption.

**Recommendation:** Appropriate patient education should be provided repeatedly during drug collection clinic days. Where a patient misses the drug collection clinic the health worker should immediately trace either the patient to find out the true status of the patient and outcome recorded or appropriate action taken to ensure treatment continued.

### PC-85-29 Factors influencing TB defaulting at diagnostic level at Kakamega Kenya

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**Objective:** To determine the cause(s) of pulmonary tuberculosis patients defaulting at diagnostic level in delivery of standard number of sputum specimens and or in results collection and to establish the basic information that was provided during their 1st visit.



**Design:** The perspective study on PTB sputum microscopy defaulters that was conducted (Jan to Oct 2010).

**Setting:** The exercise was carried out at Kakamega regional referral hospital, Kenya.

**Methods and intervention:** All new PTB suspects were referred to the laboratory for sputum microscopic examination. Three cell phone contacts were captured and retained. Patients that took 48 hrs to return were traced and comprehensive questionnaire administered.

**Results, conclusion and recommendation:** Patients seen  $n = 1890$ , Successfully traced defaulters  $N = 420$ , social-economic pressure = 80%, stigmatized and others = 20%, information effectiveness 95%.

—Research for rapid technique for diagnosis key to caseholding.

### PC-709-29 Effect evaluation on intervention of providing traffic subsidies to pulmonary tuberculosis patients

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**Objectives:** To explore the proper way of providing traffic subsidies to the pulmonary tuberculosis patients and provide evidence in making relevant policies.

**Methods:** Field trial method was used by selecting all of the 425 new smear positive tuberculosis patients (NSP) detected from April to December in 2008 both in WX County and S County as the intervention group, and those NSP registered in the same period of the previous year as the control group. The traffic subsidies were given to the intervention group during all the treatment period but in different ways in the two counties. Data collected by the same questionnaire and the routine TB patients register data was reviewed for evaluation.

**Results:** 82% of the NSP were peasants. The average traffic fee for round-trip from home to the local TB dispensary of the NSP in WX county and S county was respectively  $31 \pm 20$ RMB and  $22 \pm 10$ RMB. 44% of all the NSP reported that they couldn't afford the traffic fees for revisiting 3–4 times during the whole treatment period. The total amount of the traffic subsidies that the NSP in WX county and S county received was on average  $87 \pm 47$ RMB and  $59 \pm 23$ RMB respectively. The smear examination rate at the end of the 2nd treatment month and the rate of taking drugs on time during the whole treatment period of the intervention group were higher than the control group in the both counties. Both of the smear examination rate at the end of the 5th treatment month and that at the end of the 6th treatment month of the intervention group were higher than the control group in the S county.

**Conclusion:** The patients' treatment adherence was effectively improved by giving the traffic subsidies. It

was proper to set the traffic subsidies standard according to the distance between the patients' home to the local dispensary. It is suggested that traffic subsidies intervention should be included as part of the national policy on TB control.

### PC-866-29 Impact de l'application de mesures incitatives sur les taux de succès au traitement

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**Contexte :** A Madagascar, dans la région de Mahajanga le taux de dépistage est très important mais la prise en charge est compliquée par la pauvreté dans une population souvent immigrée professionnelle. Une étude opérationnelle vise à mesurer l'impact de mesures incitatives pour améliorer la prise en charge dans deux Centres de Diagnostic et Traitement dépistant plus de 500 malades.

**Objectifs :** Objectif général : Améliorer le taux de guérison des tuberculeux à microscopie positive de 75% en 2007 à plus de 85% en 2008.

**Objectif spécifique :** Identifier une solution aux problèmes d'abandon au traitement.

**Méthodologie :** Etude longitudinale dans deux CDT, comparant les taux de guérison avant et après instauration de mesures incitatives, comme remboursement des frais de transport et nutrition. D'autres CDT de la région constituent des centres témoins.

**Résultats :** La comparaison des résultats de traitement avant et après intervention montre :

—amélioration du taux de guérison de plus de 12%  
 —diminution du taux de perdu de plus de 10%.

**Conclusion/recommandation :** En zone de forte pauvreté, la subvention des malades pour faciliter l'accès aux soins peut être une solution aux problèmes d'abandon au traitement et elle contribue à l'amélioration du taux de guérison. Aussi, son application élargie doit-elle être discutée.

### PC-914-29 Rapid assessment for poverty and the support for poor TB and TB-HIV patients in Chiang Rai, Thailand

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**Background:** A previous study of Chiang Rai Hospital (CHR) reported high default rate (10–20%) of TB and TB-HIV patients. One of the reasons for default was due to unaffordable travel cost of poor patients. We raised the fund to support poor patients. As the

funding is limited, therefore we developed a rapid poverty screening tool to identify patients who are 'very poor' and need financial support for travel and livelihoods. This study reports the outcome of poverty screening and analyzed factors associated with 'very poor'.

**Design/methods:** A prospective study of TB patients diagnosed at CRH between May 2009–December 2010. We interviewed patients by using a rapid poverty screening questionnaire which composes of five dichotomized questions. We used logistic regression analysis to explore characteristics of the 'very poor' TB patients.

**Result:** Of the 742 patients receiving interview, 160 (21%) were identified as 'very poor' and received financial support. Female was poorer than male (OR 1.7, 95%CI 1.2–2.4). Hilltribes and migrants were poorer than Thai (OR 2.6, 95%CI 2.6–5.8 and OR 3.2 95%CI 1.6–6.4). Patients without education or completed only primary school were poorer than patients with higher education (OR 8.2, 95%CI 4.3–15.5 and OR 2.2, 95%CI 1.2–4.2). Farmer and unskilled labour were poorer than government employee (OR 5.0, 95%CI 1.2–21.6). Pulmonary TB was poorer than extra-pulmonary (OR 1.8, 95%CI 1.2–2.6). TB treatment default rate among 'very poor' patients was 11%, which is similar to 2008 rate. The majority of the 'very poor' default cases were migrants.

**Conclusion and recommendation:** Despite receiving financial supports for transportation and some livelihoods, TB treatment default rate in the 'very poor' migrant patients remains high and requires further investigation for reasons of default. Additional interventions to ensure treatment adherence in this group are needed.

### PC-988-29 Effectiveness of financial and social support to people with MDR-TB in Nepal

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**Setting:** Nepal/Kathmandu urban area. The Nepal National Tuberculosis Programme (NTP) started MDR-TB treatment in September 2005. A standardized treatment regimen used for 24 months to treat MDR-TB. At the start, the programme had no provision of social and financial support to people with MDR-TB.

**Objectives:** To estimate effectiveness of financial and social support in continuation of MDR-TB under DOTS plus programme in Kathmandu, Nepal.

**Methods:** Financial and social (combined) and social support was compared with no support group and their one year cohort was analysed on treatment con-

tinuation. A total of seven MDR-TB treatment centres/sub-centres were involved in the study. Qualitative research conducted using in-depth interviews with people with MDR-TB.

**Findings:** Treatment continuation rate was higher among people who received support (social and financial) and social support alone compared with no support group. More than 80% of people with MDR-TB had economic and social constraints during their treatment. In such context, the support helped people to stay on treatment. However, the support was limited in circumstances of considerable financial difficulties that people with MDR-TB had faced. In addition to the support provided, majority of them also gained considerable support from their family members and relatives. People also managed their problems by selling assets and borrowing money.

**Conclusion:** The financial support had a direct impact, helped people to stay on treatment though support was limited. The support was used mainly for food, rent, travel, schooling of children. The social support helped to increase self-esteem, decreased fear about disease & treatment, relieved tension, and raised level of confidence among people with MDR-TB and their families.

Acknowledgements: Nepal NTP, MDR-TB Centres, People with MDR-TB who participated in this study and COMDIS for research funding.

### PC-1130-29 Innovative TB management tool utilising Google™Earth and smart phone technology in eThekweni, KwaZulu-Natal

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**Setting:** KwaZulu-Natal is the second most populous province in South Africa and tuberculosis (TB) is the second leading cause of mortality in the province with TB morbidity increasing from 98 498 in 2004 to 109 556 in 2007. eThekweni District is the only metropolitan area in the province, with a population of about 3 900 000 with Durban holding the highest burden of TB cases and the worst performing metro district in South Africa; in 2009, TB cure rate was at 63%, defaulter rate at 10.7% and death rate at 5.3%. The objective is to illustrate an innovative management tool, which uses a combination of Google™Earth to map the household of TB smear+ and drug resistant (DR) TB cases, and smart phone technology to provide cost effective, real-time decision support to TB management in the eThekweni metropolitan area.

**Methodology:** Using Google™Earth, patients' home addresses in the Electronic TB Register (ETR) are geo-coded. The results of the geo-coding associated with patient information are transmitted via Global System for Mobile Communications to smart phone



technology which are used by trained tracing teams to locate, update and capture patient information. Real time data is transmitted to a centralised server for automated report and map generation. Both spatial and non-spatial information are distributed via a web portal to stakeholders. The tool was introduced in February 2010 and the smart phones are utilized by 70 contact investigation teams.

**Results:** Implementation of the tool has increased the efficiency in locating nine thousand TB smear+ and DR TB index cases. Data capturing and validation are carried out onsite resulting in decreased logistical and resource challenges faced with a paper based system.

**Conclusion:** The development of this innovative tool has assisted in gathering and transmitting vital TB management information to the TB control programme as well as associated stakeholders.

#### PC-1153-29 Returning the lost to service: adopting a systematic approach to managing loss to follow-up

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**Background:** Loss-to-follow up (LFU) prior to tuberculosis (TB) treatment completion is a major challenge to TB control internationally, especially among hard-to-reach patients with complex social problems. However, no internationally agreed standardised definition or clinical management guidance for LFU exists. We have developed a working definition and a systematic approach to managing LFU and returning patients to treatment services.

**Methods:** We reviewed all TB patients referred to Find&Treat, a pan-London specialist TB outreach service, who were LFU at any point in treatment. Information on treatment delivery (directly or self observed), risk factors, smear status, drug susceptibility and treatment interruptions, clinical management and outcomes were collected.

**Results:** In total, 225 active TB LFU patients were reviewed. 164 (73%) had pulmonary TB, of which 84 (51%) were sputum smear-positive. 35 (15%) had

drug resistant disease, of which 21 were sputum smear positive. Where known, 69% of LFU cases had a history of homelessness, 60% had drug and alcohol issues and 50% had a history of imprisonment. Cases were classified as either treatment completed, treatment stopped, transferred out, treatment re-established, treatment still chaotic, dead or still LFU. In total 167 (74%) of cases were successfully located.

**Conclusions:** Returning LFU TB patients to treatment services is an essential component of metropolitan TB control. Our approach demonstrates that in most cases it is possible to find and return hard-to-reach patients to clinical services. This work highlights the potential public health impact of LFU infectious and drug resistant cases and variations in clinical practice following unplanned treatment interruptions.

#### PC-1223-29 Mass default: reasons why patients refuse treatment for MDR-TB in Tsumkwe, Namibia

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**Background and objectives:** Tsumkwe is a constituency in very remote part of Namibia, home to the indigenous San communities, the first peoples of Southern Africa. At any given time, over 90% of patients being treated for MDR-TB at Grootfontein District Hospital are San from Tsumkwe. In June 2009, 19 of 32 hospitalised patients walked out on treatment within one month. Follow-up investigation led to a consultative meeting with these patients and their relatives. The objective of the consultation was to establish why patients defaulted treatment; what would make them return to treatment and how they expected health service delivery to be improved.

**Methods:** Two questionnaires were administered by community health workers, one for the patients who had stopped treatment and the other for their relatives. Open ended questions were used to allow the most possible responses.

**Results:** 14 out of the 19 patients who were not on treatment responded, while 17 relatives responded. The patients cited the rude attitude of the HCWs (36%) and the hospital being too far from home (36%) as having caused them to stop treatment. Responses from relatives were mostly similar. On what would bring patients closer to treatment, the more common answers were bringing treatment closer to home (in Tsumkwe) and a return of symptoms. Asked how the Ministry of Health could improve service, most people (64% of patients and 94% of relatives) felt that provision of a treatment centre in Tsumkwe would satisfy them, while a further 21% of patients also felt that social support was necessary.



**Table** Reasons why patients refuse treatment for MDR-TB in Tsumkwe

Reasons for stopping treatment	PATIENTS (n = 14)		RELATIVES OF PATIENTS (n = 17)	
	Number	%	Number	%
Hospital too far	5	36%	4	24%
Attitude of HCWs	5	36%	5	29%
Alcohol abuse	0	0%	1	6%
Delays in starting treatment	0	0%	1	6%
Death of a relative on same treatment	0	0%	1	6%
Do not know	0	0%	1	6%
<b>What would make one return for treatment?</b>	<b>Number</b>	<b>%</b>	<b>Number</b>	<b>%</b>
If treatment is provided in Tsumkwe closer to home	6	43%	5	29%
If symptoms return	2	14%	2	12%
If they are talked to	0	0%	3	18%
To get better	0	0%	2	12%
If they stop alcohol	0	0%	1	6%
<b>How can the Ministry of Health improve its service?</b>	<b>Number</b>	<b>%</b>	<b>Number</b>	<b>%</b>
Build a treatment centre in Tsumkwe	9	64%	16	94%
Provide social support to patients (food, money, etc.)	3	21%	0	0%
Provide correct treatment to patients	0	0%	1	6%
Improve information dissemination on TB/MDR TB	1	7%	0	0%

**Conclusions:** The results of this survey mirror the sentiments expressed in consultative meetings and were used to engage the community in addressing the problem of defaulters. An ambulatory treatment facility was established in Tsumkwe, supported by a social support network and better informed HCWs. This act of community engagement brought all these patients back on treatment as desired under the new arrangement.

### PC-1268-29 Nutritional status of patients at start of tuberculosis in Nairobi, Kenya

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**Background:** The number of TB cases notified in Kenya has increased tenfold since 1990 while the TB incidence of infectious forms TB increased from 32 per 100 000 in 1990 to 108 per 100 000 in the year 2007. Despite significant progress in TB control, the assessment of nutritional status and provision of nutrition support is still a challenge.

**Objectives:** To carry out nutrition assessment body mass index (BMI) of patients at the start of tuberculosis chemotherapy. This report describes the distribution of malnutrition amongst patients.

**Methods:** Standardized measurement of weight and height from all treatment facilities in 2 TB control regions. A total of 4568 patients were assessed in 12 TB control zones.

**Results:** The body mass index (BMI) for most patients was very low indicating there is severe malnutrition 24% moderate malnutrition 13%. Normal 54% and 11% overweight by the time they were starting treatment. The BMI for women was observed to be lower than that of men (cohort).

**Conclusion:** The proportion of patients severely malnourished may not complete the intensive phase of treatment due to weakness. These results are expected

to influence decisions by the ministry of public health and sanitation and partners target TB patients in existing supplementary feeding programs and integration in future. Nutrition support for tuberculosis patients will help maintain or and increase cure rates, increase adherence to drugs and reduce defaulter rates thus reducing the risk of developing drug resistance TB and premature deaths.

## EMPOWERING THE COMMUNITY THROUGH EDUCATION

### PC-237-29 Analysis of tuberculosis in Brazil's media

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**Background:** The media play is one of the most important ways of spreading information and creating concepts and myths about health and disease. In the last years, Brazil has seen a huge enhance in the number of report publications on tuberculosis (TB) in the major newspapers due to the efforts of National Tuberculosis Program (NTP) and others.

**Design/methods:** In 2009 and 2010, 618 articles were found by searching the term 'tuberculosis' on the selected newspapers. A hundred of the articles were selected. The others were excluded because they only cited the term, without developing the theme.

**Results:** In general, every month of the period, at least one article on TB was published in some of the newspapers selected. Most of the subjects, in the materials studied, were scientific, academic or focused on TB technology and research. Research and treatment approach leaded among the subjects, with 19% and 16%, respectively. About the information's well-spring, the study showed that national and foreign researchers were the largest providers on TB news (34%), followed by managers of TB programs (21%). When classified by the source, the World Health Organization was the main supplier of news (19%), followed by communities (8%), patients and former patients (4%) and the GFP (2%). Universities, scientific societies, bilateral agencies, Centers for Disease Control and Prevention (CDC) and the pharmaceutical industry contributed with 1% each. Other sources counted 7%.

**Conclusion and recommendations:** In general, information from news agencies published in Brazilian newspapers followed international patterns. The Brazilian agencies usually copy the international subjects, even when it does not reflect the truth. An example of this is the news on the multidrug-resistant TB: 12 articles in two years, mostly with sensationalism features, reporting Brazil as being at high risk for the variation, when, in fact, the the Ministry of Health just counts 1.4% registered cases.



### PC-275-29 Social mobilisation on TB with health counselors in Brazil

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**Background:** The National Health System (SUS) has as one of its principles the direct participation of the community, organized in health councils (HC), in the decisions on health policies. There are HC in the 5565 municipalities of the 27 states. In 2010, 7 seminars (6 regional and 1 national) on social control and tuberculosis (TB) were promoted by National TB Program in order to include the theme on HC's agendas, promote local knowledge, expand the discussion and develop strategies to confront the issue.

**Design/methods:** For 10 months, 6 regional seminars were held involving health counselors, community and social movements of the 27 states, capitals of every state and 181 priority municipalities for TB control. Around 500 people participated of the process. The guests discussed local issues on TB and exchanged experiences. At the end of each seminar, resolutions were discussed and voted upon. By the end of the year, a national event was conducted with representatives from all states, national managers of health, justice and other areas, parliamentarians, researchers and social movements. The recommendations from the regional seminars were discussed and voted, having as a product 32 propositions for new public health policies.

**Results:** The participants' knowledge on TB increased after these activities, especially when it comes to political debate within the health boards. Parliamentary fronts for TB were created in association with the AIDS movement, resulting in a permanent discussion group in the Midwest region of Brazil. Also several organizations, which fight against AIDS, added the TB cause to their mission.

**Conclusion and recommendations:** The approach to the advisors of the HC in every level has been very important for the TB visibility in Brazil. The lack of budget resources was an unknown problem for most of them. Moreover, these activities have enabled a rapprochement with the National Health Council, the highest body of Advocacy Brazil's health.

### PC-401-29 Community involvement in TB management in Kirinyaga District, Central Province, Kenya

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**Background:** Kenya has a large and rising TB disease burden and ranked among the twenty-two countries contributing about 80% of the world's TB cases. Poor

adherence to TB medications is a hindrance to effective TB control. WHO recommends for directly observed treatment (DOT) for TB patients. This is labour intensive and burdening health staff in high incidence areas. The community strategy recognizes that all communities are actively engaged in health activities for survival, hence the Kenya Essential Package for Health (KEPH). To strengthen the linkage between community and facility based services.

**Methods:** Community involvement in TB care was adopted by training 151 community health workers (CHWs) and forty public health technicians (PHTs) from thirty TB centers in Kirinyaga District. They offered DOTs to TB patients, sputum collection from MDR-TB suspects, educating community on TB issues, contact and defaulter tracing.

**Results:** In 2008, 1676 new TB patients were registered with three percent through contact tracing. Cure and treatment success rates increased from 80% and 84% to 85% and 89% respectively between 2007 and 2008. The MDR-TB surveillance rate improved from, 10% in 2007 to 96% in 2008. The defaulter rate went down from 12% in 2007 to 8% in 2008.

**Conclusion:** Community involvement improves TB treatment reducing defaulters. It enhances decentralization of services and reduces the heavy work load demand among the health workers. This program can be replicated in other districts with support of CHWs at minimal additional cost.

### PC-431-29 Approaching communities and health units to strengthen the actions of prevention and control

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**Background and challenges to implementation:** In Brazil, tuberculosis continues to advance in the most vulnerable segments of the population due the factors as: social inequality, population concentration, beyond the fragile structure of the public health services. Many people do not have information about the illness and they do not know when to look to the health service, creating a big challenge for the work of control of the TB for the population. Global Fund fight for Tuberculosis Brazil FGFB, in an effort to contribute to fortify strategy DOTS and to reach the vulnerable populations, initiated a work in partnership with the civil society.

**Intervention or response:** A training was elaborated to enable communities agents and health professionals to carry through action of prevention the TB in Rio de Janeiro. The training aimed to sensitize agent on TB prevention and health professionals to guarantee the implementation of the DOTS in these communities. The content of this training enclosed the biological and subjective aspects that TB brings and reflects inside in the actions of the agents of the

community. The schedule was of 30 actual hours and 6 hours for integration, when the agents had visited the unit of health and the health professionals had known the area of the actions of the agent.

**Results and lessons learnt:** Nine projects were implemented, enclosing 6 cities of the State of Rio de Janeiro and this experience will be reference for other cities of Brazil.

**Conclusion and key recommendations:** Integration and partnership between communitarian and professional agents of health are essential points for the event in the control of TB and must be one of the first steps to be worked. It is fundamental to clarify definition of papers and functions, the cooperative and participating reflection of these social actors.

### PC-506-29 Social technologies: an important instrument for tuberculosis prevention and control

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**Introduction:** Tuberculosis is a very serious public health problem in Brazil. The incidence still high and it follows reaching the populations of greater social vulnerability. The main challenge in the fight for the control of tuberculosis is the lack of knowledge of the population about the disease and the difficulties of access to health service.

**Method:** The Global Fund TB Brazil supported, technically and financially, in 20 communities, initiatives of civil society that promoted actions for the prevention of tuberculosis and for extension of the DOTS strategy. These non-governmental organizations (NGO) created and used different types of social technologies (creative tools of mobilization and participation) such as: educational stands, community radio, Positive Seal, Custom Cd, monitoring software, among others.

**Results:** The work brought up the development of community social technologies for TB prevention; broaden the population's access to information and to the health service system, facilitating the increase of the rate of detection and treatment's adherence.

**Conclusion:** Highlight the contributions of local actors, their knowledge about the reality and, above all, the way they operate and organize health actions; widen social participation of these communities and fosters a closer relationship with health services. Establish effective partnerships between civil society and health professionals proved to be a possible path to the strengthening of strategies for tuberculosis control and primary care in the health system in Brazil.

### PC-514-29 Knowledge, attitude and practices of community on TB in Myanmar

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A cross-sectional study using both quantitative and qualitative methods was conducted in rural and urban areas of (50) selected townships in 2009–2010 to assess knowledge, attitude and practices of community on TB. It also explored stigma, perceived problem for TB and opinion and suggestion of community members for TB control. Face-to-face interview with (7519) community members and (28) Focus Group Discussions (FGDs) were conducted in rural and urban areas of selected townships. Only (9%) of community member had high knowledge; (64%) had median knowledge; and (27%) had low knowledge scores about TB. Only (18%) answered germ and (38%) mentioned smoking as causes of TB respectively. About (65%) knew anti-TB drugs were free of charge and (86.9%) knew that TB was curable. Nearly half (45.9%) of respondents have heard about DOTS. The most common ways as expressed by participants to prevent TB were isolation of TB patients (47.4%), avoidance of smoking (26.9%) and avoidance of sharing dishes and utensil (22.9%). Some (45.1%) said that they would not invite TB patients to their social events. Only (3.3%) would conceal TB status of their family members. Majority (71%) perceived TB as a public health problem for their locality. Initial actions if one suspected contracting TB were going to doctor (82%), and going to drug shop (3%) and self medication (3%) respectively. Participants from FGD suggested providing health message regarding prevention about TB by using appropriate communication channels for their localities. Based on the research findings, advocacy communication and social mobilization materials for TB control have being developed.

### PC-529-29 Strengthening the community response against tuberculosis in Brazil

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**Background and challenges to implementation:** Following the international STOP TB guidelines related to the community participation for tuberculosis (TB) control, the National Tuberculosis Programme (NTP) conducted two national trainings in 2010 in order to contribute to the improvement of the capacity of Brazilian activists to develop advocacy and social mobilization actions.

**Intervention:** The training consisted of knowledge

improvement on technical aspects of TB control for Brazilian activists. The other aim of the training was to discuss strategies for developing social mobilization and advocacy activities in instances when social control can play an important role, such as guaranteeing patients' rights, and in parliament. Forty leaders with proven experience in establishing networks, working with committees, forums and NGOs that develop community actions were invited for the trainings. The participants' profile included experience in working in Health Councils to promote the exchange of knowledge and in establishment working partnerships among participants, considering the regional characteristics of Brazil. The methodology was developed to stimulate debate in the discussion groups.

**Results and lessons learnt:** The participants received the key tools on the themes, which will contribute to the improvement of community leaders, and encourage them to act as information multipliers in their fields, with their partners and social control agencies. The result expected by the NTP is the strengthening of the country's ability to formulate effective strategies and health policies for TB control.

**Conclusions and key recommendations:** Communication, advocacy and social mobilization activities developed by the NTP expands the communities' ability to contribute for TB control in their cities and in the context of public health policy formulation. The NTP needs to maintain and expand training in this area to empower communities.

### PC-620-29 'Simple cough not TB, I cannot have TB': findings from a communication needs assessment study, India

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**Background:** For moving towards TB elimination, in order to ensure early diagnosis of TB, appropriate communication strategies to the population is crucial. As part of a large ACSM project in India, communication need assessment was conducted in order to identify suitable message to develop interpersonal, mid-media and mass media communication strategies to reach the target population.

**Objective:** To identify key communication gaps at population level for early TB diagnosis.

**Methods:** Communication need assessment (CNA) was done using qualitative research methodology. CNA workshops with stakeholders were conducted in three different states in India. In-depth interviews with state and district programme managers, TB technical consultants and other providers and focus group discussions with community members were conducted. The data collected from stakeholder dis-

cussions during workshops and from the community were analyzed using content analysis.

**Results:** In each of the workshops ~20 stakeholders participated, 18 in-depth interviews and 12 FGDs (6 FGDs with males and 6 FGDs with females) with 8 to 10 participants from general community for each FGD were conducted. The major communication gaps identified which directly leads to delay in health seeking behaviour of TB suspects are: knowledge gap —'cough for more than 2 weeks as a symptom of TB', 'Simple cough cannot be TB', 'I cannot have TB as no one in my family has it'. Other important themes that emerged include: 'private providers are closer to home and provide good medicine', 'government facilities offer treatment which is longer in duration and of poor quality' and 'the social norm is going to the nearest chemist or other local providers for curing cough'.

**Conclusion and recommendation:** For early detection of TB the important communication messages should focus on cough as an important symptom for TB and the awareness that anybody can have TB.

### PC-818-29 Involving community radio stations in ACSM activities for TB control: a field report from Tamil Nadu

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**Background:** The Advocacy, Communication and Social Mobilization or ACSM strategy has been identified as very crucial for TB control. Community radio stations (CRS), operated and managed by local communities, offer opportunities for raising and addressing critical issues on TB and for establishing and sustaining communication with community.

**Intervention:** CRS were involved to improve awareness of TB and to enhance links between communities/TB symptomatics and service providers. Several CRS in Tamil Nadu, India were invited for an orientation workshop on TB to discuss innovative ways of disseminating key TB messages and an action plan was prepared for airing radio episodes. A customized and comprehensive toolkit, with background information and 'talking points' for 26 different TB topics was given to CRS along with pre-recorded capsules of ten minutes each.

**Results:** Five stations from across the state participated by broadcasting a 26-part series (of ½ hour duration each) on TB in March 2011. The series focused on various aspects of TB, from history of the disease to how it spreads, DOTS, etc. In all, a total of 130 original episodes were broadcast. Each of these episodes was repeat-broadcast for additional impact. The CRS also utilized this series to enhance links between health system functionaries in their areas and the communities they catered to.



**Conclusion:** This report has highlighted the importance of CRS as an effective medium of advocacy and awareness building on TB to improve community involvement and promote health seeking behavior. CRS build their listenership base through such programmes and communities have access to information about TB and other health care services.

#### **PC-985-29 Effectiveness of advocacy, communication and social mobilization in TB care in Pakistan**

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**Background:** In spite of being one of the main components of the Stop-TB Strategy, the contribution of advocacy, communication and social mobilization (ACSM) in TB care has not been frequently evaluated. This study aimed at assessing the impact of ACSM activities carried out during 2004–08 in Pakistan.

**Design:** A posttest, multi-method study hypothesizing that increase in the number of suspects and case detection was contributed by ACSM. Four districts (one each from 4 provinces of the country) where number of diagnostic centers remained unchanged during 2004–8 were selected for TB-data examination, household survey to assess knowledge, attitudes and practices (KAP), and qualitative interviews. A KAP survey of 1009 respondents, and 24 in-depth interviews with district TB officers, health providers, NGO partners and TB patients were completed.

**Results:** Improvement in case detection was noted in 3 out of 4 districts during the period under study. Credible record of number of suspects was not available. Improvement was found in KAP with 97% knowing at least one and over 50% aware of at least three symptoms. TB officers, health providers and NGO partners related the improvement to ACSM activities, while patients asked for more time and sympathetic attitudes from providers, and better services from the program.

**Conclusion:** The study is first step towards building the evidence on effectiveness of ACSM. It demonstrates that ACSM has been effective in improving public awareness and increasing health care utilization that contribute to improved achievement of TB-related targets. Programs should regularly assess the effectiveness of ACSM as part of the operations research.

#### **PC-1104-29 Marketplace ACSM activities to increase TB suspects referral: a field report from India**

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**Background:** The three southern districts in Tamil Nadu, southern state of India with a total population of 8.5 million.

**Objectives:** To create awareness about TB and to increase case referrals from community by market place advocacy, communication and social mobilization, ACSM activities over 3 months period in selected districts of Tamil Nadu.

**Methodology:** Monthly markets cater to several adjoining villages and form an important place which brings together community from otherwise inaccessible and hard to reach areas. Line listing of market places which were to be conducted in areas of felt need as identified in consultation with the district TB health staff was done. During the monthly markets, meetings were conducted with key representatives of villages catered by the market place, TB awareness pamphlets were distributed to community people and TB suspects were referred to the nearest designated microscopy centers.

**Results:** About 30 programs in 15 marketplaces were conducted over 3 months period. Each of the markets catered to about 10 to 15 neighboring villages, each with an estimated population of about 1000 each. About 12 000 TB awareness pamphlets were distributed. Following ACSM activities in marketplace, there were 53 referrals of chest symptomatics to nearest microscopy centers.

**Conclusion:** Market places that cater to villages which are sometimes not easily accessible forms an important place for TB ACSM activities. Since market places are also conducted regularly, they also serve as an important place to follow up community from several villages in a cost-effective manner.

#### **PC-1254-29 Tuberculosis information, education and communication materials needs assessment**

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**Background:** A 2008 assessment of 350 persons with multidrug-resistant TB (MDR-TB) in Namibia found that approximately half reported that they had received no TB education, and approximately two-thirds did not know that TB was spread via person-to-person transmission. These data suggest major gaps in education for TB patients in Namibia. A systematic needs assessment was conducted to examine the Namibian-specific factors related to effective



information, education, and communication materials for patients with TB or MDR-TB.

**Methods:** The National TB and Leprosy Program (NTLP) and CDC staff conducted a needs assessment over three months. Existing IEC materials were compiled and evaluated. Semi-structured interview guides for TB and MDR patients and providers were developed with stakeholders input. Interviews were conducted in eight TB clinics in Namibia with TB and MDR-TB patients and TB providers.

**Results:** Patients reported great desire for more information on TB. There seemed to be a disconnect between the education that providers reported they offered, and the lack of education patients reported receiving. There were several misconceptions about TB transmission; however, the majority of patients believed that TB was curable, knew that coughing for more than 3 weeks was a symptom of TB, and understood the importance of covering your cough. Both providers and patients requested more TB education materials in local languages. Clinics lacked patient education materials. Providers asked for job aids that would facilitate patient-provider communication and suggested that patient education include information on TB-HIV and alcohol.

**Conclusion:** The results of this needs assessment suggest that patient education materials need to be developed that include clear information on transmission and be available in a variety of languages. A patient-provider flipbook would also be helpful to improve the education experience and ensure consistency of messages.

### PC-1284-29 Integration of tuberculosis patients in the prevention and control activities in the Dominican Republic

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**Introduction:** Empowering people with TB has worked in the country, settling in 2007 led networks concerned with the mission to help improve the quality of life for patients, to achieve a cure, organizing the social protection of the Rights Development, education and health of those contributing to their reintegration into the family, social and labor.

**Objectives:** To promote the participation and organization of people with TB, to raise awareness, reduce stigma and discrimination, self-esteem, defending their dignity and promoting the fulfillment of their responsibilities.

**Methods:** Coordination with the National TB Programme, nongovernmental organizations (NGOs) implementing TB projects financed by the Global Fund, and community organizations, development of implementation strategy of activities for people with TB, relatives and friends.

**Results:** Inclusion in the MCP, and the Stop TB Committee, 70 active members, 300 people reached by IEC in the community, involved 130 trained in TB, stigma and discrimination, rights of the patient. Networking in 7 provinces. Management of nutritional support to patients.

**Conclusions:** The participation of those affected by supporting ACSM activities helps their empowerment and sensitizes the population on this issue by presenting the face of a person with rights, personal projects and a particular history of life disrupted by the disease, increasing the perception of risk.

### PC-1291-29 Estudio sobre conocimientos y percepción acerca de la tuberculosis, Perú

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**Antecedentes:** Es importante identificar el nivel de conocimiento, actitudes y prácticas de la población de Lima Metropolitana y Callao frente a la Tuberculosis (TB); los resultados servirán para crear estrategias de comunicación.

**Métodos:** Se encuestaron a 270 hombres y mujeres entre 16 y 34 años de distritos de Lima Metropolitana y Callao. Se aplicó un cuestionario para medir: conocimiento, percepción y actitudes, acciones para prevención, oferta informativa y medios de comunicación donde ha visto información de tuberculosis.

**Resultados:** Conocimiento: forma de contagio mediante tos o estornudo (81%), pulmón es el órgano afectado (96%), cualquiera es grupo de riesgo (40%), sabe que tiene cura (79%), se trata en establecimientos médicos (99%). Percepción y actitudes: considera grave la enfermedad (90%), piensa que puede ser mortal (68%), considera que es importante la prevención (57%); reacciones frente a la enfermedad: 45% pena, 45% temor, 32% vergüenza. Acciones: 64% no toma medidas de prevención, sin embargo 65% de estos tomarían medidas si tuvieran personas con TB en su entorno como: alimentación adecuada (56%), mejorar limpieza (54%), vacuna BCG (40%), diagnóstico precoz (25%). Oferta informativa: 56% ha visto publicidad informativa, 50% ha visto una campaña preventiva, 28% ha asistido a alguna campaña preventiva. Medios de comunicación: comerciales en TV (66%), folletos en establecimientos médicos (45%), periódicos y revistas (15%), paneles en vía pública (13%), radio (12%), internet (8%).

**Conclusiones:** El básico conocimiento sobre la enfermedad y la percepción de lejanía de la misma hacen que no se tomen medidas preventivas adecuadas. Se recomendaría hacer campañas con énfasis en la posibilidad de ocurrencia de tuberculosis en el entorno inmediato. Asimismo, sostener el discurso (mensajes clave) en el tiempo a través de estrategias de comunicación diversas.

## SMOKING PREVALENCE, EXPOSURE, CESSATION AND THE ECONOMIC IMPACT

### PC-57-29 Direct costs of medical care for diseases attributable to smoking in public hospital

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**Objective:** To calculate the cost of the medical attention of the diseases related to the smoking in the public hospitals of the GCBA.

**Foundation:** The prevalence of the smoking in the CABA is of 31.1 according to the ENFR 2005. The consumption of tobacco represents an important problem of public health, with deep consequences for the collective health.

**Material and methods:** The diseases attributable to the exhibition of the tobacco financed are: cancer of lung, EPOC, IAM and ACV, which represent 70% of all the deaths. There were selected services of public hospitals, with the intention of identifying a standard case of each diseases. There are financed the diagnostic, therapeutic procedures and of rehabilitation. There are applied institutional duties and medicines of minor value. For the estimation of the total costs, we use:

- 1 The unitary costs of four pathologies
- 2 The relative risks adapted of Europe and USA
- 3 Calculation of attributable population
- 4 The population in Argentina from 25–35 years, INDEC 2001
- 5 Prevalence of the National Survey of Factors of Risk, 2005
- 6 The annual incident in: CA of lung, IAM and ACV, similar Europe and USA
- 7 The prevalence in EPOC, similar USA.

**Results:** Total costs

Public Hospital	440 934 774
12% passive smokers	52 912 172
Total	493 846 916

It represents 12.62% of the budget in health of the Bs As Gov: \$3 912 883 705/year 2010.

**Conclusions:** The implications of the smoking on the public finance is important in order that the governments determine the fiscal and legislative policies for the control of the smoking. The economic aspects of the smoking should be an object of attention on the part of the government, for consequences for the system of health.

**Funding:** This study is framed in the Grant ARGENTINA-04-OC granted by the Bloomberg Philanthropies Foundation with administration of The Union.

### PC-62-29 Secondhand smoke exposure in restaurants in Tianjin, China

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**Background:** Evaluate the condition of secondhand smoke exposure in the restaurants so that right policy and methods would be implemented to reduce the air pollution and harm by smoking inside restaurants.

**Methods:** Data was gathered from 20 restaurants in Tianjin, China from Mar 9th to Mar 18th 2010. The concentration of particulate pollution (PM<sub>2.5</sub>) was measured using TSI SidePak Personal Aerosol Monitors. The detection time was about 39.35 minutes per restaurant and the monitor showed the PM<sub>2.5</sub> data at 1-minute intervals. Information was collected about the size of the situation of 'No Smoking' signs, smoke free area division, cigarettes advertisement and distribution in the restaurants. The information about the attitude and awareness with the SHS was also collected. The number of patrons and lit cigarettes were recorded.

**Results:** 2 restaurants set up the smokefree area. The average PM<sub>2.5</sub> level in the 20 restaurants was 55.7 µg/m<sup>3</sup>, 68.81 µg/m<sup>3</sup> for Chinese restaurants and 31.90 µg/m<sup>3</sup> for Western restaurants respectively. The maximum 1-minute peak concentration was 249 µg/m<sup>3</sup>. Approval rating of banning smoking in public places and workplaces was 88% for whole population, even though for smokers was 82%.

**Conclusions:** Smoking in restaurants made workers, waiters and customers are exposed to secondhand smoke harmful levels of indoor air pollution resulting from particles of lighting cigarettes. It is necessary to prohibit indoor smoking by the effective legislation and the comprehensive smoke-free policies in Tianjin.

### PC-74-29 Tobacco economics in Indonesia

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**Background:** Adult smoking prevalence in Indonesia is 34%, and 63% of men smoke while 4.5% of women smoke. Per capita adult tobacco consumption increased by 9.2% between 2001 and 2004. Today, up to one-half of the 57 million smokers in Indonesia will die of tobacco-related illnesses. Given the delay of up to 25 years between the time of smoking uptake and the onset of many chronic diseases, the negative health effects of increases in cigarette consumption are only now being seen.

**Objective:** To systematically review existing studies in tobacco economics to provide a comprehensive report about the economic aspects of tobacco control in Indonesia.

**Method:** Study literature and simulation of the health and economic impact of increasing cigarette price in Indonesia.

**Results:**

- 1 Some 78% of Indonesian smokers started before the age of 19 years.
- 2 Health care costs for tobacco-related illnesses in Indonesia could amount to between Rp 2.9 to 11.0 trillion per year (US\$319 million–1.2 billion).
- 3 Households with smokers dedicate 11.5% of monthly expenditures on tobacco, and such high spending has serious welfare implications.
- 4 Cigarette prices and tax rates in Indonesia are low relative to other countries, and real cigarettes prices have remained stable since the 1980s. The current tax rate (37% of sales price) is low compared with the global benchmark of 70%, and the rates are below the maximum allowable by law.
- 5 Reaching the global benchmark of 70% through a specific, or primarily specific, rather than ad valorem tax, would have the greatest health impact, and could avert between 5.1 and 11.7 million tobacco-related deaths. This increase would contribute Rp 23.8 to 75.8 trillion (US\$2.6 to 8.3 billion) additional revenue, regardless of reduced sales volumes for cigarettes.

**PC-75-29 Economic burden of tobacco use in Indonesia**

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**Rationale:** Indonesia has not ratified the Framework Convention on Tobacco Control (FCTC). Tobacco control regulation in Indonesia is not sufficient. Tobacco advertising is still allowed, tobacco excise tax is very low and small textual health warning contribute to increasing cigarette consumption. All of these contribute to increasing smoking prevalence, cigarette consumption, and number of smokers in Indonesia.

**Objective:**

- 1 To reveal the trend of smoking prevalence, cigarette consumption and number smokers in Indonesia.
- 2 To reveal economic burden of tobacco use in terms of opportunity loss especially for those in the lowest income group.

**Data:** In this presentation we use data from Indonesia Central Board of Statistic from its several type of national representative surveys.

**Methods:** Cross tabulation method has been used in this report.

**Results:**

- Smoking prevalence among adult female has risen more than 3 times from 1.7% in 1995 to be 5.2% in 2007.
- Smoking prevalence among youth male has risen more than 2 times from 14% in 1995 to be 37%

in 2007. While for youth female, their smoking prevalence rose more than 5 times from 0.3% in 1995 to be 1.6% in 2007.

- In 2007, it is estimated that there 65 million smokers in Indonesia including 428 thousand children smoker age 10–14, 4.8 million female smokers and 12 million poor smokers.
- During 2003–2007, household expenditures for cigarette among the poorest smoking household was in the 2nd position. It is higher than other 23 type of expenditures individually and it is only lower than expenditures for grains.
- Household expenditures for cigarette among the poorest in 2007 are 17 times higher than expenditure for meat, and 5 times higher than expenditure for egg and milk.

**PC-77-29 The tobacco excise system in Indonesia: hindering effective tobacco control for health**

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**Background:** Tobacco price and tax increases are considered the most cost-effective means to reduce consumption and address the burden of tobacco-attributable morbidity and mortality.

**Objective:** To describe the tobacco excise system in Indonesia and its impact on consumption and health.

**Method:** Literature reviews of excise tax and price structure for tobacco products were obtained from Ministerial Decrees of MoF. Brand-specific rates for 2008 and 2009 are derived from surveys, published data in market reports, and data reported by the MoF.

**Results:**

- 1 Tobacco tax system

The tobacco excise structure varies by 11 types of tobacco products, mode of cigarette production, and firm size as measured by production level. The tax is based on the government's retail sales price (HJE) and derived from reports detailing the cost components for each brand produced.

- 2 Current excise rates

The customs law caps excise rates for tobacco at 57 per cent of the government's banderol price (HJE), which is firm and brand specific. However, the MoF set the minimum HJE for the brand-specific range by type of product and firm production scale.

3. Industry responses

Differential tax rates by production scales provide an incentive for firms to reduce their production levels to fall within lower tax brackets.

**Conclusion:** This paper shows that the structure and implementation of the excise system can reduce or negate the impact of a tax increase on consumption. The design of the Indonesian excise system maintains the affordability of tobacco products.

### PC-102-29 Potential for tobacco cessation clinics in a poor community in Cape Town, South Africa

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**Background:** There are various programs to assist tobacco addicts to quit smoking but none, to our knowledge, in South Africa that specifically target poor communities. By investigating tobacco addiction behaviors and the proportion of smokers willing to pay for cessation resources, affordable programs can be implemented in public hospitals to curb use.

**Aim:** We investigated tobacco and alcohol dependence behaviors, collecting data to evaluate the need for focused tobacco cessation interventions from smokers at Tygerberg Academic Hospital, Western Cape, South Africa.

**Methods:** We conducted a cross sectional study in June and July 2010. Subjects were identified mainly through smoking behavior outside the main entrance to the hospital, immediately adjacent to the children's short-stay ward. The Fagerström and CAGE questionnaires were used to determine tobacco and alcohol dependence. Demographic and social characteristics in addition to knowledge of tobacco-associated health consequences and willingness to quit smoking were collected through focused questions.

**Results:** There were 100 respondents. The sample population spends over \$65 000 per year on tobacco products. The majority (75%) indicated they would like to attend a tobacco cessation program to receive help quitting and 57% indicated that they would

be willing to pay the equivalent of what they spend on cigarettes to attend. 48% of the sample showed signs of alcohol dependence and about half were co-dependent on tobacco and alcohol indicating the need for a specialized intervention program.

**Conclusion:** As over half of the sample is willing to put the money currently spent on tobacco products towards attending a tobacco cessation program, such a program could be affordable without additional resources. Establishing an affordable tobacco cessation clinic at Tygerberg Hospital would be a breakthrough in fostering healthy habits in the community.

### PC-521-29 Tabagisme chez les collégiens de la ville de Casablanca au Maroc

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**Cadre :** Le tabagisme constitue un problème de santé publique. Chez les jeunes, la tentation est encore plus grande et les conséquences plus graves; or peu d'informations existent sur l'usage du tabac par les jeunes au Maroc. Ce travail, réalisé en collaboration avec l'association Arissala avait comme objectif d'estimer la prévalence du tabagisme chez des collégiens de la ville de Casablanca et de décrire les facteurs incitant à cette consommation.

**Méthodes :** Une étude transversale était réalisée en 2010 à l'aide d'un questionnaire auto-administré aux élèves de 6 collèges de la ville de Casablanca.

**Résultats :** Le nombre de participants était 576, la moyenne d'âge était de 16,3 ans ( $\pm 2,1$ ), dont 55,4% étaient de sexe féminin. La prévalence globale du tabagisme était de 7,5% avec une prépondérance masculine : 11,4% vs. 4,6% chez les filles ( $P = 0,003$ ). Les dépenses journalières pour le tabac étaient de 10 dirhams chez les deux tiers. Plus que la moitié (52,5%) des fumeurs avaient commencé entre 14 ans et 18 ans. Les principales raisons incitant au tabagisme étaient l'influence des amis (39%), les problèmes psychiques (38%) et les problèmes sociaux (29%).

**Conclusion :** Dans notre échantillon, 7,5% des collégiens se déclaraient fumeurs. Ces chiffres, bien qu'ils soient inférieurs à ceux observés dans certains pays; restent alarmants et justifient pleinement des actions préventives tout au long de cette phase de scolarité afin de sensibiliser les jeunes avant qu'ils ne commencent à fumer régulièrement.

**Table** Demographics and key results

	Smokers willing to pay for cessation resources (n=57)	Smokers not willing to pay for cessation resources (n=43)
Median Age (years)	35 (median); 45.5 – 27.5 (75 – 25% interquartile)	33 (median); 40 – 27 (75 – 25% interquartile)
Sex	54% Female	60% Female
Currently Employed	58%	58%
Familial Environment		
Median # People in House	5 (median); 6 – 4 (75 – 25% interquartile)	4 (median); 6 – 3 (75 – 25% interquartile)
Median # Smokers in House	2 (median); 3 – 1 (75 – 25% interquartile)	2 (median); 3 – 1 (75 – 25% interquartile)
Median # Children in House (<13)	2 (median); 3 – 0.5 (75 – 25% interquartile)	1 (median); 2 – 0 (75 – 25% interquartile)
Smoking Habits		
Age started smoking (years)		
10 to 20	84%	93%
# Cigarettes Smoked/Day		
< 10	54%	53%
10 to 20	37%	37%
21 to 30	9%	10%
Rand Spent on Cigarettes/Day <sup>1</sup>		
< 10	32%	32%
10 to 20	33%	28%
21 to 30	26%	30%
> 30	9%	9%
Knowledge of Smoking Risks		
Smoking Dangerous to Self	96%	100%
Smoking Dangerous to Others	95%	100%
Signs of Alcohol Dependence (Defined by CAGE)	26%	16%
P = 0.33 (Fisher's exact test, 2-tailed)		
Tobacco Dependence (Defined by Fagerström)		
High	33%	37%
Medium	51%	43%
Low	16%	19%

<sup>1</sup> U.S. \$ = R7.08



**PC-667-29 Factors associated with high smoking cessation motivation**

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**Introduction:** Smoking cessation is known as a priority to prevent smoking related diseases and decrease the burden of these diseases. Having motivation is an essential factor for making quit attempt. The objective of this study was to investigate the level of motivation to quit according to demographic factors and smoking status.

**Method:** A group of 345 participants of smoking cessation clinic attended this cross-sectional study. Q-mat test was applied for evaluating level of motivation and Fagerstrom test was used to evaluate level of nicotine dependency. Demographic information and smoking status were collected via a questioner. One-way ANOVA and *T*-test were used to evaluate probable correlation between Q-mat and variables.

**Results:** In this study 345 volunteers were studied from which 311 (90.1%) were men. The mean age was  $37.6 \pm 11.04$  years. The mean of Q-mat score was  $15.5 \pm 5.1$ . The mean of Q-mat test in participants succeeding to quit was  $15.8 \pm 5.1$  and it was  $15.4 \pm 5.1$  in the failed attempts. ( $P = 0.4$ ) the mean of Q-mat in low dependent participants was 16.4 and in high depended participants was 14.8 ( $P = 0.02$ ). The mean of Q-mat test in participants succeeding to quit was  $15.8 \pm 5.1$  and it was  $15.4 \pm 5.1$  in the failed attempts. ( $P = 0.4$ ) The mean of FT in the ones who succeeded to quit and the ones who did not was  $5.2 \pm 2.6$  and  $6.08 \pm 2.6$  respectively ( $P = 0.03$ ).

**Conclusion:** According to the results of this study, participant's level of motivation in smoking cessation clinics is high. This suggests that level of motivation affects decision and quit attempt. Despite our expectation, level of motivation did not affect success rate. So having motivation is an essential factor for quit attends but it is not effective factor on smoking cessation success. Nicotine dependency effect on both level of motivation and quit rate.

**PC-758-29 National prevalence survey of chronic obstructive pulmonary disease in Viet Nam**

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**Objective:** To estimate the prevalence of COPD in Viet Nam by a population based survey and identify major demographic determinants of COPD prevalence.

**Methods:** A cross-sectional survey with multistage cluster sampling, stratified by urban, rural and remote areas, was carried out from September 2006 to

June 2007 in 70 clusters located in 48 provinces with approximately 24 829 participants aged  $\geq 15$  years old. All participants were interviewed, spirometry test and chest X-ray. COPD diagnosis was established when  $FEV_1/FVC < 70\%$  (post test). Point prevalence estimates, 95% confidence intervals and design effects were calculated. Confidence intervals and *P* values were adjusted for the cluster design. The survey was link with prevalence survey of tuberculosis.

**Results:** The result showed that COPD prevalence in Viet Nam population aged  $\geq 15$  years old was 2.2%, among male 3.4% and female 1.1%. The prevalence of COPD among population aged  $\geq 40$  years old was 4.2%, while that prevalence among people aged less than 40 was 0.4% only. There are significant difference between male and female in this age group (7.1% and 1.9%, respectively,  $P < 0.001$ ). The prevalence of COPD was higher in rural compared to urban areas but not yet statistical significance. Among population aged 40 or more, COPD prevalence was found highest in the North (5.7%) compared to the Central (4.6%) and the South of Viet Nam (1.9%),  $P < 0.001$ .

**PC-1000-29 Estimating the size of India's bidi market**

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**Aim:** To estimate the numbers of bidis, a widely smoked local form of tobacco, produced in India.

**Methods:** Bidi (beedi or biri) has become a leading agent of death among adult in the Indian subcontinent. An estimated 100 million people smoke bidis. Using estimates of production of tendu leaves and bidi we calculate the numbers of bidis produced in India.

**Results:** Our results suggest that from the mid-1970s, bidis rapidly grew from 0.55 trillion to nearly a trillion bidis were consistently produced from by 1989 to 1997. There has been a decrease in bidi (tobacco) and bidi leaves (tendu) production since 1998 and in the subsequent years. The current level of bidis is around 605 billion bidis, which is considerably less than 1 to 1.2 trillion bidis estimated by others.

**Conclusion:** Bidis are still the single largest preventable cause of preventable adult death in India, its consumption is declining. Cigarette consumption is growing rapidly which corresponds to the decline in numbers of bidis smokers, but not in the total numbers of adult smokers. Both bidis and cigarettes will contribute to adult mortality in India.

**PC-1242-29 Smoking prevalence among adult tuberculosis patients in Togo**A P Wachinou,<sup>1</sup> K Adjoh,<sup>1</sup> A Fare,<sup>1</sup> F Awokou,<sup>2</sup> O Tidjani.<sup>1</sup><sup>1</sup>Service de Pneumophtisiologie CHU Tokoin, Lomé,<sup>2</sup>Programme National Contre la tuberculose, Lomé, Togo.

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**Introduction:** Smoking is increasingly being recognized as an important risk factor for tuberculosis. Limited information is available on smoking in TB patients from Togo. We present results from a study to determine the prevalence of smoking among TB patients in Lomé, Togo.

