A STRATEGY TO INCREASE TUBERCULOSIS CASE FINDING IN MYANMAR'S HIGH-RISK URBAN SLUMS

Min Thu*

School of Global Studies, Thammasat University, Pathumthani 12121, Thailand

ABSTRACT:

Background: World Health Organization (WHO) estimates that only 66% of the incident tuberculosis (TB) cases are reported and that 3 million new TB cases are being missed every year. The current approach to TB case detection does not reach millions of people. Poor and vulnerable people cannot access health facilities due to barriers such as financial, geographical and cultural. Poor diagnostic services, ineffective screening, drop-out during diagnostic process and substandard care outside of the NTP make the situation worse. In Myanmar, TB prevalence is higher in urban than in rural areas (330.7 vs. 216.1/ 100,000 in population ≥15 years of age). In spite of expanding DOTS services nationwide, the TB prevalence is rising, particularly in urban areas. In 2011, Population Services International, Myanmar implemented a new intensive active case finding project under TB REACH fund of Stop TB Partnership targeting slum areas of Mandalay and Yangon regions.

Objective: (1) To determine if interpersonal communication and pharmacy-based strategies can increase case detection, and (2) to determine if these strategies are effective for detecting active cases of TB that would have otherwise been missed in urban slums and areas with high TB burden.

Methods: Considering ethical factors a 'pre-post intervention' study design was applied. In a one-year period, 60 interpersonal communicators (IPCs) and 500 franchised registered pharmacies conducted health education, performed symptom screening, collected sputum and facilitated specimen transport to the franchised laboratories. IPCs referred sputum smear positive (SS+) diagnosed TB cases to the franchised DOTS clinics, sputum negative (SS -) cases with strong symptoms to the franchised chest X-ray (CXR) centers and confirmed cases to clinics. The pharmacies referred both SS+ and SS- cases directly to the clinics.

Results: Through the IPC channel, 470,384 people received health education, 23,241 TB suspected clients were referred for sputum examination, 6,539 were referred for CXR, 1,277 SS + and 1,559 SS- TB cases were registered. In the pharmacy led channel, 1,683 suspected cases were referred for sputum examination, 240 for taking CXR, and 280 SS+ and 138 SS- were registered. Compared to the previous consecutive one-year period before the project, total registered SS+ TB cases at the regional level increased by 14% (931 to 1,063 cases) in Mandalay and 9.4% (9,473 to 10,364 cases) in Yangon through this project.

Conclusion: Using IPC and pharmacies resulted in the registration of a substantial number of additional TB cases, showing that the strategy was able to reach previously unreached susceptible TB cases.

Keywords: Tuberculosis, Slum, Myanmar

DOI: 10.14456/jhr.2015.15 *Received: September 2014; Accepted: December 2014*

INTRODUCTION

Tuberculosis (TB) is the second leading cause of death from a single infectious agent after human immunodeficiency virus (HIV) infections. Globally, 8.6 million people were infected with TB in the year 2012 and among them, 1.1 million were seen in people with HIV. In 2012, 1.3 million people died due to TB which included 320,000 HIV-positive patients. In the same year, 410,000 women including 160,000 HIV positive cases died from TB. Of the overall TB deaths among HIV-positive people, 50% were seen among women showing that TB is one of the leading causes of mortality among

* *Correspondence to: Min Thu*
E-mail: min.thu@sgs.tu.ac.th

Cite this article as: Thu M. A strategy to increase tuberculosis case finding in Myanmar's high-risk urban slums. J Health Res. 2015; 29(4): 301-8. DOI: 10.14456/jhr.2015.15

women in the reproductive age group. Even among children about 530,000 became ill with TB and about 74,000 HIV-negative children died from TB in the year 2012. Since 1990, the TB mortality rate has decreased by 45% since access to TB care has expanded substantially since the mid-1990s [1].

However, WHO estimates that only 66% of the incident TB cases are reported and 3 million new TB cases are being missed every year. These missed people continue to spread the infection and many to them die from this curable disease without effective treatment. The poor and vulnerable are disproportionately affected by TB, are less likely to have access to high quality TB care because most national programs most often reach people who have access and arrive at designated health facilities with TB symptoms. There are a number of barriers to accessing health services such as cultural, geographical and financial. Apart from these, poor diagnostic services, drop-outs during diagnostic process, substandard care outside of the NTP and ineffective screening are some of the other important reasons for failure of TB case detection. Hence, it is obvious that the current approaches to TB case detection falls short and does not reach millions of people thereby limiting the impact on the TB reduction efforts to control the epidemic [2].

