PULMONARY TB AMONG MYANMAR MIGRANTS IN SAMUT SAKHON PROVINCE, THAILAND: A PROBLEM OR NOT FOR THE TB CONTROL PROGRAM?

Ranee Wongkongdech[1], Sompong Srisaenpang[1] and Sasithorn Tungsawat[2]

[1]Department of Community Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen; [2]The Office of Disease Prevention and Control 6 Khon Kaen Province, Department of Disease Control, Ministry of Public Health, Nonthaburi, Thailand

Abstract. Most transnational migrant workers in Thailand are from Myanmar, a country with a high tuberculosis prevalence. We investigated the prevalence of suspected pulmonary tuberculosis (TB) among Myanmar migrants in communities of Mueang District, Samut Sakhon Province, Thailand. Symptom screening for those with a productive cough of more than 2 weeks was conducted by face-to-face home interviews with 4,874 participants aged at least 15 years. Most subjects (75%) were aged 15-34 years (75%), 52% were male and 60% were married. Subjects typically lived with fellow nationals in crowded, poorly ventilated apartments or row houses. Ten subjects had suspected TB, giving a prevalence rate of 0.2%. Ninety-seven percent were working in Thailand legally but 80% had no health insurance. None had sought community health services; all preferred self-medication and private clinics due to stigma associated with TB, medication costs and health center waiting times. Providing information about health insurance and introducing TB prevention and control in this group should be considered. Further studies are needed to develop a TB control program and communicable disease surveillance among migrant communities, in Thailand.

Keywords: pulmonary tuberculosis, prevalence, symptom screening, Myanmar migrant workers, Thailand

INTRODUCTION

Thailand ranks in the top 22 tuberculosis (TB) prevalence countries worldwide with an estimated TB incidence and prevalence of 0.124% and 0.182%, respectively (WHO, 2011); this is 2.5 to 4 times higher than that of Europe and the Americas (WHO, 2011). Myanmar is the source of most of Thailand's transnational migrant workforce and has a 0.384% incidence and 0.525% prevalence for TB (Bureau of Tuberculosis, 2011). The potential implications for TB control in Thailand are serious.

In Samut Sakhon, a small coastal province in central Thailand, the new TB case notification rate among non-Thais at a private hospital was 7 times higher than the overall rate for Asia (Arshad *et al*, 2010; Samut Sakhon Provincial Public Health Office, 2011). This province ranks second only to Bangkok in foreign migrants (Institute for Population and Social

Correspondence: Dr Sompong Srisaenpang, Department of Community Medicine, Faculty of Medicine, Khon Kaen University, Khon Kaen 40002, Thailand.
Tel: +66 (0) 86 861 0484
E-mail: sompong@kku.ac.th

Research, 2011). Although the actual number of illegal migrants, or those outside of the governmental reporting system, is unclear (Huguet and Chamratrithirong, 2011); it is estimated the number may be twice or triple the known number (Chamratrithirong *et al*, 2011), possibly 400,000 persons in total (Srakeao, 2011). About 90% of these migrants are from Myanmar a country with one of the highest burdens of TB and multi-drug-resistant (MDR) TB in the world (WHO, 2008). About 70% of them live in Mueang District, which has 27 community clusters consisting of 500-15,000 people (Senate Committee on Foreign Affairs, 2009). This province ranks second in Thailand for gross domestic product (GDP) (Office of the Committee on National, Economic and Social Development, 2009), derived primarily from export of processed seafood products (Rodnual, 2008). Fishing and fish processing drives demand for cheap labor from neighboring countries. The migrants come for better work and compensation opportunities than those available in their home countries and are more willing to do hard, risky and dirty work (Kerdmongkhol, 2009). Samut Sakhon is first in Thailand for seafood processing and wholesaling. There are about 5,000 factories in the province in addition to "loang", high-roofed greenhouses, or, small house-based enterprises (Archavanitkul and Wachanasara, 2009).

Several factors increase the risk of TB spread among these migrant communities, such as overcrowding and poorly ventilated housing (Chamratrithirong *et al*, 2011). Some migrants are poorly nourished, and do not present to health centers when they have health problems, or even when their health worsens (Aung *et al*, 2009). They may lack health knowledge, cannot communicate in the Thai language, and are often illiterate (Chimbanrai *et al*, 2008). Many have no health insurance (Tesana and Butsorn, 2007), or legal migrant status (Aung *et al*, 2009). Inadequate reporting systems and lack of integration with health services affects delivery TB control services (Srisaenpang *et al*, 2006; Bureau of Tuberculosis, 2011).