**Patients and methods:** It was a cross-sectional study on patients hospitalised in pneumology clinic of Lomé-Tokoin Teaching Hospital from 13 Apr 2009 to 29 Jan 2010. Two hundred and fifty (250) patients with bacteriologically confirmed pulmonary tuberculosis were included. A questionnaire to collect data about demographic characteristics and smoking were used. Data analysis were performed using simple descriptive statistics, Pearson  $\chi^2$ , and logistic regression.

**Results:** Among the 250 patients, 155 (62%) were male. Most of them were young, 71% were less than 40 years. 135 (54%) had secondary or higher education level. New smear positive cases represented 226 (90%). Smoking prevalence were 30% (ever smoker). Current smoker represented 10% and ex-smokers 20%. Comparing the characteristics between ever and never smoker, using univariate analysis, showed that male were 86% in ever smoker while they were 55% in never smoker ( $P = 0.000$ ). About the age, 56% of ever smoker were less than 40 years while they represent 78% of never smoker ( $P = 0.004$ ). About the other characteristics (education level, marital status, type of smear cases), there were no significant difference between the two groups. After multivariate analysis using logistic regression, it appeared that male gender were linked to smoking, the OR male vs. female were 8.28 (95% CI 3.49–19.64). Low education level were also linked to smoking, OR = 3 (95% CI 1.50–6.00).

**Conclusion:** Smoking prevalence in TB patients were 30% at Lomé. Male gender and low educational level were associated with smoking in TB patients which reflect the smoking behavior in the Togolese population.

**PC-1323-29 Monitoring the global tobacco epidemic: Global Adult Tobacco Survey**S Mirza,<sup>1</sup> G Giovino,<sup>2</sup> S Asma,<sup>1</sup> GATS Collaborative Group.<sup>3</sup><sup>1</sup>Global Tobacco Control Branch, Centers for Disease Control and Prevention, Atlanta, GA, <sup>2</sup>University of Buffalo, SUNY,Buffalo, NY, <sup>3</sup>GATS Collaborative Group, Atlanta, GA, USA.

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Tobacco use is a global epidemic, responsible for increasing morbidity and mortality, especially in low and middle income countries (LMI); however, comparable prevalence data on patterns of tobacco use are often

lacking for these countries. For the first time nationally representative comparable data on tobacco use are available for 14 LMI countries using the Global Adult Tobacco Survey (GATS). Data will be presented here from the GATS. The GATS is the largest and most comprehensive survey ever conducted among leading causes of non-communicable disease related deaths and its risk factors completed in low and middle income countries, covering more than 65% of the world's population. Data were analyzed from the GATS in 14 countries from 2008–2010. GATS uses a global standardized methodology. It includes information on respondents' background characteristics, tobacco use (smoking and smokeless), cessation, secondhand smoke, economics, media, and knowledge, attitudes and perceptions towards tobacco use. In all 14 countries, GATS is conducted as a household survey of persons 15 years of age or older using a multi-stage, geographically clustered sample design to produce nationally representative data. GATS Phase 1 Countries include Bangladesh, Brazil, China, Egypt, India, Mexico, Phillipines, Poland, Russia, Thailand Turkey, Ukraine, Uruguay and Viet Nam. These data represent 3.6 billion people, obtained via >300 000 in person interviews in 40 languages and dialects. Initial findings indicate there are >600 million smokers, 540 million male smokers and nearly 500 million daily smokers globally.

**PUBLIC HEALTH AWARENESS, BURDEN, IMPACT AND TREATMENT OF SMOKING****PC-27-29 First randomised clinical trial of Varenicline for smoking cessation in Iran, 2010**

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**Aim:** To evaluate effectiveness of Varenicline for tobacco cessation in this country and compare it with other measures.

**Materials and methods:** This was a randomized parallel clinical study at tobacco cessation clinics during 2009–2010. Participants were divided into three parallel groups randomly. The first group received brief counseling on cessation. The second group received nicotine patches 15 mg/daily for 8 weeks and the third group was prescribed Varenicline one 0.5 mg pill daily for the first 3 days, followed by 0.5 mg twice a day for 4 days and subsequently 1 mg twice daily for 8 weeks.

**Results:** The study had 272 participants including 160 men (58.8%) and 112 women with mean age of  $42.5 \pm 13$  years and average nicotine dependence score of  $5.5 \pm 2.8$ . Ninety one people were in the first group, 92 individuals in the second and 89 in the

third group. At the end of the first month, 128 people from total (47.1%) succeeded in quitting; this included 17 individuals (18.7%) in the first group, 60 (65.2%) in the second group and 51 (57.3%) in the third group ( $P = 0.000$ ). Follow up at 6 month and a year showed 111 people of total (40.8%) and 58 individual (21.3%) remained smoke free which included 12 (13.2%) and 6 (6.6%) in the first group, 47 (51.1%) and 23 (25%) in the second group and 52 (58.4%) and 29(32.6%) in the third group respectively ( $P = 0.000$ ). (See Figure 1.)

**Discussion:** Success with Varenicline is slightly better but not significantly different from nicotine replacement treatment.

### PC-28-29 Severity of ulcerative colitis in the Iranian population and its correlation with cigarette consumption

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**Introduction:** Ulcerative colitis is a chronic inflammatory bowel disease with relatively unknown origin. However, genetic and environmental factors are known to effect. This study evaluates correlation between cigarettes smoking and severity of ulcerative colitis in Iranian patients.

**Materials and methods:** This was a cross-sectional study. Patients with ulcerative colitis attending the Amir Alam Hospital gastroenterology clinics during 2008–2009 were included in the study. Information including smoking habits and severity of ulcerative colitis depending on number of visits to the clinic, hospitalization, radiology and pathology results were collected.

**Results:** A total of 674 patients of which 304 (45.1%) were men were studied. Of these, 160 (23.7%) subject were cigarette smokers. Average number of clinic visits per patient was  $3.8 \pm 1.8$  per year. Nonsmokers and smokers on the average had  $3.6 \pm 1.8$  and  $4.0 \pm 1.4$  visits per year ( $P = 0.02$ ), respectively. While, average number of hospitalizations per patient per year was  $1.4 \pm 1.1$  for nonsmokers and  $2.6 \pm 0.7$  for smokers ( $P < 0.000$ ). Severity of illness with respect to the pathology was from stage zero to 2 (mild) in 272 (40.4%) patients and stages 3 and 4 (severe) in the remaining 402 (59.6%) cases. Radiology results indicated mild disease in 270 (40.1%) patients while severe ulcerative colitis was reported in 404 (59.9%) patients. The frequency was unrelated to gender or cigarette consumption ( $P = 0.913$ ,  $P = 0.14$ ,  $P = 0.12$ ,  $P = 0.8$ ).

**Conclusions:** In contrast to the studies reported from other countries we did not found any correlation with severity of ulcerative colitis in patients by smoking. Moreover, the average number of visits to physician or hospitalization was found high in smokers which need further investigations and studies.

### PC-196-29 Awareness of tobacco-related health hazards among adults in China

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**Objective:** To determine the level of awareness of the hazards of tobacco smoking and secondhand smoke inhalation among adults in China.

**Methods:** Household surveys were conducted with a total of 13354 respondents aged 15 years or over from 100 counties of 28 Chinese provinces using a stratified multi-stage geographically clustered sample design.

**Results:** The findings revealed that 81.8% of the population was aware that smoking causes serious diseases, and 27.2% and 38.7% were aware that smoking causes stroke and heart attack, respectively. Only 64.3% of respondents were aware that secondhand smoke can cause serious diseases, and 27.5%, 51.0% and 52.6% were aware that secondhand smoke causes heart disease in adults, lung disease in children and lung cancer in adults, respectively. Awareness regarding smoking-related hazards across all participants was significantly associated with several factors, including gender, smoking status, urban/rural residency, education level and exposure to tobacco control publicity in the last 30 days. Awareness regarding tobacco-related hazards in smokers was significantly associated with urban/rural residency, education level, exposure to tobacco control publicity in the last 30 days, and physician's advice. Awareness relating to the hazards of inhaling secondhand smoke was associated with smoking status, urban/rural residency, age, education level, and exposure to tobacco control publicity in the last 30 days. Medical professionals were found to know more about the health hazards of tobacco compared with people in other types of employment.

**Conclusions:** Overall awareness of the health hazards of tobacco has improved in the last 15 years in China, but is still relatively poor. Improved means of communicating information and more effective warning labels on cigarette packaging are necessary for increasing public awareness of tobacco hazards, particularly among rural residents and people with less education.

### PC-203-29 Engaging all TB care providers to implement isoniazid preventive therapy nationwide

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**Objective:** We introduced the five strategies to implement isoniazid preventive therapy (IPT) in Taiwan through 2007–2010.



**Background:** IPT has been proposed and endorsed by WHO for decades, but the coverage in contacts was constantly very low in countries with TB burden. Contact investigations (CIs) were conducted by public health nurses in Taiwan routinely. IPT was not endorsed by National TB Program (NTP) before April, 2008.

**Methods:** Strengthening contact investigation was begun since July, 2007. The target of CIs was expanded and average number of contact per index case was shared with 25 counties/cities country-wide seasonally. Contacts only need to pay registration fee to the hospital and get the CXR done. Target population of IPT was contact aged younger than 13 years who had positive tuberculin skin test (TST) without active TB. IPT with directly observed preventive therapy (DOPT) was endorsed by NTP since April, 2008 through collaboration with IPT partner physicians. Proportion of contacts completed IPT with DOPT per index case became annual evaluation index since year 2008.

**Results:** A total of 420 IPT partner physicians were engaged in IPT therapy until year 2010. Training for CIs and IPT was provided to health care providers directly from NTP in year 2008 and 2009. The average contacts per index case was 2.4 in year 2005 and increased to 6.4 in year 2010. Active TB case finding through CIs in reported new TB cases was estimated to be 2.2% in year 2005 and increased to 4.5% in year 2010. In 2009, a total number of 2643 contacts received IPT, of which 90.5% were also enrolled in DOPT.

Year	IPT partner physicians	IPT training (face to face)	Active TB case finding %	The average contacts/ index case	LTBI treatment <i>n</i>
2007	—	—	2.2	4.1	—
2008	265	6	2.6	5.7	1440
2009	376	8	4.0	6.2	2650
2010	420	Internet based	4.5	6.4	3874

**Conclusions:** With engagement of public health care providers and IPT partner physicians, NTP had a chance to implement IPT national wide smoothly and efficiently in Taiwan after strengthening of CIs.

### PC-379-29 The risk of lifelong DNA damage caused by lung cancer among rural male smokers who begin at teenage

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**Background:** It is an established fact that tobacco is the major risk factor for lung cancer incidence. However, it affects more people in developing countries resulting to DNA damage.

**Goals:** To examine the effect of smoking on lung cancer risk and entire DNA damage in a relative large number of rural men, many of whom are poor and started smoking as teenagers.

**Methods:** We followed 50 232 men, ages 25 to 50 years, through a community-based tobacco control outreach program with questionnaires both in English and the local language to the North western and North eastern Nigerian Cohort Study in 2002/2003, through December 2007. We estimated relative risk (RR) of lung cancer associated with different measures of smoking initiation, duration, and intensity adjusting for confounding variables. We conducted analyses on the entire study population, among men who had smoked for at least 15 years and separately for each geo-political zone.

**Results:** Altogether, 10 240 men were diagnosed with lung cancer. Compared with never smokers, men who smoked for at least 15 years and who smoked 10 cigarettes or more daily had a higher RR. In contrast, men who had smoked for at least 15 years, but started after their 19th birthday, did not experience an increased lung cancer risk. The increased RR associated with smoking was observed among nondrinkers of alcohol, men with and without a family history of lung cancer in both geo-political zones in Nigeria.

**Conclusion:** Our results support the notion that men who start smoking as teenagers and continue to smoke for at least 15 years may increase their lung cancer risk with dramatic and lifelong DNA damage. Tobacco killed one hundred million people in the 20th century, if nothing urgent is done to reduce tobacco use, it will kill 1 billion people this 21st century. There is need for countries who are already parties to the Framework Convention on Tobacco Control-FCTC to domesticate the laws in their respective countries.

### PC-498-29 Cohort analysis of Category I smear-positive cases and their relapses

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**Aim:** Cohort analysis of Cat I Sm. Pos. cases and their Relapses when treated with Cat II under RNTCP over sixteen yrs. (1994 to 2009).

**Design:**

- Cat I regimen (2HRZE + 4HR thrice weekly) is given to NSP, NSN and EP cases.
- Relapse: Sm. Pos. cases, once cured under RNTCP, reporting back as Sm. Pos. again after a gap and are treated with Cat II.

**Method:** Cat I Sm. Pos. cases regd. from 1994 to 2009 in CC Gulabi Bagh, Delhi covering a popn. of Ten Lac, were meticulously followed up. Self-reporting relapses arising out of cured cases were put on Cat II regimen. The treatment outcome data in both situations was analysed.

**Results:** Big cohort included 7760 Cat I Pos. cases



regd. from 1994 to 2009. The avg. cure rate was 87% (range: 83.6% to 93.7%). The avg. failure rate was 4.2%. Till 31/12/2010, as many as 570 (8.4%) relapses were reported out of 6761 cured cases, On analysing the time of relapse, out of 436 relapse cases reported within three years of cure in patients regd. from 1994 to 2006, as many as 220 (50%) have been reported as early as within 6 months. The success rate of relapse cases when put on Cat II was, however, fairly acceptable, i.e., 78%.

#### Observations:

- i HIGH self-reporting Relapse Rate (8.5%).
- ii Most relapses reported within six months of cure.
- iii Significant success rate (78%) of relapse cases.

**Conclusion:** These indicate possibility of endogenous reactivation of disease in relapses thereby recommending re-appraisal of the initial Cat I regimen w.r.t.its regularity and duration.

#### PC-508-29 Effect of smoking history on survival among HIV-infected patients with TB

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**Background:** Tobacco smoking has been associated with an increased risk of active TB and poor TB treatment success including increased risk of relapse. Little is known about the effect of smoking on the outcome of concurrent TB and HIV care and treatment.

**Methods:** Cohort study of 572 adult HIV-infected TB patients receiving integrated TB and HIV care and treatment (including antiretroviral treatment if eligible) at five primary health care clinics in Kinshasa, Democratic Republic of Congo.

**Results:** At time of start TB treatment, 433 (75.7%) patients reported they had never smoked, 139 (24.3%) reported ever having smoked, of which 8 reported current smoking. Compared to patients with a history of smoking, patients who never smoked drank less alcohol, were better educated, were less likely to report more than one sexual partner, and were less likely to have a sexual debut before the age of 13 years (all  $P < 0.05$ ). There was no association between smoking and body mass index, functional status, WHO clinical HIV stage, baseline CD4 count, site of TB disease, or smear status. Among the 557 (92.2%) patients with documented outcome at the end of TB treatment, those with a history of smoking were more likely to have died (odds ratio 2.19, 95% confidence interval 1.19–4.13) or become lost to follow-up (odds ratio 5.31; 95%CI 2.48–11.37]. Mean gain in CD4 count by end of treatment was similar, 175 cells/mm<sup>3</sup> among non-smokers and 165 cells/mm<sup>3</sup> among those with a history of smoking.

**Conclusions:** HIV co-infected TB patients with a history of smoking were twice as likely to die during TB treatment, despite similar median CD4 count, WHO clinical stage, type of TB and bacillary load at baseline. Smoking prevention and smoking cessation programs are important, not only to prevent coronary heart disease, stroke, and lung cancer but also to prevent the morbidity and mortality of TB in developing countries.

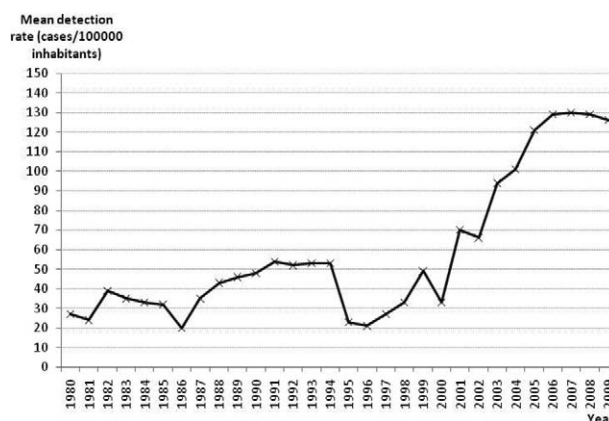
#### PC-835-29 Impact of changing health policies on the performance of the tuberculosis control programme in Cameroon

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**Objectives:** Study the impact of changing health policies in Cameroon on tuberculosis (TB) control indicators and propose strategies for improving TB control.

**Methods:** The retrospective study from 1980 to 2009 is based on documentary analysis and interviews of key informants working for the TB program. Documents consist of scientific papers on TB, annual TB reports, evaluation reports, and health policy documents from Cameroon, and WHO annual TB reports.

**Results:** TB control in Cameroon has evolved over five distinct periods. The first period, from 1980 to 1986, was characterized by free health care at the time and point of health services utilization. The second went from 1987 to 1994 and was shaped by economic crisis in Cameroon and lack of resources. The third period from 1995 to 2000 led to the creation of the national TB program, and the fourth from 2001 to 2006 was marked by the creation of the Global Fund for AIDS, Malaria and TB. The fifth period from 2007 to 2009 showed a decline in the number of TB cases detected. In 2008, with one TB treatment



**Figure** Evolution of the tuberculosis detection rate from 1980 to 2009 in Cameroon.

centre per 89000 inhabitants on average, the national average pulmonary TB detection rate was 129 new cases per 100000 inhabitants, and the cure rate of smear positive pulmonary TB was 63%.

**Conclusion and recommendations:** Successive health policies have addressed some barriers undermining TB control. However, other barriers are still remaining. TB control plans should explore and address those barriers, to optimize access and quality of health care for TB patients.

### PC-1092-29 Transiting from an 8 to a 6 month anti-tuberculosis treatment regimen in Nigeria: a journey begun in 2010

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**Background:** The 8 months anti-TB treatment regimen has been in practice since inception of the programme in 1993. Owing to the WHO recommendations for a patient centered approach and improved quality of care, the national programme in 2010 embarked on a process to transiting from the 8 to 6 months regimen.

**Materials and methods:** This is a descriptive study. The national programme introduced the need for the transition during its partner's forum meeting held in the third quarter of 2010 and a consensus for transition was reached. A working committee comprising of key stake holders was set up. Reference documents were reviewed by the working committee and the existing drug stock status and annual patient case load were accessed to determine the actual commencement period for the introduction of the 6 months regimen and drug quantification and requisition pattern for 2011. The national treatment guidelines were also revised in accordance.

**Results:** Standard operative procedures (SOPs) for the transition and engagement of treatment supporters were developed. Both SOPs were introduced to all state programmes with full commencement feasible within the 3rd quarter of 2011.

**Conclusion:** Community TB care through engagement of treatment supporters is vital for the implementation of a 6 months treatment regimen in order to ensure adherence to treatment and minimize the emergence of resistant strains of TB.

### PC-1236-29 A case-control study investigating the intersection between tobacco use, tuberculosis and HIV

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**Background:** Little research exists examining the unique intersection of tobacco, tuberculosis (TB) and HIV infection. In HIV-infected men, our objective is to determine whether the prevalence of tobacco use varies between those with pulmonary TB (PTB) compared to men without TB.

**Methods:** An unmatched case-control study of HIV-infected males in Johannesburg, South Africa was conducted. We recruited antiretroviral therapy (ART) naïve men with confirmed HIV diagnosis. Cases were HIV infected men with pulmonary TB (PTB) diagnosed by chest X-ray, positive smear or TB culture; controls were HIV-infected men with no evidence of active TB at recruitment. Current smoking was defined as any smoking within 6 months of interview/TB diagnosis. Detailed smoking histories were collected at enrollment. Significant bivariate predictors were included in step-wise multivariate logistic regression models.

**Results:** 146 HIV-infected men with PTB and 138 controls were enrolled. Mean CD4 counts (83.5 vs. 105.6 cells/dl  $P = 0.02$ ) and viral load (VL) (256 086 vs. 162 357 copies/ $\mu$ l  $P < 0.01$ ) differed slightly between cases and controls. 43% were current smokers; 46% in PTB and 38% in controls ( $P = 0.16$ ). Mean pack years was 10.7 for PTB and 6.1 for controls. PTB patients were more likely to smoke (unadjusted OR = 1.40, 95%CI: .87–2.25). After adjusting for CD4, VL, age and BMI, multivariate models showed smoking was associated with increased but not statistically significant risk for TB (OR = 1.65; 95%CI: .93–2.93).

**Discussion:** HIV-positive men with PTB smoked more cigarettes per day than non-TB patients, though current smoking prevalence (~40%) was similar for patients with PTB and those without. Smoking among HIV-infected patients is a growing concern as increased longevity from ART may result in increased tobacco related illnesses in chronic smokers. Results of this study provide a novel look at the association of tobacco smoking and TB in a special population of HIV-infected South African men.

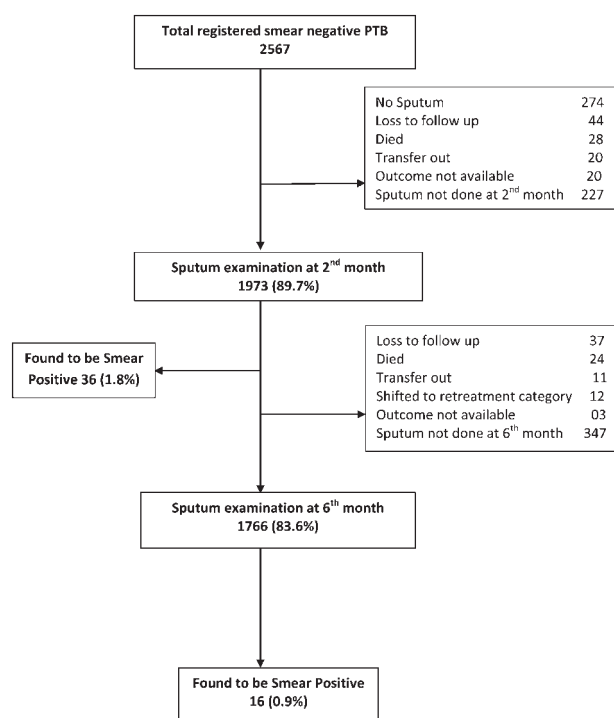
### PC-1330-29 Is a 6th month follow-up sputum smear examination for sputum smear-negative pulmonary tuberculosis patients in India useful?

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**Background:** In 2009, 1.5 million patients were placed on anti-tuberculosis treatment in India, out of which 366 381 (24%) patients were new sputum smear pulmonary TB cases. The Indian guidelines on follow up in these patients differs from World Health Organization guidelines in that the latter recommend only one follow up sputum microscopy examination, which is done at 2 months. Is there an added value of performing an additional sputum smear examination at 6 months in India?

**Methods:** Descriptive record review study. From each of the nine zones divided in Delhi, capital state of India, one TB unit that catered for the maximum number of patients in that zone was selected for inclusion in the study. All consecutive new sputum smear negative pulmonary TB patients registered in these 9 TB units from 1st January 2009 to 31st December 2009 were included in the study.

**Results:** A total of 2567 new sputum smear negative patients were registered in 9 units in Delhi. 386 did not undergo the 2 month smear and 87 did not undergo the 6 month smear for various reasons (Figure).



**Figure** Flow chart showing 2nd and 6th months sputum examination for smear negative pulmonary TB from 9 units in Delhi, India (2009). PTB = pulmonary tuberculosis.

A total of 1973 (90%) of 2200 eligible patients got their first follow up sputum examination at the end of 2 months, out of which 36 (1.8%) had turned sputum positive at 2 months. A total of 1766 (84%) of 2113 eligible patients had a 6th month sputum examination done. Of these, 16 (0.9%) patients (0.9%) had turned smear positive (additional value of the 6 month smear).

**Conclusion:** There is 1% extra yield in doing second follow up examination in sputum smear negative patients, which translates to incremental 3663 new positive patients annually detected in the programme, an intervention worth aiming at reduction of transmission of the disease.

### PC-1336-29 NNK metabolites in the urine of waterpipe tobacco smokers, cigarette smokers and non-smokers exposed to environmental tobacco smoke

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The causal relationship between tobacco smoking and a variety of cancers is attributable to the many carcinogens that smokers inhale, including tobacco specific nitrosamines (TSNAs). Relative to cigarettes, much less is known about the levels of TSNAs in other tobacco products, particularly waterpipes. In this study, we measured two metabolites, NNAL and NNAL-Gluc, of NNK (a potent lung carcinogen) in the urine of Egyptian rural males who were either current cigarette or waterpipe smokers, and in their wives who were exposed to environmental tobacco smoke. The 46 subjects included 24 (52.2%) males and 22 (47.8%) females. Of these male smokers, 13 (54.2%) were exclusive cigarette smokers and 11 (45.8%) were exclusive waterpipe smokers. Among females, 13 (59.1%) were exposed to cigarette smoke and 9 (40.9%) to waterpipe smoke. In the total group of 46 subjects the geometric mean of urinary NNAL was  $0.19 + 0.60$  pmol/ml (range 0.005–2.58). A significantly higher level of urinary NNAL was observed among males who currently smoked either cigarettes or waterpipe ( $0.89 + 0.53$  pmol/ml, range 0.21–2.58) compared to non smoker females ( $0.04 + 0.18$  pmol/ml, range 0.005–0.60,  $P = 0.000$ ). Among males, cigarette smokers had significantly higher levels of urinary NNAL compared to waterpipe smokers ( $1.22$  vs.  $0.62$ ;  $P = 0.007$ ). NNK carcinogen uptake was therefore evident in both cigarette and waterpipe smokers at an order of magnitude higher than non smokers exposed to ETS. Possible differences in smoking behavior and carcinogenic exposure between cigarette and waterpipe smokers should be further explored.

## SUNDAY 30 OCTOBER 2011

### POSTER DISCUSSION SESSIONS

#### TUBERCULOSIS AND TB-HIV PROGRAMME IMPLEMENTATION

##### PC-37-30 Patients' costs for directly observed treatment in Brazil

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**Aim:** To evaluate costs for patients and their families of the directly observed treatment (DOT) compared to the self-administered treatment (SAT) in different states in Brazil in the diagnostic and in the treatment phases.

**Method:** We interviewed 479 patients on the second month of bacteriologically proofed pulmonary TB. Direct and indirect costs were computed, as well as additional costs with help for daily tasks. The number of hours lost were multiplied by the hourly wage in Brazil. The estimated hourly wage was 1.31 American dollars, based on the Brazilian annual minimum wage in 2008, divided by the assumed number of annual hours of work based on a 44 weekly hours of work contract. Average costs were extrapolated to the projected total informed number of DOT and follow-up visits throughout the entire duration of the patient's TB treatment, which was assumed to be 6 months. Data were collected in 8 cities in Rio de Janeiro state, Belém (Pará), Curitiba and Paranaguá (Paraná) and Fortaleza (Ceará).

**Results:** Although TB diagnostic tests, consultations and drugs are free of charge in Brazil, costs for patients are high, considering their low income. Higher costs were in Belém, and lowest in Paraná (in Paranaguá, DOT is community-based, which reduces costs with travel and waiting time). DOT costs doubled in Paraná and increased by 4-fold in Belém and Ceará (Table). In the pre-diagnostics phase, patients' costs were higher in SAT facilities, while in the treatment phase, costs were higher in DOT facilities. Most patients' costs were due to lost hours. These high costs for patients may be hampering the targeted 85% cure rate recommended by WHO.

Sponsored by CNPq 551497/2007-6, ICOHRTA 5 U2R TW006883-02, ENSP 011-LIV-10-2-3

	Directly observed treatment	Self-administered treatment	P value
Rio de Janeiro State, n = 218	n = 115	n = 103	—
Pre-diagnostic	40.2 (104.2)	44.2 (81.1)	0.38
Direct	16.2 (21.0)	25.7 (34.0)	0.11
Indirect	25.1 (102.0)	18.4 (73.6)	0.11
Post-diagnosis	127.7 (274.6)	48.8 (44.2)	<0.01
Direct	64.4 (206.1)	20.7 (30.7)	0.05
Indirect	63.3 (181.5)	28.1 (31.9)	0.03
Total	186.9 (299.8)	107.8 (110.6)	<0.01
Belém, n = 89	n = 81	n = 8	—
Pre-diagnostic	62.1 (80.8)	83.3 (174.8)	0.54
Direct	44.0 (74.5)	73.4 (175.5)	0.36
Indirect	18.1 (18.1)	9.9 (9.9)	0.21
Post-diagnosis	146.7 (134.5)	35.8 (24.7)	0.02
Direct	1.7 (5.6)	1.1 (2.4)	0.75
Indirect	145.0 (134.4)	34.8 (22.9)	0.02
Total	207.0 (158.2)	116.0 (170.7)	0.13
Curitiba/Paranaguá, n = 100	n = 54	n = 46	—
Pre-diagnostic	37.8 (65.5)	29.2 (34.6)	0.43
Direct	22.9 (58.8)	16.1 (37.5)	0.48
Indirect	14.9 (18.1)	13.1 (15.1)	0.60
Post-diagnosis	31.3 (42.6)	16.3 (11.5)	0.02
Direct	3.3 (10.2)	1.3 (3.1)	0.21
Indirect	11.9 (16.2)	6.4 (4.6)	0.03
Total	69.1 (88.4)	45.5 (39.5)	0.10
Fortaleza, n = 61	n = 25	n = 36	—
Pre-diagnostic	20.4 (26.9)	52.3 (63.5)	0.02
Direct	10.2 (23.0)	27.4 (54.8)	0.15
Indirect	10.2 (16.4)	25.0 (22.8)	0.01
Post-diagnosis	157.3 (197.9)	58.3 (114.6)	0.02
Direct	39.4 (123.3)	20.3 (101.6)	0.50
Indirect	117.9 (114.4)	38.0 (26.0)	0.01
Total	177.7 (210.4)	110.6 (129.4)	0.13

##### PC-141-30 Decision analysis and cost considerations when scaling up care against tuberculosis

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The Global Plan to Stop TB 2011–2015 states that in order to achieve certain diagnostic and treatment milestones by 2015, we need to estimate related costs and other resources used by national TB programs. Thus, there is an urgent need to fully understand the aspects of decision making in funding diagnostic and treatment services. Under a contract for the US Center for Disease Control, we used decision tree modeling to evaluate 3 public health interventions against TB. This paper will present key concepts from economic evaluations, decision tree methodology, and findings of the analyses and discuss use of this technique and implications for scaling up care against tuberculosis. Decision modeling was implemented to evaluate following interventions: 1) Testing algorithm: tuberculin skin test vs. Quantiferon in detection of latent TB, 2) Treatment algorithm: INH-rifapentine and DOT vs. INH-rifapentine self administered or INH-9 months of treatment, (3) Adherence algorithm:



standard treatment vs. adherence intervention. We implement sensitivity analyses to determine range of number of TB cases averted and cost per case averted for an at-risk sample of 6000 patients. In testing algorithms, we found that 39–70 cases could be averted using TST testing compared to 44–74 cases averted with QFT. QFT testing cost an additional \$35 727 to \$38 836 per case averted. In treatment algorithms, we found that the incremental cost of using SAT INH/rifapentine is only \$5440 per additional case averted. The cost increases to \$25 481 per case averted if INH/rifapentine is administered by DOT. Adherence intervention may result in 2.3 to 4.8 cases averted with an estimated cost of \$250 631 to \$589 046 per case averted. Decision tree analysis is an effective and inexpensive method to inform decision makers on approaches to TB elimination and provides with valuable information on selecting strategies to support the scale up efforts against TB around the world.

### PC-573-30 Operationalizing external linkages in tertiary care hospitals for control of TB in Pakistan

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**Background:** In Pakistan a tertiary care hospital (TCH) caters the needs of patients from many districts. Since the initiation of TB DOTS services in TCHs in Pakistan, we have noticed a rapid increase in case finding with increase in default rate. There is a dire need to organize a pre-registration referral system in TCHs to enhance the patient access to nearest TB care services.

**Objective:** a) To enhance the access of DOTS services for the patients and b) to rationalize case registration in TCHs to achieve better outcomes.

**Methods:** It is an operational search and comparing case notification and outcomes before and after the intervention of pre-registration referral system. A comprehensive directory with support from cell phone was used as a tool for effective communication system with the patient and the registering health facility.

**Results:** A total of 134 newly diagnosed TB cases in 3 TCHs of Pakistan in the year 2010 who were referred to their nearest health centers were evaluated. Out of 134, 111 (83%) were found registered at their designated nearest health facilities in respective districts. From the remaining cases 6 (4%) got admission in other health facility, 5 (4%) died, 12 (9%) were not retrieved.

**Conclusions:** The early implementation experience has shown a significant change in the pattern of case registration at TCHs and may lead to better outcome indicators. The current intervention has been considered to be scaled-up in other TCHs in Pakistan.

### PC-582-30 Assessment of quality of TB surveillance data in six selected states in southern Nigeria

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**Introduction:** Tuberculosis data are used to evaluate the effectiveness of TB program interventions, identify deficiencies and inform policies and programs. They are also used for advocacy, resource mobilisation and allocation both nationally and internationally. Considering the importance of TB surveillance data, how reliable are data used in monitoring the NTP? This study is aimed at verifying the reliability of data collated and submitted from DOTS facilities to the NTP in selected states in southern Nigeria.

**Methodology:** A total of 29 facilities providing TB services were selected purposively from six states in southern Nigeria based on treatment success rate as reported in 2009. In each selected facility, the following records were reviewed for concordance; patient treatment cards and facility TB register, facility TB register and facility laboratory register, facility TB register and LGA TB register, LGA TB register and TB quarterly reports. Furthermore, a total of 273 patients were selected for interview to validate information contained in the treatment cards.

**Result:** Agreement between data sources was relatively high. Agreement between patient treatment card and facility TB register and facility TB register and laboratory register was 97% and 85% respectively. The level of concordance observed between facility TB register and LGA TB register for cases notified was 99.5%. Then treatment outcome for new and re-treatment cases were 98.0% and 91.9% respectively. Similarly, agreement between LGA TB central register and LGA quarterly reported data for cases notified was 97.9%, treatment outcome for new cases (98.4%) and re-treatment cases (90.6%). All the patients interviewed confirmed the information as recorded in their treatment cards.

**Conclusion:** The study revealed that NTP data in southern Nigeria is fairly reliable. However, variations were observed among the states and at various levels.

### PC-713-30 Role of mid-CP follow-up sputum microscopy in management of smear-positive TB patients

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**Background:** Sputum positive (SP) TB patients receiving 1st line drugs are recommended to undergo 3 (or 4) follow-up sputum microscopy examinations for monitoring of treatment progress. However, as per guidelines of the Revised National TB Control Program (RNTCP) in India, questions have been raised on the utility of mid-CP follow-up. This study was conducted to assess the proportion of SP patients whose management is affected by mid-CP sputum examination.

**Design/methods:** A descriptive study involving review of existing records maintained by RNTCP staff was undertaken in five districts of Bihar, India. If mid-CP follow-up smear microscopy results were useful in early identification of failures, it was considered 'critical'.

**Results:** Among the 1486 SP patients registered during the study period (July 2009 to September 2009), mid-CP follow-up was done in 627 cases (48%). Overall, it helped in/could have helped in early identification of 'failures' in 7 cases. This amounts to less than 0.5% of all SP patients who were recommended to undergo this follow-up. Interestingly, it wasn't critical in any of the new sputum positive (NSP) cases who became negative at the end of intensive phase (IP) treatment.

**Conclusion and recommendations:** Mid CP follow-up is intended to identify failure cases earlier and initiate drug susceptibility testing (DST), and is thus, an important tool to control the spread of drug resistant TB. But for around 80% of NSP patients, who experience sputum conversion at the end of IP, this follow-up seems to play no role in guiding further management and declaring outcomes. With RNTCP's plan to test all smear positive TB patients for DST at diagnosis, the utility of mid-CP may further be diminished. In addition, the reduced laboratory workload may be diverted for increased diagnostic work-up. Thus, the recommendation for routine use of mid-CP follow-up in all smear positive TB patients may be revisited.

### PC-857-30 Harmonizing government of Swaziland/international partners efforts in TB-HIV care in Swaziland

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**Aim:** To harmonize implementation of TB-HIV integrated services in Swaziland to improve programme performance indicators.

**Background:** Swaziland has highest TB and HIV prevalence in the world. TB-HIV co infection rates above 80%, a cause for concern because it further complicates the disease patterns. The burden of disease attracted a number of international partners interested in assisting alleviate the situation. The coming in of many partners was an opportunity to win the battle against the two diseases. However partner's efforts were not coordinated which resulted in duplication of services and channeling of resources to same interventions, a cause for concern.

**Method:** The NTCP coordinated partner's efforts. Partners identified and requested to submit their annual implementation plans. One annual plan was developed to harness partner's contributions in TB care. Quarterly meeting to review progress on implementation. Strategic documents developed jointly as well as mobilizing for resources. Treatment success has greatly improved significantly in the past three years. The country have made tremendous progress in regard to TB-HIV collaborative services, HTC uptake and cotrimoxazole therapy.

**Results:** The treatment outcomes in the country has greatly improved 58% in 2008 to 78% in 2009, 10% increase from previous year. Introduction of HTC services in TB clinics increased uptake from 64% in 2008 to 84% in 2009.

**Conclusion:** Coordination of partner's contribution in TB care has improved treatment outcomes significantly and accessibility to TB-HIV integrated services in rural areas where over 70% of the population live.

### PC-958-30 Comprehensive state review of performance of districts under RNTCP in Rajasthan, India

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**Setting:** The state of Rajasthan in India, fully covered under Revised National TB Control Programme (RNTCP) since 2000, has been performing well with respect to projected targets (85/70), yet enormous challenges remain in sustaining achievements while maintaining quality. Over the years performance in desert, semi-desert and border-district has remained sub-optimal in terms of case detection. Performance of these districts were analyzed in detail resulting in a strategy, leading to an identification of the problems and focused on removing bottle-necks for comprehensive involvement of all stake-holders to ensure 'universal access for quality TB care by all'.

**Objectives:** To find out gaps in implementation and achievement, to evaluate the status of implementation in these districts and to give recommendations to bridge the gaps and achieve optimal level of performance.

**Methods:** The state level team visited these districts

for 3 days and reviewed the performance in detail as per specific protocol in the year 2009. Post field visits, observations made by team were discussed with programme officers and staff in presence of state level officers and district health officials, districts were apprised of constraints identified, corrective action taken and suggested by team and issues need to be addressed at state level. State level officer-in-charge of these districts followed up the issues identified during this exercise and made follow-up visits.

**Results:** The performance improved substantially in the year 2010 in the districts Jalore (case detection from 70% to 92%), Jodhpur (case detection from 51% to 65%), Barmer (case detection from 53% to 58%) and Bharatpur (case detection from 54% to 57%), marginally in districts Bikaner (case detection from 68% to 70%) and Jaisalmer (case detection from 56% to 57%) and no change in district Jhunjhunu (case detection 56%) after this intervention by the State. This activity is being undertaken on a regular basis in low performing districts.

#### **PC-1258-30 Recruitment and retention of community volunteers in implementing CTBC project in Nigeria**

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**Issues:** Experience from many high burden TB-HIV countries has shown that CTBC is an effective and acceptable means of improving access to quality TB services. The success of community involvement in practice depends on the quality of relationship between health personnel and community volunteers (CV). This study reviews the process of engagement and retention of CV in a CTBC program in Nigeria.

**Description:** The recruitment of CVs begins with community engagement through advocacy and mobilization activities. The selection process is inclusive and based on set criteria. Once selected, the CVs subsequently work under the supervision of community-based organizations (CBOs) to carry out specific functions which include health promotion, identification and referral of TB suspects to health facilities, provision of treatment support for TB patients; and tracking of contacts and defaulters.

**Results:** The analysis for 6 districts with CTBC activities for the period January 2008 to January 2010 shows that 204 CVs were engaged; 98 females and 106 males with a mean age of  $38 \pm 10$  years. About 77% of them were married, 3.9% had no formal education while others (96.1%) had education ranging from primary to university levels. Majority (81.4%) had a regular occupation while only 48.0% were able to state their level of income from their regular jobs. Some LGAs gave financial incentives to CVs ranging from \$13 (33.3%) to \$17 (36.8%). A third of CVs had no financial incentives. The retention rate for all

6 LGAs was 98.5%. Attrition rates were higher among those who received no incentives (34.4% cf. 0.7%),  $P > 0.05$ . CV characteristics entered into a backward binary logistic regression model did not predict retention or attrition.

**Conclusion:** Retention rates among CVs in these cohorts were high. This low attrition rate can be attributed to the inclusive selection process which makes CVs highly acceptable within their communities.

#### **UNDERSTANDING STIGMA: IMPACTS ON TUBERCULOSIS AND HIV PROGRAMMES**

##### **PC-29-30 Care and support for people living with dual TB-HIV disease in Nepal**

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**Background:** There are support and care activities exist for people living with HIV/AIDS in communities in Nepal. The few organizations that give support and care to people living with HIV/AIDS but there aren't any care and support program for people living with tuberculosis (TB). Most of HIV positive people have co-infection of Tuberculosis and the main cause of death of HIV positive people due to TB co-infection and hepatitis C as well. We can't find any care and support program for people living with dual disease (HIV and TB), and often people living with HIV/AIDS are discriminated by the communities. In order to eliminate the stigma and the discrimination of people living with HIV/AIDS and TB, we planned this project in a small town called Hetaude.

**Intervention or response:** To eliminate the stigma and the discrimination towards peoples living with HIV/AIDS and TB and to strengthen their participation in HIV/AIDS and TB prevention programs, TB-HIV education, TB-HIV care and support designed to give them support and care need to be integration.

**Results:** 18 people living with dual disease (TB and HIV/AIDS) joined the project.

**Conclusion:** In Nepal there is a high number of people living with HIV/AIDS who are co-infected by TB need help, but there is no emotional and mutual care and support for them. Our project shows that we can do something for people living with dual disease (HIV/AIDS and TB) in additional.

### PC-59-30 Communication interventions to raise awareness and fight TB-associated stigma in Azerbaijan

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**Background:** In Azerbaijan knowledge about TB transmission, the importance of early detection and treatment adherence is low, contributing to a high number of defaulters and high MDR-TB rates. Our project developed national-scale communication interventions to contribute to TB detection and treatment and fight stigma. No comprehensive advocacy, communication and social mobilization activities had been implemented in Azerbaijan previously.

**Interventions:** We developed six print and video materials for various audiences. Research findings were used to develop key messages for the 'TB is not shameful. Get treated' campaign. Behaviour change communication and entertainment-education approaches were employed to produce two public service announcements (PSAs) and an educational documentary, which were broadcast on national and regional TV in November–December 2010 (950 showings).

**Results:** An omnibus survey and focus group discussions were used to evaluate the project outcomes. The first wave of the survey was conducted in June 2010, prior to the campaign and accounted for non-readers/viewers. Four FGDs with 20 participants demonstrated that those who read/viewed project materials received comprehensive information regarding TB symptoms, the importance of early detection and treatment by TB specialist. Viewers/readers reported that they would seek immediate health care if symptoms of TB arose. Omnibus survey results found that individuals who saw/read TB messages vs. those who did not were twice as likely (100 vs. 49%) to name ways of TB transmission correctly.

**Conclusions:** Communication interventions are vital in the struggle to overcome TB-related stigma as well as to raise awareness about TB. The use of television proved to be effective in reaching big audiences. Innovative entertainment-education approaches provided an appropriate and appealing way to deliver complex messages.

### PC-574-30 Low level of awareness leading to stigma towards persons with HIV/AIDS

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**Aim:** HIV thrives among mobile populations. Truck drivers particularly the long distance truck drivers are more vulnerable to HIV infection, because they travel a lot, remain cut off from the mainstream society, often engage in activities such as having unsafe

sex with commercial sex workers and fellow crew members, in order to reduce their loneliness.

**Methods:** In this study interviews of 75 truck drivers at Badami Bagh Truck Stand, Lahore, Pakistan, were carried out on non-random basis, using convenient sampling technique through a structured questionnaire. The objective was to assess link between level of knowledge about HIV/AIDS and the attitude towards persons with AIDS.

**Results:** 50% of the truck drivers were found unaware about the role of needles as a means of spreading HIV/AIDS. 30–40% thought that needles had nothing to do with the transmission of AIDS. Forty to fifty percent of respondents had the misconception that AIDS can be contracted by casual contact and by being in the same room with a person with AIDS. Two thirds of the truck drivers were of the view that monogamy and condom use is an effective method for AIDS prevention. An association between low knowledge of AIDS and high negative attitude towards persons with AIDS was found to exist, which was statistically significant.

**Conclusion:** Long distance truck drivers in Pakistan have serious gaps in their knowledge about HIV/AIDS, especially its modes of transmission, signs/symptoms and prevention. Stigma towards persons with AIDS.

### PC-778-30 Tuberculosis treatment adherence and mortality are predicted by low social capital

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**Background:** Social capital quantifies perceived social support and is associated with successful treatment, but its relationship to TB is unknown. TB is a stigmatized disease so we hypothesized that TB may be associated with diminished social capital, potentially impairing access to care. We therefore studied social capital associations with TB.

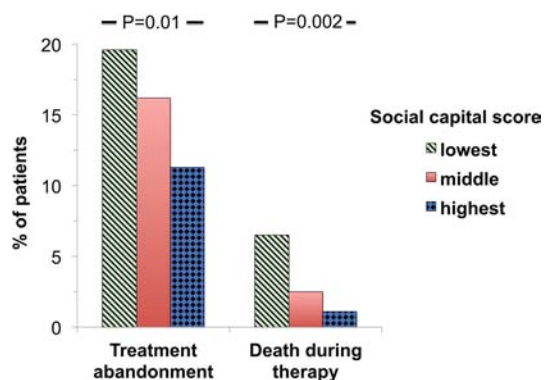
**Methods:** Social capital and demographic factors were assessed in TB patients ( $n = 1226$ ), a group of their healthy household contacts ( $n = 329$ ) and randomly selected community controls ( $n = 478$ ) in impoverished periurban shantytowns in Peru. A questionnaire was developed consisting of 83 questions encompassing the micro, meso, and macro-levels of social capital including support (government, community, and individual), perceived safety and trust. Exploratory principle component analysis was used to identify correlated variables.

**Results:** Indicators of social capital were lowest in



TB patients, higher in their contacts and highest in controls, e.g., community support was respectively 5% vs. 9% vs. 12% ( $P < 0.001$ ). Principle component analysis determined that social capital was described in one main dimension encompassing support (68 items), safety and trust (15 items). This social capital score was reduced in TB patients ( $P < 0.001$ ), males ( $P < 0.001$ ), those with less education ( $P = 0.001$ ) and those undergoing TB re-treatment ( $P = 0.01$ ). Patients with low social capital at the time of diagnosis were more likely to abandon treatment ( $P = 0.02$ ) or die during treatment ( $P = 0.01$ ), as shown in the graph. These associations were independent of markers of disease severity.

**Conclusions:** Social capital was reduced in TB patients, especially those who failed to complete treatment or died during treatment. Therefore assessing social capital predicts a high-risk patient group who should be offered supplementary care. Interventions that increase TB patients' social capital should be evaluated for their potential to improve treatment adherence and survival.



### PC-801-30 Knowledge, attitude and practice regarding TB among general population in Afghanistan

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**Background:** Selecting ACSM activities relies on KAP survey data which include TB questions. KAP survey can identify knowledge gaps, cultural beliefs, or behavioral patterns that may facilitate understanding and action, as well as pose problems or create barriers for TB control efforts. A KAP survey could also explore ways to involve general population on utilization of TB services.

**Objective:** To explore knowledge, attitude and practices regarding tuberculosis among general population.

**Methodology:** A cross-sectional multi stage cluster baseline survey was conducted, from July to December 2010 in 17 provinces, considering the security situation.

**Results:** Totally, 2321 households were interviewed. Among them, 47.4% of respondents knew that TB spreads through air flow, and 89% knew at least one symptom of TB. For nature of disease, 59% of respondents think TB is a serious disease. 96.5% replied that TB is curable. For health seeking behavior, 46.6% of respondents replied that they will seek immediate treatment after developing TB symptoms while remaining respondents stated cost of treatment and difficulties in transportation as barrier. 30% of respondents were informed on TB through TV, 25% by radio. 86% of respondents reject living with TB patients and only 14% want to help them.

**Conclusion:** This survey identified stigma against TB patients in the community. However, most of the respondents knew the symptoms of TB, and that it is curable. Majority of them did not know that TB services are free of charges. NTP should design media and community based interventions to overcome these problems.

### PC-950-30 The effect of stigma on the knowledge and screening for pulmonary tuberculosis among HIV-positive

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**Setting:** Tuberculosis is a condition with obvious signs and symptoms. Therefore, feeling stigmatized or embarrassed because of being diagnosed with TB can hinder an individual from health seeking behaviors. With the burden of tuberculosis in Nigeria which ranks 4th among countries with high TB burden in the world, this study is aimed at investigating how health seeking behavior will control the spread of TB in Nigeria.

**Objectives:** To determine the effect of stigma on the knowledge and screening of TB among people living with HIV/AIDS in APIN Centre JUTH North Central Nigeria.

**Methodology:** This is a cross-sectional study. A total of 60 patients who were HIV positive and diagnosed with TB were questioned on 16 questions ranging from knowledge of TB to their health seeking behavior when they had symptoms of TB. Data were collected after ethical committee in JUTH. Data were analyzed using the EP1 info method.

**Results:** 13.3% of the respondents were below 25 years and 6.7% were within the ages of 46–55 years. Most of the respondents were middle aged (26 to 45 years), 53.3% of the respondents were females while 46.7% were male respondents. From the total number of respondents: 75–90% were aware of the mode of transmission of TB, 69.2% of the respondents also feel ashamed to be associated with the disease while 56.7% of the clients say they don't socialize because of the fear of embarrassment. 89.7% of these clients get financial support from their loved ones.

**Conclusion/recommendations:** The study shows that patients have a broad knowledge of the symptoms of TB but feel ashamed of the disease. This invariably affects their health seeking behavior to get treatment and it becomes a public health concern. To this effect therefore, my recommendation is that more emphasis should be laid on the fact that TB can be cured during health education about TB and also risk involved in caring for TB patients so that they get more social support.

### PC-1230-30 Developing a TB stigma index in Zambia and South Africa

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**Background:** Despite the application of HIV stigma indexes, there is no comparable TB stigma index theoretically informed and validated, and little data of this type on TB patient stigma experiences. An opportunity to develop a TB stigma index arose within a community randomized trial (ZAMSTAR, 2006–2009) which aimed, as a secondary outcome, to reduce TB and HIV stigma in 24 selected Zambian and South African community sites.

**Methods:** Multi-methods—including reviewing HIV indexes and other TB stigma literature, analysis of qualitative data from the communities, translation and piloting, consulting an international stigma consortium—were used by a mixed disciplinary team to generate key conceptual domains and a list of indicators. Both TB and HIV indicators were administered (2006/7) to a cohort of 11 530 respondents (TB patient/household member/person living with HIV) in TB patient households in all sites. Based on the results from the baseline, and informed by qualitative data, fieldwork process and translation issues, the variables were sorted to identify best performing variables across key domains.

**Results:** In our index, 82 variables were grouped according to 5 conceptual domains. After baseline analysis, the set was reduced to 16 variables across the 5 domains (4 of which also apply to HIV): TB transmission fears (3 variables) and TB-HIV shame and blame (1) for household members; and enacted stigma (9), internalized stigma (2), disclosure (1) for TB patients/PLWH.

**Conclusion:** This TB stigma index has proven to be a useful tool for measuring TB stigma in high HIV prevalence settings.

## CHILD TUBERCULOSIS, BCG AND LUNG HEALTH

### PC-496-30 Retention patterns of an adolescent cohort in Western Kenya in preparation for future vaccine trials

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**Background:** The risk of tuberculosis (TB) disease following infection begins to increase in the age range 12–18 years. This high risk population group is therefore a prime target for new TB vaccines. Ability to track and retain an adolescent cohort are essential prerequisites to conducting future vaccine trials in this age group.

**Objectives:** To estimate the prevalence and incidence of TB among adolescents in Western Kenya.

**Methods:** 5004 adolescents aged between 12–18 years were enrolled for one year and followed up every four months for one to two years. Efforts were made to locate participants moving out of the study area. Descriptive statistics were used to calculate the monthly retention percentages while bivariate (pooled *t*-test for equal variances) analysis was used to test for differences in mean retention rates at the 95% confidence level using 12–14 year olds as the baseline group and the other age groups as the comparison groups. This analysis was also done comparing males and females.

**Results:** The average retention for this cohort was 79%. Retention was similar between male and female adolescents ( $P = 0.24$ ). There was a significant difference in retention between 12–14 (85.21%), 15–17 (72.15%) and 18 (59.71%) year olds ( $P = 0.0022$ ).