WHO South-East Asia Region estimated that in 2011 there was 5 million prevalent and about 3.5 million incident cases of TB which is about 40% of the global TB burden. Annually, 480,000 people die of TB in this region [3]. Out of 11 member countries, 5 countries namely Bangladesh, India, Indonesia, Myanmar and Thailand are among the 22 high TB burden countries [3]. Most cases continue to occur among young adults, especially in the most productive age group of 25-34 years and male-to-female ratio among new smear-positive TB cases was 2:1 in 2011[3].

In Myanmar, the prevalence of TB was 377-616 cases per 100,000 and the incidence of TB was 322-435 cases per 100,000 according to 2012 data [1]. The mortality rate for TB, excluding HIV positive individuals, was 23-84 per 100,000 in the same year [1]. TB prevalence in Myanmar is three times higher than global average and is the highest in Asia [4]. In 2009 and 2010, the nationwide TB prevalence survey was done in the country. According to the survey findings, smear-positive TB prevalence was 242.3 (186.1-315.3)/100,000 population aged 15 years and above, and bacteriologically confirmed TB prevalence was 612.8 (502.2-747.6)/100,000 population 15 years and above. TB prevalence was higher in urban than in rural areas (330.7 vs. 216.1/100,000 population 15 years and above) [5]. In spite of nationwide extensive expansion of the direct observed treatment short course (DOTS), the TB prevalence became higher than expected, particularly in urban areas. In 2006, DOTS coverage in the country had already achieved 95% [6]. In the second national sputum smear-positive TB survey conducted in 1994, overall smear-positive TB prevalence was 104 cases per 100, 000, and prevalence was higher in rural than urban populations (117/100,000 vs 73/100,000).

The 2009-2010 survey also revealed that 59% of smear-positive cases and 64% of TB-suspected symptomatic patients had not visited any medical service facility when they had symptoms of chronic cough [5]. They ignored the symptoms, self-medicated or visited traditional healers or pharmacies. In the survey, only 27% of smear-positive participants and 22% of TB-symptomatic participants visited medical facilities beyond pharmacies. Also, the results showed that only 15-36% of TB-symptomatic chose to seek services from the public sector [5]. In risk analysis, the survey found that non-farmers, illiterate and urban residents among the observed socioeconomic factors had an increased risk of having TB (OR>1, $p<0.05$), supporting the high notification rate in urban congestive setting [5]. Therefore, these were the primary reasons, the survey strongly recommended the following:

> "The informal sector and pharmacies that are patients' first contacts should be involved in the TB control and care network.
>
> Collaboration with the private sector, aggressive case detection measures should be taken for people in congested urban areas, where the TB burden is high."

Based on the survey's findings and recommendations, Population Services International/ Myanmar (PSI/M) implemented a one-year new active case finding project in Yangon and Mandalay, the most populated regions with large areas of slums so as to reach the unreached, suspected TB clients in 2011. PSI/M is one of the famous international non-government organizations working to improve health status of the poor and vulnerable through social marketing and franchising strategies. PSI/M has started its TB program through Public-Private Mix DOTS strategy since 2004. Its TB program has strong partnership with NTP and working in 150 townships in all states and regions in 2011 [4]. Before initiating IPC and pharmacy channels, the program has two channels – 884 active franchised DOTS general practitioners in urban and peri-urban