We conducted this study to investigate the prevalence and distribution of suspected pulmonary TB (PTB) cases and factors that influence TB control among Myanmar migrants in Mueang District, Samut Sakhon, Thailand. This information can inform TB control authorities in Thailand and Myanmar to improve TB control in these countries.

MATERIALS AND METHODS

Study site

This study was conducted in Mueang District, Samut Sakhon Province, a central, coastal province along the Gulf of Thailand with large fishing and fish processing industries that attracts many migrant workers. The study was implemented with the agreement and support of the governor, the chief of the provincial health office, the chief of Ban Kampra Tambon Health Promotion Hospital and the village headman.

Study design

This was a cross-sectional survey using questionnaire data obtained through face-to-face interviews. Identified "suspected" TB cases were then followed up with an in-depth interview.

Participants

Participants consisted of 4,874 Myanmar migrants selected using a one-stage cluster sampling method. Inclusion criteria were Myanmar migrants without Thai nationality living in Mueang District,

aged at least 15 years who had migrated to Mueang District for work, or "followers" (family members or children who came with the worker migrants), and lived in the community for at least three months. Both legal and illegal migrants were included in the study.

Instrument

The survey questionnaire covered 3 main areas: 1) suspected PTB symptoms, such as productive cough of more than 2 weeks, blood stained sputum, chest pain, breathlessness, hemoptysis, fever, night sweats, tiredness, weight loss, fatigue and loss of appetite (WHO, 2013); 2) socio-demographic details, work and legal status, health insurance, occupation, type and period of residence in Thailand; and 3) a history of TB treatment in their family or workplace.

The questionnaire was developed using WHO and Thai Public Health Ministry guidelines regarding TB symptomology. The questionnaire was developed in Thai initially. To assure validity it was then translated into the Myanmar language by a health worker with Thai/ Myanmar language fluency and then back-translated from Myanmar to Thai by another worker.

Data collection

The data collection team consisted of 3 interpreters, foreign health provincial government employees who could communicate well in both the Thai and Myanmar language, 7 foreign volunteers (Myanmar) and the first author (RW). First, field practice was carried out until team members could all interview accurately. Then, the 11 member team interviewed participants face-to-face, at their work if factory owners gave permission, or at the participants' homes, if the researchers were not permitted to access the factory or Loang-provided accommodation. Interview times were restricted to Sundays, before or after work.

Given the immigration status of this population, full confidentiality was stressed to the participants and verbal rather than written consent was obtained from each subject. Each participant was given a gift for their participation. (A pen and health pamphlets value about THB50.00). Participants with suspected PTB were advised to seek appropriate health care and interviewed in more detail.

Data analysis

All questionnaire data were checked and double entered into Microsoft Excel version 2007 and validated using Epi-Info (version 3.5.4) and then entered into Stata (version 13.0) to perform statistical calculations. Follow-up interviews were organized into a case study narrative format.

Ethical review

The study was approved by the Khon Kaen University Ethics Committee for Human Research (HE 561050).

RESULTS

Sociodemographics, employment and accommodation

Ninety-seven point five percent of potential participants agreed to participate. There were 4,874 participants. Fifty-one point seven percent were men, 75% were aged 15 and 34 years (mean: 28.87; range 15-85 years). Sixty-one percent were married, 36% were single and 3% were widowed or divorced. Ninety-five percent reported having a legal immigration status; 97% had a passport, 96% had a Thai labor card and 95% had a Thai temporary registration card TR 38/1. Three percent reported having no legal documents. The researchers could not verify the above

Table 1
Participant demographics, employment and accommodation data.