	Month 4	Month 8	Month 12	Month 16	Month 20	Month 24	Average
Age group, years							
12–14	90.92	86.37	84.89	78.30	71.95	77.93	85.21
15–17	81.65	73.19	71.66	62.85	52.88	61.06	72.15
18	71.52	60.99	58.20	42.78	37.86	54.37	59.71
Sex							
Male	86.73	81.50	80.22	72.53	73.06	75.35	80.40
Female	85.56	77.88	75.98	67.64	66.85	65.69	76.70

**Discussion and conclusion:** Younger adolescents showed a better retention compared to older adolescents. Our data reveal that retaining an adolescent cohort for a TB vaccine trial is possible in Western Kenya when proper tracking mechanisms are put in place as adolescents are highly mobile.

### PC-630-30 Clinical outcomes of children receiving integrated TB-HIV care and treatment at primary care clinics

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**Background:** Great progress has been made in improving the integrated approach to TB-HIV care and treatment for adults. Little is known on outcomes of integrated management of HIV-infected children with TB at primary care level in resource poor settings.

**Methods:** Prospective cohort study of HIV-infected TB patients managed at a nurse-run program in five primary health clinics in Kinshasa, Democratic Republic of Congo.

**Results:** Among the 604 participants, only 32 (5.3%) were age 17 years or less. The mean age was 10.3 years and only 7 (19.9%) were younger than 5 years of age. Eleven (34.4%) children were known HIV-positive prior to TB diagnosis, and only 1 was on antiretroviral treatment (ART). Most children were diagnosed on clinical suspicion only, with only 10 assessed by smear microscopy, and 8 evaluated by X-ray. Pulmonary TB (PTB) was the most frequent type of TB (71.9%), 2 had smear positive PTB. Six children (18.8%) had extrapulmonary TB, and 3 (9.4%) had both extrapulmonary and PTB. At time of TB diagnosis, median CD4 count was 251.0 cells/mm<sup>3</sup> and 48.4% of children had severe immunosuppression. Two children died during TB treatment, three were lost to follow up, and 27 successfully completed TB treatment. According to 2006 WHO guidelines, 24 children were eligible for initiation of ART during TB treatment. Most of these (22 of 24, 91.7%) were initiated on ART after a median of 68.0 days on TB treatment. By end of TB treatment, median CD4 count had increased to 395.5 cells/mm<sup>3</sup>, corresponding to a median CD4 count increase of 144.5 cells/mm<sup>3</sup>, and only 13.64% of children remained severely immunosuppressed.

**Conclusion:** Few children with TB-HIV were diagnosed and managed at primary care clinic level. Yet, most participating children had successful TB and ART treatment outcomes, indicating that successful integrated management of these children by nurses at primary care level in highly resource poor settings is feasible.

### PC-752-30 Pneumonia outcomes in HIV-exposed uninfected and HIV-negative children in Gaborone, Botswana

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**Background:** HIV exposed uninfected (HEU) children have higher mortality rates than their HIV unexposed (HU) peers. We describe outcomes in HEU and HU children admitted with pneumonia, the commonest cause for hospital admission, in Gaborone, Botswana.

**Design/methods:** This retrospective cohort study included all pediatric (0–13 years) respiratory admissions from April 2009 to September 2010 to the pediatric medical ward of the nation's largest referral hospital. Subjects were identified using an admission register and laboratory records. Pneumonia included broncho-, lobar, TB and *Pneumocystis jirovecii* pneumonia (PCP). The main exposure was HIV-exposure status (HEU or HU). The main outcomes were length of stay and mortality;  $P < 0.05$  was considered significant.

**Results:** Of 2877 total pediatric medical admissions, 1127 (39%) were respiratory: pneumonia (58%), asthma (18%), bronchiolitis (15%), other (9%). Total mortality rate was 6.6% (191/2877) and for pneumonia was 13.6% (89/655). Of 655 children with pneumonia, HIV status was: 294 (45%) HU, 81 (12%) HEU, 120 (18%) positive, 160 (25%) unknown. In HU pneumonias, 56% were male, median (IQR) age was 12 months (5–24), median (IQR) length of hospital stay was 3 days (1–6) and mortality was 24/294 (8%). In HEU pneumonias, 59% were male, median (IQR) age was 6 months (3–11), median (SD) length of stay was 4 days (1–7) and mortality was 8/81 (10%). Between groups there was no difference in median length of stay ( $P = 0.11$ ; Wilcoxon rank-sum) or mortality (relative risk, 1.2; 95% confidence interval: 0.57–2.59). Significance did not change when TB and PCP were removed from the diagnosis of pneumonia.

**Conclusion/recommendations:** Pneumonia outcomes did not differ in HU as compared to HEU children. Study limitations included retrospective design and inability to analyze the effect of potential confounders on outcome, e.g., comorbid medical conditions including malnutrition. Future prospective studies are required to verify these findings.

### PC-783-30 Assessing capacity for diagnosing TB in children in sub-Saharan African HIV care settings

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**Background:** Pulmonary TB is frequently under diagnosed in children infected with HIV: sputum specimens are difficult to obtain and bacteriological confirmation is rarely obtained.

**Methods:** In September 2010, a structured survey was administered at 651 facilities providing pediatric HIV care and treatment in 9 countries (Cote d'Ivoire, Ethiopia, Kenya, Mozambique, Nigeria, Rwanda, South Africa, Swaziland, and Tanzania). At each facility, means of diagnosing pediatric TB (including any of the following: clinical presentation, chest X-ray [CXR], expectorated sputum, sputum induction, gastric aspirate [GA] and naso-pharyngeal aspirate [NPA]) was assessed in relation to facility characteristics including location (urban, rural), facility type (1°, 2°, 3°), and patient volume (number of pediatric patients currently in care).

**Results:** We evaluated 651 facilities providing HIV services to over 100 000 HIV infected children. TB was diagnosed by clinical presentation at 79% (range across countries, RAC: 35%–98%) of sites. CXR was available at 51% (RAC: 18%–89%). Sputum, for smear microscopy, was obtained by expectoration at 25% ([RAC]: 4%–56%), induction at 6% (RAC: 0%–24%), GA at 5% (RAC: 0%–21%) and NPA at 2% (RAC: 0%–7%). Secondary and tertiary (84%) and urban facilities (77%) were more likely to diagnose TB using CXR compared to 1° (36%,  $P < 0.001$ ) and rural facilities (35%,  $P < 0.001$ ). GA and NPA were also more likely to be performed at tertiary and secondary (10%,  $P < 0.0037$  and 4%,  $P = 0.07$ ) compared to 1° facilities (4% and 1% respectively). Large volume sites were more likely to have NPA and GA (3%,  $P = 0.03$  and 8%,  $P < 0.00$ ) than low volume sites (1% and 3% respectively).

**Conclusions:** Few facilities had capacity to diagnose TB in children either by CXR or smear microscopy. At most, TB in children was diagnosed by clinical means alone. Decentralization of pediatric HIV services to primary care sites must occur in concert with steps to strengthen existing TB diagnostic capacity at these facilities.

### PC-847-30 Diagnosis of tuberculosis in a random population of HIV-infected children at a pediatric HIV clinic

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**Background:** Children aged 0–14 years have been estimated to contribute to almost a third of all TB cases. Tuberculosis is also the leading cause of mortality in HIV infected individuals. Diagnosis of TB is still a challenge and is complicated in children with TB-HIV co-infection due to the atypical presentation of TB. The objective of this study was to examine the role of T-SPOT®.TB assay in the diagnosis of TB infection in HIV-infected children in Uganda.

**Design/methods:** Using a cross-sectional study design, 381 HIV-infected children were randomly recruited at the Baylor-Uganda clinic at Mulago Hospital, Kampala, Uganda between March and August 2010. All children had a TST placed and a T-SPOT®.TB assay run. Sputum examination (AFB culture and smear) and chest X-rays were done to rule out active TB. Four categories of TB were determined: not TB, possible, highly probable (HP) or definitely TB. Decision to treat TB was independent of sputum results.

**Results:** Fifty-four percent (54%) of the population was female with an average age of 7.7 years (median 7.7 years). Two children (0.6%) were diagnosed with definite TB, 102 (29.7%) with HP TB, 172 (50.1%) with possible TB and only 67 (19.5) had no TB. Seven children were started on TB treatment during the course of the study; two had definite TB, four had HP and one was in the 'possible TB' category.

**Conclusion:** Without routine TB screening, childhood TB in HIV-infected children may be missed. Routine TB screening should therefore be implemented at pediatric HIV/AIDS care and treatment centers.

### PC-880-30 Risk and chances to develop tuberculosis in children with respiratory diseases

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**Goal:** To estimate risk and odds ratio for tuberculosis in children with respiratory diseases, contacted with active tuberculosis (TB) patients.

**Material and methods:** We gathered information



from 68 children contacted in families with active TB patients, all enrolled in the study were BCG vaccinated at 3rd day after birth. All enrolled were divided into two groups, number of males and females in group was equal—1st group—34 children with respiratory diseases, 2nd group ( $n = 34$ ) children without respiratory problems.

**Results:** In 1st group tuberculosis was developed in 8 persons ( $RR_1 = 0.24$ ), in second—in 3 cases ( $RR_2 = 0.09$ ), odds ratio was 2.67 ( $P < 0.05$ ).

**Conclusion:** Thus, in children with respiratory diseases, who contacted with active TB patient, OR to develop tuberculosis was 2.67 times higher than in children without respiratory problems. Taking to account the above spelled we have to provide special policy of new TB case prevention in children living with respiratory diseases.

#### PC-904-30 Integrating RNTCP with high risk setting: nutritional rehabilitation centres in M. P., India

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**Background:** Intensified case finding among groups expected to have a high TB prevalence has been recommended as a promising approach to achieve universal access to high quality early diagnosis and treatment of TB. Nutritional rehabilitation centers (NRCs) were created as a part of the IMNCI (Integrated Management of Neo-natal and Childhood Illnesses) programme. NRCs provide nutritional rehabilitation and health care to malnourished children.

**Intervention:** As malnourishment is one of the risk factor for active tuberculosis, proactive involvement of Revised National Tuberculosis Control Programme (RNTCP) with NRCs envisioned being beneficial for malnourished children in diagnosis and treatment of concurrent illness and for TB control as this provides an opportunity for early detection and management of childhood tuberculosis. Screening of all malnourished children attending NRCs for active tuberculosis and putting them on treatment using paediatric drugs available in RNTCP is encouraged.

**Results:** In January and February, 2011, 1041 malnourished children were registered in NRCs of 7 districts, 625 symptomatics were examined for TB and 112 of them were found having active TB disease.

**Conclusion and recommendation:** Intensified TB case finding among malnourished children in high risk institutional set up is programmatically feasible and this is useful for early TB case detection. This initiative would be further strengthened for malnourished children attending general hospital settings and centres of department of woman and child development.

#### PC-1106-30 Laboratory-confirmed BCG disease in hospitalised children in Johannesburg, South Africa

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**Background:** *M. bovis* Bacille Calmette-Guerin (BCG) vaccine may cause severe adverse reactions ranging from localized, regional, distant, disseminated disease and IRIS (Immune Reconstitution Inflammatory Syndrome) in HIV infected children. The vaccine (Danish strain) continues to be routinely administered to infants at birth in South Africa, a country with a high TB-HIV co-infection rate. We aimed to describe laboratory-confirmed BCG disease in children over a 6 month period in Johannesburg.

**Method:** This retrospective, cross-sectional, laboratory-based study was conducted in Johannesburg, South Africa. *Mycobacterium tuberculosis* complex isolates recovered from children < 13 years admitted to 2 tertiary academic hospitals from October 2009 to March 2010 were speciated by the GenoType<sup>®</sup> MTBC (Hain Lifesciences). Cultures from respiratory specimens, lymph nodes, fluids and tissue were analyzed. HIV results and clinical data were collected.

**Results:** Speciation was performed on 67/91 (74%) isolates, of which 7 were confirmed as BCG. Six of 18 (33%) pus specimens isolated BCG. BCG accounted for 10% and 27% of positive *M. tuberculosis* complex cultures from children < 13 years and infants less than 1 year old respectively. BCG disease contributed to 6/24 (25%) of culture confirmed TB cases among HIV-infected children. Six of 7 (86%) children with BCG disease were HIV-infected; 3 of whom were deemed to have BCG IRIS. Using the revised paediatric classification of BCG disease (2006), four cases of BCG adenitis were classified as regional BCG disease, one pulmonary TB case as distant BCG disease and one disseminated TB/BCG/IRIS as regional BCG disease because no distant site or blood was positive for BCG.

**Conclusion:** Routine speciation of positive *M. tuberculosis* complex cultures from children less than 1 year of age should be performed in high TB-HIV burden settings as BCG disease is common and is managed differently from tuberculosis.

### PC-1232-30 Mortality patterns of an infant cohort in preparation for TB vaccine trials in Western Kenya

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**Background:** The last decade has seen accelerated tuberculosis (TB) vaccine development and movement towards Phase II and III trials in high risk populations. Knowledge of infant mortality patterns will guide mortality reduction strategies needed for safe trials.

**Methods:** 2900 infants aged 0–6 weeks, were recruited from rural Siaya District, Western Kenya. Four monthly follow up visits and health facility record reviews were conducted as part of morbidity and mortality surveillance. Ancillary care was also provided. Cause of death assignment was based on a medical officer's independent review of death reports from clinical notes for health facility deaths or a narrative report by a trained study nurse for infants dying at home. Additionally, verbal autopsies were conducted by trained community workers for all deaths.

**Results:** There have been 129/2900 deaths and 18 582 ancillary care visits (July 2009 to March 2011). Seventeen (13%) were neonatal. 65(49%) had causes of death assigned. Infant mortality rate (IMR) was 39 (CI 32–46) per 1000 live births. Pneumonia, neonatal causes, gastroenteritis and malaria contributed 43% of deaths ascertained. 6 (4.6%) of the deaths were TB cases. HIV sero exposure (25%) and severe malnutrition (41.5%) were the predominant underlying causes of death.

**Discussion:** TB is an important cause of infant mortality in Western Kenya. Provision of free ancillary care reduced infant mortality by a third. Future TB vaccine trials should provide free drop-in health care as a mortality reduction strategy and to improve ascertainment of cause of death.

### PC-1245-30 BCG ostitis in children in the Sverdlovsk region, Russian Federation

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**Setting:** Since 2002 the increasing trend for ostitis with morphological characteristics of tuberculosis (TB) was detected in children of Sverdlovsk region.

Clinical manifestation in the majority of cases was like BCG ostitis.

**Aim:** To estimate actual incidence rate of post-vaccinal ostitis in children of Sverdlovsk region and to describe its medical, social and epidemiological characteristics.

**Material and methods:** We analyzed 91 patient developed ostitis with hystological attributes of tuberculosis inflammation. In 84 of 91 cases (92.3%) post-vaccinal ostitis were detected, 95.2% patients were under 3 years old; the youngest patient (4 months) had developed breastbone TB, the oldest—5 years and 9 months old—had developed BCG ostitis of II instep bone. TB in other localizations was not detected in children enrolled in the study and no one of them was exposed to active TB patient. 92% of children had lived in normal or good life conditions and demonstrated normal results in tuberculin skin test (2TE). X-ray symptoms of ostitis in small and flat bones were detected in 48.3% of enrolled children: breastbone, ribs and instep bones. Posttoxic syndrome was moderatory expressed In all patients, local symptomatic was presented by pain, movement limitation (reactive arthritis), abscess. Material from 47 patients (interoperation biopsy, archive histological material, *Mycobacterium* strains on media) was tested by PCR that allowed to detect DNA of *M. bovis* BCG in 21 cases (44.7%).

**Results:** Thus, actual incidence rate of postvaccinal ostitis in 2002 was 25 per 100 000 vaccinated; in 2003, 20; 2004, 34; in 2005–2010 about 30 per 100 000 BCG vaccinated newborns.

## TUBERCULOSIS IN HIGH-BURDEN COUNTRIES IV

### PC-444-30 Determining the true burden of anti-TB drug resistance in Minsk: routine surveillance vs. survey

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**Introduction:** Official statistics on the prevalence of anti-TB drug resistance in the city of Minsk, Belarus, where TB patients routinely receive drug susceptibility testing (DST), reflect a large and growing problem

of multidrug-resistant TB (MDR-TB). The quality of the routine DST and of the recording/reporting of data, however, has not been previously assessed.

**Objective:** To determine the true level of drug resistance and understand the accuracy of the routine system of surveillance in Minsk.

**Methods:** A drug resistance survey was conducted in Minsk between November 2009 and August 2010, during which time all newly registered smear- and culture-positive TB patients were invited to participate. In parallel to the routine DST performed at two additional facilities, DST for all specimens was performed at the National Reference Laboratory, and quality assurance was provided by the Stockholm Supranational Reference Laboratory. Patient clinical histories were carefully determined and recorded, to distinguish between new and previously treated TB patients.

**Results:** 156 new and 67 previously treated TB patients were enrolled in the survey. MDR-TB was found in 35.3% (95%CI 30.8–40.0) of new patients and 76.1% (95%CI 65.9–84.1) of those previously treated. Extensively drug resistant (XDR) TB was found in 15 of the 106 MDR-TB patients (14.2%; 95%CI 8.1–22.3). Patients under 35 years old had a 2.0 times higher odds of MDR-TB than those 35 and older (95%CI 1.0–4.2). According to official statistics from routine surveillance in 2009, 26.9% of new TB cases and 60.3% of previously treated TB cases had MDR-TB.

**Conclusions:** Very high frequencies of MDR-TB and XDR-TB have been documented in Minsk. In comparison to the survey data, the recorded levels of MDR-TB from routine surveillance data are lower. Improved quality assurance measures of routine DST and patient data recording/reporting are needed.

#### PC-485-30 Tuberculosis at old age in Denmark reflects a high infection rate at young age

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**Aim:** To study the origin of the relatively high incidence of tuberculosis (TB) in elderly persons born in Denmark, a TB low burden country.

**Materials and methods:** Incidence in 10 years age cohorts were calculated from the mortality and notification database on TB in the native Danish population 1900–2000. *Mycobacterium tuberculosis* infection prevalence (TIP) in the Danish born population in year 2000 was calculated by the Styblo method using estimates of annual *M. tuberculosis* infection rates (TIR) in the years 1900–2000. Nationwide subtyping of all culture confirmed and relapse TB cases

was introduced in Denmark in 1992. Danish born cases were extracted from the Danish TB subtyping database, containing IS6110-RFLP results on 95% of culture confirmed and 77% of notified cases 1992–2004. Cases were stratified by age and genotype and annual incidences were calculated.

**Results:** Overall TB incidence in the 10 years age groups 30, 40, 70 and 80 years of age was 2,4, 4,1, 4,5 and 6,1/100 000. Number of TB cases per 105 *M. tuberculosis* infected Danes was >250 at age <40 years and <15 at age >70 years. Subtyping showed predominantly clustered and unique in Danes <60 and >60 years of age respectively.

**Conclusion:** The relatively high incidence in elderly Danes reflects high prevalence of *M. tuberculosis* infection due to distant infection, i.e., in the beginning of 20th century. This is supported by *M. tuberculosis* subtyping with predominantly unique *M. tuberculosis* strains in the elderly and clustered in younger and middle aged Danes and analysis of mortality and incidence 1900–2000.

#### PC-552-30 Death from consumption in the 21st century in the United States

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**Background:** Despite near universal access to TB treatment in the United States, over 7% of TB cases are diagnosed at death or die prior to completing treatment. To lower TB-related mortality in the US, characterization of factors associated with death from TB is needed.

**Methods:** Retrospective chart reviews from TB patients newly diagnosed between 1/1/2005 and 12/31/2006 and who were diagnosed at death or died prior to completing TB treatment were performed by 15 TBESC sites across the US. This analysis includes 684 patients in the study catchment areas. Two researchers independently reviewed each abstracted record to classify the death as related to TB, unrelated to TB, or containing insufficient data to classify. Where disagreement occurred, a third researcher independently reviewed and classified the death. Analysis compared TB-related deaths with deaths not TB-related.

**Results:** Of 684 deaths reviewed to date, 522 (76%) were judged TB-related. Median patient age at



diagnosis was 65 years (range < 1–96 years); 69% were male. The majority of deaths (76%) occurred after treatment initiation; the remainder occurred before TB diagnosis or after diagnosis but before treatment began. From bivariate analyses, persons with bilateral disease on chest X-ray, combined pulmonary and extra-pulmonary disease, and diabetes were more likely to die a TB-related death than a non TB-related death (Table). For patients in this review, HIV was not associated with TB-related death ( $P = 0.09$ ). Persons with cancer were less likely to die a TB-related death ( $P = 0.0002$ ). Multivariate analysis is ongoing.

	TB-related (%) ( $n = 522$ )	Non TB-related (%) ( $n = 162$ )	$P$ value
Median patient age, year [range]	64.4 [0.1–95.9]	66.6 [1.8–94.4]	
Male sex	361 (69.2)	111 (68.5)	0.88
African-American race	237 (45.5)	61 (37.7)	0.08
Asian race	85 (16.3)	33 (20.4)	0.23
Caucasian race	189 (36.2)	64 (39.5)	0.45
Death after treatment initiation	390 (74.7)	127 (78.4)	0.34
Diabetes	40 (7.7)	5 (3.1)	0.04
HIV	109 (20.8)	24 (14.8)	0.09
Active cancer	56 (10.7)	36 (22.2)	0.0002
Bilateral disease on chest X-ray	209 (40.0)	39 (24.1)	0.0002
Combined pulmonary and extrapulmonary disease	129 (24.7)	14 (8.6)	<0.0001

**Conclusion:** TB contributed to the death of a substantial proportion of persons in this study. Increasing provider awareness of risk factors for death in all TB patients, as well as prevention of disease in persons with clinical characteristics that place them at higher risk is important for prevention of TB-related deaths.

### PC-593-30 The Second National Drug Resistance Survey: Cambodia still has lower levels of drug-resistant TB

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**Background:** Cambodia ranks 21st of the 22 high TB burden countries. The NTP introduced hospital-based DOTs in 1994 and expanded it to health centers nationwide in 2004, followed by community levels, with the treatment success rates being maintained over 90%. We conducted the 2nd National Drug Resistance Survey (NDRS) in 2006–2007, to measure the level of MDR-TB primarily among new TB cases and secondary among previously treated TB cases.

**Methods:** Sputum samples were collected from 30 clusters of districts across the country selected with sampling probability proportionate to the number of cases notified in 2005. Drug susceptibility test (DST) was performed for the four drugs (INH, RFP, EB and SM) by an internationally recommended method.

**Results:** A total of 781 isolates (725 from new and 56 from previously treated cases) were tested for DST. Ninety-nine (13.6%, 95%CI 10.7–17.3%) of the new cases, 12 (20.8%, 95%CI 11.3–35.1%) of previously treated cases showed drug resistance to at least one of the four drugs. Prevalence rates of drug resistance to INH and RFP among new cases were 7.4% and 1.8%, respectively. There were ten (1.4%, 95%CI 0.8–2.5%) among new and six (10.0%, 95%CI 4.8–19.6%) among previously treated cases. Those aged 55 years old or more had lower prevalence of any drug resistance, although there was no clear trend between age and prevalence of drug resistance. Prevalence of any drug resistance and MDR was higher in diagnostic centers located in provincial capital cities than in those in other areas, although not statistically significant.

**Conclusion:** Despite the decentralization of TB services and the introduction of the current regimen in 2005, the prevalence of MDR-TB among new cases is still reasonably low. It is, however, strongly recommended that the third NDRS be conducted after 2011 and that NTP should set up a sentinel surveillance system for monitoring a trend of drug resistance, at least RFP, among previously treated cases.

### PC-695-30 Results of drug resistance survey among AFB-positive pulmonary TB cases in Khartoum State, Northern Sudan

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**Aim:** To determine the prevalence of drug resistant and multi-drug resistant *Mycobacterium tuberculosis* strains among Sudanese patients with pulmonary tuberculosis, and to determine the patterns of resistance against first line anti-tuberculosis drugs.

**Methods:** This was a cross-sectional and comparative study. Following informed consent, data was collected for consecutively registered sputum smear positive patients from selected NTP diagnostic centers in Khartoum State. Cluster sampling with probability proportional to size in order to select centers and systemic sampling to select the patients. Drug resistance was determined using conventional culture techniques as standard compare with molecular techniques using specific primers for drug resistant strains (results not appear here).

**Results:** DST was conducted in 406 isolates. *M. tuberculosis* isolates were recovered from 297 and 109



**Table** Resistance profile among study population

Resistance profile	Type of cases	
	New <i>n</i> (%)	Previously treated <i>n</i> (%)
Total	355	132
Monoresistant	50 (14.1)	22 (16.7)
Polyresistant	44 (12.4)	13 (9.8)
MDR	29 (8.2)	31 (23.5)
Susceptible	174 (49.0)	43 (32.6)
Not done:	58 (16.3)	23 (17.4)
No growth 59 (12.1)		
Contaminated 9 (1.8)		

newly diagnosed and previously treated cases, respectively. Drug resistance was found in 3.2% (13/406) of cases for INH, 1.5% (6/406) for RMP, 10.8% (44/406) for SM and 2.2% (9/406) for EMB. The rate of MDR was 14.8% (60/406); 29/60 (8.2%) were newly diagnosed, while 31/60 (23.5%) were relapsed and treatment failures. The male:female ratio was 2.6:1; most were young adults.

**Conclusion:** The frequency of MDR-TB is alarming high among newly diagnosed and relapsed/failure patients. This represents the tip of the iceberg, as the number of samples cultured in the study was only collected from one state compared to the number of pulmonary TB cases registered annually in all 15 states of north Sudan. The extent of anti-tuberculosis drug resistance in Sudan is currently unknown. Therefore, there is an urgent need to carry out a DRS in order to determine the magnitude of anti-tuberculosis drug resistance in the country. Such findings underline the need for ongoing stringent control measures to curb the spread of *M. tuberculosis* and its deleterious effects.

### PC-711-30 Major depression episode among patients with pulmonary tuberculosis: a preliminary report

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**Background:** Treatment success in patients with pulmonary tuberculosis (PTB) is affected by many factors. Depression has been associated with poor adherence to PTB treatment in some studies, leading to more adverse outcomes in these patients. The association between depression and treatment outcomes was investigated in a setting with high prevalence of PTB in the general population.

**Design/methods:** Adult patients with a first episode of PTB were enrolled from health centers in San Juan de Lurigancho district (Lima, Peru). At enrollment, patients were evaluated for Major Depression Episode (MDE) with a validated questionnaire (CES-D 5). We considered death, default and transfer to another health centre without results of treatment outcomes as adverse outcomes.

**Results:** A total of 166 patients completed the CES-D 5 scale during the enrollment visit. Of them, 68 (41%) presented a score compatible with MDE. Presenting an adverse outcome was significantly associated with MDE (PR: 1.71, CI95%: 1.09–2.67). Factors that increased the probability of presenting MDE were age (PR: 1.01, CI95%: 1.00–1.02); female gender (PR: 1.46, CI95%: 1.00–2.13), and being married (PR: 1.63, CI95%: 1.07–2.48), divorced or widowed (PR: 2.07, CI95%: 1.20–3.58) in comparison to being single. Completed education, employment status, and heavy alcohol drinker were not significantly associated with MDE. Statistical power for these hypotheses tests did not exceed 80%.

**Conclusion:** The pre-PTB treatment prevalence of MDE was higher than previously reported, and it was associated with poor treatment outcomes. The final results of this ongoing study will give further insight on the association between MDE and treatment outcomes to PTB treatment.

### PC-754-30 Profile of tuberculosis patients in Manaus, Amazonas, 2007

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**Aim:** To analyze the profile of tuberculosis patients in Manaus (AM) in 2007.

**Methods:** This is an epidemiological, descriptive, survey type study taking as a source of information, cases of tuberculosis reported in the Information System for Notifiable Diseases (SINAN). Data collection took place from 01 to 30 July 2009. The studied population consisted of tuberculosis cases those evolved to death, interruption of treatment and cure. The statistical analysis used descriptive techniques gazing frequency, mean, median and standard deviation. The  $\chi^2$  test was used to analyze the association among the groups. The level of significance adopted was 5% ( $P < 0.05$ ) for all tests. Statistical analysis was performed using the software Statistica 8.0.

**Results:** In 2007, there were 1.952 reported cases of tuberculosis in the city of Manaus. For the study were selected 83 cases of deaths with tuberculosis, 229 who patient dropouts and 1.268 patients who were discharged after being cured, totaling 1.580 cases. The majority, 938 (59.4%) subjects were male, predominantly brown, living in urban areas. Regarding clinical form, input type and type of treatment, there was a predominance of pulmonary tuberculosis in 1.230 cases (77.6%), 1.362 (86.2%) new cases and 1.373 (92%) patients who underwent self-administered treatment. Most cases, 1.007 (63.73%) was diagnosed in referral units and the coverage of supervised treatment

was only 8.0% of cases. The mean age was 37.5 years and median of 33.7 years.

**Conclusion:** The study shows the importance of using the information system as a tool for evaluating and monitoring the actions of tuberculosis control. In this sense, was revealed important associations in the profile of tuberculosis patients and points needs to the strengthening of primary care for diagnosis of tuberculosis and the increase of supervised treatment for tuberculosis control, as well as greater coordination of the Tuberculosis Control Program with other programs.

### PC-770-30 Resistance profile of *M. tuberculosis* identified at the Central Laboratory of Public Health

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**Background:** In 2008, about 440 thousand cases of multidrug-resistant (MDR) tuberculosis (TB) emerged worldwide. Between all incident TB cases all over the world, a proportion of 3.6% is estimated as MDR, causing about 150 thousand deaths (WHO, 2010).

**Objective:** To know the drug resistance profile of *Mycobacterium tuberculosis* strains identified in the Central Laboratory of Public Health of Minas Gerais state (Laboratório CENTRAL de Saúde Pública do Estado de Minas Gerais—LACEN-MG), during the year of 2010.

**Methodology:** Descriptive and retrospective study of resistance profile, utilizing the LACEN-MG databank.

**Results:** Within a total of 1498 samples referring to 863 patients, 400 positive cultures and 1077 negative ones were observed, with 21 cultures (1.4%) presenting contamination. Out of the total of positive cultures, 302 isolates of *M. tuberculosis* from 210 patients were observed, being 94.0% isolates from pulmonary origin and 6.0% of extrapulmonary origin. 64.3% of patients were of male gender, and 35.7% of female. The observed MDR incidence was 11.9%, equivalent to 25 patients. Respecting to resistance profile, the following standards were observed: 78.1% sensible strains; strains resistant only to rifampin 5.1%; only to isoniazid 5.4%; only to streptomycin 5.1%; resistant to rifampin + isoniazid 25.6%; resistant to rifampin + isoniazid + streptomycin 25.6%; resistant to rifampin + isoniazid + ethambutol 5.1%; resistant to rifampin + isoniazid + streptomycin + ethambutol 7.7%; resistant to isoniazid + streptomycin 10.3%.

**Conclusion:** The inter-gender fractions are according to bibliographical descriptions, evidencing higher percentage for male sex. The high proportion of MDR is due, mainly, to the fact that LACEN-MG is

the Laboratory Reference Center of MG state, receiving this way, materials from the most complex patients, and hospitals as well.

### PC-806-30 Economic burden of tuberculosis on households in an urban slum area in Dhaka, Bangladesh

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**Background:** Tuberculosis (TB) poses high burdens to patients and their families among low and middle-income countries. We assessed the economic burden of tuberculosis on households before start of specific TB treatment in an urban population in Dhaka, Bangladesh.

**Methods:** The study was conducted in an urban slum in Dhaka, Bangladesh. TB cases were identified through active surveillance. All cases were treated by DOTS centre. Field workers interviewed all TB cases and collected data on health care expenditure, work loss and coping strategies adopted by the households.

**Results:** Forty TB cases were detected and enrolled in the study. Seventy five percent of them were involved in earnings and had an average monthly income of US\$37 in immediate preceding month. Two-thirds of earning patients were unable to work from 2 to 30 working days (mean 16 days) because of illnesses in the preceding month of diagnosis. On an average, TB patients made 2.6 visits to health care providers before start of specific TB treatment and spent US\$12 to get properly diagnosed. This expenditure included provider fees, diagnostic cost, medicine cost, cost of transport and other related costs. About 48% households had to adopt some coping strategies (loan, donations, selling of properties, etc.) to compensate the health care expenditure and work loss.

**Conclusion:** TB has high economic burden on households due to work loss and diagnostic costs before initiation of specific treatment among urban population in Bangladesh. Our findings warrant reduction in diagnostic delay of TB cases which could reduce economic burden to the families.

### PC-879-30 High rate of non-tuberculosis mycobacteria in multidrug-resistant tuberculosis suspects in Cambodia

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**Background:** Cambodia is among the 22 highest TB burdened countries globally according to the WHO. There is growing evidence of the incidence of lung disease due to non-tuberculous mycobacteria (NTM) worldwide; however there is very little data about its incidence in South-East Asia. We report the first epidemiological data about NTM in patients who were screened for multi-drug resistant (MDR) TB in Cambodia.

**Methods:** From January 2009 to December 2010, patients suspected of pulmonary MDR-TB were screened in the MDR-TB expansion program implemented by Cambodian Health Committee (CHC) working in partnership with the Cambodian national TB program. After direct exam, sputum samples were sent for liquid culture (MGIT) and identification (AccuProbe). In case of the detection of NTM, species were identified by GenoType Mycobacterium CM assay. Patients were offered counseling and testing for HIV.

**Results:** Of the 807 patients screened for MDR-TB there were: 70 (9%) CAT I failures, 191 (24%) CAT II failures, 34 (4%) MDR-TB close contacts, 16 (2%) CAT I M2/M3 non-converters, 105 (13%) relapses and defaulters, and 391 (48%) retreatment cases. Of 383 (47.6%) with a positive culture, 166 (43%) were confirmed NTM and 217 (57%) were confirmed *Mycobacterium tuberculosis* by identification with 69 MDR (18%). Among those patients with NTM median age was 55 years, 87 (52%) were female, HIV status was known in 166 (100%) and positive in 2 (1%). 137 NTM cases (83%) were smear negative. 1 was co-infected with *M. tuberculosis*. NTM species were identified in 140 cultures of 92 cases: *M. scrofulaceum* in 43 (31%), *M. avium* complex in 37 (26%), *M. abscessus* in 17 (12%), *M. interjectum* in 9 (6%), *M. fortuitum* in 5 (4%), *M. malmoense* in 2 (1%), *M. kansasii* in 1 (1%), and other species in 26 (19%).

**Conclusion:** NTM infection is frequent in HIV-negative Cambodian patients failing first-line TB treatments or requiring retreatment. More studies are needed for better documentation of epidemiology and management of NTM in Cambodia.

### PC-983-30 Frequent detection of *Pneumocystis jirovecii* among smear-negative suspected recurrent PTB

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**Introduction:** Respiratory infection is a leading cause of morbidity and mortality especially in association with HIV. PCP and bacterial infections are common respiratory pathogens. Recurrent tuberculosis is commonly most suspected cause of pulmonary symptoms among HIV infected adults previously treated for PTB and those with sputum negative are unnecessarily started on anti-TB chemotherapy. This exposes HIV infected persons to unnecessary pill burdens, overlapping ART and anti-TB drugs toxicities and drug interactions.

**Setting:** National Referral TB Treatment Center, Mulago Hospital Kampala.

**Objectives:** To determine the prevalence of *Pneumocystis jirovecii* among smear-negative suspected recurrent PTB in HIV infected adults in Kampala.

**Methods:** Patients with cough  $\geq$  2 weeks, sputum AFB negative, HIV+ and aged 18–60 years, were eligible. Patients underwent sputum induction and evaluated for *P. jirovecii*. Septrin and ART use were recorded. We did a univariate analysis to study association of *P. jirovecii* with some selected factors (HAART, Septrin use, CD4 count) using odds ratios.

**Results:** Between March 2008 and October 2010 a total of 115 patients (51.6% mean; mean age 37.1 years; SD 9.0) 56% unemployed or skilled workers were enrolled. Their main CD4 count was 273.0 (SD 207.9). Eighteen per cent had *P. jirovecii* pathogens detected in their induced sputum and 25/28 were on septrin prophylaxis and 14/28 were on HAART.

**Conclusion:** *P. jirovecii* infection rate is high despite septrin prophylaxis probably indicating resistance to septrin, low adherence to septrin and HAART and colonisation with *P. jirovecii*.



### PC-1267-30 Is the prevalence of tuberculosis in adolescents in Western Kenya high enough for tuberculosis vaccine trials?

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**Introduction:** The risk of tuberculosis (TB) disease following infection begins to increase in adolescence, which makes this high risk population a target for new TB vaccines. Establishing the prevalence of TB disease is important to the design of TB vaccine trials.

**Methods:** A prospective cohort study of 5004 adolescents aged 12–18 years was conducted in rural Western Kenya in an area under health and demographic surveillance (HDSS) in randomly selected clusters. TB suspects were defined using clinical criteria, history of contact with a TB case and/or a positive mantoux and investigated through sputum examination (microscopy and culture), and chest radiography. Definite TB was defined as two smear positive/culture positive TB and probable TB as a clinician's diagnosis based on clinical and radiological criteria. Cluster adjusted prevalence estimates were calculated. Risk factors of TB were further examined in a binary logistic regression model.

**Results:** Out of 5004 adolescents enrolled, 1775 (35.5%) were found to be TB suspects. 22 (definite and probable) and 15 definite TB cases were identified reflecting a prevalence estimate of 4.4/1000 (95%CI 1.95, 6.85) and 3/1000 (95%CI 1.74, 4.26) respectively. Urban residence (OR 3.61, 95%CI 2.4, 5.5) and a positive mantoux (OR 11.6, 95%CI 3.6, 37.6) were identified as risk factors for TB.

**Discussion and conclusion:** The prevalence estimated indicates adolescents in Western Kenya are a suitable target population for TB vaccine trials. Urban residence and positive mantoux could be used to identify sub populations of adolescents at high risk of developing TB.

### PC-1303-30 Resistance patterns of drug-resistant TB cases of a national reference hospital in Peru

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**Settings:** One of the principal strategies for the control of MDR-TB is the monitoring of quality in drug susceptibility testing (DST) in local and reference laboratories.

**Objective:** To describe the patterns of resistance and compare the DST results of a national reference hos-

pital with the National Reference Laboratory (NRL) in Peru.

**Design:** We reviewed all the cases with sputum culture-confirmed drug-resistant TB of the 'Hospital Nacional Edgardo Rebagliati' from Lima, Peru, in December 2010. Microbiologic data were abstracted from medical records.

**Results:** Eighty cases with DST with a mean age of 33.88 years ( $\pm 18.81$ ) were reviewed. From them 45 cases (56.25%) had primary resistance, 58 cases (72.5%) were MDR, 3 cases (3.75%) were XDR, and 19 cases (23.75%) were mono or poli-resistant. From MDR cases the most frequent resistant were to streptomycin (79.31%), thioacetazone (57.14%), ethionamide (43.48%), ethambutol (46.55%) and pyrazinamide (41.38%). Only 18 cases had both DST from hospital laboratory and NRL, with a mean concordance of 73.26% for first-line and second-line drugs, the worst was for ethambutol (61.11%) and the best for isoniazid (94.44%).

**Conclusions:** MDR-TB is the most frequent pattern of resistance and near a half of them were primary cases, frequently associated to resistance to other first-line drugs. Hospital DST has a high concordance with the National Reference Laboratory.

## MDR-TB TREATMENT

### PC-208-30 Results of intensive treatment phase in MDR-TB patients suffering from diabetes mellitus

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205 MDR-TB patients were treated in the specialized MDR-TB department of oblast TB hospital in 2010, 15 (7.3%) of them were suffering from severe course of diabetes mellitus (DM). 5 (33.3%) had DM of the first type, 10 (66.7%)—DM of the second type. There were 3 (20%) patients with co-infection MDR-TB/DM/HIV and 1 (6.7%) patient with XDR-TB/DM. Age of the patients fluctuated from 18 to 68 years old. Extended forms of TB prevailed and were diagnosed in 13 (86.7%) of cases. Level of glucose in blood varied from 10 to 20 mmol/l; in 3 (20%) cases this level was less than 10 mmol/l. Insulin therapy (20–40 units of insulin) was prescribed to 14 (93.3%) patients, hypoglycemic medicines per os—to 1 (6.7%) patient. Drug resistance to 2–6 anti-TB drug was found out: to HR—in 3 (20%) cases, to HRS—in 4 (26.7%) cases, HRSE—in 6 (40%) cases, HRSEt—in 1 (6.7%) case, to HRSEQK—in 1 (6.7%) case. Treatment scheme included six anti-TB drugs; it was compiled in accordance with drug resistance profile. Treatment



results were assessed in 6 months after completion of intensive treatment phase. Sputum smear conversion and positive clinical and radiological changes were achieved in 11 (73.3%) patients. Smear/culture conversion was not achieved in 4 (26.7%) cases because of treatment default in 3 (20%) patients and XDR-TB in 1 (6.7%) case. Thus use of adequate regimens of chemotherapy in patients with MDR-TB/DM allows to achieve rather high smear/culture conversion rate among this group of patients despite severe course of disease and such complications as polyneuropathy and retinopathy.

### PC-323-30 Efficacy and safety of linezolid for the treatment of extensively drug-resistant tuberculosis

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**Objectives:** Extensively drug-resistant tuberculosis (XDR-TB) has recently emerged as a global public health problem. Linezolid is a new antibiotic with activity against *Mycobacterium tuberculosis* in vitro and in animal studies. To evaluate the clinical efficacy and safety of Linezolid for the treatment of XDR-TB.

**Methods:** Since April 15th, 2009, we have applied Linezolid-based chemotherapy in the treatment of 14 cases XDR-TB patients. We adopted individual-based chemotherapy regimens based on the patient medication history and drug susceptibility test results. Patients received 600 mg of linezolid twice daily for the first 1 to 2 months, followed by once daily thereafter. The longest period of treatment is 11 months; the shortest is 2 months, with an average 6 and a half months.

**Results:** The body temperature of three in 4 cases with fever returned to normal in the second day after using linezolid. The 8 patients showed significant improvement in cough, sputum; chest tightness, breath shortness and other symptoms also improved. In the 6th months after treatment of Linezolid, chest CT showed that 10 patients presented cavity closure. Smears conversion was achieved in all eight patients. The mean time to smear conversion was 8 to 210 days with the average of 64 days. Culture conversion was achieved in all 14 patients. The mean time from the start of linezolid treatment to culture conversion was 8 to 210 days with the average of 63 days. One case had neutropenia, four cases had asymptomatic moderate anemia. Peripheral neuropathy affecting the lower limbs was observed in 3 patients. 2 patients developed optic neuropathy at 6 months.

**Conclusion:** Linezolid-based chemotherapy for treatment of XDR-TB can significantly improve clinical symptoms, promote lesion absorption and cavity closure, and accelerate sputum negative conversion.

### PC-331-30 Integrating MDR-TB scale-up into Zimbabwe's National TB Programme using standardised planning tools

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**Background:** To assist countries to scale up multidrug resistant tuberculosis (MDR-TB) diagnosis and care integrated into the National TB Program (NTP), tools were developed by PATH in consultation with the World Health Organization (WHO), with funding from the United States Agency for International Development. The tools aim to create a streamlined process for countries to devise, implement, and monitor their MDR-TB scale-up plans. The tools were piloted in Zimbabwe, which had an estimated 1000 cases of MDR-TB among its 46 000 TB notifications in 2009.

**Response:** The NTP convened a stakeholders' workshop to develop an MDR-TB Operational Plan, 2011–2012 using the following tools. A Results Chain was used to set targets toward achieving Zimbabwe's Strategic Plan goals. To analyze the current situation, participants used an Essential Elements List, consisting of WHO recommendations divided into first and next steps for MDR-TB scale-up. A Country Checklist shows current performance using standard indicators compared to global or national targets. Participants prioritized gaps and designed interventions displayed on a Template. Priority gaps were costed using WHO and Global Fund Budgeting Tools. Next steps are to secure partner commitments and government endorsement, mobilize needed resources, and organize regular monitoring reviews.

**Lessons:** Involvement of stakeholders was critical to conducting the gap analysis, prioritizing and addressing bottlenecks, and achieving participant buy-in. The need for country-specific MDR-TB procedures was highlighted. Although the scope was limited to the detection and treatment of MDR-TB, participants anticipated that improved laboratory capacity, specimen transport, infection control, and contact investigation could strengthen the overall NTP.

**Conclusions:** Based on participant feedback, the tools have been revised ([www.path.org/tuberculosis](http://www.path.org/tuberculosis)) and may be useful to countries planning to scale up MDR-TB case detection and treatment.

### PC-544-30 Efficacy of homeopathy as an adjuvant in the treatment of pulmonary tuberculosis

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**Background:** Tuberculosis is a global emergency with an urgent need for development of new drugs or shortened therapy.

**Objectives:** The present study was carried out to explore whether any benefit could be achieved by the addition homeopathy to the conventional anti-tubercular chemotherapy.

**Methods:** In a randomized double-blind placebo controlled study, new cases with smear-positive TB ( $n = 120$ ) were given homeopathy or placebo for 16 weeks in addition to conventional chemotherapy. Patients were followed for 6 months after completing treatment regimen of conventional treatment. Primary outcomes were faster sputum conversion at 8 weeks. Secondary outcomes were weight gain, clinical symptoms, and change in haematological assessment after week 8 and week 24. Patients were followed to observe any relapse after 6 months of treatment.

**Results:** The patients treated with homeopathy as an adjuvant therapy along with anti-tuberculosis drugs had a faster clearance of tubercle bacilli from the sputum as compared to the placebo group ( $P < 0.001$ ), until the eighth week of treatment all patients converted to AFB negative. In placebo group 18.3% remained positive and continued first stage of treatment for next 4 weeks. Compared with the placebo group, the homeopathy group showed significant improvement, defined as increased weight gain and faster reduction of symptoms, such as cough. Change in ESR was significantly higher in the homeopathy ( $P = 0.0001$  and  $P = 0.0001$  for group and time effects) as was the increase in hemoglobin ( $P = 0.0001$  and  $P = 0.001$  for group and time effects). At follow up, there was no relapse in homeopathy group; where as 11.67% of placebo group had relapsed converted in sputum positive.

**Conclusion:** These findings provide preliminary evidence that homeopathy may be a promising adjunctive therapy for patients with tuberculosis. Faster conversion of sputum should prevent the development of resistant mutants.

### PC-651-30 Profile determination of resistance to pyrazinamide in *M. tuberculosis* strains

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**Introduction:** Pyrazinamide (PZA) is a drug of first line treatment for drug-resistant and sensitive TB, is

the only eliminates populations of bacilli in acid inhibition phase. Pyrazinamide is also included in the management of multidrug-resistant tuberculosis (MDR-TB), since it is assumed that resistance to this drug is low and treatment with second line drugs required the inclusion of a first line drug is usually PZA in MDR patients in our country. PZA susceptibility testing for *Mycobacterium tuberculosis* is not performed routinely in many countries including Bolivia.

**Objectives:** To determine the profile of PZA resistance in patients with a history of previous treatment in Bolivia.

**Methodology:** We analyzed 261 isolates of *Mycobacterium tuberculosis*, 111 were resistant to some first line drugs, 150 were sensitive, all of that study through the pyrazinamidase test (Wayne method).

**Results:** From the series of 111 cultures were resistant to four first line drugs, 59 were resistant to PZA equivalent to 53%. The detail was as follows:

- 48 were mono-resistant (to SM 27, INH 14, RMP 6, and EMB 1), of which 52% were resistant to PZA.
- 16 were poly resistant (a-INH SM 11, SM-2 RMP, EMB SM-1, SM-INH-EMB 2), of which 44% are resistant to PZA.
- 47 MDR (INH + RMP resistance) of these 57% resistant to PZA.

**Conclusions:** It is necessary to evaluate the efficacy of PZA in patients with any drug resistance TB and especially MDR-TB.

### PC-682-30 Quality assessment of routine DR-TB surveillance at sub-national level in the Russian Federation

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**Background:** Among high multi-drug resistant tuberculosis (MDR-TB) burden countries the Russian Federation (RF) has one of the most comprehensive DR TB routine surveillance system (DRRSS). Evaluation of quality of Russian sub-national DRRSS is relevant for understanding quality of the national DR report.

**Methods:** DR TB 2009 data of Russian DOTS cohorts (prison not included) and prevalence reporting forms were collected and analyzed. Three expanded WHO criteria were considered to classify the regional DRRSS in two groups, A and B: (1) not less than 90% accuracy of drug susceptibility tests (DST) for RIF and INH for labs covering  $\geq 75\%$  ('A') and 50%–75% ('B') of new TB cases (NC) notified in the region, (2) culture confirmation  $\geq 50\%$  ('A') and 35%–50%

('B'), (3) sufficient level of ss+ confirmation of cavity TB (SCCV).

**Results:** Countrywide, a prevalence of 15.4% of MDR-TB among NC (2009) was reported which was closed to WHO estimation (15.8%). All notified MDR-TB incident cases in the Russian Federation (RF) represents not less than 70% of WHO estimation of all MDR-TB cases. Number of regions met grading criteria of DR data 'completeness' has reached 37 (sequentially increase from 6 and 20 regions, which met criteria in 2006–2008 according previous WHO DR TB reports). Thirteen regions have shown a decrease of MDR-TB among NC in 2008–2009. Eighteen regions, met 'A' criteria, have shown 20.1% as a median of MDR-TB among NC (Q25:15.3%; Q75:22.6%). The regions met 'A' criteria demonstrate relatively high level of the most indexes reflected DR surveillance performance: culture confirmation rate of NC and DST coverage among them were respectively 58.4% (95%CI 57.5%; 59.2%) and 97.2% (95%CI 96.8%, 97.7%) vs. 41.8% and 91.4% for RF, accordingly,  $P < 0.001$ . SCCV was 69.2% (95%CI 68.0%, 70.4%) vs. RF: 59.3%,  $P < 0.001$ .

**Conclusion:** Improvement of DR TB surveillance data at sub-national level influences the overall quality increase of DR TB reporting data in the RF.

### PC-719-30 Plasma cycloserine concentration and treatment outcome of multidrug-resistant tuberculosis patients

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**Aim:** To evaluate the plasma concentration of cycloserine and its relevance to treatment outcome of MDR-TB patients in northern Taiwan.

**Methods:** MDR-TB patients receiving anti-TB treatment (including taking cycloserine for more than 5 days) from April to October 2009 were enrolled in Taipei Medical University–Wan Fang Hospital. Blood samples were drawn two and six hours after cycloserine administration. Plasma concentration of cycloserine was measured with a high-performance liquid chromatography coupled with tandem mass method (LC-MS/MS). Medical records were reviewed on December 31 in 2010.

**Results:** Thirty-two patients, including 23 males and 9 females, with a mean age of  $32.9 \pm 17.1$  years, were enrolled. The mean cycloserine dose was  $8.8 \pm 1.3$  mg/kg. The mean plasma concentrations of two and six hours after drug administration were  $19.7 \pm 8.3$   $\mu$ g/ml and  $18.1 \pm 8.7$   $\mu$ g/ml, respectively. Seven patients (21.9%) had higher drug level at 6 hours than 2 hours, suggesting delayed absorption. Eighteen patients had both 2-h and 6-h concentrations below 20  $\mu$ g/ml (56.3%); 2 patients had at least one

measurement exceeding 35  $\mu$ g/ml (6.25%), with one of whom experienced significant adverse effect. The other 12 (37.5%) patients had peak plasma concentration fell within the recommended range of 20–35  $\mu$ g/ml. On the end of December in 2010, 30 patients had achieved either cure or sputum conversion, while the other two patients had expired from non-TB cause after sputum conversion.

**Conclusions:** Lower-than-expected plasma cycloserine concentrations are common. Although the clinical significance of low concentrations remains uncertain, it may be necessary to optimize drug doses by clinically feasible therapeutic drug monitoring during MDR-TB treatment.

### PC-885-30 Results of MDR-TB treatment with a regimen containing moxifloxacin or levofloxacin

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**Objective:** To compare the result of MDR-TB treatment with moxifloxacin vs. levofloxacin among ofloxacin sensitive and ofloxacin resistance group.

**Background:** The treatment outcome was much better if fluoroquinolones were used in ofloxacin resistant MDR-TB. In animal study, moxifloxacin was superior to levofloxacin. So we wanted to know if the moxifloxacin was better than levofloxacin in the treatment of MDR-TB.