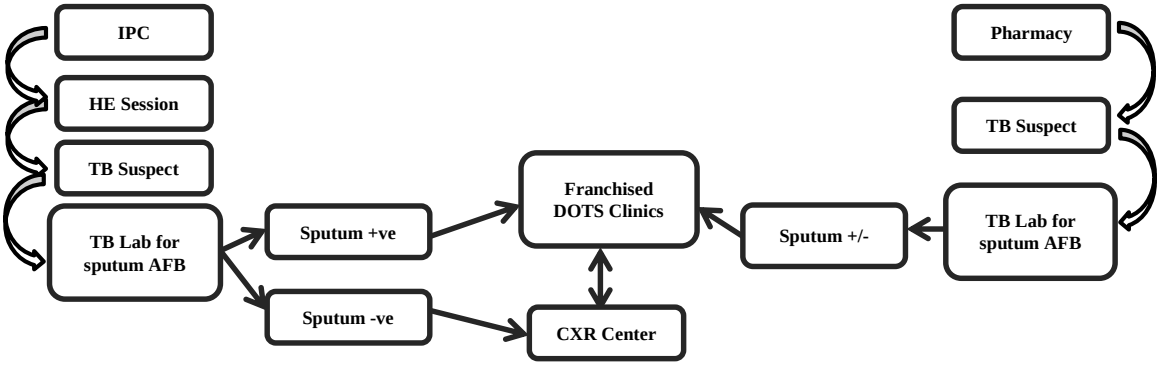

Figure 1 TB-REACH active case finding project model

areas and 1 626 primary health workers in rural areas countrywide. The former is almost totally passive case finding and the latter active. The objective of this study was to determine if interpersonal communicators and pharmacy-based strategy were more effective to detect active cases of TB that would have otherwise been missed in urban slums and areas with a high TB burden.

METHODS

Considering ethical factors a 'pre-post intervention' study design was applied.

Project design and period

The project had two channels – interpersonal communicators (IPCs) and franchised pharmacies. IPCs were PSI/M's contracted staff while pharmacies were franchised partners. These pharmacies were owned by private persons, but registered in Township Medical Office and made a contract partnership with PSI/M to provide referral services which were monitored by PSI/M's TB REACH junior officers. 60 trained IPC's conducted health talks street by street and door to door in the community. They found suspected TB clients actively by screening the audience by asking TB symptoms in health education sessions. Also, they developed a social network with local people so as to get support in finding suspected TB cases in their wards and blocks. Then, they referred the clients of 8 years and above to franchised labs for sputum examination and suspected sputum negative clients of 15 years and above to franchised chest X-ray centers (CXR) after excluding pregnancy in females by a history. In summary, the IPC's referred all sputum positive clients, CXR taken clients and suspected child cases to franchised DOTS GPs for final diagnosis and further management. Similarly, each person who are either owners or staff from 500 registered pharmacies were trained, provided information, education and given materials on TB. They conducted brief health talk to the customers who come to their shops to buy cough remedies. Then, they screened them by asking questions on TB symptoms. If they suspected TB in the clients, they referred them (≥8 years) to the labs for sputum examination. They referred children suspected cases directly to franchised clinics and the rest after sputum examination even if the results were positive or negative (Figure 1). However, the total number of pharmacies was changing as some inactive ones were dissociated from the franchise and new ones joined the network.

For each suspected case from IPC channel, transportation fee to a maximum of about USD 4 was supported by the project depending on individual requirement. The clients referred by the project channels got free services for both sputum examination and CXR taking in the franchised investigation centers. Franchised pharmacies were paid incentives amounting to less than USD 1 for each proper referral. 10 officers in Yangon and 2 project junior officers in Mandalay were assigned to supervise IPCs in the field as well as monitor and support the pharmacies.

Due to unexpected delay in permission process, the project could not start simultaneously in both regions. Mandalay was started first from Quarter (Q) 4 of 2011 to Q 3 of 2012. Yangon was begun from end of Q2, 2012 to Q2, 2013. In Mandalay, it was implemented by 9 IPCs and 78 franchised pharmacies in 8 townships, working together with 7 franchised labs, 4 CXR centers and 48 franchised DOTS clinics. In Yangon, it was done by 51 IPCs and 448 pharmacies, with 23 labs, 18 CXR centers and 193 franchised clinics.

Data collection

Data collection was done through routine project reporting process. IPCs had to submit their reports monthly in structured report format to the project junior officers. Junior officers needed to

Table 1 Results of one year active TB case finding between two channels in two regions of Myanmar

	IPC	Pharmacy
Contact per year (through Health Education)	470,384	
Suspected TB referral cases	23,241	1,683
Reach to lab	21,697	1,271
SS(+)TB detected	1,456	324
SS(+)TB registered at clinics	1,277	280
Reach to CXR center	6,539	240
SS (-), CXR (+) case detected	1,817	138
SS (-), CXR (+) case registered at clinics	1,559	138
Total Registered Cases	2,836	418

Table 2 Newly registered TB case post project according to category, region and channel

Channel	Region	Cat 1 Positive	Cat 1 Negative	Cat 2 Other	Cat 2 (Excluding others)	Cat 3 (Excluding PC)	Cat 3 PC
IPC	Yangon	1,037	494	31	142	180	427
	Mandalay	82	72	5	7	35	306
Total		1,119	566	36	149	215	733
Pharmacy	Yangon	236	53	2	17	19	23
	Mandalay	23	7		1	10	19
Total		259	60	2	18	29	42
***Grand total**		1,378	626	38	167	244	775