Characteristics	Number (%)
Gender (*n*=4,874)	
Male	2,525 (51.8)
Female	2,349 (48.2)
Age (years) (*n*=4,874)	
15-24	1,805 (37.0)
25-34	1,843 (37.9)
35-44	867 (17.7)
45-54	292 (6.0)
55 or more	67 (1.4)
Mean 28.9, Range 15(85 years, SD 9.1	
Marital status (*n*=4,874)	
Married	2,984 (61.2)
Single	1,728 (35.6)
Widowed	98 (2.0)
Divorced	64 (1.3)
Immigration documents (*n*=4,853)	
No legal documents	141 (2.9)
Passport	4,712 (97.1)
Thai Labor card	4,676 (96.4)
TR38/1: Temporary registration card	4,610 (94.9)
Health Insurance (*n*=4,868)	
No health insurance	3,880 (79.7)
Thai Health card	938 (19.3)
Thai Social Security card	19 (0.4)
Occupation (*n*=4,007)	
Unemployed	56 (1.4)
Seafood processing (factory)	1,097 (27.4)
Seafood processing (Loang)	2,335 (58.3)
Fishing	17 (0.4)
Construction	39 (0.9)
Woven sack factory	17 (0.4)
Biscuit factory	202 (5.0)
Other	244 (6.1)
Type of residence (*n*=4,215)	
Apartment	2,869 (68.1)
2 floors	1,694 (40.2)
3 floors	691 (16.4)
4 floors	407 (9.7)
5 floors	77 (1.8)
Row house	1,225 (29.1)
House/cottage	101 (2.4)
Temporary room with curtain dividers	20 (0.5)
Number of people per room (*n*=4,292)	
One person	56 (1.3)
2-4 persons	3,256 (75.8)
5-7 persons	938 (21.8)
8-10 persons	37 (0.8)
11-12 persons	5 (0.1)

Table 2
History and symptoms of PTB.

		No.	Prevalence rate
History of TB and treatment in family (*n*=4,874)			
No		4,865	99.8
Yes		9	0.1
Undergoing treatment		3	0.1
Default		2	0.0
Successfully treated		4	0.1
	Frequency	Prevalence rate	95%CI
Symptoms (*n*=4,874)	10	0.2	(0.07,0.30)
Cough ≥ 2 weeks with phlegm, including hemoptysis	10		
Hemoptysis	0		
Unintentional weight loss	7		
Low grade fevers or night sweats	4		
Chest pain with cough	5		
Other	2		

data given participant fears about being caught. Twenty percent reported having a foreign worker's health card for free access to Thai health services. This appeared to be due to the high application cost (7,000 Baht for the first year), cumbersome processing and long lead time before they received the card, difficulties using the service, and long wait times requiring time away from work. Many thought the card was unnecessary since they were healthy and private clinic access was faster, saving time away from work and their jobs were not stable, and might require a change in their job or workplace. Health insurance coverage is not mandatory for workers at small establishments (Loang). Most factory workers were required to have a social security health card to access hospitals and some factories had their own health care services.

Most participants worked in seafood processing (95%) and 58% worked in fish processing in a Loang. Twenty-seven percent at a large seafood export factory. Fourteen percent were employed in construction or in garage factories making plastic products, biscuits, sacks, or noodles. One percent were without a job: they were pregnant women, women with a young baby, elderly or unable to work. Some worked preparing sun dried anchovy fish in nearby residential areas, but had a low, unstable income.

Most workers resided near their workplace in private accommodations with their own ethnic groups (*eg*, Burmin or Mon). Sixty-eight percent lived in apartment blocks containing 10-100 apartments at a cost of 2,000-3,000 baht per room per month not include water supply and electricity. Twenty-nine percent rented a floor in a row house consisting of 5-40 apartments. Two percent rented a house

or cottage and a small number stayed in temporary rental rooms with curtain dividers. Seventy-six percent shared a room with 2-4 people per room, 22% shared a room with 5-7 people per room and 1% shared a room with more than 8 people per room. Most residences were narrow, crowded, had poor ventilation and sanitation and had no windows. Often all life activities were carried out in the same room. Most of the rooms were clean and neat, but the room or building surroundings, contained drainage ditches or rivers filled with garbage or sewage, especially at low tide. Table 1 shows participants' social demographics, employment and accommodations.

Prevalence of PTB history and suspected PTB

Nine participants (0.1%) had a history of PTB and treatment; completed treatment successfully, 3 were currently receiving TB treatment and 2 defaulted on treatment and had PTB symptoms. Ten participants (0.2%) (95%CI: 0.07-0.30) had PTB symptoms. All 10 suspected PTB cases reported cough with phlegm, sometimes with bloody sputum and long standing chest pain with cough. Five had unintentional weight loss of 1-2 kg, and 4 had fevers or night sweats (Table 2).