**Method:** Patients were divided into 3 groups according to moxifloxacin/levofloxacin used and drug susceptibility test of ofloxacin. There were 3 groups: ofloxacin sensitive and moxifloxacin used (MS group), ofloxacin resistant and moxifloxacin used (MR group), ofloxacin sensitive and levofloxacin used (LS group). Smear conversion rate, culture conversion rate of 2nd, 6th, 12th, 18th month and treatment outcome were compared.

**Result:** 66 MDR-TB patients were eligible to the inclusion criteria. 39 patients were in MS group, 14 in MR group and 13 in LS group. Culture conversion rate of 6th month was 82.1% in MS group, 64.3% in MR group and 100% in LS group ( $P < 0.05$ ). Otherwise, no differences were noted in sputum conversion rate and culture conversion rate among different groups and different time other than 6th month culture conversion rate. Favorable treatment outcome was 82.1% in MS group, 50.0% in MR group and 92.3% in LS group. ( $P < 0.05$ ). Death rate was 17.9% in MS group, 28.6% in MR group and 7.7% in LS group. Treatment failure rate was 0% in MS group, 14.3% in MR group and 0% in LS group. All deaths were not related to tuberculosis.



**Conclusion:** Treatment outcome was good when moxifloxacin or levofloxacin was used in ofloxacin-sensitive MDR-patients. But treatment outcome was worse in ofloxacin-resistant group even though moxifloxacin used. But the poor result may come from high mortality rate which was not related to TB disease.

### PC-1014-30 Cost and cost-effectiveness of MDR-TB care and treatment in Nepal

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**Objectives:** To assess the costs and cost-effectiveness of care and treatment of MDR-TB according to international guidelines in resource limited setting.

**Setting:** Nepal. The National TB Programme started to treat MDR-TB patients in September 2005 with standardized regimen on ambulatory basis and daily supervised treatment by health workers.

**Methods:** Costs and cost-effectiveness with and without MDR-TB programme were compared. Costs during treatment were analysed in year 2005/06 prices from a societal perspective, i.e., public sector, private provider and patients/attendant costs were considered. Effectiveness was measured as the number of cases cured and the DALYs gained.

**Findings:** Preliminary results show that total average cost per patient treated was US\$2896, of which US\$1992 was from the health system perspective. The societal cost per patient cured in the MDR-TB programme was US\$2194. Preliminary results show good cured rates for MDR-TB patients. Final data on treatment outcomes and cost-effective analysis will be presented at Conference.

**Conclusion:** There is a strong economic case for scaling-up MDR-TB treatment in Nepal. This study also sets out an example on the feasibility and excellent results of a MDR-TB programme with standardized regimen, ambulatory approach and limited financial resources.

### PC-1041-30 Cycloserine 250 mg and central nervous system side effects on multidrug-resistant tuberculosis

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**Background and challenges:** Cycloserine 250 mg, given to patients based on their weight, it is used as part of the standardized regimen for treatment of MDR-TB patients in Lesotho. Cycloserine is given with pyridoxine 25 mg for every 250 mg of cycloserine.

**Intervention or response:** We conducted a retrospective study to determine the prevalence of (CNS) side

effect related to the use cycloserine among our MDR-TB patients in Lesotho.

We looked at the records of the first three hundred patients enrolled under the National MDR-TB program by checking their records for interruption due to one or more of the (CNS) side effects such as: psychosis, confusion, convulsions, depression and abnormal behavior.

**Results and lessons learnt:** 29% of the first 300 patients enrolled in the MDR-TB program, had developed one or more of the CNS side effects and as a result the dose of cycloserine was decreased or even temporary stopped.

**Conclusions and key recommendations:** High percentage of patients developed CNS side effect. MDR-TB program should be equipped to manage side effect of cycloserine, and trained personnel should be in place to handle severe cases of psychosis. Treatment supporters and family members should be trained to identify early signs of abnormal behavior and report to health providers immediately.

### PC-1126-30 Effectiveness of a therapeutic regimen using clofazimine for MDR-TB treatment in Brazil

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**Background:** Since 2000, the standardized regimen for MDR-TB treatment was composed of amikacin, ofloxacin, ethambutol, terizidone and clofazimine (CFZ). In 2005, according to WHO guidelines, the use of CFZ was discontinued, reserving this medicine for the treatment of leprosy, and replaced by pyrazinamide (PZA).

**Objective:** To evaluate the possible increase in effectiveness of MDR-TB treatment by using CFZ.

**Methods:** Open non-randomized trial comparing therapeutic regimens with CFZ or PZA for MDR-TB treatment. The increase in effectiveness of the therapeutic schemes was calculated based on comparison of risk factors adjusted for individual and clinical/laboratory aspects related to MDR-TB treatment outcomes. Data were extracted from MDR-TB data management system.

**Results:** From 2000 to 2008, 2224 patients were admitted for treatment and among them, 23 were excluded due to missing data. 1331 (60.5%) were cured, 230 (10.4%) defaulted, 169 (7.7%) failed and 471 (21.4%) died. 1006 patients were taking the regimen with CFZ (experimental group) and 1218 were taking the regimen with PZA (control group). These



groups (experimental vs. control) were similar when discriminated by age (40.4 vs. 40.9 years), sex (66.5% vs. 63.8% of men) and previous TB treatments (96.1% vs. 95.9%) respectively. However the groups were different in other areas: education level of at least 8 years of schooling (18.7% vs. 26%), alcoholism (97.6% vs. 90.2%), illicit drug use (1.5% vs. 3.6%), mental illness (0.7% vs. 1.6%), HIV seroprevalence (5.9% vs. 8.6%) and supervised treatment (31.4% vs. 43%) respectively. The increase in effectiveness was 19.5% ( $P < 0.005$ ). However, when adjusted for sex, age, education, alcoholism, drug use, mental illness and supervised treatment this increase falls to 17.4% losing its statistical significance.

**Conclusion:** According to this data analysis, there is no evidence of increased effectiveness in the treatment regimen using CFZ compared with the regimen using PZ.

### PC-1237-30 Older vs. newer fluoroquinolones prior to TB diagnosis: no effect on fluoroquinolone MIC

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**Background:** Fluoroquinolone (FQ) exposure prior to tuberculosis (TB) diagnosis is common. It is unknown whether exposure to older-generation, less-potent FQs is associated with greater FQ resistance in *M. tuberculosis* than newer-generation agents.

**Methods:** We performed a nested case-control study among newly-diagnosed TB patients who were reported to the Tennessee Department of Health January 2002–December 2009. We matched each FQ-resistant case to two FQ-susceptible controls from the same year of diagnosis: one FQ-exposed and one -unexposed. Data on FQ exposure up to 12 months before TB diagnosis were obtained from the TennCare (Medicaid) pharmacy database, hospital and clinic records, and a FQ exposure survey. Ciprofloxacin and ofloxacin were considered older-generation FQs; levofloxacin, moxifloxacin, and gatifloxacin were considered newer-generation agents. FQ minimum inhibitory concentration (MIC) was determined by agar proportion using ofloxacin. MIC was used as an indicator of resistance severity.

**Results:** Of 25 FQ-resistant cases, 16 had FQ exposure prior to TB (2 only to older, 12 only to newer, 2 to both). Of the 50 FQ-susceptible controls, 25 had FQ

exposure (7 only to older, 14 only to newer, 4 to both). The 25 cases had a median MIC of 64 µg/mL (interquartile range [IQR] 64–256 µg/mL) and the 50 controls had a median MIC of 1 µg/mL (IQR 1–1 µg/mL; ranksum  $P < 0.001$ ). Among all 75 patients, the median MIC of 9 patients exposed only to older FQs was 1 µg/mL (IQR 1–64 µg/mL), of 26 exposed only to newer FQs was 2 µg/mL (IQR 1–64 µg/mL), of 6 exposed to both older and newer FQs was 1.5 µg/mL (IQR 1–64 µg/mL), and of 34 FQ-unexposed was 1 µg/mL (IQR 1–8 µg/mL) (Kruskal-Wallis  $P = 0.46$ ).

**Conclusions:** In this study population, there was no evidence of a difference in ofloxacin MIC among those exposed to older FQs prior to TB diagnosis compared to persons exposed to newer FQs.

### PC-1286-30 Treatment of multi- and extensively drug-resistant TB with linezolid in the intensive phase

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**Background:** Some known antibacterial drugs can be used as anti-tuberculosis agents. But all of them must initially be tested as a component of long-term polychemotherapy. The most promising one, linezolid (Lz), is now in the spot-light of TB-experts [G.B. Migliori et al., *Eur Respir J* 2009; 34: 387–393].

**Aims:** To obtain data on efficacy and safety of Lz in the treatment of multi- (MDR) and extensively (XDR) drug-resistance tuberculosis (TB).

**Methods:** The prospective unblinded non-randomized one-centered study, includes 35 pulmonary TB pts (18–71 y.o., 21 m and 14 f); MDR in 19 pts (7 new and 12 re-treatment), XDR in 16 (3 and 13). Lz (600 mg q.d.) was included in treatment regimen, tailored by drug susceptibility tests, as 4th, 5th or 6th drug (4–20 weeks). XDR was the strict indication for Lz, MDR—only if found impossible to create the adequate chemotherapy regimen (min 4 drugs) due to intolerance and/or resistance to second-line drugs.

**Results:** After 4 weeks of treatment in all cases the evident resolution of clinical and X-ray symptoms was obtained. The sputum smear negativation totally score 85.7% (30 pts): 73.3% after 8 week, additional 6.7% after 12 weeks and 3.3% else after 16 week. The severe side-effects, attributed to Lz, were obtained in 2 pts (5.7%): peroneal neuropathy and obstinate vomiting. Anemia, thrombocytopenia were not registered.

**Conclusion:** The regimens included L (min 8 week) are high-effective in MDR and XDR-TB in spite of long-term ineffective previously treatment. The Lz safety is quite well over a period of 8–16 weeks. Lz must be considered as a drug of choice after obtaining more accurate information on optimal length of administration, taking into account its high price.

## TUBERCULOSIS CONTACT SCREENING

### PC-101-30 Interferon-gamma release assay and 4-month rifampicin preventive therapy for household contacts

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**Objectives:** To identify populations at risk of active tuberculosis is important for the allocation of public health resources. Longitudinal studies addressing this issue in household contacts are lacking.

**Method:** Household contacts of pulmonary tuberculosis patients were prospectively enrolled to receive chest radiography, sputum studies, and T-SPOT.TB assay at the initial visit. Repeat examinations every 6 months for 3 years, and 4-month rifampin preventive therapy for T-SPOT.TB-positive contacts were provided if consent was given. Factors predicting T-SPOT.TB-positivity and the development of active pulmonary tuberculosis were investigated.

**Results:** 583 contacts were enrolled with a follow-up duration of  $20.7 \pm 9.4$  months. 176 (30.2%) were T-SPOT.TB-positive initially and 32 (18.2%) of them received preventive therapy. Old age, living in the same room/house with the index case, the index case having a high smear grade (3+~4+) and pulmonary cavitation were associated with T-SPOT.TB-positivity. Active tuberculosis developed in 9 contacts; risk factors included T-SPOT.TB-positivity without preventive therapy, living in the same room, and the index case being  $\leq 50$  years or female. 108 (61.4%) T-SPOT.TB-positive contacts had repeat examinations. Forty-five had T-SPOT.TB reversion and none of them developed active tuberculosis.

**Conclusions:** Household contacts who are old, have high exposure intensity, and whose index case is highly infectious should be the priority population

for T-SPOT.TB screening. Those being T-SPOT.TB-positive without reversion during follow-up and living in the same room as the index case are at risk of active tuberculosis and require close follow-up or preventive therapy.

### PC-125-30 Cost comparison of three strategies for contact screening of latent tuberculosis infection in Brazil

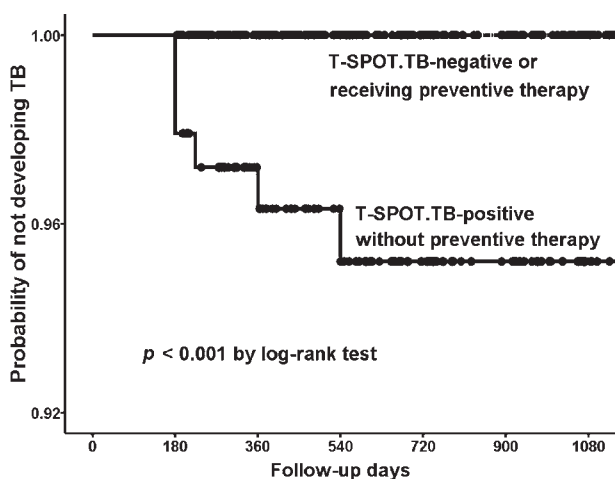
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**Aim:** To compare the costs of three strategies detection of latent tuberculosis infection (LTBI) in routine clinical practice in a high burden country.

**Methods:** The costs of screening for LTBI, including patient visits to the physician, tuberculin skin test, radiological examination and preventive treatment with isoniazid were calculated. The first strategy involved the current NTP guidelines of TST on close contacts; the second relied on the newer QuantiFERON®-TB Gold In-Tube (QTF-GIT); the third involved TST followed by confirmation of positive results by QTF-GIT. Among the advantages of the newer IGRAs are its increased specificity, since it is not affected by previous BCG vaccination and most nontuberculous mycobacteria, both frequent in high burden regions. The models' parameters were based on existing literature and considered TST to have a sensitivity of 77% and a specificity of 59% and the QTF-GIT 70% and 96%, respectively. Micro-costing analysis of TST and QTF-GIT, including costs of equipment, consumables (gloves, syringes, etc.), nursing and staff time were used. A hypothetical cohort of 1000 contacts and a 9-month isoniazid preventive treatment with a 100% adherence rate were considered. Costs are in 2010 US dollars (US\$).

**Results:** For the micro-costing analysis, the mean costs were US\$6.87 per TST and US\$45.98 per QTF-GIT. The main cost items were consumables: the kit for QTF-GIT and the tuberculin for TST. The total costs for the strategy relying solely on TST was US\$44 880, while the strategy using only QTF-GIT was US\$73 420. TST followed by QTF-GIT cost US\$57 000. The TST accounted for an extra 178 patients treating for LTBI, which accounted for an extra US\$10 500.

**Conclusions:** The use of QTF-GIT for diagnosis was the most expensive strategy despite its higher. Cost-effectiveness analyses considering other and outcomes and data from high-burden low and middle-income countries are necessary.



**PC-522-30 Added value of IGRA on number of persons diagnosed with and treated for LTBI**

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**Background:** In 2007 the use of IGRA in combination with TST  $\geq 5$  mm was accepted for the diagnosis of latent TB infection (LTBI) in risk groups for exposure to *M. tuberculosis*. Since 2007 IGRA have gradually been introduced in TB control practice, though full implementation has been hampered because of financial constraints.

**Study:** Evaluation of the added value of IGRA for TB control practice in terms of numbers of cases of LTBI diagnosed and started on preventive treatment compared with previous guidelines for diagnosis of LTBI based on TST alone.

**Method:** TB control departments recorded results of IGRA and background information for all persons tested with IGRA in an electronic database in the period 2008–2010. Data were analyzed according to exposure groups.

**Results:** Data on 3925 persons were recorded, of whom 2149 TB contacts. Overall 1087 (28%) of the IGRA tests were positive. The percentage of IGRA-positive persons increased with level of exposure and size of TST (Table). In total only 692/1775 persons (39%) with a positive TST had a positive IGRA and were eligible for preventive treatment. Furthermore,

Exposure group/IGRA positive (%)	THT (in mm)				No TST	Total IGRA positive/total tested (%)
	0–4 mm	5–9 mm	10–14 mm	$\geq 15$ mm		
Contact investigation —1st & 2d ring ZN+	3/31 (10%)	15/138 (11%)	88/376 (23%)	290/509 (57%)	33/130 (25%)	429/1184 (36%)
Contact investigation —ring/ZN unknown	0/21 (0%)	4/66 (6%)	28/173 (16%)	137/247 (56%)	11/59 (19%)	180/566 (32%)
Contact investigation /3d ring ZN+/ZN–/ source investigation	0/20 (0%)	4/70 (6%)	25/145 (17%)	63/131 (48%)	4/30 (13%)	96/396 (24%)
Possible recent exposure*	3/23 (13%)	9/135 (7%)	48/286 (17%)	44/178 (25%)	19/119 (16%)	123/744 (17%)
No likely recent exposure <sup>5</sup>	4/33 (12%)	24/168 (14%)	53/331 (16%)	94/268 (35%)	33/99 (33%)	208/899 (23%)
TB suspect	0/18 (0%)	2/14 (14%)	6/16 (38%)	21/42 (50%)	22/46 (48%)	51/136 (38%)
<b>Total</b>	<b>10/146 (7%)</b>	<b>58/591 (10%)</b>	<b>248/1327 (19%)</b>	<b>649/1375 (47%)</b>	<b>122/483 (25%)</b>	<b>1087/3925 (28%)</b>

\* Includes periodical screening health care workers and travellers returning from travel to high endemic areas.

<sup>5</sup> Includes baseline test in health care workers, travellers to high endemic areas etc.

273 persons with a negative TST and 122 with no TST were eligible for preventive treatment (36% of all persons with a positive IGRA). Of those with a positive IGRA 705 persons (65%) started preventive and 39 persons (4%) curative treatment. The number of persons to be screened for LTBI increased through the inclusion of BCG-vaccinated individuals as a new target group. About 1263 (32%) IGRA tests were performed in this group, of who 428 persons (34%) had a positive IGRA.

**Conclusion:** The policy of IGRA combined with TST to identify persons recently infected with LTBI is more effective than TST alone by reducing considerably the number of persons diagnosed with LTBI. Follow-up of the cohort in a future study will provide information on both the negative and positive predictive value of IGRA for the progression to tuberculosis.

**PC-652-30 Use of the T-SPOT.TB assay to detect latent tuberculosis infection among TB contacts in Shanghai**

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**Background:** The contacts of known TB cases could contribute greatly to the overall TB disease burden in certain settings and therefore become the major concern of the TB control in the community.

**Objective:** To investigate the prevalence of latent tuberculosis infection (LTBI) among the population in contact with diagnosed pulmonary TB patients registered in the district CDCs from Shanghai, and to identify the possible risk factors for LTBI.

**Method:** Totally 45 diagnosed TB patients each of 7 district CDCs and average 3 contacts per index case were purposefully selected in 2010. The questionnaire interview was performed to acquire the socio-demographic information from contacts and to assess the degree of their exposure to index cases. LTBI screening was by T-SPOT.TB and by chest radiographs. LTBI was defined as the T-SPOT.TB positivity as well as the absence of clinical features of TB.

**Results:** Of 966 enrolled contacts, 59.5% were men; median age was 47 year; the household contact took the majority (79.4%). LTBI was detected in 29.7% of subjects ranging from 19.9% in Minhang district to 45.0% in Pudong new area. By univariate and multivariate analysis, those who had contact with the smear-positive TB patients were 4.8 times more likely to have a positive T-SPOT.TB than those who contact the smear-negative TB patients (95%CI, 1.67–6.83); household contact significantly increased the likelihood of LTBI by 3.7 times (95%CI, 1.82–5.91). Furthermore among household contacts, the risk of T-SPOT.TB positivity was higher in first-degree



relatives compared with more distant relatives and nongenetically related households and were increased with age, ventilation condition as well as frequency and duration of contact.

**Conclusion:** A high prevalence of LTBI was observed among the TB contact in Shanghai and meanwhile this study highlighted the significance of intervention among the household contacts and those in contact with the smear positive TB patients.

### PC-832-30 Treatment of latent tuberculosis infection in Norway: who, why and how?

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**Aim:** To obtain baseline information on initiation and completion of treatment for LTBI in Norway.

**Background:** Despite a steep increase in the number of individuals treated for LTBI, there is little data on how the patients are identified and the treatment is carried out.

**Results:** All patients starting treatment for LTBI during 2009 were included. The three most important reasons for starting treatment were origin in a high burden country, a positive tuberculin skin test and a positive interferon gamma release assay (IGRA) test. HIV test was done in 36%. Sputum samples for culture were collected in 69% prior to treatment. Of these, 64% had a report of negative culture at the time of treatment initiation. A 3 months regimen with rifampicin and isoniazid was preferred in almost all patients (95%). 607 (84%) patients completed the treatment. Significant predictors for completion were health region, sex and the use of directly observed treatment (DOT). Almost one third 199 (28%) reported side effects. Serious side effects leading to termination of treatment were reported in 50 (6.9%) cases. The use of DOT varied with health region, patients' background and age.

**Conclusions:** Completion rate for treatment of LTBI in Norway was high in 2009. There is an observable positive effect of DOT and higher age on the completion rate. Many patients experienced side effects, but serious side effects were rare. There was some variation between health regions in the handling of LTBI.

### PC-886-30 Strategic approach for contact tracing of sputum positive cases to increase early case detection

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**Background:** Evaluation of contacts of sputum positive TB cases offers a major opportunity for early

case detection. Revised National Tuberculosis Control Programme (RNTCP) guidelines emphasize the importance of contact tracing and provide various opportunities for same but there are some gaps in its implementation. One of the major reasons is that it has not been systemically integrated with routine programme activities.

**Intervention:** A Guidance Document for tracing and evaluation of contacts of sputum positive cases is developed in line with the various opportunities available in RNTCP for same. This includes documentation of contact tracing in existing RNTCP records. This document is communicated to District TB Officers and they were suggested for evaluation of contacts of sputum positive TB cases with the help of programme staff, field staff, community volunteers and NGO/CBO volunteers working in the programme and its reporting.

**Results:** In January and February, 2011, 2149 symptomatic contacts of sputum positive cases were examined for TB in 9 districts and 89 of them were found having active TB disease.

**Conclusion and recommendation:** Contact tracing can be systematically implemented with routine programme activities. Focusing on this is yielding in terms of early and increased case detection.

### PC-955-30 Factors undermining the investigation of households contacts of TB patients: the case of FCT, Abuja

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**Introduction:** Preventing tuberculosis (TB) among household contacts of persons with TB disease and treatment of contacts with latent TB infection is a recognized strategy in the detection, control and elimination of TB. This study aims at establishing the determinants for compliance of general health workers with the National TB and Leprosy Control Program (NTBLCP) in evaluating household contacts of TB patients diagnosed in DOTS treatment facilities in FCT Abuja, Nigeria.

**Methods:** Facility records of 320 TB patients were examined over a one year period Jan–Dec 2009 to ascertain if the under 6-year-old contacts of sputum smear positive TB patients were investigated as stipulated in the NTBLCP guidelines. To understand the factors hindering the non-investigation of TB contacts; in-depth interviews were conducted with 39 DOTS clinicians.

**Results:** More than 80% ( $P < 0.05$ ) of patients' records show that under 6-year-old contacts of TB patients were not investigated. The level of education of the DOTS provider is significantly ( $P < 0.05$ ) associated with the screening of contacts of TB patients.



Supportive supervision by the state and national program officers had a positive impact on investigation of household contacts of TB patients.

**Conclusion:** The household contacts of majority of diagnosed TB patients receiving care at the DOTS facilities are not evaluated. Forgetfulness by the DOTS provider is the singular most important factor undermining contact investigation which suggests the need for utilization of innovative approaches such as signage at the DOTS sites. The study underscores the need of the state program to evaluate the quality of service provision.

### PC-1026-30 Risk factors for positive IGRA in populations at risk for TB infection in the Netherlands

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**Background:** In the Netherlands 70% of TB cases occur among non-Dutch born persons. Since the introduction of IGRA, target groups for screening for latent infection with *M. tuberculosis* (LTBI) have been extended with BCG-vaccinated individuals, including immigrants from endemic areas. It is yet unclear to what extent previous exposure history interacts with the diagnosis of recent infection and the cost-effectiveness of targeted preventive treatment of LTBI in these groups.

**Objective:** To determine risk factors for a positive IGRA under operational conditions in a TB control program in a low prevalence country.

**Method:** TB control departments recorded results of IGRA including risk factors and previous exposure history for 4512 persons in an electronic database in the period 2008–2010. Data were analyzed with multivariate analysis for the total group and for TB contacts only.

**Results:** Valid data on 3925 persons were recorded, of whom 2149 TB contacts. Overall 1087 (28%) of the IGRA tests were positive. Results of the multivariate analysis are presented. Being IGRA-positive was associated with male gender, age and several factors both related to recent as well as previous exposure and negatively associated with length of stay in the Netherlands. The same associations were found among TB contacts, except high incidence in the country of birth was not associated with IGRA positivity in the multivariate analysis.

**Conclusion:** IGRA positivity is associated with male gender and factors related to exposure in the past as well as recent exposure. The positive predictive value of IGRA for progression to active tuberculosis in persons with (possible) previous exposure especially

among recent (<10 years) immigrants is likely to be influenced by this phenomenon. Follow-up of the cohort in a future study will provide information on the positive predictive value of IGRA for the progression to tuberculosis.

### PUBLIC-PRIVATE MIX AND TUBERCULOSIS DRUG SUPPLY

#### PC-33-30 The global drug facility: increasing access to MDR-TB drugs through innovation and action

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The Global Drug Facility (GDF), a procurement initiative of the Stop TB Partnership, ensures access to competitively priced, quality assured anti-TB drugs for countries in need. GDF has met an increased demand for MDR-TB medicines, from supplying 19 countries in 2007 to 54 countries in 2010 due to increased detection and diagnosis of MDR-TB patients.

As part of the MDR-TB Scale Up programme, GDF has accelerated its efforts to source and engage quality-assured suppliers to ensure that a sufficient quantity of medicine is available to countries. Since 2007, GDF has:

- Procured medicines for 74 countries, including 22 of the 27 high burden MDR-TB countries;
- Increased the number of MDR-TB drugs available from 11 in 2008 to 25 in 2010;
- Tripled the number of suppliers of MDR-TB products from 5 in 2008 to 15 in 2010;
- Negotiated stable and sustainable prices valid from 12 to 24 months for all products without conditionality of volume commitments, avoiding treatment cost fluctuations due to market volatility, currency fluctuations and manufacturing cost increases;
- Enabled programs to rapidly start treatment, by decreasing the delivery lead time to 19 days using a Strategic Rotating Stockpile of 5800 treatments funded by UNITAID. 39 countries benefited in 2009, and 52 countries in 2010.
- Begun development of innovative mechanisms such as a Strategic Revolving Fund, Market Allocation System and much needed forecasting tools to incentivize manufacturers and better meet country demand.

Through its actions GDF will ensure that the future demand for drugs is met and a sustainable market is created.

**Future innovations to meet increased demand:** While GDF's actions to date have succeeded in achieving many market improvements, further incentivization



**Figure** Countries served through GDF's MDR-TB mechanism, 2007–2010.

is needed. Given that the MDR-TB medicine market is limited in size with high barriers of entry, GDF has engaged in key innovative approaches to render the market more attractive to suppliers.

### PC-190-30 TB strategic pharmaceutical management information system in Dominican Republic

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**Aim:** DR didn't have a PMIS providing accurate information for procurement and distribution of pharmaceuticals. Untimely placement of procurement orders was responsible of stock outs of TB medicines around 2007. MSH/SPS provided technical assistance to develop a strategic system based on simple indicators.

**Methods:** DR is a small country (48 730 km<sup>2</sup>) with good transportation infrastructure. The farthest health facility is around 5 hours from the capital where the central medical store (CMS) is located. Stock outs in intermediate warehouses or health facilities can be solved within a few hours, if the CMS is appropriately supplied. But due to the lack of information, purchase orders were usually placed after security stocks were consumed, which caused stock outs to ripple through lower levels of the system. In absence of a comprehensive PMIS, MSH/SPS assisted in the development of a system based on quarterly collection of one indicator: availability expressed in months according to consumption. This indicator is obtained by dividing the availability of medicines (in units) by the average monthly consumption. Since July 2010 this information is collected in the CMS, and increasingly in regional warehouses. It has supported timely procurement and distributing medicines to the periphery. This strategic PMIS is currently providing information to other MoH programs including HIV, while a more comprehensive system is developed.

**Conclusion:** In small countries with good transpor-

tation systems, a strategic PMIS based on simple indicators provides accurate and timely information to prevent stock outs.

### PC-344-30 Private-public partnership for drug resistant TB management in Nepal

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**Aim:** Share experiences of private public partnership for multi-drug resistant TB programme implementation in Nepal.

**Methods:** Review of past 5 year experiences, achievements, challenges and constraints of MDR-TB programme implementation through public private partnership in Nepal. Analysis of cohort reports, feedback and observations from NTP trimesterly meetings and supervision visits.

**Results:** GLC approved MDR-TB programme started in September 2005 using fully supervised ambulatory standardized treatment regimens. To improve access programme expanded to 12 treatment centre and 54 sub treatment centres within government PHC services and sites run by partners in public and private sectors. Almost 50% of the MDR-TB treatment centres and 30% of the sub treatment centres operate

Programme components	Nepal National TB Programme Partnership for Drug Resistant TB Programme		
	NTP Partners	Agencies involved	
Policy development	✓	✓	NTC, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO
Guideline/protocol	✓	✓	NTC, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO
Planning	✓	✓	NTC, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO
Coordination	✓	✓	NTC, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO
Training	✓	✓	NTP, RHD, D/PHO, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO
Supervision	✓	✓	NTP, WHO
Laboratory quality control	✓	✓	NTC, GENETUP
Culture	✓	✓	NTC, GENETUP
DST	✓	✓	NTC, GENETUP
Monitoring and evaluation	✓	✓	NTP, WHO
Procurement		✓	WHO
Logistics	✓		NTP
Technical assistance			STAC, WHO
Programme implementation	✓	✓	NTC, BNMT, INF, GENETUP, HERD, NRL, NATA, STAC, TBCN, WHO, semi-autonomous institutions, public and private hospitals

under NTP partners including medical colleges, INGOs and public and private hospitals. German Nepal Tuberculosis Project laboratory provides services of NRL including culture and drug sensitivity testing. NTP leadership, clear policy, guidelines and timely provision of training, drugs and other requirements are essential for effective collaboration. Regular supervision, monitoring and evaluation from NTP are key to ensure implementation as per national policies and guidelines. Treatment outcomes are comparable and some times better in sites run by NTP partners. Involvement in DR TB management is considered prestigious and gives credibility to private sector partners. Public private partnership has been acknowledged by GLC and other external reviewers as one of key reason for excellent performance of DR TB programme in Nepal.

**Conclusion:** Strong NTP leadership, presence of standardized policies, guidelines, regular monitoring and supervision from NTP are essential for effective collaboration. Partner commitment, defined roles and responsibility, regular supply of requirements and training are fundamental for successful implementation of MDR-TB programme through partners.

### PC-502-30 Engaging private pharmacies as active partners in TB control: preliminary findings

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**Objectives:** To present the case of private pharmacies as a potential active referral sites for walk-in TB symptomatic clients to DOTS facilities; to determine the contribution of the pharmacy sector to effective local TB case detection.

**Background:** Self-medication among TB symptomatic patients increased from 24% to 43% based on National TB Prevalence Survey in 2007. PTSI, a sub-grantee of TB LINC project, trained 119 pharmacies to encourage health seeking behavior in DOTS providing health centers among clients with TB symptoms. This activity took place in 12 key cities and provinces in a resource-limited and TB high burden country, Philippines.

**Design/method:** Pharmacies were selected based on: high visibility location; close proximity to the DOTS facilities; and pharmacy personnel's interest in training. Training and IEC materials were developed to facilitate identification of TB symptomatic clients based on the presence of cough for 2 weeks, referral to DOTS facilities, and recording of referrals. Referral rate, access rates and contribution to case detection were determined. Local drugstore owners, pharma-

cists associations, and government partners were also engaged to provide advocacy support to mitigate self-medication practices.

**Results:** From August 2010 to January 2011, there were 942 TB symptomatic cases identified by engaged pharmacies among their clients and were referred to DOTS facilities. Of those referred, 99 (11%) accessed DOTS facilities. Among those who accessed, 14 (14%) were new smear positive cases and were started on treatment under DOTS.

**Conclusion:** Pharmacies can be an effective source of referrals for self-medicating TB symptomatic patients. Although local policy supports restrictions to over the counter sale of anti-TB drugs, there is a need to further strengthen pharmacy sector to effectively contribute to TB case detection.

### PC-516-30 Dispensing anti-TB drugs among pharmacies in selected townships, Myanmar

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A cross-sectional descriptive study was conducted in South Okkalapa Township, Yangon. It determined availability and use of anti-TB drugs among drug shops; knowledge about TB; dispensing anti-TB drugs and opinion on involving TB control activities of drug sellers. A total of 97 drug sellers involved in semi-structured interview questionnaire. Identification of anti-TB drugs by using check list, validation of dispensing practice of drug sellers by mystery clients and 4 focus group discussions were conducted. Of them, 32 (35%) drug shops had anti-TB drugs and 38% sold anti-TB drugs during last month. Child combination (R-cinex kid) was found to be the most selling drug (61.9%). About 59% of drug shops had first line drugs and the rest had second line drugs. About 79.4% had low knowledge on sign and symptoms of TB (mean knowledge score = 13.8 for 33 items) and 97.9% had low knowledge on anti-TB treatment (mean knowledge score = 3.8 for 21 items). Some 21.6% of drug sellers said they referred TB suspect cases to nearest health center. The rate of selling anti-TB drugs from the drug shops were significantly decreased after these drugs were given free of charge from the health centre. Most of the drug sellers obtained knowledge about dispensing drugs by on-job training. They would like to attend short training about TB from health personals during weekends. The study highlighted to organize the drug sellers to involve in TB control activities by providing necessary information about TB and process of referral to health centers.



### PC-611-30 Engaging community pharmacists in DOTS programme for TB control: public-private initiative in Mumbai, India

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**Introduction:** India accounts for over one fifth of all TB cases worldwide. The Revised National Tuberculosis Control Program (RNTCP) provides free anti-TB medicines. Under the RNTCP there have been several public-private partnerships to expand the provision of DOTS (Directly Observed Treatment, short course), but community pharmacists have been described as a neglected link.

**Objectives:** The objectives of the current programme, are to set up DOT services in community pharmacies and thus involve trained community pharmacists in TB case detection and referral, awareness and in delivery of DOT medicines in pharmacy.

**Method:** After a small pilot by Indian Pharmaceutical Association in 2006–07, a collaborative programme was scaled up in Mumbai and nearby areas in Feb, 2010. A selected group of community pharmacists (till date 126) were trained for DOTS protocols with the cooperation of City TB Officers in respective areas. Total four city corporations are involved.

**Results:** One year following the initial training, 38 pharmacists have started delivering DOT services and more than 50 pharmacists have referred chest symptomatic cases to government's diagnostic microscopy centers. City TB office and pharmacists themselves keep record of the pharmacist referred cases. All pharmacists are distributing the TB literature to the patients. Pharmacists have expressed a high level of socio-professional satisfaction.

**Table** DOTS TB Pharmacist Project, Mumbai, India, overview of the project, April 2010 to end February 2011

Area	Training date	No. of participant pharmacists	No. of DOTS provider pharmacists	No. of patients
Dombivli	13th April, 10	13	02	05
Kalyan	13th April, 10	34	09	21
Mumbai	10th May, 10	25	06	19
Navi Mumbai	20th April, 10	41	14	16
Bhivandi	27th Oct, 10	13	07	16

**Conclusion:** Appropriately trained community pharmacists can contribute to public-private mix for TB control in India. Considering the fact that there are approximately 500 000 pharmacists in India, this initiative, if scaled up nationally has huge potential to make significant impact in TB Control. Organizers are

working towards this national scale up of the work and pursuing the matter with Ministry of Health, Government of India.

### PC-1070-30 Stock management of second-line MDR-TB medication in limited resource countries: experience from Lesotho

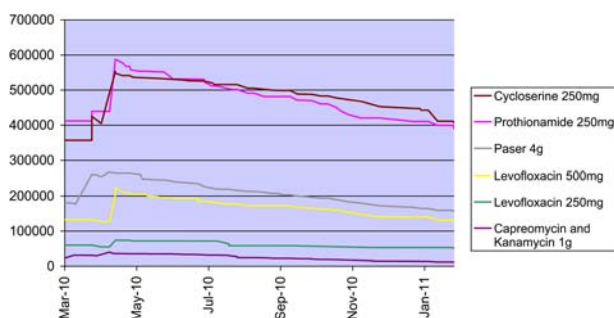
M Gamil, K J Seung, H Satti. Partners in Health, Maseru, Lesotho. e-mail: muhaned\_gameel@yahoo.com

**Background and challenges:** Since 2006, Partners In Health Lesotho (PIHL) has been the sole provider of treatment for MDR-TB patients in Lesotho. As the program has grown, the need for a systematic way to manage and predict the stock level of MDR-TB medication, has become even more imperative. The program usually receives one year stocks annually, which has led to challenges of managing the stock, given the relatively short shelf life of some items and different batches with close expiry dates. Other factors that have an impact on the stock level, such as enrollment, mortality, treatment interruptions due to severe side effects and inconsistency of time between the order submission and the delivery of the medications to the program in Lesotho, complicate predictions of the stock level.

**Intervention or response:** PIHL implemented stricter (WHO) standards of Good Storage Practice (GSP). Medications were organized according to the principle of first expiry, first out (FEFO). The implementation of bin cards in addition to electronic system improved the pharmacy's ability to report any transactions of medications and allowed for continuously updated data, which could be analyzed frequently. Average monthly consumption (AMC)—the sum of what had been consumed in a definite number of month divided by the number of months—was calculated and used to estimate the duration of the stock in hand, based on standard drug doses.

**Results and lessons learnt:** The improved stock data and AMC calculations allowed PIHL to determine the likelihood of consuming the medication stock and take proper action.

**Conclusions and key recommendations:** The MDR-TB medication stock can be successfully managed by continuous monitoring and analysis of the stock levels to prevent any possibility of stocking out.





## SCALING UP CARE THROUGH HUMAN RESOURCE DEVELOPMENT

### PC-58-30 A partnership for scaling up capacity building for operational research in TB control

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**Background:** Since 1963, the Research Institute of Tuberculosis Japan Anti-Tuberculosis Association (RIT/JATA) has conducted annual international training in tuberculosis (TB) control for participants from low-income countries. This has been supported by the Japan International Cooperation Agency (JICA). Strengthening global human resources capacity in operational research (OR), has been of major importance within the course curriculum since 2005.

**Intervention:** The course organizers developed and coordinated the curriculum. The three month course was run in joint partnership/collaboration with the World Health Organization (WHO), the United States Centers for Disease Control and Prevention (US-CDC), the International Union Against Tuberculosis and Lung Disease (The Union), and the Médecins Sans Frontières (MSF). A final output of this training is that each participant has developed an OR.

**Results:** During the first month, two US-CDC staff held introductory sessions in OR and participants developed the first OR proposals. Two weeks later, the Union and MSF lecturers gave further practical exercises and helped participants refine their proposals. Four RIT faculty staff coached the participants until their final presentation at the end of the course, which was evaluated by a WHO officer. There were a total of 104 participants from 38 countries who have been trained since 2005. Challenges have included participant selection, a systematic post-training follow up, continuing mentorship and facilitation for implementation of OR proposals in the participants home country.

**Conclusion:** The RIT/JATA has successfully conducted an international training course on OR with wide collaboration with international agencies and partners. Although the outputs in terms of development of OR proposals is impressive, one of the main challenges is the translation of such proposal into implementation on the ground.

### PC-169-30 TB in the workplace: partnership for scaling up TB care in Mombasa

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**Setting:** Mombasa district, Kenya.

**Aim:** To scale up TB care in Mombasa by partnering with companies at the workplace.

**Methods:** Mapping of companies was done in the district. Meetings with senior managers in mapped companies and information on tuberculosis and the need to control TB in our environments was discussed. The senior managers were either to attend or identify a focal person to attend a sensitization meeting on TB. Following this meeting, the managers requested a TB sensitizations meeting for the peer educators in their companies. Peer educators from these companies were then sensitized on TB disease, transmission and treatment.

**Results:** 103 companies were mapped, 50 of the companies accepted the invitation and 47 senior managers attended the one day sensitization. Peer educators from 37 companies took part in the TB sensitization. Among the peer educators trained 15 companies had patients who had TB and were on treatment. Following the establishment of TB at the workplace we see more referrals from these companies. Stigma in some of the companies has reduced, in some companies the human resource is the dot supporter.

**Conclusion and recommendation:** Partnership should be sort in all institutions. By sensitizing these companies, they are able to suspect and refer TB suspects. Stigma among the patients is less, some of the peer educators have become DOTs supporters for the TB patients. Workplaces should be used for suspecting, referring, diagnosis and adherence support to TB patient.

### PC-392-30 Effectiveness of training course on quality assurance of chest radiography taking in the Philippines

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**Background:** Unsatisfactory quality of chest radiography for diagnosing smear-negative tuberculosis leads to over or under diagnosis, resulting mismanagement and waste of resources. The present study aims to determine the short-term effectiveness of a training course in taking quality chest radiography.

**Methods:** It is a cross-sectional study through reviewing chest radiographs before and after the training among radiological technologists in Tondo, Manila and in Payatas, Quezon City in the Philippines from 2009 to 2010. The course participants submitted six chest radiographs, taken approximately within three months before and after attending the training. Two senior radiological technologists who were blinded assessed the chest radiographs independently using an assessment sheet developed by the Tuberculosis Coalition for Technical Assistance (TBCTA). The scores per every six assessment factor were summed. Paired *t*-test was applied to compare the scores on chest radiographs taken before and after the technicians attended the training.

**Results:** 40 radiological technologists from 11 facilities in Tondo and 9 in Payatas participated in the training. 36 participants submitted required set of chest radiographs. The assessment of the chest radiographs indicated that the training was effective to improve the performance of taking chest radiographs in terms of identification marking (paired *t*-test, degree of freedom = 35,  $t = 2.757$ ,  $P = 0.009$ ), contrast ( $t = 2.650$ ,  $P = 0.012$ ), sharpness ( $t = 2.616$ ,  $P = 0.013$ ), artifacts ( $t = 3.314$ ,  $P = 0.002$ ), and total score of the six factors ( $t = 5.041$ ,  $P = 0.000$ ). The training didn't show its effectiveness to improve two assessment factors, patient positioning ( $t = 1.171$ ,  $P = 0.250$ ) and density ( $t = 0.971$ ,  $P = 0.339$ ).

**Conclusion:** The significant improvement of the total score of the six assessment factors strongly suggests its positive impact of the training course for radiological technologists on improvement of the quality of chest radiography.

#### PC-419-30 The impact of Zambia Tuberculosis and Leprosy Trust (ZATULET) in the NTLF in Zambia

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**Background:** ZATULET registered in 1998 is a Zambian NGO in the health sector working as a TB and Leprosy NGO. Due to TB and HIV co-infection in Zambia (70%) ZATULET got involved in the HIV/AIDS activities.

**Main activities:** Community mobilization and sensitisation, referring TB suspects for diagnosis, screening TB suspects, collecting sputum samples, DOTS implementation and supervision, VCT, dispensing ARVs to TB-HIV co-infected patients. This report is outlining the activities and achievements of UK's Big Lottery Funded TB Project in Zambia. This grant was got through Target TB, UK.

**Setting:** The 8 project sites are located within the

Ministry of Health clinics and ZATULET community clinic. 4 outcomes to achieve:

- 1 15% increase in number of TB cases detected by ZATULET year on year
- 2 ZATULET branches meet and exceed WHO target of 85% treatment completion and cure rates by year 5
- 3 By end of year 5 at least 75% of target population reached with information and knowledge about TB
- 4 By end of year 5 at least 50% of beneficiaries report improvement in overall welfare.

Achievements July 2007–October 2010

Activities	Number
TB suspects referred for sputum test	22 937
Suspects diagnosed with TB	3 696
Cured	855
Completed treatment	902
People referred for VCT	11 740
People reached with TB information	1 238 571
People reached during World TB, AIDS Days	73 829

**Conclusion:** Non governmental organizations in the health sector play an important role in strengthening the NTP activities. Volunteers reach in the communities where public health workers do not regularly reach.

#### PC-455-30 Governmental partnerships in Brazil for tuberculin skin test training

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**Background and challenges to implementation:** In 2010, recommendations for tuberculosis (TB) control in Brazil have been updated. One of the changes concerns the formal recommendation of treating latent TB infection (LTBI) in adults where TB incidence is lower than 50/100 000 inhabitants. Also, the National Tuberculosis Program (NTP) is trying to make sure that every person living with HIV/AIDS has access to the tuberculin skin test (TST) and the treatment of LTBI, if necessary. In order to provide standardized diagnosis of LTBI, the NTP is promoting and supporting training of trainers (TOT) in TST. The aim of this work is to present Brazil's governmental experience in partnering among different levels of the public health sector for the promotion of TOT in TST.

**Intervention and response:** The NTP promoted and supported, in 2010, eleven nurses TOT in the techniques of application and reading TST, partnering by the National Department of AIDS and State Health Secretariats (SHS). The Brazilian training model involves a complex structure, and to carry out the training, it takes 80 to 100 arms per trainee. The NTP

provided human resources (national reference nurses) and the partners gave logistical support. The SHS were responsible for providing the arms. All trained nurses were inserted in a talent bank and had to plan at least one training for healthcare workers (HCW).

**Results:** In early 2010, the NTP had a group of 13 national reference nurses. By the end of the year, there were 77 new nurses able to reproduce the knowledge and three other state trainings had occurred without interference of the NTP.

**Conclusions:** The partnerships were key to the success of increasing the number of reference nurses in TST, which will contribute to the effective decentralization of LTBI diagnosis and, indirectly, to the improvement of epidemiological TB indicators in Brazil. In addition, by the end of 2011, the NTP will be able to just supervise the state trainings.

### **PC-615-30 An innovative training programme to increase participant knowledge and attitude for TB ACSM project**

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**Background:** The Union is implementing one of the world's largest TB ACSM project in India. This project is being implemented to cover 700 million population. Training programmes aimed at increasing the knowledge, attitude and skills of the project staff to implement ACSM activities is crucial for the success of the project. However, there is very limited guidance on how to conduct training programmes to implement ACSM activities for TB care and control.

**Objective:** To develop a training programme to build the capacity of project staff to implement ACSM activities and to assess the effectiveness of the training.

**Methodology:** An innovative 5 day intensive structured training programme using participatory methods, daily quizzes and reflections was developed and conducted for the project staff in three batches. The thematic areas for training and assessment included basics on tuberculosis epidemiology, NTP, the project activities including concepts of ACSM, interventions in the cough to cure pathway, M&E of the NTP and that of the project. A before and after comparison study was conducted to assess the effectiveness of the training. Knowledge and attitude were assessed by structured questionnaire comprising of 20 and 10 questions respectively.

**Results:** Out of 73 participants, 65 completed both pre and post test. Of the 1300 correct responses possible on knowledge, during pretest 50% were answered correctly. This increased to 77% during post training test. Largest increase was in the sub-thematic area on default and retrieval (84%) followed by NTP (78%) and monitoring (76%). The average score on the attitude increased from 46% to 60%.

**Conclusion and recommendation:** This innovative ACSM project training methodology was able to improve the knowledge and attitude of the participants to the satisfactory levels. The quality assurance methods used in the training were found to be very useful and are good models for similar training.

### **PC-669-30 Development of ex-TB patient and community group network**

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**Objective:** Increasing community involvement and ex TB patient groups in TB program.

**Methods:** Assessment was done to TB patient group in 5 provinces of Indonesia to explore the potential of existing TB patient group and found out activities that have been done. Furthermore, meeting will be conducted to develop the concept, work plan and to implement the plan and submit a funding proposal.

**Results:** TB patient group was initiated by ex TB patient. Total 102 TB patient group has been assessed with activities includes: identify TB suspect, mentoring TB patients, reporting the side effects to health staff, education for TB patient and their family, patient charter socialization, conduct generating income activities. Since 2006 there are 8 corporate that committed to helping activities, such as for food and transport for TB patients under treatment. TB patient group is monitored by the health center to ensure their activities inline with the program. Coalition of TB patient group named the Pamali TB Indonesia.

**Conclusion:** TB patient group is very helpful in early TB case finding and improve cure rates. However, there is still need for funding to support operational costs and the necessary of legal provisions to develop and growing the group activities.

### **PC-860-30 Partnership with the community to combat TB in the rural areas of Africa: experiences from Ghana**

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**Background:** Tuberculosis (TB) is a major public health problem in Africa. The TB epidemic has grown rapidly with spread of HIV/AIDS. Case detection, stigma, superstition and treatment compliance were identified as impediments to the successful control of TB in the continent. Partnership with the community became essential particularly in the areas of care and support if the National TB Control Programmes (NTP) is to achieve targets.

**Aim:** This is aimed to provide a framework for community partnership in TB control response especially

in areas of increasing case detection and treatment success/compliance and also to identify socio-cultural barriers affecting TB control.

**Method:** Exploiting the traditional customs and hierarchies that prevails within Ghana and the continent, an advocacy, communication and social mobilization (ACSM) process was applied to sensitize and partner with the chiefs, queen-mothers, opinion and community leaders and their communities to stem the tide.

**Results:** Partnership with the community is an effective way of improving access and quality TB care services; it enhanced case finding, treatment success, DOTS supervision, political will and community involvement. Demystification and de-stigmatization of TB was another good result as it is no longer a compelling barrier to accessing treatment. Central region treatment success from increased from 66.6% to 89.8%, cure rate 62.9% to 87.1% and defaulter rate 19.1% to 1.2% from 2005–2008.

**Conclusion:** There is compelling evidence to demonstrate that community partnership is an effective way of improving access, quality TB care services and reducing stigma. Traditional leaders are very good tools for advocacy.

#### PC-876-30 Involving affected people in the fight against TB in low-incidence countries: UK's TB Action Group

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**Background:** Cases of tuberculosis (TB) have risen by 57% in England over the last 20 years, with 8286 reported in 2009. TB is managed overwhelmingly through a clinical model of health, with limited focus on the socio-economic and other determinants of health. While there is a history of user involvement in other infectious diseases (e.g., HIV), until relatively recently little attention was paid to the role of service users in TB care and control.

**Interventions:** TB Action Group (TBAG) was established in 2008 through the work of TB Alert, the UK's national TB charity which is the Department of Health's lead partner in raising awareness of TB among affected communities. TBAG's members, who all have personal experience of TB, are active in:

- contributing to national and local consultations to review TB policy and improve service design and delivery
- increasing knowledge of the patient experience amongst health professionals
- speaking to community representatives at national TB seminars
- raising awareness among the public through media advocacy

- providing telephone and online peer support to patients.

Members' stories also provide the basis for www.truthabouttb.org website and a multi-lingual DVD.

**Results and lessons learned:** No country can effectively respond to TB without engaging affected individuals. Specific factors relating to the diagnosis and treatment of TB in a low incidence country creates motivation for people to get involved.

**Conclusion and key recommendations:** Health service stakeholders increasingly recognise, through the work of TBAG, the importance of service user involvement. A more structured national mechanism for service user input in all localities is required, which TB Alert is well placed to establish.

#### PC-913-30 Training of Kenyan health workers improves use of smear microscopy and DOT but not IPT

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**Background:** The lack of staff to provide HIV-TB services has led to substantial investments in training. Policy makers need to know if training yields high returns on investment (ROI). Do TB-HIV trainings enhance use of smear microscopy, DOT, and/or IPT for HIV+ clients?

**Methods:** A secondary analysis of nationally and regionally representative data from the 2004 Kenya Service Provisions Assessment (KSPA) of 1332 TB and/or HIV service providers within 440 public and private facilities compared performance of specific duties between those with and without TB-HIV training.

**Results:** Although a majority of the TB-HIV workforce is female (56.9%), participation in TB-HIV training was less common among women of all cadres (OR 0.41 CI 22–0.78). After controlling for other factors, training in TB diagnosis is strongly associated with use of smear microscopy (OR 3.4 CI 1.6–7.3). Mid-level health workers are less likely to use smear (OR.35 CI 19–0.63). Training in TB treatment increases the likelihood that providers will directly observe treatment (OR 3.3 CI 1.3–8.9). Other factors positively associated with DOT included receiving supportive supervision (OR 3.2 CI 2.0–5.0) and TB drug supply (OR1.2 CI 1.1–1.4). Barriers to providing DOT included non-participation in the national DOTS program (OR.0.20 CI 0.1–0.7) and working where high volumes of smear microscopy are done (OR 0.7 CI 0.5–1.0). Provision of IPT for HIV+ clients was low, independent of IPT training, and unexplained by other factors in multivariate analysis.