Cat 1 Positive = new smear positive case, Cat 1 Negative = new smear negative, severe case, Cat 2 Other = previously treated, sputum negative case, Cat 2 = previously treated, sputum positive case, Cat 3 (Excluding PC) = new smear negative, not severe case (other than PC), and Cat 3 PC = primary complex case

*Grand total by category differ number with total registered cases from grand total of table 1 for categorized cases were reported by treatment started date from the clinics and so some cases were started treatment just over project period.

combine IPCs report under their supervision as well as submit active pharmacies' monthly data in their assigned territory. Then, all reports and data had to be submitted to PSI/M's management and information system unit (MIS) to put them into database. At the same time, those data were also combined by the project senior officer himself regularly as a part of project monitoring process to analyze and track the trends and progress of the project to take timely supervisory action. On the other hand, detail information of the registered TB cases in franchised DOTS clinics was collected monthly by the health services operation team members who monitored the clinics, using also the structured report formats. The information also had to be reported into the MIS. Finally, the MIS unit entered all of these data into a central database and prepared quarterly reports for NTP and donors.

RESULTS

In one year period, IPCs reached and conducted health talks to 470,384 urban slum dwellers and among them 23,241 suspected TB cases were referred and 21,697 clients reached labs for testing. Among them, 1,456 were diagnosed as sputum smear positive and 1,277 were registered in franchised clinics, 6,539 people were referred for CXR and 1,817 cases were diagnosed as being CXR positive. Of them, 1,559 took treatment in franchised clinics. In the pharmacy channel during the one-year project period 1,683 suspected TB clients were referred and 1,271clients reached the labs. Among them, 324 cases were diagnosed as sputum positive and 280 were registered in the clinics, while 240 cases were referred for taking CXR and 138 were diagnosed as CXR positive and all cases were registered in clinics. Comparing two channels, suspected TB cases who really reached the labs through IPC channel was 93% and through pharmacy channel was 76%. Sputum positivity rate through IPC and pharmacy channels were 6.7% and 25.5% respectively, while primary drop out in sputum positive cases were 13% and 14% respectively (Table 1).

In both Yangon and Mandalay, Category 1 positive cases were most of the registered cases by IPC channel. Second was Category 1 negative in Yangon but the second largest in Mandalay was Category 3 PC (Table 2). In pharmacy channel, the case trend is the same with IPC channel in both regions. The largest number of registered cases was Category 1 positive, 236 in Yangon and 23 in Mandalay. The second largest registered category was Category 1 negative in Yangon with 53 cases.

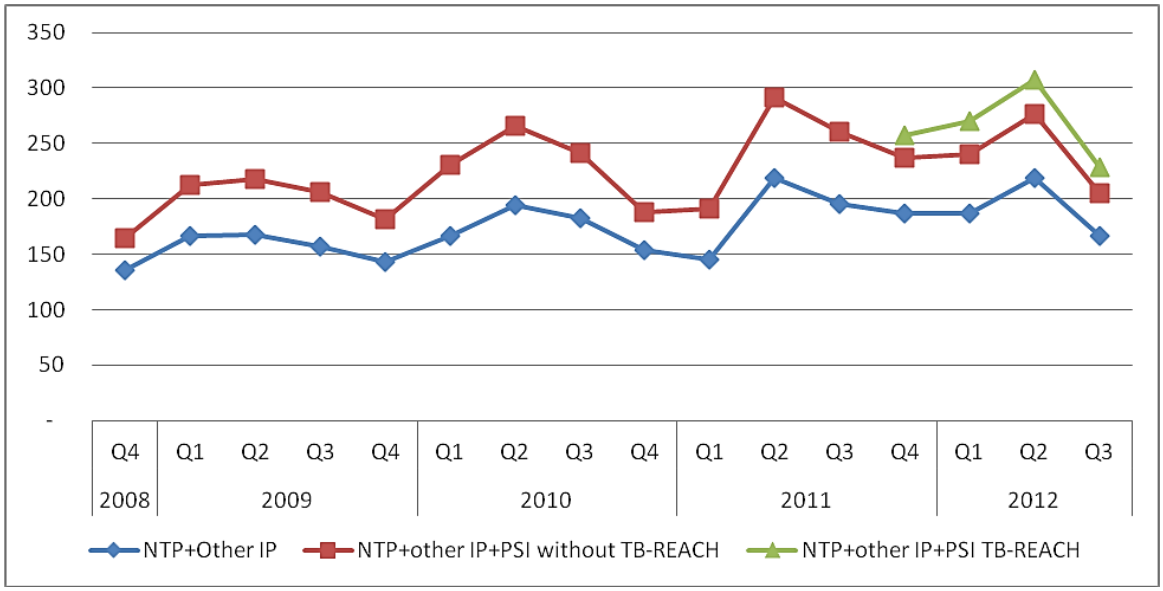

Figure 2 Comparison of trend in SS+ TB cases in Mandalay before and after TB REACH project