Follow-up interviews with suspected PTB cases

The 10 participants suspected of having PTB had a mean age of 37.5 years (range 24-50 years); 7 were males.

Case 1. He was a thin, middle-aged builder who lived with 5 persons including his youngest child, aged 10 years. He had lived in Thailand for 22 years in a row house near a government health facility. He had been treated for TB at private clinics for 4 weeks the previous year, but stopped treatment because of high cost and because he felt better. He then went to a government hospital and was told he did not have TB. A year later, he developed cough productive of bloody sputum, chest pain, fever and weight loss for a month. Although he suspected he had TB, he could not afford treatment and needed to work. He was self-medicating with herbal medicine from Myanmar and stated that *"worked hard all day until he sweat which made (me) feel more comfortable and my condition (will) improve"*.

Cases 2 and 3. There were 2 cases in 1 family, a father and his 7 year old daughter. The lived with the girl's mother. Seven years previously, the father had been diagnosed with TB and received 5 months uninterrupted treatment from a government hospital, until treatment was considered complete. Now he had cough with phlegm and occasional blood in his sputum. The family had not sought medical treatment since they expected their symptoms would improve soon and did not believe it was TB.

Case 4. He was a young man who worked at a factory 20 kms from his home. There was a shuttle service leaving at 5:00 AM and returning approximately 8.00 PM and he always worked overtime. He had symptoms for more than 2 months, including cough with phlegm, weight loss and low grade fever. He did not seek treatment because he was *"too busy"* and *"it was not a severe illness and unlikely to be TB"*. He purchased medicine from a drug store and used herbal medication from Myanmar. He had to keep working because if he was absent or suspected of having TB he would be fired.

Case 5. She was a 40 year old, thin woman who weighed only 36 kgs and had chronic cough, chest pain and low back pain for more than 3 months. She had a 1

year old breast feeding son. Her husband had not returned from work on a fishing boat over a year previously and the family was very poor. The eldest son worked to support the family, but he had to send almost all of his money to a broker. They had illegal labor documents. A neighbor helped to provide medicines to relieve her symptoms. The woman did not go to the hospital due to a lack of money, no child care and fear of being caught.

Case 6. This woman lived in dark, poorly ventilated rooms modified from a garage with her husband. She had self-medicated but thought the symptoms were not severe. She feared other people would suspect her of having a dangerous disease if officials or strangers visited her home.

Four other suspected PTB cases all initially agreed to a follow-up interview after the first survey, but two returned to Myanmar for treatment and the remaining two declined, apprehensive it might affect their lives and jobs. A month later the researcher attempted further interviews with 6 suspected PTB cases but could only find 2 of them still living and working in the same place. They had not sought health care although they still had symptoms.

DISCUSSION

We studied the prevalence of suspected PTB among migrant Myanmar workers in Samut Sakhon Province, Thailand. Out of 4,874 migrant workers examined, we found 9 with a previous history of PTB and 10 with suspected PTB, giving a suspected PTB prevalence rate of 0.2%. This finding differs from the WHO (2011) estimate for Myanmar of 0.525%. Naing *et al* (2012) found 29.8% of migrant workers (6% factory workers) in Songkhla Province, southern Thailand had TB symptoms. A Myanmar government survey found 3.3% of those examined had TB symptoms (Ministry of Health, The Republic Union of Myanmar, 2011). Our researchers noted others living in the same apartment blocks had TB symptoms in some participants who reported no symptoms during the formal interview.

We believe the reported 97% of participants having appropriate Thai residence/labor documents to be an overestimate; their reported 80% having no health insurance coverage is inconsistent with this 97% proportion. This hard to reach, vulnerable, marginalized group is open to exploitation by employers and law enforcement authorities, especially if they are illegal migrants. They did not trust strangers because of fear of capture and repatriation back to Myanmar, also inconsistent with the 97% reported rate of Thai legal documentation. We did not visually verify their documents. It is possible the "legitimate" labor force is small. There is understandable reluctance to acknowledge health problems and/or access health care services.