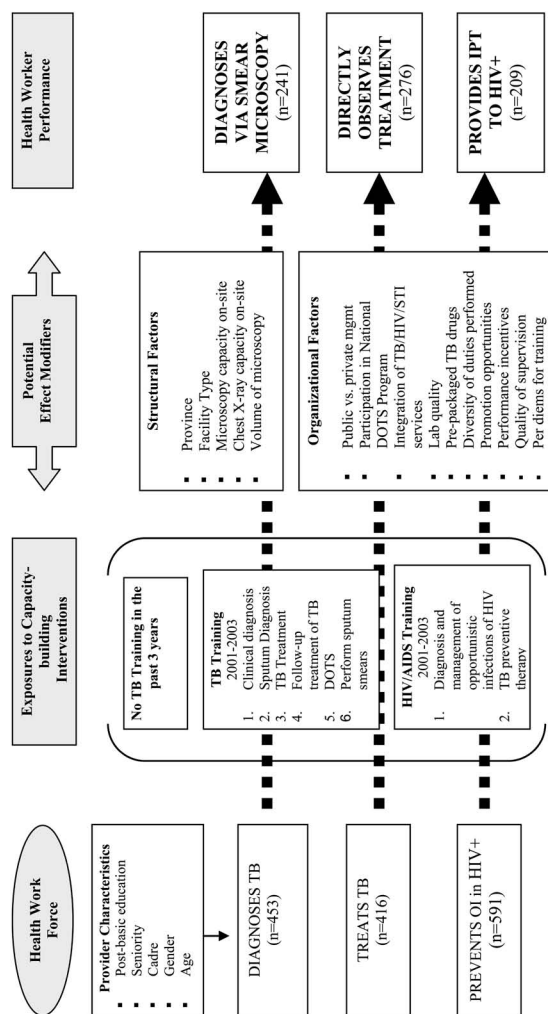


Figure Conceptual framework.

Performance of essential TB skills was not associated with health worker characteristics (e.g., age, gender, education or TB experience), nor was it associated with public or private sector.

**Conclusions:** Although training is not undertaken by all staff equally, TB training is associated with performance of 2 of 3 core TB-HIV tasks. Contextual factors such as supportive supervision, policies, and supplies remain key drivers of health worker performance.

**PC-922-30 Promising practices in TBACSM in hard to reach communities of India**

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**Background:** Over the past two years (2008–2010), World Vision, in cooperation with its partners has contributed to strengthening the efforts of the Revised National TB Control Programme (RNTCP) in reducing TB mortality and morbidity in India. This project was implemented among the most vulnerable and geographically remote communities. New and innovative ways were developed to maximize the health benefits that could be achieved through combined efforts in the areas of (ACSM). The attached ‘Promises

Practices’ document provides insight and information that can serve as a guide and model for those who wish to replicate and/or learn from them.

**Intervention:** The promising practices has shown preliminary positive results and meets criteria as defined in attached document. These practices recognize contribution to RNTCP objectives and allows for their expansion and replication. They are evidence-based and scientific methods were used for developing sound practices.

**Lessons learnt:** These practices have demonstrated that people have benefited immensely from the interventions, making them more knowledgeable. The Promising Practices will achieve the best results possible, when implemented in coordination with local partners and the local community.

**Conclusions:** This documented TBACSM Promising Practices has helped improve results in TB treatment and management. This Promising Practices document serves as an authentic record, presenting an overview of the activities in a manner that is easy to understand and replicate. Each of these activities and interventions resulted in stepping-up the quality of community interaction which resulted in people availing of healthcare services in a timely and efficient manner. In fact, this practice has received a great deal of attention from the state government to be replicated for other programs. The video documentary is available on these promising practices.

**PC-969-30 Partnership as a veritable tool to address TB control challenges in Nigeria**

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**Aim:** Nigeria has the highest tuberculosis (TB) burden in Africa and is 4th among the 22 TB high burden countries globally (2009 Global TB report). Although the National Tuberculosis and Leprosy control programme (NTBLCP) aims at detecting 70% of these cases and cure 85% of them, only about a third are being detected annually. The aim of this study is to demonstrate how a partnership can be of concrete help to the national programme.

**Methods:** The Nigeria Stop TB partnership (NSTBP) was launched in April 2009 to support the NTBLCP address this and several other challenges. Following its take off, the NSTBP did a mapping of partners working in TB control in the country together with the TB services they provide. Based on their core competencies, each partner took activities from the national TB plan for implementation. Most of these activities are related to advocacy communication and social mobilization (ACSM).

**Results:** The NSTBP has become a platform where partners came together and started implementing activities (mainly ACSM) from the National TB plan. This has undoubtedly addressed the much needed co-ordination of partner activities as well as provided an opportunity to measure the contribution of these activities (using the National M & E system) to the overall national programme targets.

**Lessons learnt:** The NTBLCP has the ownership of the programme and partners, who decide to buy into one national TB control plan, work together to contribute to the achievements of the TB control goals in the country.

**Conclusion:** Partnerships could be veritable tools to help the NTBLCP address key challenges of the programme.

### PC-989-30 Barriers for community participation in TB control programme in East Nusa Tenggara, Indonesia

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**Background:** The central role of communities in the response to tuberculosis has long been recognized and imperative for successful programmes, particularly in high endemic settings where TB workers are overburdened and have multiple responsibilities. The World Vision Indonesia has provided TB training to health cadres in rural areas since 2008 and encouraged them to refer TB suspect or supervise TB treatment. We investigated the barriers for health cadres participation in TB control program.

**Methods:** We conducted focus group discussions with 4 groups of active TB cadres and with 4 groups of inactive TB cadres in 4 districts of Nusa Tenggara Timur province. Each group consisted of 8–10 consent individuals. In-depth interviews to TB staff at district health office was conducted to explore the barriers from a different perspective.

**Results:** We identified two main sources of barriers, first is barriers from community and second, barriers from health provider. Barriers from community were high dependency of community to cadres, cadres awareness to risk of TB infection, and poor health seeking behavior. Barriers from provider were unavailability of monitoring and supervision system, non-regular training, delayed diagnosis, and ineffective referral system.

**Conclusion:** Continuous assistance from local TB staff, as well as clear systematic guideline are needed to support community participation in TB control.

### PC-1109-30 A successful partnership for scaling up universal access to TB care in a hilltribe minority village

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**Background:** Minorities people in most parts of the world have higher TB prevalence but less access to health care service. This is also true for Nong-Kaew, a hilltribe minorities village in Chiang Rai, Thailand where TB notification rate is about 5–8 times higher than the provincial rate. High drop out from TB treatment (15–20%) among hilltribe patients were mainly due to poverty and language barriers. We planned an intervention to explore the extent to which hilltribe women volunteers and the Local Administration can be mobilized to reduce the TB problem in Nong Keaw.

**Intervention:** Two hilltribe women leaders were invited to attend a TB women volunteer workshop. After the workshop, they consulted with an NGO partner and the local administration, as well as involved other women in the village to plan and implemented TB control activities.

**Results:** The hilltribe women volunteers successfully developed a proposal requesting budget from the Local Administration to support the following activities; 1) developing TB education in hilltribe language and raising community TB awareness 2) conducting household survey for persons with TB symptoms twice a year (Table 3) supporting transportation to the hospital for suspected TB cases and TB patients 4) visit to TB patient's home to ensure treatment adherence and to give encouragement and 5) establishing a TB patient fund which poor patients who lost their income can borrow without interest.

**Conclusion:** The hilltribe women volunteers in partnership with an NGO and the local administration promote access to TB diagnosis and treatment for hilltribe people. The experiences from Nong Kaew have been transferred to other communities.

**Table** Outcome of household survey for TB symptoms in Nong-Keaw hilltribe village, Chiang Rai, Thailand

	First survey	Second survey	Third survey
Number of people	N/A	822	787
Having TB symptoms	31	33	28
Submitting sputum examination	28	21	22
Diagnosed as TB and received TB treatment	1 (AFB+)	2 (AFB-)	3 (AFB+ = 1 and AFB- = 2)

## PROGRAMME APPROACHES TO TUBERCULOSIS DETECTION

### PC-263-30 Diagnosis of tuberculosis: the user's route in the health system, Brazil

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**Background:** By knowing the patient's route for tuberculosis diagnosis may facilitate the identification of the most sought health services and promote early case detections.

**Aim:** To analyze TB patient's route in the health system, from the first contact with service to the diagnosis.

**Methods:** A descriptive study was conducted in Ribeirão Preto, São Paulo, Brazil. Data collection was conducted in two steps: first, a structured questionnaire was applied to 100 TB patients in order to recover their route since they felt sick until the TB diagnosis and then, secondary data were collected from the TB records state system and municipal system of electronic medical records. The analysis was performed using descriptive statistics. The route was represented by a diagram (flowchart).

**Results:** 69% of respondents sought first the emergency department, followed by 16% who sought primary health care (PHC) and 15% who sought specialized services. Among those who sought PHC, it was observed that 68.5% had to search three or more services to obtain the diagnosis, and 93.8% of these diagnoses were made in specialized services, showing that the first visit to the PHC was not enough for diagnosis elucidation. Of those who sought emergency care, 26% went three or more times to health services until TB diagnosis, which usually was performed on specialized services. Only 8.7% of diagnoses were made at the first visit to health facility. The specialized services diagnosed 53.3% of cases that visit this service.

**Conclusion:** Technological support and staff training in different health services can influence the speed in TB diagnosis, as well as the number of visits and type of sought health services.

### PC-318-30 Health-seeking behaviour and access to tuberculosis diagnosis in city of Brazil

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**Aim:** Describe the context to timely access tuberculosis diagnosis in São José do Rio Preto, SP, Brazil.

**Methods:** Descriptive-exploratory study was conducted with 99 TB patients diagnosed between November 2008 to November 2009, residents in São José do Rio Preto, SP, Brazil. The data was collected using an adapted version of the Primary Care Assessment Toll (PCAT) to evaluate TB care. In order to define time until health services search and establishment of diagnosis, median value was calculated and used as the cutoff point to determine patients and system delay. The analysis was performed by calculating a ratio measurement (odds).

**Results:** For pulmonary cases, time to search health services and obtainment of care was 15 days. Male patients, those with age from 30–49 years, new cases, without HIV co-infection, smokers and alcoholic consumers, searching for health facilities away from their homes when care was needed, referring self-medication, and those who used to search for care at drugstores showed a higher delay until the first search for a health service after the onset of TB symptoms perception. Patients who sought for Primary Health Units, those who hadn't a consultation immediately, whose diagnosis hypothesis weren't TB, without smear or X-ray requested, referred to others services, with more than 3 times of attempts to receive care, and those who weren't diagnosed at the first contact presented higher delay to TB diagnosis. Among extra-pulmonary cases, patient delay was 12 days and health services delay was 25 days.

**Conclusion:** The study shows a weakness of health services performance for TB cases detection, as well as the influence of patients' clinical and behavioral characteristics to the diagnosis delay. This requires a comprehensive strategy involving the incorporation of shares of control by health professionals, community awareness about TB and actions that create TB care networks.



### PC-341-30 Contribution of community health workers in case-findings and DOT provision in Afghanistan

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**Aim:** The community-based DOTS (CB DOTS) was established in 2009 with technical and financial support from the Tuberculosis Control Assistance Program (TB CAP), a USAID-funded project in four provinces; Badakhshan, Baghlan, Jowzjan and Hirat provinces of Afghanistan. We assessed CHWs' role in TB suspect identification case findings and DOT provision to TB patients in the community.

**Methods:** We reviewed the CB DOTS data and conducted interviews with CHWs and facility staff using a data collection tool to capture data on TB-suspect identification by CHWs; the number turned out to be TB SS+ and number that were/are under DOT from CHWs. From April 2009–October 2010, 5787 CHWs were trained in TB suspect identification; referrals to diagnostic centers; and DOT provision to TB patients.

**Results:** The number of TB suspects referred by CHWs increased from 2290 (16%) in 2009 to 8013 (30%) in 2010. Additionally, new TB sputum smear-positive cases detected by CHWs more than doubled from 201 (13%) cases in 2009, to 575 (27%) in 2010. DOT provision by CHWs also shows marked improvement from 2009 to 2010 as it increased from 793 (50%) to 1074 (66%).

**Table** Community health workers' contributions to TB care provision to community in four provinces

	2009		2010		Total	
	Total	CHW contribution <i>n</i> (%)	Total	CHW contribution <i>n</i> (%)	Total	CHW contribution <i>n</i> (%)
TB suspect identification	14445	2290(16)	23405	8013(30)	37850	10303(27)
New TB SS+ case detection	1469	201(13)	2100	575(27)	3569	776(22)
DOT provision	1598	793(50)	1623	1074(66)	3221	1867(58)

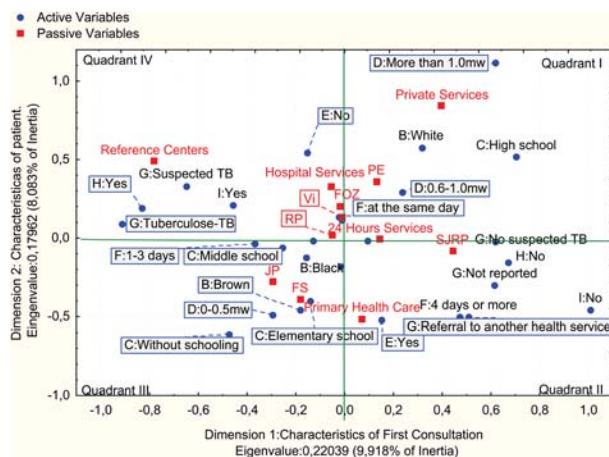
**Lessons learnt:** From assessment, it is evident that CHWs contributed significantly on TB-suspect identification, case-detection, and DOT provision for TB-patients in the community. Over a two-year-period, number of identified/referred TB-suspects, TB-SS+ cases notified and DOT provided by CHWs increased considerably. Thus, we would recommend the scale-up of the CB-DOTS program to other provinces.

### PC-381-30 Evaluation of effectiveness of first contact to tuberculosis diagnosis in seven cities in Brazil

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**Aim:** To evaluate the effectiveness of first contact for access to tuberculosis diagnosis in seven cities in Brazil.

**Methods:** Cross-sectional study in seven cities with 706 TB patients. The analysed variables were socio-demographic, access and first contact with a health service, characteristics of the first consultation with a health professional, kinds of health services and study cities. Multiple correspondence factor analysis was used to evaluate the associations among the categorical variables in factorial plan, Figure 1.



Key: Municipalities - Ribeirão Preto - RP, São José do Rio Preto - SJRP, Vitória - VI, Pelotas - PE, Foz do Iguaçu - FOZ, João Pessoa - JP e Feira de Santana - FS.  
Categorical Variables: B: race/color (black, white, brown); C: schooling (without, elementary, middle, high, college); D: personal income per capita (0 - 0.5 minimum wage (mw), 0.6 - 1.0 minimum wage, more than 1.0 minimum wage); E: health service that is close to your home (yes, no); F: number of days to get a medical consultation (at the same day, 1-3days, 4days or more); G: Healthcare provider statement for diagnosis hypothesis (suspected TB, not reported, no suspected TB, tuberculosis, referral to another health service); H: test BK (yes, no); I: test X-ray (yes, no)

**Figure** Factorial plan for the dimensions characteristics of the first consultation and characteristics of patients.

**Results:** Fig. 1, Quadrant 1, searched for private services (PS) related to race/color white patient, middle school, 0.6–1.0 minimum salary family per capita income, living in Pelotas (PE). Quadrant 2, searched for 24 h services (HS), related to the first visit: BK was not requested, there was no suspicion, no diagnosis in patients, living in SJRP. In Q2 and Q3, turning to Primary Health Care (PHC) is associated to a brown patient, low level of education/income, nearby service, patient referred from João Pessoa (JP) and Feira de Santana (FS). In Q4, Hospital Services (HS) meant being served on the same day, patients from Ribeirão



Preto (RP), Vitória (VI), Foz de Iguaçu (FOZ). Reference Centers (RC) associated to the request of tests (BK, X-Ray).

**Final considerations:** Services associated to TB diagnosis at the first visit was RC, followed by HS. PHC services serve low income patients and refer them to another service, thus delaying the diagnosis.

### PC-451-30 Brazil's experience in decentralization of tuberculosis diagnosis, 2001–2008

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**Background:** In Brazil, the Unified Health System (UHS) ensures universal and free access to care. The structure of the local health systems stems from the Primary Health Care (PHC), with emphasis on the Family Health Strategy (FHS). Tuberculosis (TB) control is one of the ten priority areas of FHS. The objective of this work is to analyze whether the decentralization of TB control activities accompanies the process of expanding the coverage of FHS advocated by the country.

**Design/methods:** New smear positive TB cases diagnosed between 2001 and 2008 reported in the national information system for notification of diseases were selected. The cases were stratified according to the type of reporting health service (primary, secondary, tertiary and hospitals) and compared with the coverage of FHS. Data were provided by the National Tuberculosis Control Program (NTP) and Department of Primary Care. Tabwin 3.5 and EpiInfo 3.5.1 were used to consolidate and analyze data.

**Results:** Throughout Brazil, there was an increase in the coverage of the FHS (25% in 2001 to 49% in 2008) and in the percentage of smear positive TB diagnosed by PHC (47% in 2001 to 57% in 2008). Nationally, increase in the coverage of the FHS was not always followed by a similar enhanced decentralization of diagnosis. There were two regions (Midwest and North) where a significant and comparable increase in both indicators was observed, however only 15% of the smear positive TB cases in the country were reported in these regions. The other three regions (South, Southeast and Northeast) that comprise approximately 85% of the smear positive TB cases in the country presented the national pattern.

**Conclusions and recommendations:** The expansion of FHS does not guarantee the implementation of TB control activities in PHC. One of the major remaining challenges for the NTP is the effective decentralization of these technical activities, in order to facilitate expansion of access to timely diagnosis and treatment.

### PC-460-30 Effectiveness of involving corner stores in Santo Domingo for improving referral of TB suspects

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**Background:** Increasing tuberculosis (TB) case detection in urban neighborhoods requires new partnerships with local leaders.

**Objective:** This quasi-experimental study assessed the effectiveness of involving owners of shops in referral of customers with chronic TB symptoms.

**Design/methods:** To evaluate the effect of the interventions upon recognition and referral of symptomatic customers, trained actors visited 103 shops before and 2+ weeks after intervention to seek advice for a standard set of chronic symptoms reflecting pulmonary TB. A control group ( $n = 15$ , 14%) of shops was included. Shops in the intervention arm ( $n = 88$ , 86%) received a motivational visit ( $\pm 15$  min) from NTP volunteers. An unweighted score of 6 TB referral behaviors was constructed. Shops received 1 point each for a) spontaneous recognition of TB symptoms, b) recognition of TB symptoms when suggested, c) recommendation to seek medical diagnosis d) not attempting to sell medicines e) having TB health education materials on site and f) referral to the TB program using a referral slip or brochure. To detect a change in mean TB referral scores a one-way repeat-measure ANOVA was performed. Alpha was set at 0.05.

**Results:** Overall mean post TB referral scores increased in both groups ( $F = 21.02$ ,  $P < 0.000$ ). Mean scores among shops exposed to interventions (2.9) exceeded controls (1.8) ( $F = 5.39$ ,  $P = 0.022$ ). Compared to controls, shops in the intervention arm were twice as likely to refer customers to a doctor (28.6% vs. 59.2%) and to accept TB as a possible cause when suggested (6.8% vs. 48.3%). Visited shops were more likely to refer TB suspects to the TB program (6.7% vs. 36.4% OR 8.0, 95%CI 1.2–63.1  $P = 0.02$ ). Attempted sale of medications also declined in the intervention group.

**Conclusion:** Grocery owners' recognition and referral of TB suspects increases with a simple motivational visit. Future research should explore the effectiveness in terms of TB cases identified.

### PC-487-30 Care-seeking behavior of pulmonary TB suspects in urban slums for early coverage by NTP in India

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**Background:** Cough persisting for more than two weeks is a symptom of active TB. While information on care-seeking behaviour of TB suspects from urban and rural India is available, little is known about those from urban slum populations. The USAID funded, Market-based Partnerships for Health (MBPH) project intends to understand care-seeking behavior with the vision of enabling early diagnosis and improved access to the National TB Control Program (NTP) in India.

**Methods:** Urban slums in Uttar Pradesh (UP) and Karnataka were selected based on 2008 NSP CDR rates, population size and geographic distribution. Door-to-door surveys were conducted and chest symptoms were identified. They were interviewed using a semi-structured interview schedule.

**Results:** 1526 chest symptomatics in UP and 1515 in Karnataka were interviewed by December 2010. 75% of respondents in UP and 58% in Karnataka sought treatment from healthcare providers. Of them, 78% in UP and 99% in Karnataka visited an allopath. Most are stated to have followed provider advice on diagnosis and treatment. Only 16% of respondents in UP and 48% in Karnataka reported that providers recommended sputum microscopy. In UP, risk perception of TB and knowledge of how TB is caused are drivers of positive behavior, while quality of care and knowledge that TB is curable are determinants in Karnataka.

**Implications for TB control:** The study recommends investments to focus on changing provider behaviour. However, there is also need to carry out targeted and area specific communication to improve care-seeking behavior and demand for DOTS by TB suspects.

### PC-515-30 Working with patients to intensify case finding through empowered TB and TB-HIV patients

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**Background:** Over the last ten years, the country has witnessed a tenfold increase in the number of TB cases; this is despite having met the two targets of case detection and treatment success in 2009. Empowering TB and TBHIV co-infected patients in intensifying improved case-finding has resulted in more identification and notification of suspects at community level. This in turn has resulted in timely diagnosis and thus appropriate treatment.

**Intervention:** Through TB REACH wave 1, KAPTL/

TAG in collaboration with DLTLD identified 220 community volunteers, 25 community health workers, 11 field officers and laboratory locum staff to intensify case finding in 11 districts, in 4 towns in Kenya. These teams used approaches like door to door, contact investigation, referral of suspects, community dialogue forums, screening camps and health education to get to the targeted populations of 6 million. 2289 index TB cases diagnosed in a referral hospital and 528 consented to household visits. Sputum collection sites were identified, screening was also done through TBHIV clubs based on peer to peer referrals among others. Participants received results with referrals to government clinics and private clinics for TB treatment and isoniazid preventive therapy as indicated.

**Results:** 873 household contacts were screened for TB. 38 had previously undiagnosed TB, 410 were identified through TB screening camps, 710 through peer to peer referral, 3878 through door to door.

**Conclusions:** Among the approaches selected above, Intensified case-finding (ICF) in household contacts of TB patients resulted in accelerated detection of both TB and HIV in undiagnosed contacts, thus breaking the cycle of transmission among the two high risk groups. Working with TB and TBHIV patients proved to be an important component of enhancing case finding.

### PC-688-30 Impact of 2010 World TB Day celebration in Afghanistan

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**Aim:** To assess the impact of 2010 World TB Day (WTBD) celebration in Afghanistan.

**Methods:** Review of provincial reports of 19 provinces, case study, field visit, face-to-face meeting and group discussion.

**Results:** 320 targeted health facilities celebrated World TB Day, self-referral increased by 20%, awareness of 14000 people increased through 280 religious leaders speech, more than 80000 pieces of IEC materials distributed for 1300 health facilities and 11000 health posts of 34 provinces. At least 12000 female and male audiences participated in 60 TB school quizzes at 19 provinces. More than 19500 audiences and 684 players participated in 20 football, cricket and or volleyball matches. About 31000 health workers, local, community and religious leaders participated in WTBD Celebration at 310 HFs of 19 provinces. WTBD messages and events, including sport matches, school quizzes and gatherings published and broadcasted through 15 national and local TVs, newspapers, international, national and local media. Culture of World TB Day celebration introduced to health facilities and community. World TB Day Celebration contributed on achievement of, suspect cases

referred by Community Health Workers (CHWs) increased from 16% 2009 (before WTBD 2010) to 34% in 2010 (after WTBD 2010), DOT by CHWs increased from 34% in 2009 to 50% in 2010, suspect detection rate in 625/100 000 OPD in targeted provinces comparing to 417 in non targeted provinces. SS+ rate increased from 6139 in 2009 to 6742 in 2010 and treatment success rate from 83% to 85%.

### PC-691-30 Sex differences in numbers of TB suspects at diagnostic centres in Pakistan

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**Background:** It is widely recognised that barriers to accessing tuberculosis (TB) diagnosis, particularly amongst female patients, are important to address in order to improve case detection rates. Few studies have analysed whether characteristics of TB diagnostic centres have different effects on health service utilisation by men and women. The objective of this study was to investigate the effect of diagnostic centre characteristics on sex differences in the number of female and male suspects registered at centres in Pakistan.

**Methods:** Ten districts were selected across the four provinces of Pakistan and data was collected on male and female TB suspects in all diagnostic centres within the district. Data on diagnostic centre characteristics including size, accessibility and types of services provided was collected from representatives of each diagnostic centre using a structured questionnaire. A multiple regression analysis was conducted to evaluate the influence of diagnostic centre characteristics on sex differences in suspects registered at a centre.

**Results:** Of 143 DOTS-reporting diagnostic centres in the ten districts selected, interview data was obtained from 142 and outcome data was obtained from 141. The multiple regression analysis showed that local diagnostic centres that are accessible by foot registered relatively higher numbers of female than male TB suspects. More centralised facilities that are further from homes, larger facilities, and those with evening opening hours registered relatively more male than female suspects.

**Conclusions and recommendations:** In order to enhance case detection and access to TB care for women, it is particularly important that local health facilities are well-functioning and equipped for TB diagnosis. The number of male suspects going through the DOTS-reporting system, rather than to alternative providers, may be improved by offering TB screening after working hours in selected DOTS-reporting centres.

### PC-1139-30 An authentic voice: the integral role of TB peer educators in metropolitan TB control

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**Background:** In London, 1 in 6 tuberculosis (TB) cases are hard-to-reach due to homelessness, drug/alcohol use or imprisonment. These groups are at high risk of delayed diagnosis, infectious and drug resistant TB and poor treatment outcomes. The Berlin Declaration (2007) stated that affected communities are essential partners in TB control. While initiatives involving hard-to-reach communities in HIV control have proven effective, evidence to support their contribution to TB control activities is lacking. We aimed to improve service access and uptake of screening among hard-to-reach groups by harnessing the authentic voice and experience of former TB patients from these affected communities.

**Method:** Eight former TB patients with experience of homelessness and drug/alcohol dependence were recruited and trained as peer educators to work alongside TB clinics and a mobile screening service. Qualitative and quantitative methods were used to evaluate their impact on service access and screening uptake.

**Results:** Over a 17-month period peers recruited 6532 hard-to-reach clients resulting in 53 hospital referrals and 14 cases of active TB. Following training for homeless hostel workers from TB peers, screening uptake increased from 44% to 75%. 92% of attendees at a peer training session agreed that 'hearing from someone who has had TB has motivated me to tackle TB'.

**Conclusion:** Our evaluation demonstrated that trained peer educators can improve service access and screening uptake and provide an authentic voice of experience that homeless people can relate to. Peer involvement should be integral to tackling metropolitan TB among hard-to-reach groups.

### PC-1172-30 Using targeted approaches to improve TB case detection in Accra, Ghana

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**Background:** Low TB case notification remains a challenge despite NTP's successes in implementing WHO Stop TB Strategy. An estimated 36% of expected TB cases were detected and notified in 2009.

**Interventions:** Selected interventions piloted in Accra Metropolis to improve TB case detection. A hospital-based systematic active TB screening of OPD attendants presenting with cough history, regardless of other presenting symptoms was implemented in selected



health facilities. Contact investigation of index TB cases were intensified and systematically carried out. Persons living with HIV attending 5 ART clinics were systematically screened for TB symptoms. Pharmacy and chemical seller operators were recruited to screen clients purchasing cough mixtures for cough and refer eligible persons to nearby private and public laboratories for sputum examination.

**Results:** Over a period of 6 months, 3567 TB suspects (almost twofold increase) were identified and referred for sputum examination and 523 new TB cases diagnosed including 150 from the ART clinics.

**Lessons learnt:** Health facility structures such as OPD settings can be adapted to accommodate interventions. Health services linkages with civil society through task-shifting reduced health staff workload and facilitated TB screening.

**Conclusion:** Systematic active screening of OPD attendants, household contacts and pharmacy clients is feasible under programmatic conditions. Pharmacies are willing partners to screen clients for TB.

#### **PC-1183-30 Findings from a quantitative study to inform an integrated communication campaign to improve case detection**

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**Background and challenges to implementation:** India continues to bear almost a fifth proportion of global TB cases, which has serious implications on the country's economy, affecting the productive age group, male 15–54 years. Although the Indian government has been working to curb the prevalence of TB since the 1960s through an impressive TB control programme, the desired goals have still not been achieved. Under Global Fund Round 9 funding PSI/India is working with the prime recipient The Union on strengthening the ACSM aspect of national TB control program. The project is across 30 districts in five states—Bihar, Rajasthan, Punjab, Haryana and Karnataka.

**Intervention or response:** A quantitative study was conducted recently (Dec–Jan 2011) with the objectives of measuring current levels of early detection behaviour and identifying key determinants associated with it. The behaviour was captured through community's intended behaviour of seeking treatment in the incident of having cough for 2 or more than 2 weeks. Logistic regression analysis was performed to identify determinants associated with seeking cough care.

**Results and lessons learnt:** Certain knowledge items including knowledge about cough for 2 or more weeks being symptomatic of TB, availability of diagnosis facilities, social support from friends, family and provid-

ers and several beliefs associated with early detection behaviour. Further analysis including the SWOT analysis will help to prioritize among these determinants.

**Conclusions and key recommendations:** The research findings are expected to help strategize an effective integrated communication campaign that is much needed to achieve the yet distant objectives of the TB program in India.

#### **PC-1190-30 Lessons learnt from visiting the homes of chronic TB patients in Nigeria: a call for action**

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**Background:** Nigeria is the fourth of the 22 high burden TB countries with an estimated incidence rate of 311 per 100 000 population. WHO estimates that the prevalence of multi drug resistant TB (MDR-TB) among new TB cases is 1.8% and 9.4% among previously treated TB patients. Access to treatment is still limited and basic protocols to prevent infection spread are not adequately observed. We share lessons from an intensified effort to find chronic TB patients in two local government areas (LGA) of Cross River State, Nigeria.

**Methods:** A community TB home visiting team was assembled and a tool developed to capture their observations from chronic TB patients. Using the LGA TB registers, 58 category 2 defaulters were purposively sampled. 41 of these patients were reported dead while the remaining 19 were visited in their homes and history of TB treatment, risk factors for MDR-TB transmission in their homes, and the presence or absence of TB symptoms in household contacts were observed.

**Results:** Of the 58 patients sampled, 41 (70.6%) were reported as dead from the registers, while 19 (29.3%) were reported as alive. Among those found alive, 2 (10.5%) patients had died from complications of the disease unknown to the health facility staff. The visit further revealed that 15 (88.2%) were identified as category 2 defaulters and 2 (11.7%) identified as category 2 failures. Even though, there were no symptomatic contacts, majority of the patients lived in inadequately ventilated homes that were overcrowded with an average of 3–5 persons in a room.

**Conclusion:** The exercise revealed an alarmingly high mortality rate of the TB patients and underscores the need to urgently improve upon diagnosis of drug resistant TB in Nigeria. TB prevention measures should also be vigorously strengthened in the home of TB patients.



### PC-1252-30 Multiple factors influencing tuberculosis case detection: a case study of DOTS training programme

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**Background:** The DOTS strategy has started since 1996 in Indonesia, but high tuberculosis (TB) morbidity and mortality were still reported. In 2009, TB DOTS training was conducted in East and Central Jakarta for community health workers (CHWs) and health staff from primary health centres (Puskesmas) and private sectors. The evaluation showed the trainees' improved knowledge. In 2010, the Case Detection Rate (CDR) in these areas decreased 20% compared to previous year. This study aimed to examine factors influencing the trainees' case detection.

**Method:** Data about case detection experience were gathered using focused group discussions with trainees. In depth interviews with selected health officials were also conducted.

**Results:** The trainees experienced various obstacles in case detection. Limited awareness, stigma, transportation and economic status have hindered patients to access diagnostic service. The CHWs were motivated to detect and refer patients but confused with their specific task and reward system because the National TB Programme (NTP) doesn't include their role. Furthermore, recent governmental financial policy limited Puskesmas to conduct TB promotion. Private sector was favored for convenient time service and complete facility compared to Puskesmas but only limited number of them that actually report their cases.

**Conclusion and recommendations:** The trainees' TB case detection contribution to CDR seemed to be limited and influenced by community behavior and policy enforcement. Future DOTS training intervention should address these factors. We recommend to include private sectors and CHWs into NTP. Future study is needed to investigate reasons of decreased CDR in this area.

## DOTS EXPANSION II

### PC-218-30 Community systems contributing to good treatment outcomes

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**Objective:** To recognize the impact of investing in community level TB care as a sustainable approach to improved TB outcomes.

**Background:** In 2009 Namibia's Case Notification rate (CNR) was 634/100 000 with a national Treatment Success Rate (TSR) of 82% among new smear positive patients. In 2010 Project HOPE completed a

two year program implementing community-based tuberculosis care (CBTC) in three northern regions in Namibia in collaboration with the Ministry of Health and Social Services (MoHSS).

**Intervention:** Project HOPE implemented a CBTC model aimed at improving treatment outcomes and strengthening referrals to TB-HIV services. The program was comprised of community advocacy activities, adherence education, mapping TB caseloads, provider initiated testing and counseling, contact tracing and training DOTS supporters. The program recruited 55 community case workers, attached to 55 health facilities in the three regions and reached over 4000 TB patients and provided health education to over 100 000 community members.

**Results:** The table below illustrates the CNR in 2009, TSR, % of patients with known HIV status and defaulter rates between 2007–2009 in the 3 regions.

Region	CNR per 100 000 population (2009)	TSR, %			TB patients with known HIV status, %			Defaulter rate, %		
		2007	2008	2009	2007	2008	2009	2007	2008	2009
Oshana	479	83	84	82.5	54	72	87	7	2.7	0.8
Oshikoto	621	77	84	86.4	46	62.8	76	9	2.3	1.4
Kavango	568	77	74	80.5	55	70	76	6	8	5.9

The successes were attributed to regular supportive supervision sessions with the community volunteers, improved record keeping at the health facility, and close monitoring of TB patients.

**Recommendations:** Investing in effective community systems approach in TB care contributes towards improved outcomes through provision of information and access to HIV testing. Sharing program reports and collaboration with the MoHSS promotes ownership of the TB program, fostering a sustainable approach in implementing TB programs.

### PC-459-30 How much funding is needed to scale up TB services? Answers from some Cambodian health centres

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**Aim:** To meet the need for good quality TB services it is important to understand how much funding is needed to provide those services and to strengthen the health care delivery system. We present a methodology for estimating these funding needs at health centres and we show findings from Cambodia.

**Methods:** In 2008 a study was carried out for the Cambodian Ministry of Health to estimate the cost of the basic package of health centre services provided in 2007 and to show how much additional funding would be needed to successfully scale up TB

and other priority services. The health centre costs were estimated using direct, standard costs for each service and by allocating shared costs across those services. Data from 6 health centres were analyzed to estimate TB treatment costs using a spreadsheet tool called CORE Plus.

**Results:** The data showed that the average actual cost of a full course of TB treatment at the health centre level would have been \$67.85 (\$51.10 for TB drugs and supplies, \$11.53 for staff and \$5.23 for fixed operating costs). These figures, however, reflect insufficient staffing and inadequate operating expenditures, and to ensure that sufficient resources were available to provide good quality services, a total of \$76.12 was needed (an increase of \$8.27). If TB services are scaled up to full coverage the total cost per treatment would be \$75.15, which reflects some economies of scale. Note that these figures only cover the operating costs of providing treatment at a health centre; they do not include the cost of diagnosis, community activities or supervision and they do not include capital costs.

**Conclusion:** The analysis showed that health centre services were under-resourced in 2007 and it is assumed that TB services would have been affected along with other services. The expenditure required to treat a TB patient would need to have been higher to take into account the need for increased staffing and operating functions.

### PC-810-30 Decentralising TB services to the township hospitals in Guangxi province, China

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**Background:** The county CDC isn't sufficiently accessible in hilly and rural Guangxi. We have successfully piloted a model in Guangxi, where the central township hospital (TH) was designated as the diagnostic centre while peripheral THs as treatment hospitals. The new project aimed to increase the reproducibility of the model by allowing THs for both the TB diagnosis and treatment.

**Methods:** Three townships (GS, TT and BL) were selected for pilot from Oct 2007 to Sep 2008. The sputum microscopy was provided and quality assured at these THs. If positive, patients were treated and managed in the TH. If negative, patients were on a 10-day antibiotic trial, if symptoms not improved, referred to the CDC for further diagnosis. Routine data were collected for descriptive analysis and qualitative data were collected from project meetings and filed visits.

**Results:** TT has the highest proportion (95%) of TB

suspects sent for sputum test, and the largest number of negative patients treated in the TH. BL has the smallest proportion (6%) of the positive cases treated in THs. On average, 10% of patients sent for sputum test were identified as positive. Challenges of decentralization included strong motivation, sufficient workload, and coherence with the current health policy framework, strong capacity and good internal and external communication of the hospital.

**Conclusion:** Decentralizing both the TB diagnostic and management services to the THs was feasible in west China with poor accessibility. However, success will depend on the well-functioning primary health care system.

### PC-824-30 Tuberculosis services in both rural and urban areas in Bangladesh increased DOTS coverage

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**Introduction:** BRAC, an NGO in Bangladesh implementing Tuberculosis Control Programme with the guidance of National Tuberculosis Control Programme (NTP), reaching a population of 91 million in 42 districts and 5 city corporations in Bangladesh. Among this, city corporations cover 4.4 million population. MoU between NTP and NGOs was signed in 1994 for rural and in 2001 for urban areas.

**Objective:** To assess the case finding and treatment outcomes in rural and urban areas supported by BRAC.

**Methodology:** BRAC community volunteers are involved in referral, providing DOT and the disseminating messages on TB. Laboratories are established in government and BRAC facilities. In urban areas, medical college hospitals, workplaces and private medical care providers are also involved in DOTS implementation.

**Result:** In 2010, a total 95 124 patients were diagnosed in BRAC supported area. Case detection rate was 78% and 84% in rural and urban respectively. In rural area, 10% smear negative and 11% extra-pulmonary cases were diagnosed and in urban area it was 11% and 19% respectively. In 2009, treatment success rate was 93% in rural and 90% in urban. Default rate was 1.2% in rural and 1.9% in urban area. Retreatment failure rate was higher in urban (2.8%) than rural (2.1%) area.

**Conclusion:** Due to availability of diagnostic facility at large hospitals, extra-pulmonary patients were diagnosed more in urban area in comparison to rural. Defaulter and transfer out are more in urban due to migration. Special interventions for urban area are needed to improve the referral mechanism and increase treatment outcomes.

**PC-842-30 Client satisfaction in relation to TB services in urban Nepal**

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**Settings:** Since implementation of DOTS the National TB Programme has achieved and sustained the international target of TB treatment success rate. The NTP has been focusing on client oriented quality services for people with TB. The study was conducted in urban Kathmandu. All together 57 DOTS centers are delivering TB services in the study area.

**Methods:** Exploratory/descriptive study. Stratified random sampling and probability proportionate to size techniques was adopted to identify 17 centers and 384 TB patients. In-depth interviews and focus group discussions were held among people with TB and their family members, service providers, and community people.

**Objectives:** To assess the clients' satisfaction in relation with TB services delivered by DOTS centers in Kathmandu district.

**Findings:** More than three quarters of patients found satisfied with basic TB services. More than 90% said availability of TB drugs/drugs/service providers at the point of service delivery. Likewise, 88% were found satisfied with treatment and behavior of service providers. However, patients complained about long waiting hours and less access to DOTS centres especially among vulnerable population groups.

**Conclusion:** In general, operational aspects of DOTS services found satisfactory which was statistically significant with regards to clients' satisfaction level. However, long waiting hours of services and limited access to DOTS centers hindered the satisfaction of clients. In addition, availability of drinking water, sanitation and cleanliness of centers, communication between clients and service providers were found inadequate and were the factors in determining satisfaction level.

**PC-993-30 Improvement on TB treatment outcome in DOTS implementation during a 15-year period in CRS, Nigeria**

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**Background:** Improved treatment outcomes have been demonstrated in TB control programmes with well established and sustained DOTS interventions implemented over time. The objective of this study was to determine the progress in attainment of treatment outcome targets for national TB control programme in Cross River State of Nigeria where DOTS implementation started since 1994.

**Methods:** A retrospective review of routine TB surveillance data reported by the state programme to the National TB and Leprosy Control Programme from the period 1994–2008 was conducted. Information on the number of microscopy centre and DOTS centres that were established during this period was collected. The programme performance targets were reviewed against expansion efforts both in diagnostic facilities as well as treatment centres to determine the progress achieved during the period.

**Results:** During the 15-year period, a cumulative 25 124 tuberculosis patients were notified with 13 320 (53%) of them new smear positive cases. On average 8% increase in case notification was reported each year by the programme (range < 1% to 28%). The treatment outcome improved from 65% to 84%. AFB laboratory facilities increased (7 vs. 21) and treatment facilities (32 vs. 102) from 1994 to 2008.

**Conclusion:** There was 19% improvement in treatment outcome during the 15-year period of implementing DOTS interventions. The increment in case notification had been minimal with respect to expanded access to diagnostic and treatment services. This underscores the need for programme managers to investigate innate factors which might play vital role in improved programme performance.

**PC-1117-30 Partnership in TB control: Namibia's success story**

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**Background:** Namibia adopted the WHO DOTS strategy in 1999. The country had limited human and financial resources for TB control, reflected by low treatment success rates (TSR) of 64% (cure rate 46%) in 2000.

**Response:** In 2002 KNCV TB Foundation started providing technical assistance (TA) to the Namibia TB Programme (NTP). The partnership between NTP, KNCV and WHO strengthened the country's strategic and technical approach, leading to increased donor funding and staff at all levels, as well as donor supported TA. A TB strategic plan and updated TB guidelines were published; and training modules were developed. Two grants from the Global Fund were secured (Round 2 US\$1.5m and Round 5 US\$18m); funding by USAID and PEPFAR through the TB Control Assistance Program (TB CAP) increased from US\$118k to US\$2.2m per year, and Centers for Disease Control (CDC) laboratory support intensified. Partnering with community based organisations (CBOs) strengthened case finding and implementation of community based DOT. Partnering with the International



Training and Education Center for Health and The Union was crucial in TB, TB-HIV and MDR-TB capacity building. Coordination was through quarterly National Steering Committee (comprising government and partners) meetings.

**Results:** TSR improved from 64% in 2000 to 82% in 2008 (see chart); case detection rate improved from 76% in 2002 to 87% in 2006. 73% of TB patients had a known HIV status in 2008, compared to 15% in 2005; and eligible HIV positive TB patients have access to HIV care. Programmatic management of drug resistant TB is fully established and functional.

**Conclusion:** Technical and financial assistance with effective partner coordination and delineation of roles can positively impact on TB programme performance where political commitment is high. Involvement of CBOs can help to increase DOTS access, with consequent improved treatment outcomes. Involvement of a dedicated training division facilitates sustained capacity building.

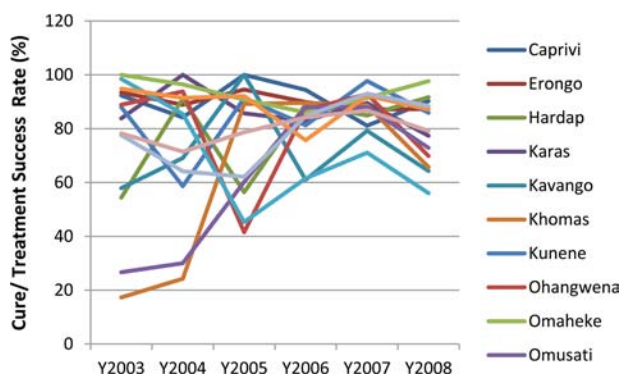
#### PC-1188-30 Using peer review mechanisms for TB data quality improvement in Namibia

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**Background:** Namibia had a high case notification rate of 634/100 000 in 2009. The country has 34 non-substantive district TB coordinators responsible for data collection, leading to challenges in ensuring timely quality data. The inter-regional variation and intra-regional fluctuations in the percentage of successfully treated TB patients who had a 'Cure' outcome (see chart) reflects suboptimal patient follow-up and poor data quality; which is more pronounced before 2006.

**Intervention:** The NTP introduced quarterly district review meetings (QDRMs) (GFATM funded) where all regions review, verify and audit their district-level data in the district's TB treatment cards, TB registers and quarterly reports; as well as conducting training on data management as well as identifying programmatic challenges. The QDRMs are used to produce the regional TB reports, which are subjected a week later to further review at the zonal meetings (USAID-funded) where 2–3 regions perform a peer review of their data.

**Lessons learnt:** Quarterly review meetings have been conducted since 2007, with significant improvement in the timeliness and quality of data, as observed by a 2009 external review. Follow up data queries have been reduced to a minimum and there has been a significant focus by regional and district staff on the importance of good quality data. Noting its usefulness, the initiative has been expanded to TB-HIV data and is also planned to be introduced for ART data. There



has been an improvement in the inter- and intra-regional consistency of data as evidenced by the proportion of successfully treated patients with a 'cure' outcome (see Figure).

**Conclusions/recommendations:** Significant improvements can be made in data quality by allowing implementers to conduct peer review of their data. This can be implemented as a combined exercise for the major public health diseases in the country, and should therefore be funded by the Ministry of Health to ensure sustainability.

#### PC-1253-30 Establishing TB-poverty control strategies within the national TB control programme in Kenya

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**Background:** Tuberculosis (TB) and poverty are closely associated. Recent literature on TB rates in Kenya suggests that besides the established links between HIV and TB prevalence, poverty and social deprivation also contribute to TB burden. Kenya has a high rural-urban disparity in poverty levels with both logistical and financial barriers being faced by vulnerable populations in accessing TB services.

**Goal:** To ensure equitable access to tuberculosis services.

**Objective:** To address the economic, geographical, gender and socio-cultural related barriers to accessing TB services and to advocate and to mobilize resources for poverty & gender activities.

**Method:** Establishment on a pilot basis of a TB-poverty & gender initiative in two districts experiencing limited access to TB services.

**Indicators:** Number of the new diagnostic sites opened; treatment outcomes by gender and proportion of TB patients receiving nutritional support.

**Achievements:**

- Decentralized TB services increased from 38 treatment sites to 51
- 6 new smear microscopy sites opened
- ARV and TB clinics schedules harmonized



- TB-HIV patients receiving nutritional support
- Two community sputum collection sites established
- TB poverty & gender objectives included in the 2011–2015 national strategic plan.

**Conclusion:** Implementation of poverty initiatives has lead to further decentralization of TB services.

**Recommendations:** There is need for the NTP and partners to closely monitor and document poverty activities.

### PC-1262-30 Recruitment and retention of community volunteers in implementing CTBC project in Nigeria

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**Issues:** Experience from many high burden TB-HIV countries has shown that CTBC is an effective and acceptable means of improving access to quality TB services. The success of community involvement in practice depends on the quality of relationship between health personnel and community volunteers (CV). This study reviews the process of engagement and retention of CV in a CTBC program in Nigeria.

**Description:** The recruitment of CVs begins with community engagement through advocacy and mobilization activities. The selection process is inclusive and based on set criteria. Once selected, the CVs subsequently work under the supervision of community-based organizations (CBOs) to carry out specific functions which include health promotion, identification and referral of TB suspects to health facilities, provision of treatment support for TB patients; and tracking of contacts and defaulters.

**Results:** The analysis for 6 districts with CTBC activities for the period January 2008 to January 2010 shows that 204 CVs were engaged; 98 females and 106 males with a mean age of  $38 \pm 10$  years. About 77% of them were married, 3.9% had no formal education while others (96.1%) had education ranging from primary to university levels. Majority (81.4%) had a regular occupation while only 48.0% were able to state their level of income from their regular jobs. Some LGAs gave financial incentives to CVs ranging from \$13 (33.3%) to \$17 (36.8%). A third of CVs had no financial incentives. The retention rate for all 6 LGAs was 98.5%. Attrition rates were higher among those who received no incentives (34.4% cf. 0.7%),  $P > 0.05$ . CV characteristics entered into a backward binary logistic regression model did not predict retention or attrition.

**Conclusion:** Retention rates among CVs in these cohorts were high. This low attrition rate can be attributed to the inclusive selection process which makes CVs highly acceptable within their communities.

## TOWARDS ADHERENCE TO TUBERCULOSIS TREATMENT II

### PC-94-30 Receiving professional support

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Tuberculosis, by modifying people's daily lives, requires the inclusion of new shares that cannot always be performed by the person, who now requires further assistance to manage these demands. Emotional difficulties also arise in the face of the illness, made worse by a lack of emotional support by family, and contribute to bad experience in treatment. Having someone who offers support in times of need can facilitate coping with problems and reduce the negative effects of the disease. This is a qualitative study of the social support of people with tuberculosis, using Grounded Theory as a methodological reference. Data were collected through interviews with five sample groups totalling 26 people. The coding and analysis of data allowed us to identify two categories: family support and professional support. This work will present the subcategory receiving professional support. The support network for people with tuberculosis is not very extensive, consisting primarily of health professionals and family and friends/neighbors. Social support networks are of importance to people with TB, since the feeling of being loved and valued helps individuals to escape isolation and better cope with the disease. The role of health care extends beyond disease control through guidance about the transmissibility of the disease and the treatment, and especially the control of drug use. It requires a broader understanding of the situation of people with TB, including the changes the disease engenders in patients and the difficulties they face, from both a social and a physical and relational point of view. In this sense, actions also extend, for example, to mobilizing and expanding the network to support these people. In order to play this role, those who provide the necessary support need to have a greater knowledge of these networks of interactions as they happen.

### PC-395-30 Relapse among pulmonary tuberculosis patients after DOTS implementation in Taiwan, 2006–2008

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**Background:** Coverage of directly observed therapy, short course (DOTs) in Taiwan is over 90%. To understand the magnitude for tuberculosis (TB) relapse in Taiwan after DOTS implementation, we conducted a retrospective observational study.

**Methods:** All 24 306 pulmonary TB cases reported to the National TB Registry during January 1, 2006 to March 31, 2008 were enrolled. Relapse was defined as having bacteriological evidence of TB recurrence after completing anti-tuberculosis treatment. Genotyping with mycobacterial interspersed repetitive units-variable number tandem repeats (MIRU-VNTR) was used to differentiate re-activation from re-infection of paired isolates taken from relapsed patients. Information on demographic characteristics and the case management were collected and analyzed.

**Results:** A total of 230 patients met case definition. Of these, 77% were men; median age was 64 years (11–89). The relapse rate was 0.095% after following-up for at least one year after completion anti-tuberculosis treatment. Of the 57 isolate pairs available, 27 (47%) were of the same genotype (re-activation); 15 of the 27 pairs (56%) belonging to the Beijing genotype. There were 13 (23%) re-infections. All other isolate pairs were contaminated. The DOTs coverage rate for initial TB treatment was 55% among 217 relapsed patients.

**Conclusions:** The relapse rate was only 0.095% after DOTs implementation. More than half of the available paired isolates from reactivated patients were of the Beijing genotype. Enhanced case management and stringent implementation of DOTs might prevent relapse. To understand the risk for developing relapse, more prospective studies are needed.

### PC-767-30 Pharmacotherapeutic follow-up in tuberculosis control, Brazil

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**Background:** Tuberculosis (TB) patients are strong candidates for the development of Pharmaceutical Care (PC), mainly considering the context of treatment adherence. In the current perspective, the pharmacist represents an essential member in the multi-disciplinary team and care of these patients. The PC purpose is to increase the drug treatment effectiveness, in concomitance to detection of drug related problems (DRPs).

**Objectives:** To develop the pharmaceutical care addressed to TB patients from the Hospital of Clinics of the Federal University; to describe the characteristics of drugs utilization, DRPs; to intervene according to patient necessities; developing also a pharmacotherapeutic followup.

**Patients/methods:** This is a prospective study, for patients followup in the TB clinic of HC/UFMG, Belo Horizonte, developed between 2009 August and 2010 December, utilizing the PC methodology professed by Cipolle et al., 2002.

**Results:** A total of 49 patients were included in the study. The average age was of 45 years (17 to 68 years), and the majority of patients were of male gender. A total of 36 DRPs was identified, being that the main DRP was the adverse reaction to medications used to treat TB (47.0%), followed by effectiveness DRP (25%).

**Discussion:** As verified in other studies, more than 50% of patients with TB exhibited adverse reactions to medications. These reactions could be related to occurrence of drug interactions in the therapeutic scheme, and/or drug interactions with other medications of concomitant use to treat other pathologies. The interventions were developed as necessary. More than 80% of patients were discharged for cure.

**Conclusion:** The pharmacotherapeutic followup in the TB treatment is a possible practice, identifying DRPs, whose solution could improve the patient quality of life and the understanding of his/her infirmity, resulting so in improvement of his/her adherence to pharmacological treatment.