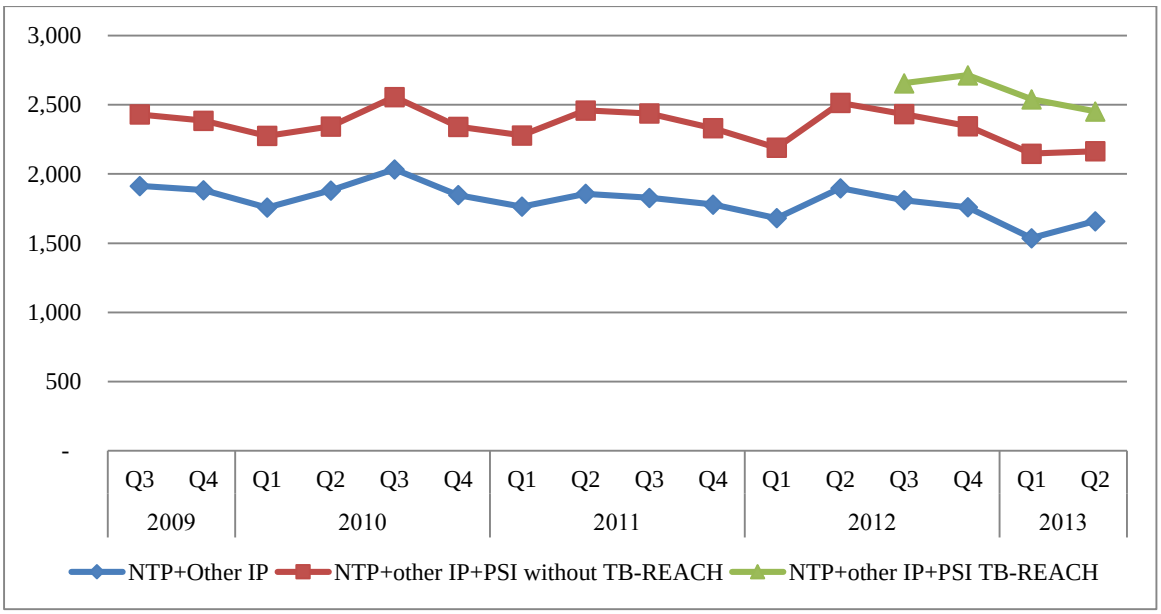

Figure 3 Comparison of trends in SS+ TB cases in Yangon Region before and after TB REACH project

Meanwhile, Category 3 PC in Yangon was only19 cases. As a result, Primary Complexes cases contributed 57% of total registered cases in Mandalay project and 17% in Yangon. New sputum smear positive cases were 19% of total registered cases in the former and 48% in the latter (Table 2).

The project enabled to register additional sputum smear positive (SS+) TB cases to regional level TB register (including NTP, other partners, PSI/M's regular TB program and PSI/M's new active case finding project) in both regions. In Mandalay, the regional level data registered a 14% rise in number of SS+ TB from 931 to 1,063 cases while in Yangon, the registered cases increased by 9.4% from 9,473 to 10,364 cases due to this project, when compared to the same period in the previous one-year period without the project (Figure 2 and 3).

During the project, 79% of franchised clinics in Mandalay and 77% in Yangon participated in the project and 53% (41/78) & 55% (246/448) of active franchised pharmacies referred at least one case in Mandalay and Yangon respectively. In the franchised labs, the average number of sputum smear slides per quarter increased from 373 to 499 slides in Mandalay and from 897 to 1,492 in Yangon during the project year compared to previous

one-year period without project as shown in Figure 2 and 3 [7, 8].