There are three major factors that influence these suspect legal documentation rates. The first is data bias due to worker fear of the social stigma attached to TB and possible detection by authorities without having an appropriate legal status. Fear of losing their job if they admitted to having TB symptoms was common and fear of being repatriated to Myanmar if they had a contagious disease. Therefore, some who had obvious symptoms went back to Myanmar then returned to work again.

Our research team took steps to build trust. The lead researcher stayed at the sub-district health promotion hospital and became known to migrants who

used those services and also observed local religious community events, such as the Candle Festival and a priest ordination ceremony. Small gifts and health education material were givien to all participants. The team used Myanmar volunteer interpreters and local health workers when approaching participants. This required care, since the familiar health worker uniform and ID card creates anxiety among those in the accommodation blocks, suggesting the presence of a severe disease such as TB or a legal status problem. Hospital staff who provided home-based DOT treatment parked their official cars away from patient accommodations to be less conspicuous.

Another factor was selection bias due to difficulty in accessing participants with TB risk factors. Some factories and dormitories did not allow researcher access to employees, especially in Loang. Only 5 of the 103 sites allowed us access (2 suspected cases were found in the 5 sites accessed). Many participants had to be interviewed on weekends, holidays before or after work. Those who worked the night shifs, slept during the daytime and could not be interviewed. Some factory owners claimed that an annual worker health check was provided if workers had an immigration document, health or social security card, or that workers were referred to nursing or health care providers if they had symptoms; 2 suspected cases were found in a dormitory near one factory. Foreign Health Volunteers (PHAMIT) assisting with local TB surveillance and free TB drug distribution screened for TB at some factories. However, even after following appropriate local government and community leader research approval processes, some factories only permitted access to a human resource manager or security staff. There was a fear that factories would be closed or orders would stop if workers with TB were identified.

The third bias was summary measure bias due to incorrect health beliefs among participants. For example, some believed PTB symptoms must be severe and should always include hemoptysis, chest pain, breathlessness or cough for 2 weeks before needing treatment. Therefore, when questioned about suspected PTB they replied in the negative. Active case detecting might have identified more cases than passive case detection, which we used in our study.

In summary, we studied the prevalence of PTB symptoms among Myanmar migrant communities in Samut Sakhon, a small coastal province in central Thailand. Our data findings probably underestimate the PTB prevalence rate and overestimate the legal documentation rate. Migrant workers were living in high risk TB transmission conditions with poor health service access. This poses a serious challengs for TB control programs.

We recommend developing active case screening methods to ensure more accurate migrant TB prevalence estimates and reviewing mandatory community health center services, such as specific budgeting for TB screening and treatment in high risk populations. We recommend stronger collaboration across Thai and Myanmar health agencies and more effective engagement with factory and dormitory owners. Improving health outcomes among these Myanmar migrant groups requires stronger surveillance, treatment and control strategies than exist at present.

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REFERENCES

Archavanitkul K, Wachanasara K. The migrant act: The work of aliens 2551 with the occupation lists for foreigners. (Online) [Cited 2012 Aug 8]. Available from: http://research.mol.go.th/2013/rsdat/prg/showdetail.php?vid=LGWLWM1&title

Arshad S, Bavan L, Gajari K, Paget SNJ, Baussano I. Active screening at entry for tuberculosis among new immigrants: a systematic review and meta-analysis. *Eur Respir J* 2010; 35: 1336-45.

Aung T, Pongpanich S, Robson MG. Health seeking behaviors among Myanmar migrant workers in Ranong province, Thailand. *J Health Res* 2009; 23: 5-9.

Bureau of Tuberculosis, Department of Disease Control, Ministry of Public Health. TB situation report cohort 1/2011. Nonthaburi: Bureau of Tuberculosis, 2011. [Cited 2012 Jul 7]. Available from: URL: http://www. tbthailandorg/images/present/pre-20110608123507-1.pdf

Chamratrithirong A, Holumyong C, Aphipornchaisakul K. Livelihood of migrant workers in 11 major provinces of Thailand in 2010. Nakhon Pathom: Institute for Population and Social Research, Mahidol University, 2011. [Cited 2013 May 7]. Available from: http:// http://www2.ipsr.mahidol.ac.th/ ConferenceVII/Download/2011-Article-08.pdf

Chimbanrai B, Fungladda W, Kaewkungwal J, Silachamroon U. Treatment-seeking behaviors and improvement in adherence to treatment regimen of tuberculosis patients using intensive triad-model program, Thailand. *Southeast Asian J Trop Med Public Health* 2008; 39: 526-41.