### PC-830-30 Integration of mobile-phone based observations into community-based MDR-TB DOTS programme

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**Background and challenges to implementation:** Treatment of multidrug-resistant tuberculosis (MDR-TB) requires intensive and long treatment regime. Community-based treatment such as DOTS can be effective to improve compliance and monitor ongoing patient progress. In many regions, extensive scale-ups for MDR-TB treatment are being planned, but this poses a challenge of increasing information and personnel management.

**Intervention or response:** In Korangi, a low-income community of Karachi, Pakistan, a pilot was undertaken to examine the feasibility of integrating mobile-phone based electronic data capture into a community-based MDR-TB DOTS program. A software application, openMRS-mobile, was developed for the pilot. The openMRS-mobile application connected directly to the openMRS Electronic Medical Record system via the xForms module. 3 community-based treatment supporters (not medical personnel) were given a mobile-phone with openMRS pre-installed. They could connect to the openMRS EMR system from their phone and access only their patient's information. For each DOTS encounter, they could then record on the phone the encounter parameters including the GPS location and the time and date. These encounters were then instantly uploaded to the openMRS database.



**Figure** Screenshots of openMRS-mobile application for use with MDR-TB DOTS encounters.

**Results and lessons learnt:** Training of treatment supporters only took a few days inspite of lack of prior experience in kind of data collection and the system was positively received by treatment supporters. To-date over 600 encounters have been captured by the active treatment supporters. Patients have not objected to the use of such a system to record encounters.

**Conclusions and key recommendations:** The use of mobile-phone-based data collection in community-based DOTS programs is a viable intervention in community DOTS programs. To realize the full benefits of increasing operational efficiency, this intervention should be combined with automatic alerts to assist program managers in day-to-day operations.

### PC-903-30 Impact of timing of sputum collection and poor recording of dates on smear conversion and cure rate

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**Background:** Achieving WHO targets for smear conversion and cure rate have been a challenge. The electronic TB register (ETR.Net) algorithm indicates sputum collection from 21–70 days after start of treatment for smear conversion and from 120 days for cure (with an earlier negative smear). We aimed to investigate the extent to which timing of sputum collection and quality of recording dates had on these indicators in relation to the algorithm.

**Methods:** Data for new smear positive TB patients from TB registers at selected clinics in 4 high-burden districts in KwaZulu-Natal for Quarter 1 and 2 of 2008 were analysed in relation to the ETR.Net algorithm. Smear conversion was determined for Quarter 1 and 2 combined and cure rate determined for Quarter 1.

**Results:** 4127/5491 (75.2%) of patients had negative smear results at 2–3 months. However, only

3239 of the negative patients had sputum collected from 21–70 days, making the actual smear conversion rate 59%. Of the remaining negative patients, 785 had sputum collected after 70 days from start of treatment, 35 had sputum collected < 21 days after treatment started, 27 had intensive sputum dates earlier than treatment start date and 41 had no intensive sputum collection date. 1633/2889 (56.5%) patients had negative smears at intensive and end of treatment and regarded as cured. However, 59 of these patients had end sputum collected before 120 days, 42 had missing or invalid intensive sputum collection dates and 17 had end sputum date missing. Thus the cure rate was effectively reduced to 52.4% (1515/2889).

**Conclusions and recommendations:** Collection of sputum too early or late in relation to the ETR.Net algorithm and poor recording of sputum collection date reduced the smear conversion and cure rate despite patients having negative smear results. Training of clinic staff on correct timing of sputum collection in relation to the algorithm and proper recording of dates alone will improve the sputum conversion and cure rate.

### PC-933-30 Mechanism of late TB patient tracer and retrieval in a tertiary care context in Pakistan

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**Background:** Pakistan ranks 8th among the high TB burden countries in the world. It has 1100 country-wide TB diagnostic centers with a yearly around 265 000 newly diagnosed TB patients. The TB patients who interrupt treatment during follow-up are expected to be future defaults, especially in situations where there is high case registration such as tertiary care hospitals (TCHs). This requires a need for innovative early retrieval mechanisms for registered TB patients.

**Objective:** Develop and test the effectiveness and feasibility of a late patient retrieval system in TCHs in Pakistan.

**Methods:** It is an operational research based on implementation of intervention in the three TCHs in 2010. Default trays with specified compartments have been introduced for early identification of patients who interrupted DOTS treatment for a pre-defined time period. These patients were contacted on cell phone by the DOTS facility staff at TCH. The TB patients were counseled and persuaded on a structured format.

**Results:** A total number of 1569 cases were registered from which 467 (30%) cases interrupted treatment.

Of these, 446 (95%) were contacted on telephone for follow-up. Among them, 376 (84%) cases continued their treatment from respective TCH, 25 (6%) died whereas 45 (10%) cases reported to have continued treatment from other sources.

**Conclusions:** This intervention seems to be promising for minimizing the default rate in TB patients managed at the TCHs.

### PC-945-30 Inter-personal communication in tuberculosis: experience from Rajasthan, India

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**Background:** State of Rajasthan in India implemented Revised National TB Control Program (RNTCP) in phased manner (1998–2000) in all the districts with corridor expansion strategy. This fast expansion of services was appreciated by various national as well as international agencies. In the following years during supervision and monitoring it was observed that there is a communication gap between patients and the program officers, which is adversely affecting the quality and credibility of the program. It was felt that such individualized dialogue between a medical provider and patient helps define his/her feelings and to make informed decisions regarding treatment.

**Method:** To overcome this gap an 'Interpersonal Communication Slip' (IPC slip) was designed which pasted on every Patient Wise Box (drug box with entire course of anti TB treatment) with clear and concise communication messages and circulated for use in the DOT centers from the year 2000 onwards. The aim was to advocate, educate and counsel the TB patients in making an informed decision. Regular meetings between patients and program officers were organized for problem solving as well as motivating the patients for treatment adherence. This was documented in the IPC slips of the PWB.

**Conclusion:** This intervention helped in increasing the knowledge of the patient and boosting the case holding (sputum conversion rate from 90% in 2000 to 92% in 2009 and NSP cure rate from 85% in 2000 to 88% in year 2009) while reducing the default rate among such cases from 7% in 2002 to 5% in 2009 in the state.

### PC-1003-30 Diabetes mellitus increases risk of failing treatment in drug-susceptible TB patients

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**Background:** Diabetes mellitus (DM) is identified as an important risk factor for tuberculosis. The public health approach to DM can significantly influence tuberculosis (TB) control in countries with high prevalence of both diseases. This cohort study, conducted in the state of Kerala, where the prevalence of DM in the general population is 18%, examines feasibility to integrate screening for DM in TB patients under treatment within the national TB programme (NTP) and analyses TB treatment outcomes within the cohort.

**Methodology:** Out of 14 districts implementing the NTP, 5 were conveniently selected to integrate screening for DM among TB patients. A cohort of smear positive TB patients registered in the 3rd quarter of 2009 was screened for DM by estimating fasting and post meal blood sugar levels with colorimetric method. Their TB treatment outcomes were transcribed from the TB register and analysed. Patients failing treatment were further evaluated for drug resistance.

**Results:** 1971 adult TB patients were registered in the 3rd quarter of 2009 of whom 1093 were smear positive (814 NSP, 279 re-treatment cases). Diabetes screening was done for 813 patients (75%) and 180 were found to have diabetes (22%). The failure rate among smear positive patients with diabetes (8%) was higher than that of patients without diabetes (5%). Failure rate was significantly higher in case of previously treated patients with and without diabetes (22% vs. 10%). 30% (16/53) of patients failing treatment were found to have multi drug resistant TB. The failure rate with drug sensitive TB was 4% in non-diabetic, while it was 6% in diabetic.

**Conclusion and recommendation:** It is feasible in programme settings to routinely screen tuberculosis patients for diabetes and link them to diabetes care available in the general health system. Higher failure rates in drug sensitive tuberculosis with diabetes call for more studies to analyse implications for TB control.



### PC-1200-30 Poor treatment outcomes of non-MDR-TB patients who fail first-line anti-TB treatment in South India

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**Background:** Under India's Revised National TB Control Programme patients who remain sputum-positive after 4–5 months of a first-line anti-TB treatment regimen (MDR-TB suspects) have sputum samples sent for culture and drug susceptibility testing (DST). Patients diagnosed with isoniazid and rifampicin resistance (MDR-TB) are shifted to an MDR-TB treatment regimen; else they are continued on a standard 9-month re-treatment regimen dosed thrice weekly containing first line anti-TB drugs.

**Objectives:** To determine the treatment outcomes of MDR-TB suspects who are not resistant to isoniazid and rifampicin in 7 districts in Andhra Pradesh.

**Methods:** Retrospective cohort study; we reviewed routine programme records including TB registers for MDR-TB suspects with DST results reported as not resistant to isoniazid and rifampicin during the period July 2008 to December 2009.

**Results:** Of the 204 patients, the mycobacterium TB bacilli culture and drug susceptibility tests for first line anti-TB drugs (isoniazid, rifampicin, streptomycin and ethambutol) showed that 83 (41%) were pan-sensitive, 31 (15%) had mono-drug resistance, 30 (15%) had resistance to two or more drugs and 58 (28%) were culture negative and 2 (1%) had non-tuberculosis mycobacterium. Review of programme-reported treatment outcomes found that 84 (41.2%) failed (i.e., sputum positive at the end of treatment), 66 (32.4%) cured, 36 (17.6%) died, 13 (6.4%) defaulted, 2 (1%) treatment completed, 1 (0.5%) transferred out and 2(1%) were not available.

**Conclusion:** Reported treatment outcomes were exceedingly poor among patients who had already failed a first-line anti-TB treatment regimen, were found to not have MDR-TB, and were subjected to a first-line drug containing re-treatment regimen. Further studies are urgently needed to assess the reasons for poor treatment outcomes and also to identify appropriate management strategies for such patients.

### POLICY AND PROGRAMME IMPLEMENTATION

#### PC-56-30 Increased risk of tuberculosis after gastrectomy and chemotherapy in gastric cancer

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**Background:** Malignancies and their treatment methods for risk of tuberculosis were not very well understood. For example, gastrectomy for peptic ulcer had increased risk but the role in gastric cancer was unclear. Chemotherapy is also a question for tuberculosis.

**Methods:** A retrospective cohort study from 2000 to 2006. 2215 patients diagnosed with gastric cancer at our hospital were compared to data from the Centers for Disease Control (CDC), Taiwan, to identify confirmed cases of tuberculosis.

**Results:** In patients with gastric cancer without gastrectomy history and previous anti-TB treatment, the overall crude incidence of new onset tuberculosis was 788 per 100 000 person-years. Compared with the general population, the overall age-sex standardized incidence (SI) in gastric cancer patients was 134.3 (SIR: 2.11,  $P < 0.05$ ), and the recurrence rate among patients with previous anti-TB treatment was 18% (4/22) after gastric cancer diagnosis. Gastrectomy was a significant risk factor for active TB incidence (SI (95%CI): 159 (80–237), SIR: 2.5,  $P < 0.05$ ), and chemotherapy alone seemed to be a risk factor but without statistical significance (SIR: 12.5,  $P > 0.05$ ). Multivariate analysis showed old age, male gender, previous anti-TB treatment, and gastrectomy as significant risk factors for tuberculosis. In stratified analysis, an interaction between old TB patterns on chest films and chemotherapy was observed.

**Conclusions:** Old age, male gender, previous anti-TB treatment, and gastrectomy were significant risk factors for tuberculosis. An increased risk of TB incidence after chemotherapy was observed especially in patients with old TB pattern chest films initially, which might suggest us the effect for chemotherapy on reactivation of tuberculosis.

### PC-71-30 Pathology of camel tuberculosis and molecular characterisation of its causative agents

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A cross sectional study was conducted on 906 apparently healthy camels slaughtered at Akaki and Metehara abattoirs to investigate the pathology of camel tuberculosis (TB) and characterize its causative agents using postmortem examination, mycobacteriological culturing, and multiplex polymerase chain reaction (PCR), region of difference-4 (RD4) based PCR and spoligotyping. The prevalence of camel TB was 10.04% (91/906) on the basis of pathology and it was significantly higher in females ( $\chi^2 = 4.789$ ;  $P = 0.029$ ). The tropism of TB lesions was significantly different among the lymph nodes ( $\chi^2 = 22.697$ ;  $P = 0.002$ ) and lung lobes ( $\chi^2 = 17.901$ ;  $P = 0.006$ ). Mycobacterial growth was observed in 34% (31/91) of camels with grossly suspicious TB lesions. Upon further molecular characterization using multiplex PCR, 68% (21/31) of the colonies showed a positive signal for the genus *Mycobacterium*, of which two were confirmed *Mycobacterium bovis* by RD4 deletion typing. Further characterization of the two *M. bovis* at strains level revealed that one of the strains was SB0133 while the other strain was new and had not been reported to the *M. bovis* database prior to this study. Hence, it has now been reported to the database, and designated as SB1953. In conclusion, the results of the present study have shown that the majority of camel TB lesions are caused by mycobacteria other than *M. tuberculosis* complex. And hence further identification and characterization of these species would be useful towards the efforts made to control TB in camels.

### PC-307-30 Extra-pulmonary tuberculosis in Lebanon

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**Background:** A retrospective study of TB in Lebanon reveals that despite the decreasing number and incidence of TB in general, extra-pulmonary tuberculosis (EPTB) does not cease to increase, representing more than 40% of all TB cases.

**Methods:** From 2000 to 2010, TB cases were classified as pulmonary and extra-pulmonary TB. Extra-pulmonary TB cases were also classified as lymphatic, pleural, abdominal, osteo-articular, uro genital, meningitis, miliary and others. Multiples factors were eval-

uated to explain the high prevalence of EPTB, including age distribution, gender, nationality, HIV situation and other risk factors.

#### Results:

- Among 5078 TB cases, 2108 were extra pulmonary (41.5%)
- Localization study of EPTB cases reveals 42% lymph nodes, 30% pleural effusion, 10% abdominal, 6% osteo articular, 6% uro genital, 2% meningitis, 1% miliary and 3% for other localizations.
- Male/female sex ratio for EPTB: 0.68.
- Age distribution reveals a peak between 15 and 35 years (50% EPTB) with a predominance of females (60%).
- TB-HIV co infection: 39 cases only among the total TB cases (28 are EP), without repercussion on our EPTB data.
- EPTB represents 31% of all TB cases in the non national population.

**Conclusion:** The high EPTB prevalence in Lebanon is not related to HIV status or to non national TB patients. It is predominant in the female group and the young age group. *Mycobacterium bovis* should be evaluated and probably has a certain role in this situation: 52% of EPTB are lymph nodes and abdominal, and both are preferred localizations of *M. bovis*. MOTT also could play a certain role. More investigation and further studies are needed to clarify causes of this increase in EPTB cases.

### PC-328-30 IOM Nairobi: active TB case finding contributes to global TB control

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**Background:** On average one case of infectious tuberculosis (TB) if untreated will infect 15 people annually. Each case detected early and appropriately treated benefits the global community beyond the immediate borders. Many TB patients are transmitting TB before becoming symptomatic and getting appropriate diagnosis and treatment. Pre-immigration health assessment for USA, Canada, Australia, New Zealand, and UK includes active screening for tuberculosis. The International Organization for Migration (IOM) performs pre-immigration health assessment for some of the migrants to above countries, and for these countries active TB case finding is a key component of this examination.

**Methodology:** Hopeful migrants who are referred for pre-immigration health assessment undergo TB screening which includes, history review, physical examination, chest X-ray (CXR), and sputum analysis where indicated. Those who meet the TB case definitions are treated under directly observed therapy (DOT). This is done in partnership with the Kenya National TB Programme (NTP).

**Results:** From 2002 to 2009, the IOM Nairobi Clinic has registered a total of 718 TB cases. 256 were smear/culture positive (160 migrants and 96 Kenyans), 414 smear/culture negative, while 48 were extrapulmonary TB (EP-TB) cases. Treatment outcome was 86.3% (221) cured for all cases, while for migrants, the cure rate was 91.2% (145), treatment completed for all case was 95% (440). Overall treatment success rate of 92.1% (661), default 2.2% (16), transfer out 3.9% (28), died 1.7% (12), treatment failure 0.1% (1).

**Conclusion:** The 256 cases if untreated would have translated to further 3825 new infection in one year. If the same migrants traveled without diagnosis and treatment, this transmission would have been extended to their resettling destinations spread out in different continents not to mention the lengthy in-flight hours in confined space. Importance of pre-immigration TB screening.

#### PC-371-30 Risk factors associated with human and bovine tuberculosis in Jigawa state, Nigeria

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The aim of the study was designed to examine the knowledge, attitude and practices of those who are directly involved with livestock in the study area. A cross-sectional survey was conducted from June, 2003 to July, 2006 in twelve local government areas of Jigawa state, Northwest part of Nigeria, in conjunction with parallel study on tuberculosis testing on cattle. Four hundred and thirty five households that were interviewed about knowledge, attitudes and practices with regards to tuberculosis. On the average more than 50% of the households in the study population reported at least one activity considered a risk factor for transmission of zoonotic tuberculosis. These activities were mainly related to handling animals and animal products, and include milking, slaughtering and living in the same house with animals. These activities were more in the pastoralist groups. Analysis of risk factors associated with the occurrence of the disease in this area revealed that the reactor rate among the age groups differ significantly ( $P < 0.01$ ), with older cattle affected than younger cattle and calves. The proportion of indigenous cattle reacting positively was significantly higher ( $P < 0.05$ ) than that of the exotic breeds. More male cattle were affected than females. There was no significant association between pregnancy and reactivity to CIDT, but significantly more lactating cows than non-lactating cows were positive. In conclusion the results in this study provide preliminary information

about potential risk factors that were found to be associated with BTB status in cattle. Therefore, future control strategies of BTB should consider area of livestock production and the types of grazing strategies as important risk.

#### PC-384-30 Evaluation of *M. tuberculosis* complex lineages in a Canadian province

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**Background:** Spacer oligonucleotide typing (spoligotyping) is a low resolution genotyping method for members of the *Mycobacterium tuberculosis* complex (MTBC). Though its use in contact tracing and short-term outbreak investigations is limited, it is a useful tool in longer-term population-based studies. The aim of this study was to use spoligotyping to investigate the diversity of MTBC lineages currently circulating in one Canadian province.

**Methods:** All MTBC strains from a single Canadian province that were submitted in 2009 and 2010 were genotyped for this study. Isolates were genotyped using MIRU-VNTR and spoligotyping. Strain lineages were determined using the MIRU-VNTRplus database.

**Results:** The 249 MTBC strains were genotyped using spoligotyping revealing 59 patterns. Two lineages, Delhi/CAS and Ghana, account for more than half of the strains at 25.3% and 24.9% of the strains respectively. The EAI lineage was assigned to 14.46% of strains and 11.24% of strains have spoligotyping patterns not closely associated with current lineages. Other lineages present include Haarlem ( $n = 17$ ), S ( $n = 14$ ), LAM ( $n = 6$ ), UgandaI ( $n = 4$ ) Beijing ( $n = 3$ ), X ( $n = 3$ ), Bovis ( $n = 2$ ) and 1 strain each from West African 2, NEW-1, Cameroon and UgandaII. Seven strains were equally related to multiple lineages.

**Conclusions:** Currently, MTBC isolates in the study group are predominated by the Delhi/CAS and Ghana lineages. Almost 15% of strains fall into the EAI lineage and just over 10% of isolates fall into undefined lineages. The remaining 25% of isolates fall into 12 different lineages. This may indicate that the majority (~75%) of MTBC cases in this province are due to recent/local transmission and are not imported from outside of the province.

**PC-393-30 Risk factors associated with early mortality of TB patients**

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**Background:** Death before or soon after treatment initiation of tuberculosis (TB) is an alarm of delayed TB diagnosis. This study was to investigate risk factors associated with early mortality of TB patients in Taiwan.

**Methods:** We use the Taiwan National Tuberculosis Registry Campaign to identify bacteriological confirmed TB cases (positive smear in acid-fast stain or culture of *Mycobacterium tuberculosis*) reported from 2002 to 2007 as a retrospective cohort, then linked with the Taiwan national registered HIV dataset to confirm the HIV status of reported TB patients. Further linked with the national death registry to confirm date of death and capture additional deaths. Death occurred before or within 30 days of TB diagnosis was defined as early TB mortality.

**Results:** Among the 56 110 TB patients, 2587 (4.6%) died before initiation of TB treatment, 3400 (6.1%) died within 30 days after TB diagnosis and 6956 (12.4%) died before completion of TB treatment. The proportion remained stable during the study period. There were 286 (0.51%) HIV and TB coinfecting patients and 12.9% of them had early TB mortality, compared to 11.0% of HIV uninfected/unknown TB patients, no significant difference. In multivariate analysis using survived TB patients as reference group, increased age and patients with HIV infection had higher risk for early mortality, the adjusted OR is 2.00 (95%CI 1.95–2.05 per 10 year-old increase) and 6.40 (95%CI 4.27–9.60) respectively.

**Conclusions:** Elderly people and those with HIV infection had higher risk to have early TB mortality, which maybe due to delayed TB diagnosis. Measures to prompt TB diagnosis such as public and health care workers education should be promoted.

**PC-482-30 Pregnancy a new risk factor for TB disease? A national cohort and self-controlled case series study**

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**Introduction:** Tuberculosis (TB) incidence has increased in the UK over the last decade. The study of TB in pregnancy is important because of adverse outcomes in mother and child. The aim of this study was to analyse the epidemiology of TB in pregnancy in the UK, and establish, whether pregnancy is an independent risk factor for TB in order to inform public health policy, prevention and early detection strategies.

**Methods:** Using a cohort based on the UK General Practitioner Research Database (GPRD), incidence rates (IR) and rate ratios (IRR) of TB events in three time periods were compared using Poisson regression: pregnancy, a period of 6 months post-partum, and outside of pregnancy. In addition TB risk was calculated using a nested self-controlled case series (SCCS) analysis which implicitly adjusts for time-bounds covariates.

**Results:** Combined pregnancy and post-partum TB rates (15.4 per 100 000 person years, py) were significantly higher than rates outside of pregnancy (9.1 per 100 000 py,  $P = 0.02$ ). Compared to risk outside of pregnancy, TB risk was not significantly increased during pregnancy (IRR 1.29, CI 0.82–2.03), but significantly increased post-partum (IRR 1.95, CI 1.24–3.07), adjusting for age, region and deprivation. These observations were confirmed in the SCCS (IRR 1.62, CI 1.01–2.58 and 1.03, CI 0.64–1.65).

**Conclusions:** There is a significantly increased post-partum TB risk and this is very likely pregnancy-related, but occurs post-partum due to administrative, diagnostic or immunological delays. Our results can inform public health policy, such as targeted screening programmes to minimise this risk.

**PC-555-30 *Mycobacterium bovis* disease in the Netherlands**

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**Background:** In the Netherlands, zoonoses gained renewed interest due to a large outbreak of Q-fever, involving more than 4000 patients since 2007. Bovine tuberculosis (TB) is now one of the 18 zoonoses reconsidered in the Netherlands for increased surveillance, although the country has a disease-free status for more than 10 years. This status is held if the annual prevalence within the livestock remains below 1%. The monitoring of disease-free status is based on visual inspection during meat control. We studied the epidemiology of *Mycobacterium bovis* disease in humans to determine risk factors for transmission.

**Methods:** Characteristics of human TB cases notified between 1993 and 2009 were obtained from the Netherlands TB register. Cases with culture-confirmed disease with either *M. bovis* or *M. tuberculosis* were



included and compared. We excluded cases caused by other *M. tuberculosis* complex strains such as *M. africanum*, *M. canettii* or *M. bovis* BCG.

**Results:** In the Netherlands, 1.6% of culture-confirmed TB cases were caused by *M. bovis* (265 cases) and 97% by *M. tuberculosis*. *M. bovis* patients were significantly more often born in the Netherlands (57% vs. 33%) and more frequently had extrapulmonary disease (60% vs. 31%) than patients with *M. tuberculosis* TB. 77% of natives with *M. bovis* TB were older than 54 years, against only 24% of the foreign-born *M. bovis* patients.

**Conclusion and recommendations:** In the Netherlands, *M. bovis* TB in humans is relatively rare. Epidemiological information suggests that this disease is mainly a result of infections acquired decades ago in the Netherlands or from infections acquired during residence abroad. Cases in the younger native population (34 cases were younger than 55 years) are striking and require further research. We recommend molecular typing and comparison of *M. bovis* strains of these patients and those retrieved from animals, to survey possible human-human or animal-human transmission in the Netherlands.

#### PC-644-30 Association between MDR-TB and social and demographic factors in regions of Russia

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**Background:** The threats posed by the emergence of multi-drug resistant tuberculosis (MDR-TB) require an investigation of the risk factors associated with MDR-TB transmission among population strata throughout the Russian Federation.

**Methods:** We analyzed 11 262 new culture-positive pulmonary TB cases having results of drug susceptibility testing (DST), notified in 7 regions (Belgorod; Ivanovo; Kaliningrad; Novosibirsk; Orel; Saratov; and Tomsk) of Russia between 2007 and 2009. 1695 of 11 262 cases were DST-confirmed MDR-TB cases. Each region's drug-resistance TB surveillance satisfied the WHO Class A criteria for accuracy and Class A or Class B criteria for representativeness. We conducted a case-control study using data collected from national TB notification forms and laboratory registers.

**Results:** Our log-regression model found that among new TB cases, young age (<35 years), alcohol abuse, and urban habitation were associated with greater risk of MDR-TB, respectively (odds ratio [OR] = 1.3, 95% confidence interval [CI]: 1.2–1.5; OR = 1.4, 95% CI 1.2–1.6; and OR = 1.4, 95% CI 1.1–1.8). Re-

tired status was found to be associated with decreased risk of MDR-TB (OR = 0.7, 95% CI 0.5–0.9). We found the presence of cavitary TB to have a significant association with MDR-TB only in Novosibirsk (OR = 1.7, 95% CI 1.4–2.1). This may be the result of selection bias associated with Novosibirsk's DST prioritization in patients who present with cavitary TB. We found sex to have a significant association with MDR-TB (male vs. female OR = 1.1, 90% CI: 1.01–1.2). When we ran the model and excluded Novosibirsk, the association between sex and MDR-TB became significant at the 95% level (OR = 1.2, 95% CI 1.01–1.3).

**Conclusion:** Our study suggests that among new TB cases, differences in odds of MDR-TB among strata reflect the increased risk of MDR-TB transmission among the following population groups: young age (<35 years); urban habitation; males; and alcohol abuse.

#### PC-1073-30 Evaluation of the Tuberculosis Genotyping Information Management System—United States, 2010

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**Background:** Universal genotyping of tuberculosis (TB) isolates has been available in the United States since 2004; however, challenges in accessing and managing genotyping data have impeded its use by state and local TB programs. In March 2010, the Centers for Disease Control and Prevention launched the TB Genotyping Information Management System (TB GIMS), a secure Web-based genotyping data management application. We evaluated TB GIMS and uses of genotyping among state and local users 6 months after TB GIMS launch.

**Methods:** We sent TB GIMS users a Web-based survey of user characteristics, uses of genotyping data, timeliness of results, and overall satisfaction with the system. We stratified survey data by high- (>100 TB cases/year) and low-burden (<100 cases/year) states.

**Results:** Of 337 active users, 189 (56%), representing 48 states, responded to the survey. TB epidemiologists (27%) and laboratorians (25%) predominated; 60% of respondents used TB GIMS in routine activities. The most common use of genotyping data in both high- and low-burden states was to confirm known epidemiologic links among cases (67%). Respondents from high-burden states were more likely to use genotyping to expand contact investigations, prioritize outbreaks for intervention, find previously unknown epidemiologic links, and define the scope of an outbreak ( $P < 0.01$  for all). Although most (79%) respondents were satisfied with TB GIMS overall, 36%

of respondents from high-burden states, and 8% of respondents from low-burden states, were not satisfied with the timeliness of the system.

**Conclusion/recommendations:** TB GIMS has been integrated into TB genotyping activities, but uses of genotyping differ greatly by TB burden of individual jurisdictions. Timeliness of results remains an issue, particularly for high-burden states. Future efforts should investigate causes of underutilization of genotyping data and barriers to timely availability of genotyping results.

### PC-1094-30 Anomalous MIRU-VNTR loci and their impact on the genotyping of *Mycobacterium tuberculosis*

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**Background:** Universal genotyping of Mtb has proven useful for TB case investigation and control. PCR-based genotyping techniques, such as MIRU-VNTR provide rapid turn around time, excellent discrimination and can be automated. During our implementation of 24 loci MIRU-VNTR (MIRU24), strains with anomalous loci required additional investigation. Here we describe our analysis of these strains and suggest solutions for dealing with anomalous MIRU24 loci.

**Methods:** MIRU24 was performed using an Applied Biosystems 3130xl Genetic Analyzer and analysis was performed with GeneMapper v4.0. Loci were considered 'anomalous' as follows: no product detected after repeated testing; the amplified product was an unusual size; or two equivalent products were present at a single locus. To improve our understanding of the causes of these issues, we examined problematic loci and designed new primers for DNA sequencing of repeat regions with anomalous characteristics.

**Results:** More than 2300 clinical isolates were genotyped using MIRU24. Approximately 2.5% of strains had anomalous loci requiring further investigation. We found 10 different anomalous loci, however more than 80% of these involved only 4 loci (2165, 1955, 2163b, 0577), with loci-2165 being the most problematic and representing more than 1/3 of the genotyping issues. Each type of anomaly had a distinct cause, such as PCR failures due to deletion or mutation of primer sites, and double peaks likely due to mixed infections.

**Conclusion:** To date the idiosyncrasies of MIRU24 have not been fully addressed, and labs must be aware of the technical difficulties and possible sources of error. Like any PCR-based method, mixed template material and changes to primer binding sites are detrimental to amplification. Better understanding of the reasons behind some of the issues surrounding

MIRU24 genotyping has allowed us to make procedural changes to improve the efficiency and quality of our genotyping program.

### PC-1166-30 Factors associated with increased likelihood of default and death among TB patients in Cape Town, South Africa

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**Setting:** An urban tuberculosis (TB) clinic, Cape Town, South Africa with a high HIV and TB burden.

**Objective:** To assess factors for increased likelihood of default and death among TB patients treated with 1st line medications.

**Design:** A prospective cohort study of TB patients  $\geq 15$  years old who were interviewed, educated and provided incentives upon diagnosis. In addition to routine smear diagnosis, a sputum culture was requested. Chart and TB registry reviews were conducted. Patients who defaulted or died were each compared with those successfully treated, using logistic regression.

**Results:** Among 627 interviewed patients, 502 (89.2%) successfully completed treatment, 85 (13.6%) defaulted and 37 (5.9%) died. Based on a multivariate model, increased likelihood of default was associated with: younger age, retreatment for TB, smear positivity, extra-pulmonary TB, HIV-positivity, unknown HIV status, incorrect perception of how TB is contracted, patient disclosure of their TB status to  $< 2$  persons. Based on a second multivariate model, death was more likely with: culture negativity, unemployment, and shortness of breath.

**Conclusion:** Socio-economic support among TB patients may modify the likelihood of both default and death. Default may be reduced by increased follow-up, improved education about TB transmission, and stigma reduction. HIV positive status and extra-pulmonary TB may be related to unregistered deaths. Knowledge of culture status may further guide treatment and use of culture should be expanded. Clinicians should view HIV-infected patients with culture-negative TB and TB patients with shortness of breath in this setting as possible risk factors for death.

## TUBERCULOSIS IN HIGH-/LOW-BURDEN COUNTRIES

### PC-68-30 Female gender preponderance in caries of the spine

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**Setting:** NGO-run, primary health care-centers and tuberculosis (TB) outpatient departments in urban and semi-urban slums of Kolkata and Howrah, India.

**Objective:** To assess the gender ratio of patients with caries of the spine.

**Methods:** We reviewed the files of all patients with caries of the spine diagnosed in our primary health care-centers and TB outpatient departments between 2005 and 2011. The said institutions are equally accessible to patients of both genders and of all age groups. Diagnosis of caries of the spine is made on the basis of clinical, radiological (including MRI), microbiological and histopathological signs.

**Results:** We identified 185 patients with caries of the spine, 133 females and 52 males, leading to a gender ratio of 2.6 : 1 (female to male). A similar gender ratio (2.9 : 1 female to male) exists in the subgroup of 27 children and adolescents (<18 yrs. of age) with caries of the spine.

**Discussion:** To our knowledge, such a significant female preponderance among patients with caries of the spine has not been reported from elsewhere. Hormonal factors behind the observed skewed gender ratio seem unlikely as this ratio exists already in children. We raise the hypothesis that vitamin D deficiency, a frequent finding in the female but not in the male population of the urban slums of Kolkata and Howrah, may have a role in bone manifestation of extrapulmonary tuberculosis.

### PC-437-30 Progress towards tuberculosis elimination in Havana city, 1995–2009

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**Background:** Havana's health services work on tuberculosis (TB) elimination.

**Objectives:** To assess the trend of TB new cases reports (TNCr) as impact indicators of TB control program.

**Methods:** The total percentage variation (TPV) and the annual mean percentage variation (AMPV) of TNCr rates according to the clinical–bacteriological categories, age, municipality distribution and TB-HIV co-infection were analyzed and estimation for TNCr 2010–2012 was done by exponential smoothing techniques and it was compared to the observed values.

**Results:** Overall TNCr steady decline from 16.8 in 1995 to 8.2/100 000 population in 2009 (51.2% and 3.7% TPV and AMPV respectively). Decline occurred in 15–64 and ≥65 years old (77.1% and 5.5% TPV and AMPV were the values of the last categories), but not declining in <15 years groups. Only the Old Havana and La Lisa municipalities didn't reduced TNCr (26.6% and 16.5% TPV and 1.9% and 1.2% AMPV respectively). Marianao municipality showed an increase from 4.4 in 2004 to 13.5/100 000 populations in 2009. TB-HIV co infection notification increased from 3 in 1995 to 18 cases in 2009. Continuous TNCr decline was estimated for the triennium 2010–2012 (6.9, 6.0, 5.0 per 100 000 respectively).

**Conclusions:** The TB trend shows a steady decline up to 2009, except TB-HIV co-infection in which the number of cases increases in the study period. The TNCr fits to the expected values slightly over the estimates figures.

### PC-452-30 Knowledge and practices of community pharmacists on tuberculosis control according to Nigeria guidelines

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**Background:** National Tuberculosis and Leprosy Control Program (NTBLCP) adopted Stop TB strategy in 2006 as a result of high TB burden which outlined engagement of all care providers including community pharmacists (CP) in TB control. However, there were no previous baseline studies done on knowledge and practices on TB control among this cadre which is needed to appraise the potential role and contribution to TB control which forms the basis of the study.

**Methodology:** A cross sectional descriptive study using pre-tested structured questionnaire was conducted in November, 2007 among 47 CP randomly selected in Osogbo, South West, Nigeria. Verbal consent was taken before given the questionnaire. Sampling technique was a convenient sampling. Data were analyzed using SPSS version 16.

**Result:** Almost all CPs interviewed (80.9%) were seeing TB suspects and had a good knowledge on TB etiology (100%) and air borne route of transmission (70%). Majority (90%) did not know TB treatment duration and standardized drug regimen for adult (93%) and children (97.9%). Less than half (40.4%) regarded sputum microscopy as the best test to confirm diagnosis of pulmonary tuberculosis. In addition, majority (99%) had no previous training on standard guidelines on TB control by the national program.

**Conclusion/recommendation:** Community pharmacists were seen TB suspects with inadequate knowledge on Nigerian guidelines on TB control. NTBLCP must take appropriate measure to educate and train community pharmacists in TB management.



### PC-537-30 Association between amount of directly observed therapy and mortality during TB treatment in Taiwan

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**Objective:** In Taiwan, tuberculosis (TB) remains the most common notifiable infectious disease. In 2006, directly observed therapy (DOT) was adopted as a national policy for people on TB treatment. To optimize patient care, we assessed whether the amount of DOT during TB treatment is related to improved survival.

**Methods:** We analyzed data prospectively collected on all new, pulmonary TB cases reported to the national web-based registry between January 1, 2007 and June 30, 2008. Standardized data were entered directly into the registry by public health staff from routine medical and laboratory records. Amount of DOT, defined as the proportion of days an official DOT observer witnessed therapy, was categorized into 0%, ≤60%, and >60% DOT, based on the median (60.6%). Multivariable Cox proportional hazards analyses were conducted to assess the independent relationship between amount of DOT and mortality.

**Results:** Of 11 568 patients with outcomes at twelve months, the proportion of days during which an official DOT observer witnessed therapy was >60 percent for 5167 (44.7%) patients, ≤60 percent for 4618 (39.9%) patients, whereas for 1783 (15.4%) patients, there were no recorded days of observed therapy. Death during TB treatment occurred in 2031 (17.6%) patients. In proportional hazards analysis, after controlling for age, sex, bacteriology results, and a non-WHO recommended treatment regimen at baseline, a dose-response effect was found between proportion of therapy observed and death. Having >60 percent DOT (adjusted hazard ratio [aHR] 0.02; 95% confidence interval [CI] 0.01–0.02) and ≤60 percent DOT (aHR 0.20; 95%CI 0.19–0.22) significantly decreased the risk of death compared with having no DOT.

**Conclusion:** In a large programmatic setting in Taiwan, the most important determinant of improved survival among patients on TB treatment was amount of DOT, highlighting the importance of universal, high-quality DOT in TB control.

### PC-607-30 Pathologie respiratoire dans la population générale en Algérie : enquête Nationale Santé 2005

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**Introduction :** La transition épidémiologique est une réalité dans beaucoup de régions dans le monde, particulièrement en Algérie. Les actions engagées dans le

cadre du projet TAHINA sont des tentatives de réponse visant l'élaboration de recommandations à l'attention des acteurs du système de santé impliqués dans la gestion de cette transition épidémiologique.

**Objectifs :** Analyser la pathologie respiratoire en population générale.

**Méthodes :** Etude transversale réalisée en 2005, Echantillon de 16 wilayas, en grappes à 3 degrés (126 districts × 40 ménages). 4818 ménages enquêtés. Personnes composant les ménages : 32 463. L'enquête à porté sur la détermination des épisodes aigus, la fréquence et les motifs de consultation et la fréquence et les motifs d'hospitalisation.

**Résultats :** Episodes aigus de pathologie respiratoire : 27,8% global, 32,4% chez l'homme et 19,9% chez la femme. Affections aiguës des voies respiratoires supérieures 36,1%, grippe et pneumopathies 26,2% et maladies chroniques des voies respiratoires inférieures 15,1%. Consultations pour pathologie respiratoire : 26,4% global, 21,9% chez l'homme et 31% chez la femme. Affections aiguës des voies respiratoires supérieures 37,2%, grippe et pneumopathies 23,2% et maladies chroniques des voies respiratoires inférieures 15,9%. Hospitalisations pour pathologie respiratoire : 4,6% global, 3,7% chez l'homme et 5,5% chez la femme. Maladies chroniques des voies respiratoires inférieures 43,8%, autres affections aiguës des voies respiratoires inférieures 12,3%, affections aiguës des voies respiratoires supérieures 9,1%.

**Conclusion :** En population générale, les pathologies respiratoires sont fréquentes. On retrouve principalement les affections aiguës des voies respiratoires supérieures, les gripes et pneumopathies et les maladies chroniques des voies respiratoires inférieures.

### PC-609-30 Analyse de la charge de morbidité respiratoire en milieu hospitalier en Algérie, ENS TAHINA, 2005

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**Introduction :** L'Algérie constitue un modèle des situations observées actuellement dans les pays en développement en raison de la double transition démographique et épidémiologique. La morbidité respiratoire reste un problème de santé publique.

**Objectifs :** Analyser la charge de la morbidité respiratoire en milieu hospitalier.

**Méthodes :** Enquête transversale en milieu hospitalier ciblant 3 Centres Hospitalo-Universitaires, 10 établissements spécialisés et 48 hôpitaux de district. Un résumé standard de sortie sur les patients hospitalisés sur une période de 15 jours a été analysé.

**Résultats :** Sur les 19189 hospitalisés, la proportion de malades hospitalisés pour affections et/ou infections respiratoires représentent 11,7% [IC 95%, 11,3%–12,2%].



Selon le sexe on retrouve 16,6% [IC 95%, 15,8%–17,5%] chez l'homme et 8,7% [IC 95%, 8,2%–9,2%] et selon l'âge 26,5% [IC 95%, 25,1%–27,9%] chez l'enfant et 8,0% [IC 95%, 7,6%–8,4%] chez l'adulte. Selon la classification du Global Burden disease, la morbidité respiratoire représente 15,1% [IC 95%, 14,3%–15,9] et 13,0% [IC 95%, 12,31%–13,8%] respectivement parmi les maladies transmissibles et non transmissibles.

**Conclusion :** La morbidité respiratoire reste la principale cause d'hospitalisation. Elle occupe le 1er rang des hospitalisations sans accouchements. Elle reste très fréquente chez l'enfant et touche beaucoup plus le sexe masculin. Une stratégie adaptée de santé publique s'impose avec en amont l'APSR comme approche à intégrer dans les programmes de santé respiratoire à développer.

### PC-827-30 Analysis of TB using regular surveillance data during 1995–2009

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**Rationale:** 45% of population is estimated to be infected with TB. About 40 000 TB cases occur annually; of them 20 000 are infectious. Between 5000–7000 deaths annually are attributed to TB. The surveillance system of TB is started from treatment centre level, district level, and regional level and then national level has been strengthened over the years.

**Objective:** The study aim was to see the situation of TB disease by registration categories in Nepal using regular surveillance data.

**Methods:** An analytical and retrospective study of TB surveillance data from 1995 to 2009 periods was analyzed.

**Results:** During the study period, the notified TB cases of all form 479 824 were recorded. Of these, 202 948 were new smear sputum positive cases (42%), 136 153 were new smear sputum positive cases (28%), 79 748 were extra pulmonary (17%), 21 751 were standard regimes (5%) and 39 224 were re-treatment TB cases (8%). Out of those retreatment cases, 29 752 were relapse TB cases (76%), 4221 were failer TB (11%) and 5251 were return after default TB cases (13%). Of 202 948 new smear sputum pulmonary cases, 136 779 were male TB cases (67%) and 66 169 were female TB cases (33%) with ratio 2.07:1; over the years the female cases are slightly increasing. The trend of the TB situation in Nepal remains almost similar given the assumption that the HIV situation remains stable in the country.

**Conclusion:** The analysis can provide future information to guide program planning and management to achieve programme goals and targets.

### PC-840-30 Exploring the magnitude of SS+ cases among internally displaced populations in 6 provinces of Afghanistan

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**Background:** Internally displaced populations (IDPs) are at high risk of developing TB with poor access to TB care services in Afghanistan. Under TB REACH wave 1, NTP Afghanistan and ATA-AP jointly initiated active case finding among IDPs in 6 provinces of Afghanistan from December 2010.

**Objective:** To explore the magnitude of sputum smear positive TB cases among IDPs.

**Methodology:** Through active case finding by designated mobile teams. Verbal screening of IDPs in selected camps was applied. Three sputum samples were collected from the identified suspects and transported to the selected microscopic center for direct smear examination. Independent registers for TB suspect and SS+ TB cases were used for data collection for duration of 3 months from 6 provinces namely Herat, Kunduz, Paktia, Nangarhar, Kunar and Kandahar, and analyzed.

**Results:** A total of 48 003 individuals IDPs were screened for TB, among them 1137 (2.4%) TB suspect were identified. The result for smear direct examination among suspects showed 46 (4%) positive TB cases. This shows a 0.1% prevalence of TB cases among this group of population. Considering trend of case notification rate, seasonal fluctuation and low case notification rate during first quarters of the year, 96/100 000/3 month case notification rate among IDPs is significantly higher than than general population (49/100 000/y).

**Conclusion:** This intervention identified a 2 times higher TB case notification among this group of population than general population, so NTP has to address active case finding for this group, with provision of effective treatment, and incorporate it in their future strategic plan.

### PC-870-30 Tuberculosis situation in lepers and their families in Madayar and Sagaing townships of Myanmar

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**Setting:** Study was conducted in leper communities, residing in Nanttharmyaing village, Madayar and Myayadanar village, Sagaing townships of Myanmar.

**Objectives:** To explore tuberculosis situation among leprosy patients and their families.

**Method:** A cross-sectional study was conducted at 2 selected townships. The study started in June, and ended in July, 2010. The health education sessions were provided prior to the TB screening. TB screening was conducted using TB symptoms screening followed by compulsory chest radiological examination. Those who had abnormal chest X-ray findings, had gone through sputum smear microscopic examination for acid fast bacilli (AFB) by sending 3 sputum specimens.

**Results:** Of 1440 lepers and their family members screened with chest radiological examination, 213 (14.8%) had any abnormal opacity in the lungs and sent for sputum smear microscopic examination. Only 2 lepers were found sputum smear positive for AFB and they were all male and one had grade 2 disability. The prevalence of TB among lepers was 139/100 000 population. Forty one patients with chest X-ray opacity and smear negative results were put on anti-TB treatment. Only 5.6% of patients with any chest X-ray opacity had previously treated with anti-TB drugs.

**Conclusion:** Although it is lower than the smear positive TB prevalence of most recent survey, which was 174/100 000 population in 2009–2010, the prevalence among lepers was not a small disease burden. National TB Programme has to keep on the good collaboration with leprosy control programme to detect and treat all the hidden TB patients in neglected groups like lepers is highlighted.

### PC-1020-30 Implementation and evaluation of universal genotyping of tuberculosis in a multicultural population

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**Background:** Ontario is Canada's most populous and multicultural province. Tuberculosis (TB) rates are low, but transmission continues to occur and re-activation disease is a concern in some communities.

TB control requires effective methods for diagnosis and surveillance. In 1997, the Ontario Public Health Laboratories (PHL) implemented RFLP-based genotyping for comparison of *Mycobacterium tuberculosis* strains, but <15% of strains were typed annually. Molecular epidemiology can complement public health activities and guide resource utilization, but a comprehensive strategy is necessary to achieve this.

**Response:** Ontario's Universal Typing of Tuberculosis (OUT-TB) initiative started in 2008. One *M. tuberculosis* isolate from every active case is genotyped by 24 loci MIRU-VNTR and Luminex-based spoligo-typing. These PCR-based methods are rapid and are performed on heat-inactivated liquid cultures (MGIT 960, BD, USA). Data is stored in BioNumerics 6.1 (Applied Maths, Belgium) and the Access (Microsoft, USA) front-end includes custom scripts for specimen management, data analysis and reporting. A web-based module for secure, remote access to OUT-TB data is in pilot testing with local TB control personnel.

**Results:** Between 1 January 2008 and 31 December 2010, genotyping was performed on 1436 (96%) of Ontario's 1494 culture confirmed cases. Complete patterns were obtained for 1272 (85%). Unique patterns were obtained for 81% of isolates. Of 80 strain clusters, 50 (62.5%) involved pairs and only 7 contained >5 isolates. The largest ( $n = 12$ ) was a potential pseudo-cluster of Manila lineage strains. Two others represent transmission within Inuit ( $n = 11$ ) and urban homeless ( $n = 8$ ) populations.

**Conclusions:** The OUT-TB program has uncovered unexpected transmission events, linked cases from geographically distinct health units, and redirected contact tracing investigations. This strategy is proactive rather than reactive and enables the PHL to guide Ontario's TB control efforts.

### PC-1056-30 Characterisation of mycobacterial strains from Ghana using MIRU/VNTR genotyping

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**Background:** Mycobacterial interspersed repetitive units/variable number tandem repeat (MIRU-VNTR) typing is a simple and reproducible tool for transmission studies. Our aim was to establish this method in Ghana and to use it to characterize *Mycobacterium tuberculosis* isolates.

**Method:** Lineage classification was done using RD 9, 12 and 4 followed by characterization by customized (based on the discriminatory power of locus with

specific lineages) 12 loci MIRU-VNTR typing. Hunter Gaston Discriminatory Index (HGDI) was estimated for each of the loci.

**Results:** A total of 171 isolates comprising 141 *Mycobacterium tuberculosis sensu stricto* (MTBss) and 30 *M. africanum* (Mafric) were typed producing 154 distinct patterns (130 MTBss; 24 Mafric). 8 clusters of 2 strains each, 1 cluster of four strains and 4 clusters of 2 strains each and 1 cluster of 5 strains were identified among the MTBss and Mafric strains respectively. Among the MTBss isolates, HGDI analysis showed that eight MIRU/VNTR loci, (numbers 10, 40, 2163b, 2165, 3690, 4052, 4165 and 0577) were 'highly discriminatory' (DI:  $\geq 0.6$ ), four MIRU/VNTR loci (numbers 1955, 2401, 23, and 0424) were 'moderately discriminatory' (DI: 0.3–0.59). Amongst Mafric strains in addition to loci 2163b and 4156 being the most discriminatory, loci 0424, 4052 and 10 were highly discriminatory, while loci 0577, 1955, 2165, 40, 23, and 31 were 'moderately discriminatory'. MIRU 27 was poorly discriminating.

**Conclusion:** While most loci among the MTBss were highly discriminatory most loci for Mafric were moderately discriminatory supporting the notion that the discriminatory power of MIRU-VNTR loci varies by MTBC lineage.

## BACTERIOLOGY OF MYCOBACTERIA

### PC-8-30 Comprehensive proteomic profiling of clinically relevant strains of *Mycobacterium tuberculosis*

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**Background:** The genome of *Mycobacterium tuberculosis* is one of the most conserved microbial genomes and extreme genetic homogeneity is exhibited amongst members of the species and close relatives. However, despite genetic homogeneity, mycobacterial strains exhibit vast discrepancies in phenotypic presentation in clinical settings.

**Hypothesis:** We hypothesize in this study that different of the MTBC and some clinically relevant non-tuberculous mycobacteria (NTM) strains will have measurable differences in their proteome and that these differences could reveal bacterial factors which might in-turn shed light on the observed phenotypic differences.

**Aims:** The overall aim of this project is to use mass spectrometry tools to quantitatively and qualitatively investigate the total proteomic complement expressed by various epidemiologically significant strains within the MTBC as well as clinically relevant NTM strains.

We aim to generate a panel of candidate proteins that we will further query in clinical sample material using multiple reaction monitoring (MRM) MS in a 'targeted proteomics' approach to quantify the expression of the selected proteins in specific mycobacterial strains at the site of disease.

**Methods and results:** Using a linear ion trap Orbitrap instrument, the LTQ Orbitrap Velos, together with data analysis using the Sequest search engine, a mean of 700 proteins was identified using two or more high confidence peptides across the 8 strains in this study. Although all major classes of proteins are represented in every strain, considerable differences have also been observed in the proteins identified amongst strains mainly in the stress response, lipid metabolism and kinase activity categories.

**Conclusion:** Our results conclude that MS technology is sophisticated enough to allow identification of a large number of proteins spanning various orders of magnitude in abundance without prior fractionation required.

### PC-388-30 Mouse model of pulmonary disease after aerosol infection with *Mycobacterium xenopi*

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**Rationale:** Opportunistic respiratory infections due to *M. xenopi* are on the rise in industrialized countries and current therapies are inadequate. Only two experimental studies with the beige and Swiss mouse models iv-infected have been performed so far. As aerosol inhalation is the probable route of infection in humans, we hypothesized that aerosol infection of mice would better recapitulate human infection and permit better assessment of the response to antibiotic treatment. Our first objective was to determine which strain of mice was the most susceptible to aerosol infection.

**Methods:** Four strains of mice were tested: BALB/c, C57Bl/6, Beige, and athymic nu/nu (Nude). For each strain, thirty 6-week-old females were simultaneously aerosol infected with  $4.7 \pm 0.12 \log_{10}$  of *M. xenopi* ATCC # 19971. At 1, 2, 3, 4, 8, 12 and 23 weeks post-infection, body weight was measured and three mice per group were sacrificed for gross lung lesions, spleen weight, and lung and spleen CFU counts. From week 4 to 12, 9 mice of each group were treated with clarithromycin 100 mg/kg per day 5 days a week. Three treated mice of each group were sacrificed at week 8 and 4 at week 12.

**Results:** In BALB/c, C57Bl/6, Beige and Nude mice infected with *M. xenopi*, the lung CFU counts steadily increased to reach 5.57, 5.92, 5.99, and 5.75  $\log_{10}$ , respectively at week 4; 6.35, 6.72, 6.60 and 6.93



log<sub>10</sub>, respectively at week 8; 6.51, 6.43, 7.69, and 6.63 log<sub>10</sub>, respectively at week 12; and 6.59, 6.72, 8.16, 7.32 log<sub>10</sub>, respectively at week 2. In all mice, *M. xenopi* disseminated to the spleen. Clarithromycin treatment reduced significantly, by 2 log<sub>10</sub>, the lung CFU counts in all strains of mice.