DISCUSSION

Although urban residents seem to have easily accessibility to both public and private DOTS facilities, the 2009-2010 national TB prevalence survey showed that this was not true and socio-economic disparity was present. Many susceptible people do not reach the DOTS facilities in time because of lack of awareness about early symptoms, the importance of early diagnosis and need for full treatment for TB [9]. According to WHO Myanmar data, 45% of people residing in urban areas are slum residents [10]. Although DOTS services are free, slum residents who are largely daily wage earners are unwilling or unable to lose a day's wage or spend money on transport or medicine for early minor symptoms [9]. The situation of slums such as poor housing, poor sanitation, poor ventilation and crowded households also favors easy spread of TB [11]. To increase early detection of unreached clients in slums, a new project by PSI/ Myanmar was undertaken, in which particularly the IPC component, appears to have been most successful, especially by increasing health education activities and referring clients to appropriate services. The direct effect of IPC was that it increased active case finding and helped in registering cases in PSI/M's franchised clinics. The indirect effect is that it raised the awareness of TB and free DOTS services (not limited to PSI services but all DOTS services) among the community. Here, the concept of the additional case finding is really important to measure the effectiveness of the project. Even though the project could register many cases through its channels, if the regional combined registered TB cases did not increase, it does mean that the design of the project has failed to reach previously unreached people and just sharing the existing case load (people who were already reached) among existing DOTS services. The project registered a 14% increase in SS+ TB cases in Mandalay and 9.4% in Yangon compared to the previous year before the project suggesting that this project design was capable of reaching the underserved populations in slum areas who had not been reached with existing DOTS programs and projects.

The IPC strategy for detecting cases and referring clients for treatment was more successful than the pharmacy-based strategy. The IPC program had fewer dropouts during lab referral and could register more TB cases than pharmacies because. IPCs were PSI/M staff and were managed directly whereas pharmacists were franchised partners and PSI/M could only provide motivation and external support when needed. Apart from that the incentive of USD 1 to pharmacies for correct referral was not enough to attract them financially. The main factor contributing to fewer dropouts during sputum referral process was due to timely modification of the project design. At the very initial phase of the project, IPCs were not assigned to provide sputum collection service. In Mandalay, it was not an issue since almost all IPCs had their own motorbikes which were the main private transportation in that region. In Yangon, during first few weeks of the project, it was learned that most suspected slum residents had no willingness to spend their time for sputum examination although actual public transportation fee was supported. Hence, organizing sputum collection became part of Yangon IPC's task. Between two channels, positivity rate was remarkably higher in the pharmacy channel. The main reason was that most of the cases referred by pharmacy channel were relatively late and therefore more severe cases than those compared to IPC channel. Pharmacy owners could convince TB suspected customers with three or more symptoms for sputum referral more easily than ones with early symptoms (only one symptom alone like 2-week cough). In Mandalay project, childhood primary complex cases were more than half of the total registered cases. Thus, in Yangon project being implemented almost 1 year later than Mandalay, the child cases were strictly screened by strong cooperation and collaboration among the project staff, franchised GPs and respective district NTP's TB specialists to make sure to avoid over diagnosis. As a result, childhood TB cases in Yangon project contributed only about 17% of total cases.

In the project, the main challenge of pharmacy channel was inactiveness of nearly half of the franchised pharmacies. Most pharmacies showed strong willingness because of township medical officer's (TMO) involvement in selection and recruitment process, but actually did not actively participate later in the project. Pharmacy owners have to deal with TMO annually for getting registration to run legally theirs in the townships. Another factor, time constraint of the pharmacies contributed to poor participation. As most of the customers in slums came to pharmacies after office hours, trained staff or owner of the franchised pharmacy could not give enough time to focus on suspected TB clients in such busy hours. Some pharmacies solved this problem by making further appointment with suspected customers at less busy time, but most customers did not come back. The last but least was social stigma which is still a