Huguet JW, Chamratrithirong A. Thailand Migration Report 2011. Migration for development in Thailand: Overview and tools for policymakers. Bangkok: IOM Thailand, 2011. [Cited 2012 Aug 7]. Available from: http://www.dpiap.org/resources/pdf/TMR-2011_12_03_27.pdf

Institute for Population and Social Research, Mahidol University at Salaya, Phutthamonthon, Nakhon Pathom. The program of population & housing census 2010. Nakhon Pathom: Institute for Population and Social Research, 2011. [Cited 2012 Febuary 26]. Available from: www.ipsr.mahidol.ac.th/ipsr/ Research/WatchCensus 2010

Kerdmongkol A. Thai government policy on migrant workers and their social and cultural effect.The report presented at 4th Asia Human Rights Forum; February 17, 2009 at Korea University in Seoul, South Korea "Migrant workers' contributions and local perceptions in Asia".

Ministry of Health, the Republic Union of Myanmar, Department of Health National Tuberculosis Programme. National Tuberculosis prevalence survey 2009-2010. Naypyidaw: Ministry of Health, 2011. [Cited 2013 Mar 7]. Available from: URL: http:// http://www.searo.who.int/myanmar/documents/TB_Prevelence_Survey_report.pdf

Naing T, Geater A, Pungrassami P. Migrant workers' occupation and healthcare-seeking preferences for TB-suspicious symptoms and other health problems: a survey among immigrant workers in Songkhla province, southern Thailand. *BMC Int Health Hum Rights* 2012; 12: 22.

Office of the Committee of the National Economic and Social Development (NESDB). The project explores the economic and social development of the household [Internet]. Bangkok: NESDB, 2009. [Cited

2012 Oct 1]. Available from: http://social.nesdb.go.th/

Rodnual P. Migrant worker lives in Thai rural community: the case study of migrant workers from Myanmar in Khokkham Sub-district, Mueang District, Samut Sakhon Province. Pathum Thani: Thammasat University, 2008. [Serial online] [Cited 2012 Jun 10]. Available from: http://http://digi.library.tu.ac.th/thesis/gv/0050/01TITLE.pdf

Samut Sakhon Provincial Public Health Office. TB situation at Samut Sakhon Province 2011. Documentation and reporting for TB meeting about TB situation in quarter 2nd, 2011.

Srakaew S. Situation of migrant workers and their children in Samut Sakhon: Labour Rights Promotion Network Foundation, 2011. [Cited 2013 Jan 2]. Available from: URL: http://www.lpnfoundation.com/LPN-Reseach/

Srisaenpang S, Pinitsoontorn S, Singhasivanon P, *et al*. Missed appointments at a tuberculosis clinic increased the risk of clinical treatment failure. *Southeast Asian J Trop Med Public Health* 2006; 37: 345-50.

Tesana N, Butsorn A. Delay in diagnosis and treatment of pulmonary tuberculosis between 1987 and 2007: literature review. *Thai J Tuberc Chest Crit Care* 2007; 29: 89-120.

The Senate Committee on Foreign Affairs. The report of trip to study in the Burmese community: 8-9 December 2009. (Online) [Cited 2012 Apr 20]. Available from: http://www.google.co.th/url?url=http://www.senate.go.th/committee2551/committee/files/committee5/samutsakorn%2520trip.doc&rct=j&frm=1&q=&esrc=s&sa=U&ei=o_LyVP6rL8vmuQTvy4DYCw&ved=0CBMQFjAA&usg=AFQjCNEehQdOwZphLPVkHdVrIog-2AWlxw

World Health Organization (WHO). Global tuberculosis control: WHO report 2011. Geneva: WHO, 2011. [Cited 2012 Jan 2]. Available from: http://www.who.int/tb/publications/global_report/2011/ gtbr11_main.pdf

World Health Organization (WHO). Systematic screening for active tuberculosis:principles and recommendations. Geneva: WHO, 2013 [Cited 2013 Oct 30]. Available from: http:// www.who.int/tb/ tbscreening/en/

World Health Organization (WHO). Tuberculosis control in vulnerable groups. *Bull World Health Organ* 2008; 86: 733-5.