**Conclusion:** Nude mice were the most susceptible to aerosolized *M. xenopi* infection.

### PC-1085-30 Patients requiring treatment for *M. avium* complex lung disease may not meet ATS/IDSA criteria

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**Background:** Studies of *Mycobacterium avium* complex (MAC) pulmonary disease rely on diagnostic criteria and treatment recommendations developed by the American Thoracic Society (ATS) and the Infectious Disease Society of America (IDSA). Application of ATS/IDSA guidelines in routine clinical practice has not been adequately studied. Categorization of disease into nodular/bronchiectatic (NB) or fibrocavitary (FC) forms based on radiologic features may not be fully discriminatory and fails to account for antecedent lung disease.

**Methods:** We performed medical record review of electronic and paper records for HIV-negative adults diagnosed with MAC pulmonary disease 1993–2006 who were treated by infectious disease or pulmonary specialists at an academic medical center. We categorized patients as having primary (without known antecedent lung disease) or secondary MAC (with smoking history or antecedent lung disease).

**Results:** Among 72 patients, 74% were female and median age was 64 (range 38–88). Nineteen (26%) were categorized as primary and 53 (74%) as secondary. 31 (43%) of treated patients did not meet ATS/IDSA criteria, most often for lack of multiple positive cultures. Most (83%) had cough as a presenting symptom; 9 reported hemoptysis and 3 each had fever and night sweats. Nodules were the most common recorded radiographic finding (27), followed by bronchiectasis (18) and cavities (14). Four patients had both nodules and cavities and therefore could not be categorized as either NB or FC. 11 had been previously treated for MAC. All received a macrolide-containing regimen with median treatment duration 12 months (range 1–60). Outcomes data were consistent with published series.

**Conclusions:** Categorization based on antecedent lung disease indicates that a majority of our patients have secondary MAC lung disease. ATS/IDSA criteria fail to identify a substantial proportion of patients with MAC lung disease who are considered candidates for treatment by specialists.

### PC-1086-30 The increasing proportion of nontuberculous mycobacteria in culture-positive sputum in Korea

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**Background:** Nontuberculous mycobacteria (NTM) are ubiquitous organisms in the environment. While low burden countries may differ in terms of NTM incidence and pathogen types, most studies suggest an increasing incidence of NTM isolation over the last decades. As the prevalence of tuberculosis in Korea has declined, there might be significant changes in incidence rate of NTM.

**Objective:** To assess the frequency of NTM and characteristics of patients with NTM, we analyzed results of smear microscopy and culture of sputum from public health centers (HC).

**Methods:** Consecutive sputum specimens collected for smear microscopy and culture in 253 HCs from January 2005 to Jun 2009 were analyzed. Two sputum samples were collected per patient who visited HCs, and examined with smear microscopy at HCs. Specimens were then transferred to Korea National Tuberculosis Association (KNTA) branch laboratories and cultured on 2% Ogawa media. If NTM grew, species were identified by PCR restriction fragment length polymorphism analysis at Korean Institute of Tuberculosis (KIT).

**Results:** During the period, a total of 626267 sputum specimens were cultured by KNTA branch laboratories. Contamination rate was very low (0.39%) and 6.5% were culture positive for TB and 0.83% for NTM. While smear positive rate and culture positive rate had declined, the proportion of NTM among positive cultures had been gradually increasing (8.6% to 14.3%). Of 29293 smear-positive specimens, 77.6% were culture positive for TB and 6.7% for NTM. Species identification revealed *M. intracellulare* was most common NTM, followed by *M. avium* and *M. kansasii*. Patients with NTM were significantly older (median age 70 years vs. 44 years) than TB patients and more common in rural area.

**Conclusions:** As TB prevalence decreases and life expectancy increases in Korea, the relative incidence of NTM is increasing. Therefore, more attention should be paid for proper differentiation of TB from NTM.



### PC-1122-30 Molecular identification of nontuberculous mycobacteria in the national reference laboratory for TB

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Although nontuberculous mycobacteria (NTM) cause a broad spectrum of human disease, they still represent a diagnostic challenge. Molecular techniques have replaced conventional methods for appropriate species identification of NTM and, accordingly, the national reference laboratory (NRL) for tuberculosis (TB) in Serbia introduced the GenoType<sup>®</sup> Mycobacterium CM and AS (HAIN Lifescience) assays for identification of isolated cultures of NTM. All laboratories included in the TB laboratory network in Serbia send cultures of mycobacteria exhibiting ambiguous phenotypical traits to NRL for molecular identification. During the period from January 2009 through December 2010, 321 cultures of mycobacteria were analyzed by the GenoType CM and AS assays, and, 172 were identified as NTM. Only three cultures of NTM were isolated from skin specimens, while 169 were recovered from respiratory specimens. Among the NTM cultures, isolates of *M. xenopi* were most frequent (32), followed by *M. fortuitum* (18), *M. avium* (17), *M. peregrinum* (11), *M. chelonae* (8), *M. intracellulare* (7), *M. abscessus* (5), and *M. kansasii* (5). The remaining 56 cultures of NTM were identified as *Mycobacterium* sp., which suggests that they were most probably contaminants. The molecular assays enabled reliable laboratory confirmation of diagnosis of NTM lung disease in 16 patients and *M. chelonae* skin infection in one patient. Two most frequent causative agents of the NTM lung disease were *M. xenopi* and *M. avium*. The precise data on incidence of NTM infections in Serbia are still lacking, but systematic application of molecular tests for identification of these bacteria may be a major step towards that goal.

### PC-1194-30 16S rRNA AND *hsp65* gene sequencing for identification of non-tuberculous mycobacteria

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**Introduction:** Genotypic methods not only provide rapid identification of non-tuberculous mycobacteria (NTM) but also facilitates the identification of a greater number of them.

**Objective:** Evaluate the identification of NTM by sequencing a fragment of 700 bp and 450 bp of the 16S rRNA and *hsp65* gene respectively.

**Material and methods:** All NTM isolated in our laboratory were identified by GenoType Mycobacterium CM (common mycobacteria) and/or AS GenoType Mycobacterium (for additional species) (Hain Lifescience GmbH, Nehren, Germany). In those isolates in which the species was not determined by GenoType sequencing was used. We studied a partial sequencing of the 16S rRNA gene (700 bp) and *hsp65* gene (450 bp) for the identification of NTM. The sequencer used was a Beckman Coulter CEQ 8000 (Beckman Coulter, Inc.).

**Results:** From 2005 to 2010 a total of 1486 NTM were identified by GenoType Mycobacterium CM and/or AS GenoType Mycobacterium in our laboratory. Only 95 (6.3%) of them was used for sequencing in order to identify the species. The species most frequently identified by sequencing was *M. terrae complex* (14).

**Conclusions:** GenoType Mycobacterium CM and/or GenoType Mycobacterium AS is a method of identification of non-tuberculous mycobacteria fast, easy to perform and interpret. Sequencing is a laborious technique that requires time and expensive equipment, we will only make it when a commercial technique, as GenoType Mycobacterium, can not identify the NTM.

### PC-1228-30 Species identification of NTM using GenoTypeCM and GenoTypeAS for the diagnosis of mycobacteriosis

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**Setting:** There is a big problem with diagnostics of mycobacteriosis in Russia. Species identification of mycobacterial cultures is not performed in bacteriology labs over Russia. There are no any statistical data for the incidence of NTM detection. Our purpose was to exam cultures from BACTEC MGIT 960 (BD, USA) searching for NTM to establish final diagnosis—mycobacteriosis for patients from CTRI hospital. Study was performed from January 2010 to February 2011. 1605 positive MGIT tubes were studied. Primary screening of cultures was performed using standard microbiological techniques (blood agar culture, Ziehl-Neelsen stain). Additionally real-time PCR IS6110 was done for all 1605 cultures. For suspected samples species identification using GenoTypeCM/AS (HAIN Lifescience, Germany) were carried out. Of 1605 cultures, 84 cultures (5.2%) belonged to NTM. Using GenoTypeCM/AS we performed species identification for 81 strains from 84. Following spectra of NTM strains were detected: *M. fortuitum* (15 strains), *M. peregrinum* (2 strains), *M. chelonae* (5), *M. abscessus* (6), *M. xenopi* (3), *M. gordonae* (5), *M. simiae* (7), *M. lentiflavum* (4), *M. kansasii* (9),

*M. avium* (22), *M. intracellulare* (3). 3 strains were detected by Hain test-system as a *Mycobacterium* ssp. For 13 patients NTM strains belonged to the same species were revealed from sputum more than one time. It allows physicians to confirm diagnosis mycobacteriosis for these patients.

**Conclusion:** 5.2% of 1605 cultures obtained from BACTEC MGIT 960 were NTM. 13 patients with mycobacteriosis were detected. Usage of GenoType-CM/AS kits helps to perform accuracy species identification of NTM, it helps physicians to ensure accurate diagnosis and prescribe adequate treatment.

### PC-1263-30 Is pyrazinamide an immunomodulator in the treatment of tuberculosis?

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**Background:** Z is a key sterilizing drug in the treatment of TB. Mechanisms of Z activity are controversial. In addition (i) Z has no anti-TB activity at neutral pH in-vitro, (ii) Z monotherapy has limited activity in mice and guinea pigs, and (iii) Z has poor early bactericidal activity in humans. It has been hypothesized that Z exerts its sterilizing activity through an immunomodulatory effect, especially since Z demonstrated activity against Leishmaniasis (Mendez et al., 2009). This hypothesis was tested by assessing (i) the activity of Z alone and in combination in mice infected with *Mycobacterium bovis* which lacks pyrazinamidase and thus Z resistant and (ii) comparatively the activity of Z against *M. tuberculosis*-infected BALB/c and nude mice, the latter being deprived of mature immune T-cells.

**Methods:** First experiment. Mice aerosol-infected with 3.7 log<sub>10</sub> CFU of *M. bovis* were treated 2 wks later (lung CFU, 6.55 log<sub>10</sub>) for 16 wks with the following combinations: Rifampicin (R)+ isoniazid (H), RZ, HZ and RHZ. Controls included: untreated, R (10 mg/kg) alone, Z (150 mg/kg) alone and H (10 mg/kg) alone. Lung log<sub>10</sub> CFU counts were assessed after 1, 2, 4, 8 and 16 wks of treatment. Second experiment. Nude and BALB/c mice were concomitantly infected with *M. tuberculosis* and treated 2 weeks later with R+ ethambutol (E), REZ, along with RHEZ and untreated controls. Lung log<sub>10</sub> CFU counts were assessed at 2, 4, 6 and 8 wks.

**Results:** (i) In mice infected with *M. bovis*, Z did not contribute towards reduction of CFU when either given alone or in combination with other drugs, indicating that Z had no immune modulatory activity. In nude mice, no effect of Z was detected by CFU counts at week 2 of treatment but at weeks 4 and 6, the gross lung lesions were much more reduced in REZ than in

RE treated mice, suggesting antimicrobial activity. Results of CFU counts are pending.

**Conclusions:** Immunomodulatory benefit of Z in TB could not be conclusively identified.

### PC-1273-30 Nontuberculous mycobacterial lung diseases in TB referral clinical center

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**Background:** Numerous recent studies suggest an increasing prevalence of pulmonary nontuberculous mycobacteria (NTMB) diseases. Due to similar manifestation and detection of acid-fast bacilli in sputum, substantial part of patients may be considered as pulmonary tuberculosis (TB).

**Methods:** In 2008–2010 40 patients (1.8%) from referred in Moscow TB Control Center as TB-suspected were identified as pulmonary NTMB diseases by ATS/IDSA criteria. For NTMB identification the cultivation (both liquid and solid media), biochemical testing, high-performance liquid chromatography and molecular methods were used. In 9 pts surgical specimens (after lobe or segment resection) were used for diagnostic.

**Results:** In 40 pts equally male and female, 19–78 y.o., were presented, all immunocompetent. In 32 cases were detected slow (MAC—14, *M. kansasii*—10 and *M. xenopi*—8) and in 8—rapidly growing NTMB (*M. fortuitum*—5, *M. chelonae*—3). In 38 cases (95.9%) respiratory or intoxication complains were obtained. X-ray pattern includes cavities (42.5%) and/or nodular dissemination (75%) with multifocal bronchiectasis (17.5%), with some variations due to NTMB species. AFB were obtained in sputum smear in 62.5% (25 pts). The treatment was complicated by broad spectrum of drug resistance: in 22.5% (9 pts) was detected MDR (MAC—5, *M. xenopi*—1, *M. kansasii*—1 and rapidly growing NTMB—2 pts) and in 37.5% (8—MAC, 2—*M. xenopi* and 5—rapidly growing NTMB)—XDR. The best treatment outcomes obtained in *M. kansasii*, in spite of resistance in all 10 cases to isoniazid, the rifampine and fluoroquinolones susceptibility give an opportunity of the adequate treatment (3, 4 or 5 drugs).

**Conclusion:** TB clinics must be concerned about NTMB, especially in MDR and XDR cases. For adequate treatment all NTMB must be tested with all TB-drugs and maximum available other antibacterial drugs.

## DRUG SUSCEPTIBILITY TESTING FOR TUBERCULOSIS

### PC-177-30 Recovery rate of *Mycobacterium tuberculosis* from frozen sputum subjected to long term storage

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**Background:** Tuberculosis is a major public health problem in Ethiopia. Diagnosis and treatment of drug resistant tuberculosis remains a challenge in the country. This study aimed to assess whether single morning sputum could be stored at  $-20$  degree Celsius for extended period of time at remote settings, then transported and successfully cultured for *Mycobacterium tuberculosis*.

**Methods:** Single morning sputum was collected from consecutive smear positive tuberculosis patients, diagnosed at Gondar Hospital, Gondar Health Center, Metema Hospital, Bahir Dar Hospital and Debre Markos Hospital between March and July 2009. Specimens were stored at the study sites, and sent to mycobacteriology laboratory in the University Hospital Leipzig, Germany, where specimens were processed and inoculated into BacT/ALERT 3D system, Löwenstein-Jensen and Gottsacker media.

**Results:** A total of 319 patients were enrolled in this study. The median specimen storage time was 132 days (range 16–180 days). Of all specimens, 283 (88.7%) were culture positive by any of the three culturing systems. Four contaminated specimens in all culturing systems were successfully isolated on Middlebrook-7H10 agar, thereby the recovery rate increased to 287 (90.0%). The length of sputum storage time had no significant effect on the recovery rate of *M. tuberculosis* in all culturing systems.

**Conclusions:** Single morning sputum specimens collected at remote settings, stored at  $-20$  degree Celsius for long periods without addition of preservatives can yield a high recovery rate. These findings suggest a simple and cheap alternative method of sputum storage for epidemiological and drug resistance studies in low-resource countries.

### PC-361-30 DNA chips for rapid identification of 15 mycobacteria species and rifampicin resistance in *M. tuberculosis*

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**Background:** Tuberculosis (TB) is still a major public health problem nowadays and multidrug resistant tuberculosis (MDR-TB) had become a serious problem in the world. The distribution of a profile of resistance to anti-mycobacterial agents is very important for clinicians trying to select an adequate regimen for patients. Nontuberculous mycobacterium (NTM) infections had become more popular in the world especially in AIDS and chronic respiratory disease patients. Diseases caused by NTM are hard to distinguish from tuberculosis and many NTM strains are resistant to first-line antituberculosis drugs.

**Design/methods:** DR.Chip Biotech, Inc. has invented a polymer DNA chip. This technology provides many benefits such as an easier production process and lower material cost for the production of DNA chips. We had developed a DNA chip which could simultaneously differentiate at least 15 clinical important mycobacteria and detect the rifampicin resistance. We used 16S rRNA and rpoB duplex PCR and 15 specific probe for species identification, 6 probes for rifampin resistance.

**Results:** There were 202 mycobacterial species had been studied. The DNA chips identified 149 NTM strains including 53 *M. tuberculosis* complex (50 wild type TB and 3 MDR-TB), 77 *M. avium* complex, 19 *M. abscessus*, 13 *M. fortuitum*, 8 *M. goodii*, 6 *M. kansasii*, 2 *M. chelonae*, 2 *M. scrofulaceum* and 22 other NTMs. The sensitivity was 98.7% (147/149), specificity was 99.3% (148/149) for NTM. For *M. tuberculosis*, the sensitivity and specificity was 100%. There were three multiple drug resistance strains (mutation point was 531 (TCG→TTG) and could be detected by our chip rapidly and correctly.

**Conclusion and recommendations:** The chip might provide rapid mycobacterial species' identification and simultaneously tuberculosis drug resistance detection.



**PC-438-30 Concordance of two drug susceptibility testing methods with *M. tuberculosis* from Arkhangelsk, Russia**

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**Objective:** To determine concordance of results of two drug susceptibility testing (DST) methods of clinical isolates of multidrug-resistant (MDR) tuberculosis (TB) in Arkhangelsk region, Russia, 2005–2006.

**Methods:** Isolates were tested in two laboratories: Arkhangelsk Regional TB Laboratory used absolute concentrations method on Löwenstein-Jensen (LJ) medium with drug concentrations (mcg/ml): isoniazid (INH) 1.0, rifampin (RIF) 40.0, ethambutol (EMB) 2.0, streptomycin (SM) 10.0, kanamycin (KM) 30.0, amikacin (AMK) 8.0, capreomycin (CAP) 30.0, ofloxacin (OFL) 2.0, ethionamide (ETA) 30.0, PAS 1.0; resistance was defined as growth of  $\geq 20$  colonies. The Molecular Biology Laboratory of State Scientific Center of Applied Microbiology and Biotechnology, Obolensk used proportions method on Middlebrook 7H10 agar with concentrations (mcg/ml): INH 1.0, RIF 1.0, EMB 5.0, SM 10.0, KAN 5.0, AMK 4.0, CAP 10.0, OFL 2.0, ETA 10.0, PAS 2.0; resistance was defined at a critical proportion of  $\geq 1\%$ .

**Results:** A total of 79 isolates from 41 patients were tested; 65/79 (82%) isolates had at least one discordant result. DST results were discordant for INH in 1 (1%) of 79 cultures, RIF—1 (1%), EMB—19 (24%), SM—5 (6%), AMK—9 (11%), KAN—19 (24%), CAP—0 (0%), OFL—2 (3%), PAS—16 (20%), ETA—43 (54%).

**Conclusion:** Concordance of DST results for INH, RIF, SM, CAP and OFL was  $>90\%$ ; these drugs can be included in treatment regimens based on DST results. Concordance for EMB, KAN, ETA and PAS was  $\leq 80\%$ . We recommend including PAS and ETA in treatment regimens of MDR-TB patients based on treatment history without relying on DST results. Better laboratory procedures for DST of these drugs are needed.

**PC-499-30 Rapid detection of *M. tuberculosis* drug resistance to second-line antibiotics in sputum samples**

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**Background:** The rapid spread of extensively drug-resistant (XDR-TB) tuberculosis and wider use of fluoroquinolones and other second line antibiotics requires development and introduction of new rapid methods for detection of resistance to these medications.

**Methods:** Recently we designed original multi-competitive allele-specific real-time PCR method for detection of main mutations in the *rpoB*, *katG*, *inhA*, *embB* genes associated with first line antibiotics drug resistance. Method is based on using simultaneously a set of 5'-fluorescent allele-specific primers and linear fluorogenic DNA probe detecting *M. tuberculosis*. The technology was employed for detection of *gyrA* and *rrs* genes DNA mutations associated with drug resistance to fluoroquinolones, amikacin and capreomycin.

**Results:** 132 sputum samples from previously treated patients with unknown resistance were studied. For 68 samples with more than  $5 \times 10^2$  *M. tuberculosis* cells mutational analysis was conducted. Results of first line antibiotics drug-resistance analysis: 51 (75%) samples were MDR, 7 (10.3%), monoINH-resistant, 2 (2.9%), monoRMP-resistant, 8 (11.8%) susceptible. Results of second line antibiotics drug-resistance analysis (from 51 MDR-samples): 22 (43.1%) samples were FQ-resistant, 25 (49%) CAP/AM-resistant, 12 (23.5%) were resistant to all above indicated antibiotics. Therefore 12 patients were determined as patients with XDR-TB. Agreement of results between real-time analysis and culture methods was 87% for FQ and CAP/AM antibiotics (for FQ 84%; for CAP/AM 89.6%). Sensitivity of real-time methods as compared with cultural method was 90%, specificity 98% (FQ 96%, CAP/AM 100%).

**PC-716-30 Colorimetric redox indicator assay for detection of extensively drug-resistant *M. tuberculosis***

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**Background:** Colorimetric redox-indicator (CRI) assay has been recommended by WHO for screening patients at risk of MDR-TB. CRI assay is faster than



conventional proportion method (PM) on solid medium and less expensive than commercial liquid culture and line probe assays. Few studies have evaluated the performance of CRI assays to detect resistance to second-line drugs.

**Objectives:** To assess the performance of the CRI assay in a multicenter study and establish the minimal inhibitory concentrations (MICs) and critical concentrations of rifampicin, isoniazid, ofloxacin, kanamycin and capreomycin.

**Methods:** The study was performed in two phases. Phase I determined MICs of each drug. Phase II established the critical concentrations by CRI compared to the PM.

**Results:** A strain was considered resistant by CRI assay if the MIC was >0.5 mg/L for rifampicin, >0.25 mg/L for isoniazid, >4.0 mg/L for ofloxacin, and >5.0 mg/L for kanamycin and capreomycin. Sensitivity was 99.1% for isoniazid and 100% for the other drugs; specificity was 97.9% for capreomycin and 100% for the other drugs. Critical concentrations for rifampicin was 0.5 mg/L; for isoniazid 0.25 mg/L; for ofloxacin 2.0 mg/L; and 2.5 mg/L for kanamycin and capreomycin; overall accuracy was 98.4%, 96.6%, 96.7%, 98.3% and 90% respectively.

**Conclusion:** The CRI assay is accurate for rapid detection of XDR-TB. It is faster than conventional drug susceptibility testing on solid medium, has the same turnaround time that BACTEC MGIT 960 but is less expensive and could be an alternative method for low-income countries.

### PC-777-30 Improving drug-resistant TB diagnosis in South African children by intensifying specimen collection

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**Rationale:** Confirming a diagnosis of pediatric drug-resistant TB is challenging. We performed a prospective study of intensive specimen collection of sputum and non-sputum fluids to determine diagnostic yield and inform clinical practice.

**Methods:** From 3/2009–7/2010, TB suspects aged ≥6 mos and ≤12 yrs were enrolled at a rural hospital. Possible TB was defined as chronic cough and/or ≥2 findings: failing 2 mos of TB therapy, fever, night sweats, weight loss, failure-to-thrive, or painless superficial lymphadenopathy. Probable TB was defined as possible TB plus ≥2 findings: TB contact, CXR consistent with TB, or response to TB therapy. Children > 5 yrs had induced sputum (IS) by nebulization and chest percussion; those ≤5 yrs also received

nasopharyngeal aspiration. Three daily morning gastric aspirates (GA) were collected from inpatients unable to expectorate. All had a blood and urine specimen. Cultures were performed on solid and liquid media; blood in Bactec MycoF-lytic bottles. DST was by 1% proportion method for isoniazid, rifampin, streptomycin, ethambutol, niacinamide, ofloxacin, kanamycin, capreomycin and ethionamide.

**Results:** Of 130 patients (pts), the mean age was 4.9 yrs [SD 3.2]; 67 (61% of those tested) had HIV. Nine (8%) pts were culture-positive from ≥1 specimen; 4/29 (13.8%) of probable vs. 5/85 (5.8%) of possible cases ( $P = 0.017$ ). Among culture-confirmed, 7/9 (78%) were from IS, 3/7 (43%) from GA, 4/9 (44%) from blood, and 3/8 (38%) from urine. In pts with both IS and GA collection, IS added one case. For 1 pt, blood was the only positive specimen; in another, urine was the only positive specimen (MDR-TB). In 1 pt, XDR-TB was identified, resistant to all 9 drugs.

**Conclusions:** TB was cultured from HIV-positive and -negative children, and allowed for identification of MDR and XDR-TB. Urine, blood, and IS provided additional TB diagnoses, and compared to GA, may be preferred as a less invasive, same-day method of specimen collection.

### PC-820-30 Isoniazid heteroresistance in *Mycobacterium tuberculosis*

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**Setting:** Heteroresistance, i.e., subpopulations within an isolate that exhibit varying susceptibilities to antimicrobial agents, may challenge interpretation of drug susceptibility testing (DST) of *Mycobacterium tuberculosis* and may explain inconsistent test results between phenotypic and genotypic DST.

**Objectives:** To examine *M. tuberculosis* strains phenotypically resistant to isoniazid (INH), an important first-line anti-TB drug, that had wildtype genes associated with INH resistance, in order to elucidate reasons for discordance between phenotypic and genotypic DST. In addition, the performance of the GenoType MTBDRplus assay on *M. tuberculosis* strains with heteroresistance was evaluated.

**Methods:** We evaluated 20 INH-resistant *M. tuberculosis* strains by the manual MGIT test (BD Biosciences, Sparks, MD, USA) which had wildtype genes associated with INH resistance; *katG*, *inhA* and the *oxyR-ahpC* intergenic region. The 20 isolates were cultured on Löwenstein-Jensen (LJ) medium with 0.1 mg/L INH (LJ-INH), and the colonies were assessed for mutations in the same 3 genetic areas. The GenoType MTBDRplus assay was performed on colonies grown on LJ-medium without INH.

**Results:** Two of the 20 phenotypic INH-resistant *M. tuberculosis* strains did not grow on LJ-INH. Nine (50%) of 18 *M. tuberculosis* strains with initial wild type genes showed mutations in known genetic areas conferring INH resistance. The GenoType MTBDRplus assay identified 6 of the total 20 *M. tuberculosis* strains and 5 of the 9 isoniazid-resistant *M. tuberculosis* strains with heteroresistance as isoniazid resistant.

**Conclusions:** Heteroresistance is an important explanation for discordance between phenotypic and genotypic DST in *M. tuberculosis* strains. The results suggest that the frequency of *M. tuberculosis* strains without mutations in genes associated with INH resistance may be lower than previously believed. These important results may have a consequence for optimal treatment of tuberculosis patients and need to be confirmed in larger studies.

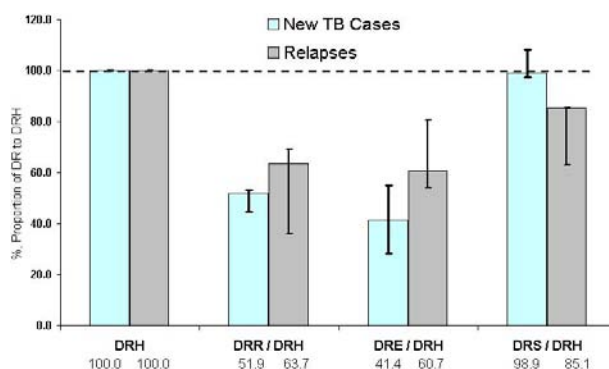
#### PC-838-30 First-line drug resistance pattern of *M. tuberculosis*: monitoring and evaluation on regional level

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**Background:** Drug resistance (DR) surveillance traditionally focuses on monitoring and evaluation on simultaneous resistance to isoniazid (DRH) and rifampicin (DRR), i.e., multidrug-resistant tuberculosis. Nevertheless, information about first-line drug resistance (DRFLD), not only DRH and DRR, but also to ethambutol (DRE) and streptomycin (DRS), can be useful both for appropriate treatment development and for problems revealing in drug susceptibility test (DST) performance.

**Methods:** The analysis included pretreatment DST results of 1734 new pulmonary TB cases (NC) and 289 relapses (RL), all notified NC and RL during 2–4 quarters 2009 in 9 regions located in different geographical parts of the Russia. The regions have DR surveillance corresponding to WHO Class A criteria for accuracy and Class A or B criteria for representativeness. The data were collected in the frame of GF project monitoring visits to the Russian regions.

**Results:** DRFLD has a high regional variety both of NC and RL respectively (median, 25%–75% quartiles): DRH—32.5% (32.2–37.7) and 64.8% (53.3–69.2), DRR—15.9% (13.5–21.4) and 44.8% (26.8–53.8), DRE—14.4% (12.2–19.0) and 37.5% (29.6–42.4), DRS—31.1% (21.5–36.6) and 53.8% (37.5–65.0). DR pattern was defined as a relation of DR for separate FLD to DRH being more stable and more important for treatment outcome prognosis; for NC and RL respectively: DRR/DRH was 55.6%



**Figure** Drug resistance (DR) to the first line drugs with relation to INH resistance (DRH), 9 Russian regions, 2009 (median, 25% and 75% quartiles).

(48.3–56.9) and 77.8% (50–83.3), DRE/DRH 44.8% (31.6–58.6) and 56.5% (50–76.5) and DRS/DRH: 94.8% (93.3–104) and 100% (77.8–100). Data have shown the close DRS to DRH and high regional variety the relationship for DRE.

**Discussion:** Data about typical regional DR pattern for FLD can help to provide not only appropriate treatment control policy but also analytical quality assurance of laboratory DST performance. Evaluation of DR pattern in the Russian territories is TB treatment control success criterion with each regional TB service having its own TB management history.

#### PC-1082-30 Routine culture and drug resistance analysis for samples processed after long shipment

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Many laboratories performing routinely culture and drug-susceptibility testing (DST) for *M. tuberculosis* combine MGIT, recommended for sensitivity and fastness, with Löwenstein-Jensen (LJ) less prone to contamination. In 2010 ITM received for investigation 2520 samples collected from 1260 patients enrolled in MSF TB programs. At reception, on average after 10 days from collection, samples were decontaminated with Nalc-NaOH 1.5% then 1252 were inoculated on MGIT and 1268 on LJ. Positive MGIT cultures showing also contaminants were re-decontaminated according to the protocol. First-line DST was performed on MGIT or on LJ and 2nd line DST on 7H11 agar medium. Results from DST were released after identification, based on morphological examination and paranitrobenzoic acid (PNB).

- Of 1260 patients investigated 446 (35.4%) were positive for *M. tuberculosis*: 328 (73.5%) with both media, 88 (19.7%) only with MGIT and 30 (6.7%) only with LJ.

- 24 atypical mycobacteria were isolated on MGIT, 11 confirmed by LJ; 12 slides from MGIT showed clumps difficult to distinguish from cords, in 3 cases cords were detected for *M. chelonae* and *M. terrae*.
- 5% of MGIT cultures were re-decontaminated to isolate mycobacteria; 6.4% 1st line DSTs on MGIT were repeated due to contamination and 5.6% on LJ due to low growth; 8% of 2nd line DSTs were repeated due to low growth.

Despite long samples shipment and high contamination rate MGIT was more sensitive than LJ so that effectiveness of using LJ in combination to MGIT should be carefully evaluated. MGIT results were delayed by PNB test; MGIT is much faster than LJ provided that a rapid test for isolates identification is available.

	Positivity rate	C+/S-	C+/S+	Contamination rate	Median time to culture result	Median time to PNB result	Median time to 1st line DST result
MGIT	432/1252 (34.5%)	113/867 (13%)	316/380 (83%)	185/1252 (14.8%)	16 [8-62]	20 [8-46]	8 [5-57]
LJ	357/1268 (28%)	74/859 (8.6%)	281/375 (74.9%)	25/1268 (2%)	29 [12-71]	29 [12-71]	42 [25-85]

Detection of cords was predictive for *M. tuberculosis* but not sufficient for identification of the isolates.

DST on solid media can require long time mainly if repetition is required, rapid phenotypic or genotypic tests should be considered for routine.

### PC-1215-30 Faster time to TB diagnosis and detection of drug resistance with the Genotype MTBDRplus assay

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**Background:** The WHO has called for the implementation of rapid TB diagnostics to detect and help combat MDR- and XDR-TB. We sought to evaluate the performance of the commercially available Genotype MTBDRplus assay, integrated into routine lab work, in the detection of *M. tuberculosis* resistance to rifampin (RIF) and isoniazid (INH).

**Intervention:** From June 2009–July 2010, consecutive AFB smear positive sputum specimens were obtained from patients referred to the Georgian National TB Program. Conventional cultures and drug susceptibility testing using both an absolute concentration method on Löwenstein-Jensen media and broth method in MGIT 960 system along with the Genotype MTBDRplus assay were performed at the Georgian National TB Reference Laboratory.

**Results:** Of 500 AFB positive sputum specimens, 456 (91.2%) had both a positive AFB culture for *M. tuberculosis* and a valid MTBDRplus assay result. Of 15 AFB culture (–) sputums, 9 (60%) had a + MTBDRplus assay (4 with MDR-TB). As compared to specimens with a (+) culture, the MTBDRplus assay detected any INH resistance in 157/175 (89.7%) isolates, and MDR-TB in 107/112 (95.5%) isolates. There was high agreement between the MTBDRplus assay and conventional DST in MDR (kappa 0.94,  $P < 0.01$ ). The most common resistance mutation for INH was S315T (88%) in the katG codon and for RIF S531L (71%) in the rpoB codon. In persons from whom INH resistant was detected, katG mutations were more common in persons previously treated for TB (96% vs. 83%,  $P = 0.02$ ). The average turn-around time in days for *M. tuberculosis* identification and INH and RIF drug susceptibility results was significantly shorter with the MTBDRplus assay (4.2) as compare to using either solid (67.3) or liquid (21.6) cultures (Table).

**Table** Time to results (in days) for detection of TB and associated drug resistance ( $n = 456$ )

	+ Solid culture results	Solid culture DST	+ Liquid culture result	Liquid culture DST	MTBDRplus assay
All Cases	34.1 (±11.3)	67.3 (±15.0)	8.9 (±3.9)	21.6 (±9.3)	4.2 (±1.8)
MDR TB	36.8 (±13.4)	70.3 (±19.4)	8.9 (±4.9)	21.0 (±8.0)	4.4 (±1.7)
INH mono R	30.8 (±9.6)	71.9 (±18.7)	8.9 (±4.7)	21.1 (±8.1)	3.7 (±1.7)

**Conclusions:** The MTBDRplus assay had a high sensitivity and specificity and greatly reduced the time to detection of MDR-TB in an area with high MDR prevalence; this test may avert patients from being placed on inappropriate treatment regimens.

### PC-1239-30 Resistance of *Mycobacterium tuberculosis* to anti-tuberculosis drugs in Nigeria

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**Introduction:** Currently the exact data about the prevalence and pattern of drug-resistant strains of *M. tuberculosis* resistance in Nigeria is not known. This study was undertaken by the Damien Foundation Belgium and aimed to determine the prevalence and pattern of *M. tuberculosis* isolates to first and second line anti TB drugs, and to determine the existence and burden of MDR/XDR among category 2 failure. **Materials and methods:** This is a retrospective study in which we analysed the prevalence of drug resistance in *M. tuberculosis* isolated from sputum samples of



Category 2 failure patients' attending various TB treatment centres in Oyo and Osun States in South West Zone of Nigeria from April 2007–September 2010. Sputum and culture isolates of pulmonary tuberculosis patients were sent to Antwerp Supra National laboratory, Belgium for DST.

**Results:** A total of 80 patients who had failed category 2 treatment were included in this study. There were 47 males (58.8%) and 33 females (41.2%). The age range was 20–60 years. The mean age was  $36.3 \pm 9.2$  years. While the peak age group was 30–39 (47.4%) years. There was no significant difference in the mean age between males and females ( $37.5 \pm 9.3$  years vs.  $34.7 \pm 9.0$  years;  $P = 0.18$ ). Resistance to all first line drugs HRES were detected in 32 (40%), while MDR observed in 47 (58.8%) and 18 (22.5%) were sensitive to first line drugs. From the 21 MDR-TB patients 2 (2.5%) have resistance to k, 9 (11.3%) patients have resistant to oflo, 3 (3.8%) patients have resistant to pro (Pro), 7 (8.8%) have resistant to Eto and 2 (2.5) showed resistance to Cs. No case of XDR-TB was diagnosed in the study.

**Conclusion:** The findings suggest that the cases of MDR-TB in the states may have appeared for any of 2 reasons: endogenous development of MDR strains due to inadequate case management, or ongoing transmission. This study points to an urgent need for the establishment of facility for external quality assured DST in different parts of the country.

#### PC-1261-30 Comparison of three different laboratory methods for drug resistance surveys

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**Background:** WHO recommends the use of liquid culture systems and line probe assays for the diagnosis of TB and drug susceptibility testing (DST). The challenges for drug resistance surveys (DRS) include comparability with previous surveys (often conducted using solid media); quality control of batches of media; contamination rates; impact of non-tuberculous mycobacteria (NTM); costs and reliability. During the 2008 national DRS in Zambia we compared results from three different methods.

**Methods:** A nationally representative sample of smear positive tuberculosis cases submitted sputum samples. Cluster sampling of 50 clusters meant that 917 sputum samples were collected from 47 centres with good geographic representation and transported to the national reference laboratory. 34 were excluded because smear positivity was not confirmed or no clinical information was completed. DST was performed using Löwenstein-Jensen ((LJ) solid) and Mycobacteria Growth Indicator Tubes ((MGIT) liquid) and the

residual decontaminated sample was used for Geno-Type MTBDRplus assays (line probe).

**Results:** Full drug susceptibility results were available from 574, 658 and 835 patients respectively. Combined (new and retreatment patients) MDR rates were 1.0%, 2.3% and 1.6% with widely overlapping 95% confidence intervals. Concordance was better between LJ and MTBDRplus than between MGIT and either other method (kappa statistics: LJ vs. MTBDRplus 0.77; LJ vs. MGIT 0.67 and MTBDRplus vs. MGIT 0.28). MTBDRplus results were available rapidly and in a larger proportion of the overall sample.

**Conclusion:** Although each assay is more expensive, the MTBDRplus is an attractive choice for laboratories conducting national DRS. All three methods gave similar overall rates, but MGIT may overestimate drug resistance, possibly because of lack of quality control when adding drugs to individual tubes (compared to LJ which is made in batches), or because of mixed infections with NTM.

#### TUBERCULOSIS DIAGNOSTICS: QUALITY ASSURANCE POLICY IN MICROBIOLOGICAL DIAGNOSTICS

##### PC-198-30 Proficiency of drug susceptibility testing for *Mycobacterium tuberculosis* in Taiwan, 2007–2010

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**Aim:** To evaluate the impact on external quality of drug susceptibility testing in clinical mycobacteriology laboratories, proficiency testing was conducted.

**Methods:** A panel of 20 *Mycobacterium tuberculosis* isolates was used in 2007, and 30 isolates in 2008–2010. Accuracy of 95% in detecting resistance to both isoniazid (INH) and rifampicin (RMP), and 90% to both ethambutol (EMB) and streptomycin (SM) was used to define a competent laboratory. Results of corrective actions were reported to Taiwan Centers for Disease Control in 2009 and 2010.

**Results:** Thirty laboratories participated in 2007, 35 in 2008, 36 in 2009 and 34 in 2010. The numbers of isolates tested in laboratories ranged from 12 to 5000. The mean accuracy in detecting resistance to INH was 95.7%, 99.6%, 99.7% and 99.5% in 2007, 2008, 2009 and 2010, respectively. The mean accuracy in detecting resistance to RMP was 97.2%, 99.9%, 99.5% and 99.6% in 2007, 2008, 2009 and 2010, respectively. The mean accuracy in detecting resistance to EMB was 82%, 92.2%, 97.2% and 96.6% in 2007, 2008, 2009 and 2010, respectively. The mean accuracy in detecting resistance to SM was 86.8%, 98.1%, 97.5% and 98.6% in 2007, 2008, 2009 and



2010, respectively. Overall, 16.7% (5/30), 85.7% (30/35), 86.1% (31/36) and 82.4% (28/34) of laboratories fulfilled the competency criteria for all drugs in 2007, 2008, 2009 and 2010, respectively. Administration error and EMB resistance detection were the main reasons for incompetence.

**Conclusion:** It is essential to provide external quality program and technical training to ensure all laboratories meet the criteria of competency.

### PC-414-30 Improving AFB microscopy EQA through slide rechecking and supervision in Ethiopia

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**Background:** Ethiopia, as is common in many resource limited countries, faces the challenges of human resource and budget to effectively implement tuberculosis (TB) sputum microscopy quality assurance. Internal quality control (QC) and external quality assessment (EQA) are not uniformly done. Tuberculosis Control Assistance Program (TBCAP) is supporting Ethiopia to improve TB diagnostic capacity at hospital and health center levels through scaling up EQA to all TB microscopy units (TMUs) in North Shoa, East Shoa, West Shoa, West Arsi, Arsi and Gurage zones.

**Methodology:** Scaling up of EQA entailed retraining of TMUs staff on acid fast bacilli (AFB) microscopy and national EQA guidelines, planning joint clinical and laboratory supervisions with timely feedback, site mentoring, implementing slide rechecking and providing key supplies to TMUs. Slides collected during supervision were rechecked at the regional laboratories. Supervision was regularly done on quarterly basis using a standard checklist and targeting 172 TMUs over a 2 year period.

**Results:** TBCAP trained 51 regional laboratory staff as trainers and 471 TMUs staff. One hundred twenty TMUs received microscopes and/or supplies/kits to enable smooth testing. The number of TMUs participating in EQA increased from 42 in the 4th quarter (Q4) of July–September, 2009 to 140 in Q4 of 2010, this being EQA coverage of 81.3% compared to 30% national average. Slides rechecking improved every quarter with proportion of high false negatives (HFN) and high false positives (HFP) decreasing steadily. Increase of HFP in Q4 was due to many new TMUs

that joined the rechecking program. Timely supervision feedback and mentoring contributed to improved QC practices.

#### Lessons learnt:

- Retraining TMUs staff, providing essential supplies, improving oversight and mentoring of staff improved EQA performance of TMUs.
- Joint clinical and laboratory supportive supervisions leveraged resources and improved EQA coverage.

### PC-480-30 Limited impact of systematic mycobacterial culture on management of smear-negative tuberculosis

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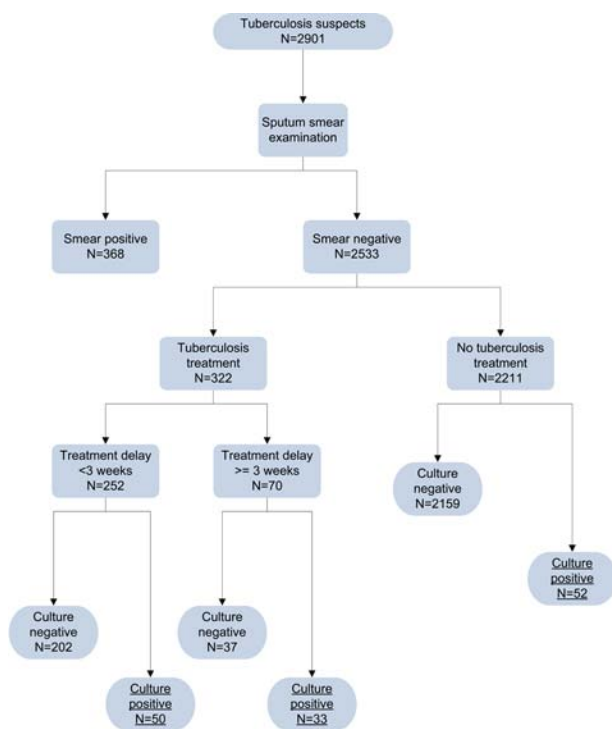
**Objectives:** To evaluate the operational impact of conventional mycobacterial culture on the management of smear-negative tuberculosis (TB).

**Methods:** Retrospective analysis of routinely collected data (1/2009–7/2010) on single diagnostic episodes at a tertiary hospital's TB clinic in Phnom Penh. We followed WHO's diagnostic algorithm. Conventional culture on Löwenstein-Jensen medium was done routinely for all TB suspects. With minimal turn-around times for culture (from sputum collection to availability of culture result in clinic) of 3 weeks, treatment initiation within 3 weeks reflected treatment decisions based on findings other than culture.

**Results:** In total, 2901 diagnostic mycobacterial cultures were done. Human immunodeficiency virus prevalence was 39%. *M. tuberculosis* grew on 374 (89%) cultures, non-tuberculous mycobacteria on 45 (11%). Contamination rate was 2.8%. Of the 2533 smear-negative suspects, 135 (5%) cultures were positive, and 322 (13%) were initiated on TB treatment (median time to treatment 5 days, inter quartile range 1–14 days). Seventy-eight percent (252/322) of cases started TB treatment within 3 weeks after initial presentation, of whom 50 cultures turned positive afterwards. For 70 smear-negative cases commencing treatment after 3 weeks, culture results were decisive in 33; hence 10% of the decisions to treat smear-negative TB were based on culture results. Whilst *M. tuberculosis* grew in an additional 52 smear-negative cases, the results did not alter their management: 6 patients had died, 16 patients had started treatment elsewhere and 30 were lost to follow-up before culture result.

**Conclusion:** Currently, systematic conventional mycobacterial culture adds little to individual management of smear-negative TB suspects. The impact of culture could potentially more than double if rapid

	Q1: Oct– Dec,09	Q2: Jan– Mar,10	Q3: April– June,10	Q4: July– Sep,10
HFN	8 (4.1%)	1 (0.3%)	5 (1.5%)	16 (0.3%)
HFP	6 (0.5%)	7 (0.3%)	4 (0.09)	26 (6.3%)



**Figure** Flowchart of all TB suspects according to smear- and bacteriological status.

diagnostic tests were applied. For the time being, a diagnostic algorithm restricting the indications for culture is recommended in our setting.

### PC-707-30 External quality assurance for sputum smear microscopy in Mongolia

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**Background:** Direct smear microscopy of respiratory specimens has been the main case detection method used for the diagnosis of TB in Mongolia. EQA system has been established in 1997. There has been an ongoing effort to strengthen the acid-fast bacilli (AFB) diagnostic laboratory network in nationwide of Mongolia, and quality control has been initiated as part of this effort.

#### Objectives:

- To evaluate the level of agreement in the readings of sputum smears for AFB between peripheral laboratories and the reference laboratories.
- To ensure quality of AFB microscopy at microscopy center level through providing EQA services.

**Method:** Blinded rechecking of routine slides collected from the peripheral diagnostic laboratories was undertaken in 36 laboratories of Mongolia between 1997 and 2010. At the beginning of EQA we collected smears for a month, rechecked all smear positive cases (100%) and 10% of smear negative

cases. Since 2004 we are using EQA employing LQAS.

**Results:** One hundred forty five thousand two hundred eighty nine slides were rechecked, 42.6% (61 907) of which were positive and 57.4% (83 382) of which were negative slides. For the past 14 years were increased overall agreement (81.1–97%), specimen quality (64.4–95.4%), size (68–89.8%), evenness (51.6–94.2%), thickness (60.1–90.7%), staining (51–87.9%), cleanness (47.8–92.6%). We were detected a total 1520 (1.1%) discordant slides. Last five years discordant slides were 324 (HFP-19, HFN-193, LFP-11, LFN-17 and QE-84). Percentage of smear positive cases out of pulmonary have risen from 34.5% at the start of the implementation EQA to 72.4% in 2010.

**Conclusion:** Good agreement was recorded in the readings of AFB among the peripheral and reference laboratories. The laboratory diagnostic capacity has improved by 2.1 times in Mongolia. Regular on the job and re-training of the peripheral laboratory staffs together with supportive supervision would help improve their performance.

### PC-737-30 Decentralisation of TB diagnostics in Thyolo District, Malawi

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**Background:** In Malawi, sputum smear microscopy is the mainstay of TB diagnosis. HIV prevalence is 12.4%, and 71% of TB patients are co-infected with HIV. TB notifications rose from 5000 cases in 1985 to 27 000 cases in 2006, coinciding with a rising HIV prevalence. In 2006, the National TB Programme recommended decentralization of laboratory services.

**Methods:** Between October 2007 and January 2011, the Ministry of Health set up microscopy services in 8 health centres in Thyolo District, and Médecins Sans Frontières supported the introduction of smear fixation at an additional 7 sites. Samples were transported from fixation to microscopy sites by bicycle or motor vehicle. The central laboratory provided ongoing supervision.

**Results:** Between 2006 and 2010, 2970 patients were diagnosed with smear-positive pulmonary TB. The annual number of smear-positive cases remained relatively constant (524 in 2006 and 505 in 2010) but the proportion of all pulmonary TB cases that were smear positive increased (36.3% of all cases in 2006 and 51.2% of all cases in 2010). In the 1st quarter of 2006, patients diagnosed with smear-positive TB travelled up to 66 km to the hospital for diagnosis, and 267 (23%) of smear-positive cases lived outside the hospital catchment area. By the 1st quarter of 2010, all smear-positive TB patients had access to

microscopy services within 10 km of their homes despite 629 (47%) of smear-positive cases living outside the hospital catchment area.

**Conclusion:** Decentralizing TB diagnostics improved access to microscopy and increased the detection of smear-positive TB. However, diagnosis of smear-negative TB remains a problem.

### PC-861-30 Evaluation of 2009 external quality assessment in Lusaka Province, Zambia

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**Background:** The University Teaching Hospital (UTH) Tuberculosis Laboratory is the Southern Regional TB Reference Laboratory in Zambia managing EQA in 32 microscopy centres. Blinded rechecking is a process of re-reading of slides from a participating laboratory to assess whether that laboratory has an acceptable level of performance. Blinded rechecking is the best method in EQA component that provides reliable assurance that a country has an effective AFB smear microscopy laboratory network supporting DOTS.

**Method:** Stored slides from 32 centres were collected on a quarterly basis and re-examined at the regional reference laboratory. A feed back was given to each site about their performances. The six (6) assessment points, smear thickness, size, staining, evenness, cleanliness and specimen quality were the criteria used for staff competency in smear preparation including smear reading ability. Total number of HFN, LFN, HFP and LFP were the criteria used for facility standard in obtaining 0% error detection in smear microscopy.

#### Results:

Activity	Results
Total slides collected from centres and examined at the reference laboratory in 2009	1884
Total errors in each criteria marked and given to facilities during blinded rechecking, %	25.60
Effectiveness of blinded rechecking per facility, %	91.0
Effectiveness of smear preparation per facility, %	54.80

**Conclusion:** EQA is progressing well. The effectiveness of smear preparation dropped to 54.8% from 85% in 2006 and 2007 due to new untrained staff in EQA who have joined the service. Therefore, there is need to train new staff in order to maintain the high standard of EQA in Lusaka Province.

### PC-1315-30 Effect of sputum volume in yield of *Mycobacterium tuberculosis* from prevalence survey sputum specimens

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**Background:** Sputum volume and appearance is known to be important in culture of *Mycobacterium tuberculosis*. WHO recommends collecting a purulent sputum specimen of at least 3 to 5 ml for clinical diagnosis of *M. tuberculosis*. In prevalence surveys sputum specimens are collected from individuals who may be less symptomatic and may therefore not be able to produce such good quality samples.

**Objective:** To measure the effect of volume on yield of *M. tuberculosis* of sputum specimens collected in a community prevalence survey.

**Method:** In the ZAMSTAR prevalence survey within 16 communities in Zambia one sputum sample per individual was collected for *M. tuberculosis* culture. In 4 communities in the period of June to October 2010 volume and appearance of specimens were recorded. Specimens were processed using the standard NALC-NaOH method. Two manual MGIT tubes were inoculated, incubated and growth was measured once a week for a maximum of 6 weeks. If growth was observed a Ziehl Neelson (ZN) stain and MPB64 assay was done to identify *M. tuberculosis*.

**Results:** Volume was captured for 4202 specimens. 2743 (65%) were 0.5 to 2 ml, 732 (17%) were 2 to 3 ml, 544 (13%) were 3 to 4 ml, 171 (4%) were 4 to 5 ml and 11 (0.3%) were >5 ml. For samples with a volume of 0.5 to 2 ml 921 (17%) out of 5485 MGIT tubes showed growth of which 15 (1.6%) tubes were identified as *M. tuberculosis*, for a volume of 2 to 3 ml 346 (23%) out of 1463 tubes showed growth of which 5 (1.4%) were *M. tuberculosis*, for specimens with a volume of 3 to 4 ml 362 (33%) out of 1089 showed growth of which 11 were *M. tuberculosis*, and for specimens with a volumes of 4 to 5 ml. 124 (36%) out of 342 tubes showed growth of which 7 (5.6%) were identified as *M. tuberculosis*.

**Conclusion:** Although more *M. tuberculosis* is isolated from sputum samples with volumes between 3 to 5 ml, *M. tuberculosis* can still be isolated from small volume samples. Efforts can be taken to improve sputum volume but small volume samples should still be processed in prevalence surveys.