problem for pharmacy channel and IPC channel when the activity was done in factory settings. Particularly, customers with early symptoms did not want to be thought as TB suspect and change to other pharmacies when franchised pharmacies tried to give health education and refer them for sputum examination. It really demotivated the pharmacies since they lost their customers which affected their business too. In IPC channel, the factory owners or managers were firstly pre-advocated to give at least two-week leave and not to fire the employers who would be diagnosed as SS+ TB cases. One main important challenge of the project was ethical dilemma of the competency of IPCs who were not trained medical professionals for deciding taking CXR in selective cases like adult suspected TB clients. The main ground for allowing IPCs to refer CXR directly was to reduce the delay in treatment and reduce indirect cost. Otherwise, the clients had to spend more time and pay consultation fees to GPs as they would not get any free services before diagnosing them as TB patients [12]. At first, many of franchised GPs were against this particular part of the project design. The matter was finally solved by either selecting at least one volunteer high performer GP in one township, who would not take charge for consulting of CXR taking decision or asking the help from district NTP TB specialists in some townships where cooperation and coordination were very strong between PSI and NTP. Sudden increase of TB case load from the intensive active case finding distinctly made burden to franchised labs and GPs. The overload of sputum smear slides was partly solved by contracting three new labs in Yangon. The most difficult challenge in the project was lack of ownership by franchised GPs. they were formerly doing passive case findings and most of their TB patients were their regular patients. Patients referred from the project were strangers for them and came from relatively lower socioeconomic status, causing difficult patient-doctor relationship sometimes. The doctor wanted IPCs and pharmacies to take responsibility for those patients' follow up and compliance. It was beyond the project design and IPCs' assigned job description. Statistically about 80% of GPs participated in the project, but most of the cases were referred to high performer DOTS GPs who showed more willingness to be involved actively in the project. However, they had already had their own high case load. The underlying reasons for primary drop out of SS+ TB cases were migration, referred to NTP and organizations which provide free HIV-TB care, patient death before registration, and even patients' denial to take treatment. Moreover, complicated TB reporting systems made IPCs confused and so, the reporting forms had to be modified to solve their problem, but caused more paper work which was a drawback.

A 14-month active case finding activity in poor urban areas screened 315,874 and diagnosed 737 bacteriologically TB cases in Phom Penh, Cambodia [13] whereas IPC channel of PSI/ M's one-year project screened 470,384 and diagnosed 1,456 SS + TB cases. In that Cambodian activity, 37 TB workers and 372 community volunteer health workers provided door-to-door health education and screening, sputum collection, referral and outreach services for interrupted registered cases [13]. In our project, IPCs were not assigned formally for interruption follow up but GPs used to ask them to follow the interrupted registered cases referred from their channel. One advantage of Cambodian project was using Xpert testing as one of the diagnostic tools, yielding 41% and 48% additional diagnoses among suspected HIV-associated and multidrug-resistant TB clients [13]. In Uganda, one three-month active case finding survey implemented in Kampala slum detected 18% undiagnosed SS + cases [14] while our project contributed to 14% and 9.4% rise of SS+ in regional level in Mandalay and Yangon. In Zimbabwe, DETECTB trial showed that untargeted periodic active case finding for SS + TB repeated every 6 months substantially contributed to SS + TB diagnosis in urban population with high HIV prevalence. Also, it showed the mobile van delivery strategy more effective than door-to-door strategy in community-based active case finding [15]. However, it cannot be concluded that one strategy fits all scenarios [13].

The role of private pharmacies in TB control has become important because of their potential role in participation in TB control by collaborating with NTP, their contribution to delayed treatment and MDR-TB, by unregulated improper selling of TB drugs and their poor knowledge of TB and DOTS services [16-20]. Like our project's pharmacy channel, projects in Vietnam and Bolivia also had the same problem of inactive participation of pharmacies. About 50% of the pharmacies were inactive in our project whereas 61% and 62% of participating pharmacies did not refer at least one case during study period in Vietnam and Bolivia [21, 22]. While 75% of sputum referral by our pharmacy channel reached the franchised labs, only 28% and 27% of the sputum referred clients actually went to the facilities in the Vietnam and Bolivia studies [21, 22]. In our project pharmacies and Bolivia Study there was high positivity rates (25% and 28%), but in Vietnam Study only 7% were sputum positive

[21, 22]. The reasons for such findings in Bolivia Study are the same like in our study. The reason for high positivity rate is that pharmacies referred more clients with advanced symptoms [22]. Accordingly, they fail to achieve the objective of early case detection [22].

CONCLUSION

The project resulted in additional number of TB case registrations both directly and indirectly, proving that it was able to reach previously unreached susceptible people. Although some effects of the project is seen, it will take many years to see the overall effect in terms of reducing TB burden. Even in its present form, the project design demonstrates an effective way to reduce the burden of TB by enabling better detection, timely diagnosis and treatment in urban slums, even though Myanmar already has a well-established DOTS program. In future implementation issues, operational barriers and challenges need to be worked out based on lessons learned from this project.

ACKNOWLEDGMENTS

We thank PSI (HQ) for permission to access the required data for the paper, the TB Dept. and MIS Dept. of PSI/M for providing the data as well as faculty members of School of Global Studies, Thammasat University, Thailand for their support.