## APPROACHES TO TUBERCULOSIS INFECTION CONTROL

### PC-297-30 TB infection control training: the experience of Vladimir Oblast TB Dispensary, Russia

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**Background:** In recent years, the epidemiological situation of tuberculosis has been aggravated with the emergence of MDR-TB and HIV. Tradition of long-term hospitalization of TB patients has contributed to nosocomial transmission of TB in Russia and has highlighted shortcomings in infection control measures. Vladimir Oblast TB Dispensary in collaboration with the Central TB Institute, with the support of the US CDC and WHO Russia has worked to improve infection control measures and address these issues through standardized training courses.

**Setting:** Vladimir Oblast TB Dispensary, Russia.

**Objectives:** The overall objective is to strengthen the regional TB Programme and to disseminate up-to-date knowledge on principles and practices, which underlie infection control strategies. The training courses offer basic skills to perform a risk assessment, technical measurements and develop a plan for sustainable interventions and to evaluate the implementation of infection control measures.

**Methods:** Since 2008, five-day courses are held at Vladimir TB Dispensary where all components of TB infection control have been implemented. The course content includes lectures, demonstration, interactive sessions, classroom exercises and practical application of infection control measures in the TB wards and laboratory. Infection control strategies (administrative, environmental and respiratory protection) and biosafety in laboratory are covered. Since 2010, specialized courses dedicated to penitentiary system, ventilation design, equipment installation and maintenance and certification, are being conducted on quarterly basis.

**Results:** To date, 294 TB specialists, administrators, chief nurses, epidemiologists and engineers from Russia, Ukraine, Kazakhstan and Belarus have been trained in Vladimir. Regular quarterly course curriculum is based on participants and international level facilitator's feedback to respond to the emergence of drug resistant TB.

### PC-367-30 Healthcare-associated outbreak of tuberculosis, Puerto Rico, 2010

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**Background:** Despite a 10-year decline in reported tuberculosis (TB) cases, outbreaks continue to represent an important challenge to TB control in Puerto Rico. In 2010, TB was diagnosed in three healthcare personnel (HCP) at a single hospital in Puerto Rico; one patient died after a 6-month delay in diagnosis. The Puerto Rico Department of Health and CDC jointly investigated the outbreak in order to identify interventions to halt further TB transmission.

**Response:** An outbreak case was defined as TB disease diagnosed January 1, 2008–October 1, 2010, in an employee, patient, visitor, or volunteer who had spent time at the hospital. We interviewed outbreak patients, reviewed medical records, and examined annual and postoutbreak tuberculin skin test (TST) results for all HCP at the hospital.

**Results:** Nine total cases were identified (including the three HCP); the seven patients with isolates available had matching TB genotypes. The index case-patient was not consistently in respiratory isolation during a 3-month hospitalization in 2008 for infectious TB. Three HCP with undiagnosed TB worked a total of 444 days while infectious. Six of the nine patients were diagnosed with TB after seeking medical attention for TB symptoms; median time from first contact with medical care to initiation of treatment was 56 days. In 2010, TST results for 45 (15%) of 299 HCP were newly positive. HCP who worked in an area where contagious HCP had worked had 3.3 times the risk (95% confidence interval: 1.5–4.7) of having a newly positive TST than HCP who had not worked in those areas.

**Conclusions/recommendations:** This outbreak highlights how undiagnosed TB can contribute to transmission in healthcare settings, placing HCP and patients at risk. Educational efforts in Puerto Rico should focus on increasing TB awareness among HCP to promote early identification and treatment of disease, as well as initiation of recommended infection control precautions.



### PC-477-30 Use of window-slits for infection control purposes in MDR-TB ward, Donetsk Oblast, Ukraine

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**Background:** Since 2006, WHO has been assisting implementation of MDR-TB Project in Donetsk Oblast with financial support of the Charitable Foundation 'Development for Ukraine'. One of activities is to support infection control (IC). 4 specialized MDR-TB wards for 200 beds were opened in Donetsk oblast and equipped with exhaust and supply ventilation. Window-slits manufactured by Tion (UK) were installed in rooms of MDR-TB ward at Donetsk Oblast clinical TB hospital, as the additional air flow source. **Objective:** To evaluate the feasibility of window-slits use to improve the ventilation system.

**Methods:** Air exchange parameters were measured in different ventilation modes, using thermoanemometer Testo 435 and smoke tests. At the time of measurements outside air temperature was -70C, in ward + 220C.

#### Results of assessment showed:

- The efficiency of ventilation system was 96% comparing to the designed one, made in accordance with Ukrainian regulations and was 2.4 as little then international standards;
- While the exhaust system or general ventilation system were switched off, the air flow was directed from the 'dirty' zone to 'clean' one;
- While the exhaust system was on and air supply was off at the open window slits air direction went from the 'dirty' zone to 'clean';
- While the exhaust system was on and air supply was off at the closed window slits air direction went from the 'clean' zone to 'dirty';
- While the supply system was on, air direction always went from 'clean' zone to the 'dirty';
- While the window-slits were open, the in-room temperature fell to +190C.

**Conclusions:** Window-slits should not be used at negative external temperatures, while ventilation system is off and the exhaust system functioning not according to the international standards.

**Recommendations:** Bring the ventilation system in line with international standards, with subsequent evaluation using the window-slits. To carry on the follow-up evaluation in the warm season.

### PC-513-30 Engaging the transport industry in a TB infection control campaign through education

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**Background:** One of the greatest challenges faced in the management of TB in Kenya, is the defaulting on treatment. This has been attributed to stigma brought about by lack of knowledge on TB infection, transmission and the importance of completing treatment. To address these issues an intensive public education campaign was carried out through the transport industry in three regions, namely Mombasa, Nairobi and Nyeri using the Matatu (public service vehicles) crews as TB ambassadors.

**Intervention:** Information was gathered through a KAP survey at the various bus terminals. The results of these surveys led to sensitization meetings on TB and infection control with the Matatu crews who were trained as TB spokespersons to empower them to communicate effectively with the commuters, production and dissemination of TB infection control stickers and TB screening camps of the crews and general public in Mombasa.

**Results:** 105 drivers and conductors were engaged in a period of two weeks. 100 were investigated for all forms of TB. 9 of them were found to have PTB with 6+++ , 1++ and 2+. They engaged 1000 members of the public 500 of whom were screened for TB with 80 being investigated for all types of TB where 3 were found to have PTB. Kongowea health facility recorded a 39% increase in case finding while Tudor health facility recorded an 18% increase case finding as a result of this partnership.

**Conclusion:** The use of persons who have actually gone through treatment to give information on the modes of TB transmission, associated risk factor, and possible signs and symptoms and importance of treatment adherence is more likely to encourage their peers and the public in general to take appropriate action in earnest. This innovative partnership has scaled up care in Mombasa and is being replicated countrywide.

### PC-558-30 Health care workers' fears associated with working in MDR/XDR-TB wards in South Africa

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**Objectives:** *Mycobacterium tuberculosis* (TB) has long been considered an occupational hazard for health-care workers (HCWs). The objective of this study was to assess HCW's fear of developing drug-resistant TB as part of a larger study evaluating infection control (IC) and HCW IC knowledge, attitudes and

practices (KAP) in drug-resistant TB hospitals in South Africa.

**Methods:** A cross-sectional descriptive study was conducted from June to September 2009 in all 24 drug-resistant TB hospitals across South Africa. HCWs were asked to complete an anonymous self-administered KAP questionnaire. HCWs were asked an open-ended question regarding personal concerns about their risk of developing drug-resistant TB. Responses were transcribed and imported into NVivo software for analysis by content analysis.

**Results:** Among 24 hospitals, 499 HCWs were surveyed; 365 (73.1%) responded to the open-ended question. Thirty-eight (11.3%) were physicians, 228 (68.1%) nurses; 59 (17.6%) nursing assistants and 10 (3%) other. Five major themes emerged: the fear of: 1) infecting others; 2) the treatment course; 3) the financial implications of infection; 4) concerns regarding family commitments; and 5) dying. The majority of HCWs stated they worry about infecting family members with MDR/XDR-TB 'I am worried that if I can develop MDR or XDR-TB I might infect my family so that makes me very worried'. The fear of treatment included the months of injections, taking many pills, the long hospital stay, poor cure rates and drug side effects. One respondent stated '... All that medications and injections—I rather kill myself than to go through what those poor patients go through'.

**Conclusions and recommendations:** Based on the analysis of these data, the greatest fear of HCWs working in drug-resistant TB wards is infecting others. This highlights the need for training HCWs working in TB wards on IC measures and specifically on how HCWs can protect themselves and others from developing TB.

### PC-586-30 Experiences and attitudes of patients towards TB infection control measures in Uganda

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**Background:** To explore how implementation of TB-infection control in health facilities impact on stigma among TB suspects and patients. Few studies have been done on how patients experience these measures.

**Methods:** The study was conducted from September–December 2010 in the districts of Mukono and Wakiso in Uganda. Twenty in-depth exit interviews were conducted among (TB suspects and TB patients). Patients were asked about their general knowledge on TB, experience in outpatient department (being triaged, separated and health education on cough

hygiene and wearing of masks) and their views on these control measures. Interviews were tape recorded and then transcribed. Data was analysed manually using thematic and content analysis.

**Results:** Both patients and suspects reported that triaging of coughers is not practised unless one is very sick or is coughing excessively. Suspects do not experience separation until after a TB diagnosis is made. Covering the mouth and nose while coughing, was viewed as a normal practice though not all coughers comply to it. Regarding use of masks some patients said they would agree to whatever the health worker tells them though they expressed that it would be against their will. For those who were not willing to wear the mask, felt that wearing a mask signifies having a dangerous disease, makes patients feel out of place and being suspected of spreading the disease. Separation was preferred to using masks, though some patients were also not comfortable with it, saying that it makes them get worried and is a sign of a dangerous disease.

**Conclusion and recommendation:** Implementation of TB control measures is still poor. Patient view these measures as stigmatising. The TB control programme needs to health educate health workers and sensitize patients. There is need for research into factors that affect implementation of TB control measures.

### PC-624-30 The impact of having a TB infection control (TBIC) focal point on TBIC activities in Afghanistan

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**Background:** The Tuberculosis Control Assistance Program (TB CAP), a USAID-funded project, implemented by Management Science for Health, assisted the Afghan National Tuberculosis Program (NTP) with assigning TB infection control (TBIC) focal points, integrating TBIC planning into general IC planning, developing TBIC standard operating procedures, and training health facility staff on TBIC. In 2010, an assessment was conducted in health care facilities in seven provinces with the objective of identifying the effect of recently appointed TB IC focal persons on the implementation of TB IC activities in health care facilities.

**Methods:** A team of TBCAP and NTP staff from the central and provincial levels visited seven provinces. Twenty eight health facilities were assessed using a standardized tool with six indicators. Twenty-one facilities had TB IC focal persons, seven did not. The team evaluated each facility documenting administrative, environmental, and personal protective controls through observation, review of charts and supplies, and the taking of environmental measurements

such as air flow, room size, etc. They also interviewed TBIC focal points and TBIC committee members.

**Results:** Facilities with a designated TBIC focal person, met 3.66 of the 6 TBIC indicators assessed, while facilities without met only 0.86 of the indicators. For example, all facilities with a TBIC focal person had a TBIC plan; none of the seven facilities without a focal person had a TBIC plan. Facilities with a TBIC focal person were more likely to have well ventilated sputum collection areas (95% vs. 57%), cough triage (52% vs. 0%) and suspect and confirmed patients using face masks (14% vs. 0%) than facilities without.

**Conclusion:** Assigning a TBIC focal point position is an important first step to promoting TB infection control measures in health facilities, and is recommended as a priority action.

### PC-702-30 Prevention and control of silico-tuberculosis in Thar Desert, India

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**Background:** In drought-stricken area of Thar Desert in India, mining is a major source of livelihood for impoverished communities. Agriculture is unreliable due to lack of rains leading to crop failures and poverty. Large numbers of people work in stone mines to earn their bread. Due to lack of health safety arrangements, silicosis is highly prevalent. Further, tuberculosis is also common in the area and majority of mineworkers live with both diseases in the form of silico-tuberculosis.

**Intervention:** GRAVIS, an NGO, has been working actively for prevention and control of silico-tuberculosis for last 15 years. It works with focus on providing diagnostic and curative services, advocacy for health safety and research on current problems. Over 600 000 mineworkers are the target group. GRAVIS runs a major hospital through which mineworkers are identified for silico-tuberculosis and are provided care and treatment. Through an outreach medical team, over 120 health education sessions are organized in mines every year. Three comprehensive research studies have been conducted to understand prevalence, current practices and mitigation measures. Advocacy with the concerned government departments on health safety is an important part of work. Due to efforts, the government had constituted a Pneumoconiosis Control Board.

**Lessons learnt:** The programme has benefited over 600 000 mineworkers. Over 7800 mineworkers have received medical services. Estimates suggest that the prevalence has reduced by nearly 15%.

**Conclusion:** There is greater sense of occupational health safety. Continuous efforts with a public health approach will need to be made to deal with this occupational health hazard.

### PC-739-30 Tuberculosis infection control in rural South Africa: information, motivation, behavioral skills

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**Background:** Nosocomial tuberculosis (TB) threatens patients and healthcare workers (HCWs), but infection control (IC) is inadequately implemented. The Information-Motivation-Behavioral skills (IMB) behavior change model may characterize and inform HCW IC implementation.

**Methods:** Confidential HCW surveys of IC IMB and self-reported IC behaviors (respirators, cough hygiene, natural ventilation) at two district hospitals with high TB prevalence in rural South Africa.

**Results:** June–August 2010: 198 surveys completed.

**Information:** HCWs understood TB symptoms/transmission/screening/triage, use of respirators/cough hygiene/natural ventilation, and increased TB susceptibility of people with HIV.

**Motivation:** Levels moderately high, though 22.8% thought IC not worthwhile. Respondents highlighted confidentiality and stigma concerns about personal TB-HIV testing (see Table). As a result of staff TB deaths, 65.5% were reluctant to work in high-risk wards and 25.7% to continue HCW employment.

**Behavioral skills:** HCWs highlighted IC challenges, including separating TB suspects at triage, asking older/male patients to cover cough, and handling personal TB-HIV testing stigma/confidentiality concerns.

**Self-reported behaviors:** Many claimed to ‘always’ wear a respirator (54.3%), instruct patients on cough hygiene (63.0%), and implement natural ventilation (67.4%) in high-risk areas. A sub-scale of variables related to perceived co-worker and supervisor social support for TB IC correlated with reported performance of all three behaviors ( $P = 0.002, 0.001, 0.006$ ).

Prompt	Proportion agreeing %
If I get tested for TB/MDR-TB/XDR-TB at this hospital, my co-workers would find out that I tested.	44.6
If I get tested for TB/MDR-TB/XDR-TB at this hospital, my co-workers would find out my test results.	41.3
If co-workers found out that a healthcare worker had TB/MDR-TB/XDR-TB, he or she would be severely stigmatized.	32.8
If I get tested for HIV at this hospital, my co-workers would find out that I tested.	31.6
If I get tested for HIV at this hospital, my co-workers would find out my test results.	25.0
If co-workers found out that a healthcare worker was HIV-positive, he or she would be severely stigmatized.	27.0

**Conclusion and recommendations:** IMB modeling is promising for monitoring and evaluating IC implementation and interventions. Beyond providing information, HCW IC interventions should focus on developing motivation and behavioral skills. Reducing stigma and increasing confidentiality may improve uptake of HCW TB-HIV testing and risk-reduction strategies. Social support from colleagues and supervisors may enhance IC implementation.

### PC-849-30 Risk reduction and inter-professional collaboration for TB infection control

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Through the joint efforts of International Council of Nurses (ICN), International Hospital Federation (IHF), World Medical Association (WMA), and International Federation of the Red Cross and Red Crescent Societies (IFRC), as part of Lilly's MDR-TB Partnership, training workshops for health professionals have been organized. The need for such workshops arose from differing standards of training for different healthcare practitioners, thus creating a demand for interprofessional education and training in the field of TB and infection control.

One key outcome of the seminars was that effective TB infection control can only be achieved through teamwork and inter-professional collaboration at all levels, from head government officials all the way to ward cleaners. It also became apparent that there was a lack of suitable materials addressing interprofessional collaboration in TB. ICN has developed a toolkit based on the experience gathered through the ICN/IHF/WMA/IFRC workshops, selected key literature, as well as on consultations with experts to address this gap in the literature.

This toolkit aims to:

- Provide an overview of the risk factors associated with TB transmission, and the main measures for infection control.
- Outline roles and responsibilities of professionals and institutions involved in TB care and control at the different national and international levels.
- Optimize TB prevention, control, treatment and to increase quality of patient care by promoting models of teamwork in TB.
- Encourage the reader to reflect on current teamwork and IC practices, and compare them with the teamwork model proposed in this toolkit.

The toolkit is directed at nurses, hospital managers and administrators, healthcare assistants, and every member of staff who is involved in TB care at every level, as well as for national and international organizations involved in TB care and control.

### PC-1016-30 TB infection control training for health care workers: lessons from Botswana

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**Background:** African health care workers (HCWs) and their patients are at high risk of nosocomial TB transmission. Despite WHO recommendations, few hospitals provide annual TB infection control training. There is an urgent need to develop effective, low-cost TB infection control training for HCWs.

**Intervention:** We developed TB infection control training for HCW in six districts, including two referral hospitals in Botswana. The curriculum had two versions: an English version designed for doctors and nurses, and a Setswana version with simplified content for medical assistants and non-clinical staff. Training was delivered to 60 different HCW daily for two weeks in each district. Training was conducted at the health facility or at a venue within close walking distance. At each facility, 10 HCWs selected by management were trained as 'facilitators' to assist with the training and lead future trainings. Pre and post-tests were done to assess knowledge transfer and a subjective evaluation was done to assess quality.

**Results and lessons learnt:** We trained 3259 HCW between March 2009 and May 2010, which represents 64% of all HCWs employed in the selected districts and facilities. At the peak of implementation the cost per HCWs trained was \$23.24. Test results showed 92% of HCWs had knowledge improvement after training, particularly HCW with less professional experience (OR 3.4 95%CI 2.6–4.3). Over 95% of HCWs felt they had learned something from each session, 97% said they would apply the training at work and 99% believed all HCW should receive the training. Key factors leading to success were support from facility managers, direct participation of local facilitators, a concise training delivered at low-cost in the workplace and a curriculum appropriate to the language and education level of HCWs.

**Conclusions and key recommendations:** TB infection control training can be delivered effectively to large numbers of HCWs at relatively low cost in Botswana.



### PC-1148-30 Results of a baseline TB infection control assessment at DR-TB treatment centres in Namibia

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**Background:** In 2009 Namibia reported 13 332 TB cases and 396 drug-resistant tuberculosis (DR-TB) cases. The 2010 antenatal HIV prevalence was 18.8%, and 60% of TB patients are HIV-positive. Programmatic management of DR-TB commenced in 2008 in 8 regional centres, without a systematic assessment of TB infection control (TB-IC). A 2009 study identified nosocomial transmission as an important factor in the spread of DR-TB in Namibia.

**Intervention:** In 2010 the Namibia NTP appointed a TB-IC officer and conducted baseline TB-IC assessments at the DR-TB sites using a standardised tool. Inspection of the facilities and measurement of air-flow direction were conducted. Interviews were held with identified facility personnel (4 per facility); each assessment took 5 hours.

**Results:** All 8 facilities had IC committees and focal persons with general IC plans. None of the plans included TB-IC and there was no TB-IC training plan. Patients were educated on cough etiquette and were given surgical masks at all facilities; but there were no IEC materials to reinforce this. 3 facilities collect sputum samples in open spaces while 5 used patients' rooms or toilets. Sputum-smear examination turnaround-time was less than 48 hours at 3 facilities; 48–72 hours at 4 facilities and more than 72 hours at 1 facility. Patient separation was not done at 6 facilities. 5 facilities utilise only natural ventilation and 3 also used mechanical ventilation. All 8 facilities keep windows open but 4 had windows which were deemed too small. Staff TB screening is done at 1 facility and N95 respirators were available and used at all 8 facilities.

**Conclusion:** Implementation of TB-IC is currently haphazard in all the facilities and current IC efforts preclude TB-IC. TB-IC should be an integral component of PMDT, and should include all stakeholders, including facility planners and laboratory services. Administrative measures need to be emphasised as the cornerstone of TB-IC.

### PC-1218-30 Infection control practices in primary health care facilities in the Western Cape Province, South Africa

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**Background:** South Africa ranks fourth highest in the world in tuberculosis (TB) burden. Such a high burden poses a greatest risk to health care workers.

**Objective:** To assess current infection control practices in minimizing tuberculosis transmission in primary health-care facilities in the Western Cape province, South Africa.

**Method:** A cross-sectional descriptive study to evaluate environmental, administrative and personal infection control practices in the Western Cape province was conducted in 2009. We randomly selected 10 primary health-care facilities for inclusion in the study. Information was gathered during walking rounds and data was interpreted to identify differences in infection control practices between the facilities.

**Results:** There were significant differences between the facilities. Our study revealed that only 2 of 10 facilities had infection control plans specific to their facilities. There were adequate supplies of protective clothing in the majority (8 of 10 facilities); the greatest need was for training and conducting TB risk assessments. Of concern was that there was no cohorting of TB patients and only 5 of the facilities had designated infection control officers on site.

**Conclusion:** All primary health-care facilities should have an infection control program. Policies for infection prevention and control should be written, readily available, updated annually, and enforced. There is an urgent need for training and improving infrastructure in primary health care settings in the Western Cape province.

### PROGRAMME IMPLEMENTATION: MDR-TB

#### PC-596-30 Evidence of a successful MDR-TB programme in Rwanda: 2005–2010 trends of case detection and treatment outcomes

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**Background:** Following the 1st tuberculosis (TB) drugs sensitivity survey in Rwanda, which revealed a multi-drug resistant TB (MDR-TB) prevalence of 3.9% and 9.4% respectively in new and re-treatment cases, an MDR-TB program was implemented. We

are describing trends in cases notification and outcomes of treatment from 2005 to 2010.

**Intervention:** In July 2005, the Rwanda NTP started an MDR-TB program. This program consists of detecting *M. tuberculosis* strains resistant to 1st line anti-TB drugs, among all re-treatment cases and in new cases with smear positive sputum at the end of intensive phase or new cases detected among close contacts of a known MDR-TB cases; classifying cases as MDR-TB or not; treating those with MDR-TB strains with a standardized 2nd line anti-TB drugs regimen under observation (DOT), ensuring close clinical and bio-medical follow-up and providing them with nutritional support.

**Results:** From July 2005 to December 2010, 414 MDR-TB cases were enrolled on second-line treatment, giving on average 69 new cases per year. During the 2005–06 period 16% of MDR-TB cases detected died before starting treatment, while in 2010 this proportion was 4%. On laboratory side, turn-around time for DST result dropped from 86 days in 2006 to 13.5 days in 2009. For the same period, duration of admission time decreased from 6.8 months to 3.2 months. Treatment success rate increased from 83% for the cohort of MDR-TB patients enrolled in 2005 to 91% for those enrolled in 2008.

**Conclusions:** In Rwanda, MDR-TB program was successful. This was a result of a strong political commitment, to overcome the problem. Due to challenges in cases detection and follow-up in ambulatory phase, decentralized MDR-TB units at provincial level are being installed and new diagnostic tests are introduced in the referral and peripheral laboratories. Given the experience gained, Rwanda hosts the East African Regional Center of Excellence in the Programmatic Management of MDR-TB.

### PC-639-30 Diagnóstico inicial de unidades de salud en México para la implementación de tratamiento para TB-MDR

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**Objetivo:** Identificar las actividades críticas para la implementación de tratamiento antituberculosis con fármacos de 2ª línea en México.

**Material y métodos:** En entrevista directa, se aplicó cédula de verificación y validación de los procesos de atención a pacientes con tuberculosis y TB-MDR en todos los niveles operativos: estado, jurisdicción y unidad de salud.

**Criterios de inclusión:** Todos los estados de la República Mexicana que notificaron la existencia de pacientes con TB-MDR en tratamiento o en espera de éste en el periodo mayo a septiembre de 2009. Se

concentró la información recopilada en una matriz de validación, donde se otorgó una calificación cuantitativa y cualitativa de acuerdo a cada variable y a cada proceso.

**Resultados:** En los 23 estados visitados se evaluaron 15 actividades clínico gerenciales críticas en el proceso de atención a pacientes con tuberculosis y TB MDR, los resultados se adjuntan en una tabla.

**Conclusión:** La atención a pacientes con TB-MDR en México, representa un reto operativo de control complejo, ya que exige organización y acciones coordinadas entre los diferentes niveles de atención; dicha organización requiere además, considerar como mínimo, la disposición de medicamentos de calidad para los tratamientos, acceso a pruebas de laboratorio confiables y oportunas, tratamiento estrictamente supervisado, atención adecuada de eventos adversos, y gestión de fármacos. Todas estas acciones tienen como fin común, brindar a los pacientes la posibilidad de facilitar la adherencia terapéutica y evitar la resistencia a la última línea de defensa farmacológica contra la tuberculosis, así como la posibilidad de recobrar la salud. Los resultados obtenidos orientan el desarrollo de actividades para mejorar los procesos de atención de casos TB-MDR.

### PC-654-30 National TB-MDR Committee: Bolivian MDR-TB management guide

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**Introduction:** The epidemiological surveillance of tuberculosis in Bolivia made through the National Tuberculosis Control Program, there are studies that have identified the trend of drug resistance tuberculosis drugs. The identifications of TB/MDR cases, from 2004 established the Bolivian National Committee MDR-TB, which is a multidisciplinary group composed of pneumologist physicians, nurses, laboratory personnel and experts in MDR-TB management, whose main objective is the technical support to National Tuberculosis Program in the management of TB MDR and give technical support to evaluation of suspected cases of MDR-TB, and treatment regimens with second line drugs and monitoring, and a second task of establishing effective ways to support the management of MDR-TB.

**Objective:** To give a document of the management of MDR-TB in services which provide TB control activities in the country.

**Methods:** The Guide including:

- All steps necessary to conceptualize it within the group MDR drug resistance overall
- Conditions of entry and exit to therapy with second line drugs
- Diagnosis of the case, bacteriological condition that documents the resistance to H and R

d Category IV treatments as standard and individualized

e Requirement for the start of treatment

f Surveillance and monitoring, other than to note patterns of behavior of MDR-TB management in special cases

g Tools for registration.

**Results:** It is expected that the implementation and use of the 'Guide' for all health establishments Level I, II and III throughout the country that deals with cases of tuberculosis, may be made to adequately conduct application be adequate for the management of patients with possible TB/MDR.

### PC-878-30 Sputum transport for MDR-TB diagnosis and follow up: a public private partnership experience in India

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**Introduction and study settings:** Revised National TB Control Programme in India is collaborating with private/NGO sector for effective implementation of MDR-TB diagnostic and treatment services in the country. Blue Peter Public Health and Research Centre is an NGO laboratory offering such diagnostic services in collaboration with the public sector. The laboratory is catering to about 17 million populations in the state of Andhra Pradesh, India.

**Aim and methodology:** The aim of the study is to determine the viability of the samples sent to a laboratory located hundreds of kilometers away from the collection site and to look at the feasibility/success of involvement of other sectors in the programme. Inventory of the movement of CPC (cetyl pyridinium chloride) kits from the laboratory to the collection sites and vice versa was established. Period of specimen transit was calculated based on the date of specimen collection and the date of inoculation.

**Results:** Sputum samples ( $n = 1004$ ; 625 for diagnosis and 379 for treatment follow up) collected between June 2009 and November 2010 were studied. Average time taken for the transportation of preserved sputum from periphery to the laboratory is 5 days; 842/1005 (84%) of the samples reached the laboratory within 7 days collection and 15% reached within the second week. Culture positivity was 58% and contamination was 1%.

**Conclusions:** Sputum transportation in CPC through PPP (Public Private Partnership) is an effective decentralized type of sputum collection and transportation in resource constraint settings.

### PC-954-30 Expansion of DR-TB treatment programme in Uzbekistan

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The drug resistant TB (DR TB) project in two districts in Karakalpakstan, Uzbekistan has provided DR TB treatment since 2003, enrolling over 250 patients per year since 2007. MSF and the ministry of health plan to provide 'Comprehensive TB treatment to all in Karakalpakstan' by 2014, aiming to provide rapid and effective diagnosis and treatment for both drug sensitive and DR TB patients. In 2010 piloting began with expansion to two new districts.

The pilot started by identifying patients who were failing Category 2 treatment, then expanded diagnostic capacity to all TB suspects by providing molecular sensitivity testing and first and second line DST (MGIT, LJ). Early diagnosis allowed early patient segregation and prevents amplification resistance through inappropriate empiric first line regimens. Until now, DS and DR TB patients begin treatment in hospital. Given the high rates of DR TB, and the difficulties in providing adequate infection control in hospital and to prevent development of waiting lists, the new program strategy aims to provide outpatient treatment where possible, from Day 1. In March 2011, ambulatory treatment for eligible patients was provided from day 1, which is a major change in TB strategy in the region. We hope that this new model of care will improve our treatment outcomes by providing more options to patients (no mandatory hospitalisation) resulting in improved adherence. Less time in hospitals with inadequate infection control may also reduce cross-infection. This model of care will require significant training and supervision to assist health care workers accustomed to admitting patients in hospital, but also requires strengthening capacity away from central TB hospitals, for example in the management of TB side effects at local health centre level. Given the complexity of comprehensive TB treatment, MSF is investing in psychosocial support for patients, TB education for patients and the community and improving infection control.

### PC-984-30 Impact of Global Fund Round 4 project on regional MDR-TB control in the Russian Federation

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**Introduction:** GF Round 4 TB project complements Federal target TB control programme and provides additional investment for improvement of regional TB laboratories, strengthening TB management and developing of regional TB social support in 82 Russian regions. GF Round 4 project funded MDR-TB treatment within 29 GLC-approved projects (GLC projects).

**Method:** To evaluate impact of GF Round 4 supported GLC projects to regional civil sector TB Control programmes in the Russian Federation based on GLC projects and national reporting forms in 2008–2009.

**Results:** In 2009 GLC projects provided treatment of 2664 MDR-TB patients out of 8075 (33.0%) registered for treatment by regimen IV. The patients were supplied with second line drugs through GLC mechanism. GLC projects covered 52.3% new TB cases (median among projects: 64.4%, 25%–75% quartiles: 17.5%–92%) and 28.3% of all MDR-TB patients (median: 35.2%, 25%–75%Q: 20.8%–49.6%). GLC projects improved MDR-TB detection and follow up comparing to other territories. In 2008–2009 MDR-TB growth among new cases was the following for GLC and non-GLC territories respectively: from 1577 to 1883 (19.4%) and from 3203 to 3879 (21.1%),  $P > 0.05$ . At the same time growth among all registered MDR-TB cases was the following: for GLC and non-GLC territories respectively: from 8407 to 9409 (11.9%) and from 18816 to 20217 (7.4%),  $P < 0.05$ . According to the data from the national follow up TB reporting form the latter increase was the result of surveillance improvement in GLC projects. GLC projects regularly reported about MDR treatment outcomes while other territories do not have the monitoring and reporting system for MDR-TB.

**Conclusion:** The first input of the GLC project to regional TB control programme is the development of proper monitoring and surveillance system of MDR-TB. GLC projects significantly contributed to Federal TB control target programme in MDR-TB management.

### PC-1005-30 Effect of a home-based care approach in management of MDR-TB patients in Delhi, India

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**Background:** A major challenge in the management of drug resistant TB is to ensure patient compliance in directly observed treatment. To address this, DOTS PLUS clinical care was linked to Home Based Care (HBC) approach for MDR-TB patients during October 2009 to September 2010 in Delhi. The five components of home-based care approach (DOTS PLUS care, counseling support, behavioral support, nursing and social support) were developed by state technical expert working group.

**Intervention:** Two paramedics visited each patient in the study group (offered HBC) once a month for counseling and behavioral support on treatment compliance, self recognition of drug side effects, personal hygiene, nutrition, infection control practices. After one year, patient satisfaction in terms of early report back to work and reduction in treatment interruptions, gathered through a structured questionnaire framed with positive-negative questions graded on Likert Scale, for the study group was compared with the control group (not offered HBC).

**Results:** In the study group having 99 MDR-TB patients, 86 (87%) were satisfied with counseling support. The median period back to work was 0–3 months for the study group as compared to 6–9 months for the control group. Positive correlation was observed between counseling support and the number of days patients report back to work in the study group ( $r = 0.25$ ,  $P < 0.01$ ). One way ANOVA was analyzed to compare the effect of HBC approach on reduction in treatment interruptions; counseling support was found to be the most significant in the study group ( $f(9, 90) = 2.67$ ,  $P = 0.01$ ) as compared to control group. The cost effectiveness of HBC approach was analyzed in terms of early report to work, patient compliance and survival probability in both groups with Markov Transition Matrix Monte Carlo calculator.

**Conclusion:** HBC approach is cost effective and appropriate tool to ensure treatment compliance in MDR-TB patients.



### PC-1077-30 GLC-approved projects in Russia supported by Global Fund Round 4: current results

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**Objective:** To evaluate progress of 29 GLC-approved projects implementation in Russia.

**Introduction:** Expansion of programmatic DR-TB management and support of national TB Programme in MDR-TB Control is one of the main tasks of the GF Round 4 TB Program in Russia (GF Round 4). Russian Health Care Foundation (RHCF) as GF Round 4 Principal Recipient with the technical assistance of WHO Country Office (WHO RUS) has coordinated implementation of regional MDR-TB Control projects within GLC mechanism since 2005. Implementation of 29 Russian GLC-approved projects was supported by the GF Round 4 grant.

**Results:** Within GF Round 4 implementation number of GLC-approved projects in Russia increased from 3 in 2007 to 29 in 2010. In the period 2007–2010 the projects enrolled 6548 MDR-TB patients: in 2007—190 patients; in 2008—1352 patients; in 2009—3330 patients; in 2010—1676 patients: 5527 (84.4%) from civil and 1021 (15.6%) from prison sectors. Only 32.5% out of all registered patients were classified as new patients but in prison sector this proportion was significant less and comprised 23.8%. Proportion of relapses among registered patients was 18.5%; treatment after default 4.7%; failure Cat I 14.1%; failure Cat II 10.3%; other 19.6%. The smear conversion rate in yearly cohorts was as follows: cohort 2008 64.4%; cohort 2009 63.1%; and cohort 2010 53.3%. Default rate remains high: cohort 2007 26.8%; cohort 2008 17.4%; cohort 2009 16.9%. Final treatment outcomes are available only in cohort 2007 where treatment success rate was low (47.4%) due to high level of defaults (26.8%).

**Conclusion:** GLC mechanism with GF Round 4 support became a trigger for the expansion of DR-TB programmatic management in Russia. Retreatment cases comprised most part of enrolled patients. As result of unsystematic treatment in the past the proportion of patients in the registration group 'other' is high. High level of defaults impedes increasing of treatment success rate.

### PC-1110-30 Impact and cost-effectiveness of different strategies to detect drug resistance

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**Background:** Drug resistant tuberculosis (DR-TB) is a serious emerging problem in low and middle income countries. Many drug susceptibility tests (DST) to detect isoniazid (INH) and/or rifampin (RIF) resistance have been endorsed by the World Health Organization (WHO), but the most cost-effective types and timing of DST remain unclear. We predicted the potential cost-effectiveness and impact of different DST strategies.

**Methods:** Using decision analysis modeling, we estimated the impact and cost-effectiveness (in terms of Disability Adjusted Life Years (DALYs) gained, deaths and MDR-TB cases averted) of several DST strategies for smear positive TB patients. Three DST types were considered: conventional, rapid detecting INH and RIF resistance, and rapid detecting RIF resistance only. Rapid DST refers to techniques which can give results in <2 weeks under field conditions, namely LPA, Xpert MTB/RIF and MODS. We considered administering DST at different time points. The prevalence of initial drug resistance and HIV were varied in the model. Key input data were obtained from published sources. Extensive sensitivity analysis was conducted.

**Results:** Performing rapid DST for both INH and RIF for all patients before start of treatment in a wide range of settings was predicted to be the most cost-effective strategy, and had the greatest impact on preventing deaths. Rapid DST for RIF only (without INH) ranks second in deaths averted and cost per death averted in settings with high and moderate prevalence of DR-TB. In settings with moderate or higher prevalence of drug resistance, the cost per DALY gained using rapid DST that can detect both INH and RIF (vs. no DST) resistance was as low as \$744.

**Conclusion:** Our findings support the rollout of rapid DST for INH and/or RIF in all patients prior to start of therapy in countries with moderate or higher burdens of DR-TB if resources permit. Rapid DST for both INH and RIF has the greatest potential impact and cost-effectiveness.

### PC-1151-30 Household contact tracing of MDR/XDR-TB patients in Msinga subdistrict, KwaZulu Natal

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**Background and objective:** Msinga sub district of Umzinyathi district, in KwaZulu-Natal province is a rural, poverty-stricken area of 180 000 people served by Church of Scotland Hospital. In 2006 an epidemic of MDR/XDR-TB cases was reported. The Department of Health has since then implemented a contact tracing program of MDR/XDR-TB patients. The objectives of the activities are to identify smear positive contacts, provide information on community transmission of MDR/XDR-TB and to improve the outcome of drug-resistant TB.

**Method:** Contact investigating staff visited homes of drug resistant TB index patients and evaluated all household members for TB symptoms. From 2006, 454 MDR and 532 XDR-TB index cases (total 986) were mapped and screened to identify household transmission. Sputum for AFB, cultures, DST was performed on all TB suspects. All under five were referred to hospital to be seen by a clinician.

**Results:** From 986 DR TB index cases, 4431 household contacts were identified, 3038 cultures were done. Number of contacts diagnosed with MDR 32, XDR 41, total DR 73. The survival of household contacts has improved compared to the index MDR/XDR-TB patients.

**Conclusion:** Household contact tracing is an important public health intervention strategy. During this period, new cases of DR were diagnosed at an early stage which interrupted the chain of transmission and improved the survival among the household contacts.

### PC-1208-30 Philippine experience: partnership in scaling programmatic management of drug-resistant TB

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**Background:** The Philippines is one of the countries with scale up plan for MDR-TB implementation which aims 80% of the estimated incident MDR cases by 2015. The Department of Health (DOH) as the steward in implementing PMDT has laid the policy environment for PMDT through Administrative Order (A.O.) # 2008-0018 as the 'Guidelines for the Programmatic Management of Drug-resistant TB (PMDT.)' The suspension of the GFATM Grant in September 2009, the total withdraw of a non government organization from PMDT by end of March 2010 have created a new scenario for the delivery of TB services.

**Political commitment:** The Department of Health has taken over full responsibility and the lead for managing and delivering PMDT, whilst the new PR (PBSP) is managing the GFATM TB Grant, not a part of the implementers of the GFATM funded TB projects. The commitment of the Lung Center of the Philippines, a tertiary government hospital to assume overall responsibility of PMDT in the country is in line with the planned over drug-resistant TB management.

**Partnership:** The multisectoral involvement by all stakeholders, including international agencies, have strengthened the Public/Private mix DOTS; Advocacy Communication and Social Mobilization; TB Laboratory strengthening to improve diagnosis. The DOH with partners have lead identifying the gaps and requested WHO assistance in the field of drug/supply management; infection control measures; information system.

**Results:** Relocation of the 139 MDR-TB patients from MMC/TDF to other Treatment Centers in NCR and Region 4A in April 2010 has worked quite well. Patients have continued quality treatment and care. Additional 5 treatment centers to the 10 existing centers were established. Introduction of new diagnostic tools.

**Conclusion:** New opportunities in simplified case finding/treatment strategies, recording and reporting of the PMDT, laboratory strengthening; drug management; monitoring system.

### PC-1217-30 Management of DR-TB among the San community, Namibia: a call for community engagement

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**Background:** Namibia started nationwide implementation of programmatic management of DR-TB in 2008. Tsumkwe constituency is in a remote part of Namibia, home to the indigenous marginalised San people. While Tsumkwe has about 10% of Otjozondjupa region's population, it contributed 15% of the region's overall TB burden in 2010, and 87.5% of the region's MDR-TB burden. This hitherto undocumented outbreak of MDR-TB came to light when 19 of 32 patients absconded from treatment at the district hospital 300 km away.

**Interventions:** An investigation was carried out to determine the reasons for the patients' withdrawal from treatment. Interviews with health workers (HCWs) blamed the patients' decision on the perceived 'primitive' nature of San, as well as alcohol dependency and a general dislike for modern medicine and conventional rules. Focus group discussions with patients, their relatives as well as traditional leaders revealed

that patients did want treatment but were unhappy with the disrespect shown by the health care workers as well as the distance to the district hospital which interfered with their egalitarian and communal decision making lifestyle. The traditional leaders were requested to discuss the need for the patients to recommence treatment for MDR-TB.

**Results:** Through the engagement of traditional leaders, patients, local government, a local non-governmental organization, and with the Ministry of Health only providing technical support, all 19 patients were re-registered for treatment, to be delivered at an ambulatory center which was set up near the local clinic, supported by a soup kitchen.

**Conclusions:** Lack of sensitivity to socio-cultural peculiarities can have a severe impact on health care delivery, with dire consequences for the spread of TB. Mutual respect and trust between patients and HCWs is paramount in achieving treatment success; and the health care delivery system should be flexible enough to respond to the needs of unique communities.

## TOBACCO CONTROL: THE SUCCESSES AND CHALLENGES IN RAISING AWARENESS AND DEVELOPING PARTNERSHIPS

### PC-90-30 Best practice tobacco control media campaigns in Russia and Eastern Europe, 2008–2011

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Russia, Poland and Ukraine—countries where smoking prevalence is among the highest in Europe, were able to simply adapt a campaign created in New York City where it was found to be highly effective in reducing smoking prevalence. The campaign materials were pre-tested, adapted for the countries and evaluated post campaign using intercept surveys. The ad ‘Cigarettes are Eating you Alive’ was utilized for mass media campaigns that included TV, radio and billboards as well as the news media to extend the reach of the campaign. The campaigns were supported by World Lung Foundation in conjunction with national and regional ministries and NGOs and were designed to support smoke-free initiatives, in an effort to begin to reduce smoking prevalence, support smoke-free initiatives and change social norms around smoking. In Russia, the ads generated significant discussion with loved ones, among those who saw it, in Ukraine one in two smokers considered quitting after seeing the ads and in Poland and Moscow city, calls to the national quit line increased significantly compared to previous months in that year (2009) and the same period a year earlier.

### PC-422-30 Innovative media engagement to turn the tide . . . breaking out of media clutter

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**Premise:** Media engagement is rather expensive and very crowded. We at Salaam Bombay Foundation use media innovatively to galvanize a movement against tobacco.

**Presentation:** Two media campaign cases:

- Quit Tobacco Movement (QTM) 2008—Campaign based on Quit India movement—India’s Freedom struggle during the British raj leading to Salaam Bombay Children, becoming the voice of the leaders urging people to fight for freedom from tobacco.
- Proud to be Tobacco free 2009—The 2008 law needed public support in implementation. This campaign took on the challenge of establishing the pride each citizen felt in making the city smoke-free. Above the Line (ATL) and Below the Line (BTL) was leveraged supported by school and community level initiatives. Salaam Bombay Foundation children modeled for the campaign and took it across communities through the advocacy initiative.

**Unique techniques:**

- Focus on radio and free air time opportunities
- Support with ground activation plans to make campaign larger than life
- Strategic tie ups like Soaps, sitcoms, radio programmes etc to carry the message at prime time
- Piggy back on religious celebrations and enlist community involvement
- Involve cultural norms in an innovative fashion.

**Outcome:** Reach—Measurable in above the line (ATL) only.

- Print—reach
  - Footprints—276
  - Readership—10 million
- Electronic—
  - Clippings shown—53
  - Viewership Reach (approx) 10 million

**Movement:**

- Children getting a high in messaging
- Children getting a platform to building life-skills through constant media exposure
- Tobacco control in kids—‘a cool thing to do’
- Government takes action around schools on sale of tobacco within 100 yards
- Several religious pandals, communities and schools took the Smokefree message forward
- 3 schools declare themselves tobacco free.

### PC-540-30 Smokers' responses to anti-tobacco television advertisements: results from ten low- to middle-income countries

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**Background:** While television advertisements (ads) that communicate the serious harms of smoking are effective in prompting quitting-related thoughts and actions among smokers, little research has been conducted among smokers in low to middle income countries (LMICs) to guide public education efforts.

**Method:** 2399 smokers aged 18–34 years in 10 LMICs (Bangladesh, China, Egypt, India, Indonesia, Mexico, Philippines, Russia, Turkey, Viet Nam) viewed and individually rated the same five anti-smoking ads on a standard questionnaire and then engaged in a structured group discussion about each ad. Multivariate logistic regression analysis was performed to compare outcomes across ads and countries adjusting for covariates.

**Results:** Three ads with graphic imagery—showing human diseased body parts or using a visceral metaphor to demonstrate tar accumulation in smoker's lungs—performed consistently highly across all countries. A personal testimonial ad performed more variably, with many smokers not appreciating features of the woman's smoking-related disease. An ad using a visual metaphor for lung disease was also more variable, due mostly to lack of understanding of medical terms.

**Conclusion:** Television ads that graphically communicate the serious harms of tobacco use in an emotional manner are likely to be effective with smokers in LMICs, and can be readily translated and adapted for local use. Ads with complex medical terms or metaphors, or those that feature personal testimonials, are more variable and at least require more careful pre-testing and adaptation to maximise their potential.

### PC-563-30 Dirty tricks of the tobacco industry: the Indonesian experience

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**Background:** Indonesia is the 3rd country with largest number of smokers in the world. Indonesia is in the process of developing tobacco control laws and regulations.

**Dirty tricks:** On legal level, dirty tricks by the industry are lobbying parliamentarians and government officials to delay passing and weakening tobacco control laws, deleting articles in the new 2009 Health Law stating that tobacco is addictive, certain individuals are used to carry out a judicial review at the

Constitutional Court that tobacco is not addictive, using media to state that tobacco is not harmful, review a book and papers that there is international movement to harm the industry. Public universities and the medical profession are used to protect their interests. On the community level, use tobacco farmers and cigarette factory workers to rally against the government at central and provincial level claiming that tobacco control laws and regulations will cause loss of jobs and income.

**Response and counter action:** The Indonesian Tobacco Control Network (ITCN), consisting of NGOs, professional organizations, and academicians involved in advocating decision makers and counter industry strong lobby and dirty tricks. Very focused advocacy is done to influence parliamentarians and ministers, distribute evidence base information and data on harm of smoking, tobacco tax, diversification of tobacco farming, industry manpower. Active use of mass media is done and journalists are trained in tobacco control. Police involved and the issue of constitutional corruption to attack the industry.

**Conclusions and recommendations:** Pressure parliament and government officials are now showing results. Tobacco control laws and regulations will be passed in 2011 or 2012. ITCN advocates that laws and regulations should be in line with the best practices of tobacco control.

### PC-976-30 Impact of media campaign on support for smoke-free policy: the case of Lebanon

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**Objective:** To evaluate the impact of a month-long national media campaign in June 2010 on the knowledge, behavior and attitudes of the public, in particular support for smoke-free policy. Various media were used, including a two-week long television advertisement, adapted from another national campaign, focusing on second-hand smoke (SHS) harm in a restaurant setting.

**Methods:** A questionnaire was developed and piloted; cross-sectional design was used on a randomly selected sample of 770 household landline telephone numbers (5% approximation, CI 95%). The questionnaire was administered by telephone to willing adult participants.

**Results:** A total of 437 individuals participated (56.8% response rate). Thirty-day smoking prevalence was higher among males than females (45.8%, 33.8%;  $P = 0.014$ ), with 5% of smokers reporting use of both cigarette and arguileh (waterpipe). A majority of 58.4% were exposed to the campaign through one



or more of the media used (road billboards, 30.5%; television, 29.0%; mall posters, 17.0%; radio, 16.7%; newspapers, 15.1%; magazines, 10.5%). The majority (93.8%) considered SHS harmful, with no difference between smokers and non-smokers ( $P > 0.05$ ). Among those exposed through television, two-thirds of smokers reported the advertisement motivated them to decrease or quit smoking. Individuals exposed through television were more likely to be bothered by SHS in restaurants (80.2%, 65.8%;  $P = 0.001$ ) and bars/nightclubs (81.0%, 66.4%;  $P = 0.005$ ) but not in other locations, and were also more supportive of banning smoking in all indoor public places (96.8%, 89.6%;  $P = .013$ ).

**Conclusion and recommendations:** The campaign was able to reach the majority of the population, strengthen support for tobacco control, in particular smoke-free policy, and motivate reduction/cessation. The use of a relatively modest number of televised media spots for a short period in a developing country has considerable impact to support tobacco control.

#### **PC-1053-30 Role of vernacular media in mainstreaming public health issues: the example of tobacco control**

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**Aim:** Tobacco control issues are poorly reported in regional and local language papers in India. Given its high use, any efforts to research and report on tobacco control issues is met with resistance from people, decision makers and policy makers. Indian Media Centre for Journalists undertook a two year project to train rural media persons on harms of tobacco use and locally relevant tobacco control issues.

**Methods:** The IMCFJ project through support of Bloomberg Philanthropies demonstrated that taking tobacco control messages to the grassroots through local language newspapers create widespread awareness, influence local decision makers, and improve implementation of the law and administration of the tobacco control programme.

**Results:** Between September 2008 and February 2011 IMCFJ conducted 22 training programmes and trained 780 vernacular mediapersons, who published nearly 1455 articles in their papers. Articles by participants were uploaded in a participant-managed blog ([www.j2jtobacco.blogspot.com](http://www.j2jtobacco.blogspot.com)).

**Conclusions:** Training local language journalists is an important vehicle for public awareness. Through the two year trainings, majority of the journalists were more aware of the harms of tobacco and tobacco control policies. Trained journalists were able to identify, research and report on tobacco related stories independently, resulting in better researched and in-depth,

locally relevant stories appearing in local papers. All major regional Hindi (22 papers with a circulation of more than 10 million copies a day) and Urdu papers have reported more on tobacco related stories as compared to the previous years. Local media is perceived as a strong ally in the tobacco control movement at state and local level.

#### **PC-1131-30 Advocating to create smoke-free area regulation in Bogor City**

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**Background:** Bogor City since 2009 has a specific local regulation about smoke free area, it's called as Perda no. 12/2009. This achievement can happen because the efforts to advocate local parliament to accelerate draft of the regulation approved as a smoke free regulation.

**Method:** The procedure and mechanism of advocating done through do socialization, information dissemination of tobacco harmful effects, campaign, dialogue, survey, press conference, put stickers, billboards and banners, hearing with local parliament. Period of activity was one year before the regulation approved.

**Results:** The advocating was done in three ways. The first way was to get support from community with activities such as public poll, campaign, survey, strengthened networking via regular meeting with health professional, hotel and restaurant association, academic community, public transport driver community, religion figures, and non governmental organization to support draft the regulation approved. The second way was to disseminate the information of tobacco harmful effects through film, leaflet or folding brochure, press conferece, seminar, interactive dialogue at radio and making articles at newspaper. The third way was to get support from local parliament with activities such as meeting with local parliament regularly.

**Conclusions:** The regulation is approved by local parliament. Advocating can accelerate the regulation approved.

#### **PC-1317-30 Educating communities on tobacco use: role of health workers in creating public awareness and influencing behaviour change**

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**Setting:** Based on a request from the Ministry of Health and Family Welfare, Government of India, the guide was developed by the Directorate General of Health Services in collaboration with The Union. The guide gives essential knowledge on the problem,

tobacco control legislation, and the adverse health effects of tobacco use and second-hand tobacco smoke, through focused messages that health workers can directly use at the most basic level. It has been disseminated through India's National Rural Health Mission to empower front-end health workers on a large scale. It has already been translated into seven Indian languages.

**Methodology:** A pilot training of health workers was organised in May 2010 in Hamirpur and Chandigarh using English version of the health worker guide with an aim to assess the usefulness of the guide as a basic guide to train the health workers for undertaking tobacco control activities at community and village levels. The methodology involved pre-training evaluation of participants, followed by participatory discussion and post-training evaluation. In total 138 and 133 health workers in three batches each were trained each at Hamirpur and Chandigarh respectively. This methodology helped in clarity on the knowledge transfer through this tool, a process for facilitating the training through training institutions routinely used by NRHM/health departments and standardization of the training process, and the capacity built in the health worker through the effective use of the guide.

**Evaluation:** An evaluation of trained health workers in educating the communities will be done in May 2011 and the findings will be presented at the conference. The outcome indicators will include: proportion of health workers who can effectively communicate with the community on ill effects of tobacco use; proportion of community members who are aware of the ill effects of tobacco use; increase in quit rates/attempts among current users/decrease in consumption of tobacco.



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