REFERENCES

1. World Health Organization [WHO]. Global tuberculosis report 2013: World Health Organization; 2013.
2. Stop TB Partnership. TB REACH, Externally evaluated results of Wave 1 projects: Stop TB Partnership; 2012.
3. Regional Office for South East Asia, Tuberculosis control in South East Asia Region. Annual TB report 2013. Delhi: World Health Organization; 2013.
4. Myanmar, WHO Country Office for Myanmar and Ministry of Health. Tuberculosis in Myanmar, progress, plans and challenges. Myanmar: World Health Organization and Ministry of Health; 2012.
5. Myanmar, Department of Health Governance. Report on National TB prevalence survey 2009-2010, Myanmar: Ministry of Health; 2010.
6. World Health Organization [WHO], Global Tuberculosis Control. WHO report 2008. Delhi: World Health Organization; 2008.
7. Myanmar, Population Services International. Project quarter and year end reports to NTP and WHO stop TB partnership. Myanmar: Population Services International; 2011-2013.
8. Management Information System Department. TB REACH Project data. Myanmar: Population Services International; 2014.
9. Thu A, Ohnmar, Win H, Nyunt MT, Lwin T. Knowledge, attitudes and practice concerning tuberculosis in a growing industrialised area in Myanmar. Int J Tuberc Lung Dis. 2012; 16(3): 330-5.
10. World Health Organization [WHO]. Slum residence: proportion of urban population living in slums by country. [Delhi]: World Health Organization; 2005.
11. Lonnroth K, Jaramillo E, Williams BG, Dye C, Raviglione M. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. Soc Sci Med. 2009; 68(12): 2240-6.
12. Mauch V, Bonsu F, Gyapong M, Awini E, Suarez P, Marcelino B, et al. Free tuberculosis diagnosis and treatment are not enough: patient cost evidence from three continents. Int J Tuberc Lung Dis. 2013; 17(3): 381-7.
13. Lorent N, Choun K, Thai S, Kim T, Huy S, Pe R, et al. Community-based active tuberculosis case finding in poor urban settlements of Phnom Penh, Cambodia: a feasible and effective strategy. PLoS One. 2014; 9(3): e92754. doi: 10.1371/journal.pone.0092754.
14. Sekandi JN, Neuhauser D, Smyth K, Whalen CC. Active case finding of undetected tuberculosis among chronic coughers in a slum setting in Kampala, Uganda. Int J Tuberc Lung Dis. 2009; 13(4): 508-13.
15. Corbett EL, Bandason T, Duong T, Dauya E, Makamure B, Churchyard GJ, et al. Comparison of two active case-finding strategies for community-based diagnosis of symptomatic smear-positive tuberculosis and control of infectious tuberculosis in Harare, Zimbabwe (DETECTB): a cluster-randomised trial. Lancet. 2010; 376(9748): 1244-53.
16. Rajeswari R, Balasubramanian R, Bose MS, Sekar L, Rahman F. Private pharmacies in tuberculosis control--a neglected link. Int J Tuberc Lung Dis. 2002; 6(2): 171-3.
17. Rutta E, Tarimo A, Delmotte E, James I, Mwakisu S, Kasembe D, et al. Understanding private retail drug outlet dispenser knowledge and practices in tuberculosis care in Tanzania. Int J Tuberc Lung Dis. 2014; 18(9): 1108-13.
18. Lambert ML, Delgado R, Michaux G, Volz A, Van der Stuyft P. Tuberculosis control and the private health sector in Bolivia: a survey of pharmacies. Int J Tuberc Lung Dis. 2004; 8(11): 1325-9.
19. Lonnroth K, Lambregts K, Nhien DT, Quy HT, Diwan VK. Private pharmacies and tuberculosis control: a survey of case detection skills and reported anti-tuberculosis drug dispensing in private pharmacies in Ho Chi Minh City, Vietnam. Int J Tuberc Lung Dis. 2000; 4(11): 1052-9.
20. Vu DH, van Rein N, Cobelens FG, Nguyen TT, Le VH, Brouwers JR. Suspected tuberculosis case detection and referral in private pharmacies in Viet Nam. Int J Tuberc Lung Dis. 2012; 16(12): 1625-9.
21. Lonnroth K, Karlsson M, Lan NT, Buu TN, Dieu TT. Referring TB suspects from private pharmacies to the National Tuberculosis Programme: experiences from two districts in Ho Chi Minh City, Vietnam. Int J Tuberc Lung Dis. 2003; 7(12): 1147-53.
22. Lambert ML, Delgado R, Michaux G, Vols A, Speybroeck N, Van der Stuyft P. Collaboration between private pharmacies and national tuberculosis programme: an intervention in Bolivia. Trop Med Int Health. 2005; 10(3): 246-50.