INT J TUBERC LUNG DIS 18(9):1099–1104

http://dx.doi.org/10.5588/ijtld.14.0001

Success of active tuberculosis case detection among high-risk groups in urban slums in Pakistan

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SUMMARY

BACKGROUND: In Pakistan, patients with symptoms suggestive of tuberculosis (TB) seek care from a wide array of health care providers, many of whom do not notify cases to the National TB Programme (NTP).

SETTING: We evaluated an active case detection intervention in five randomly selected districts in urban slums of Sindh Province, Pakistan.

OBJECTIVE: To evaluate the increase in case notification of smear-positive TB by active case finding at community-based chest camps by engaging the private providers.

DESIGN: A cross-sectional study of TB case detection associated with a project using integrated intervention and chest camps.

RESULTS: From April 2011 to September 2012, the total number of clients seen in the camps was 165 280. Of all the attendees, 13 481 (12.7%) were examined by sputum smear microscopy. The proportion of smear-positive results was significantly higher among those from engaged private providers than among those referred from camps (OR 1.54, 95%CI 1.42–1.66). During the project, the total number of smear-positive TB notifications increased over the intervention period from 5158 to 8275.

CONCLUSION: Active case detection by engaging private providers and chest camps can significantly increase the number of smear-positive TB case notifications.

KEY WORDS: tuberculosis; active case detection; private providers; chest camps

OVER 95% OF DEATHS from tuberculosis (TB) occur in low- and middle-income countries, even though screening and treatment are available free of charge through national tuberculosis programmes (NTPs).[1] One reason is inadequate case detection: it is estimated that about 3 million of the estimated 8.6 million new cases each year are not notified; many of these cases are either never diagnosed or they receive treatment in the private sector.[2] Untreated patients continue to transmit TB and those treated incorrectly can develop drug resistance; in both cases mortality is high.[3]

Although passive case detection implemented through the DOTS strategy has been shown to have a positive impact on case detection in high-burden countries,[4,5] active case finding (ACF) can be employed as a supplementary approach to reduce diagnostic delay and reach cases missed by routine services. ACF is an initiative undertaken by health care workers to identify symptomatic patients for medical evaluation and to facilitate early entry into TB care.[1] This approach has been shown to increase case detection in both clinical and community settings.[6,7] With comprehensive ACF programmes, the attendance of presumptive TB cases, TB case detection and TB treatment outcomes have all improved in patients seeking health care from private providers.[2]

Engaging all health care providers in TB care and control through public-private mix (PPM) approaches is an essential component of the World Health Organization (WHO) Stop TB Strategy. Activities encouraging collaboration between private and public health services, called PPM for TB care and control, represent a comprehensive approach to the systematic involvement of all relevant health care providers in TB. PPM can help increase case detection by between 10% and 60%, improve treatment outcomes to >85%, reach the poor and reduce costs.[8]

Pakistan reported a case detection rate of 64% in 2011 for all forms of TB, and of 50% for smear-positive TB, up from 13% in 2005.[1] To improve case notification, Pakistan has introduced PPM and has more recently expanded partnership to engage the

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Article submitted 1 January 2014. Final version accepted 30 April 2014.

[A version in French of this article is available from the Editorial Office in Paris and from the Union website www.theunion.org]

community, apply active case detection and introduce TB services into private practice. Around 20% of national notifications are contributed by private providers; this figure needs to be improved, as shown in the recent inventory study, where 28% under-reporting was observed.[9] The project currently being evaluated focused on organising chest camps for active case detection at the clinics of private non-NTP general practitioners (GPs), and on using a light-emitting diode (LED) microscope with fluorescence microscopy, as this rapid diagnostic tool has a low unit cost and is less time consuming than other tools. The current study is an evaluation of the results of this intervention.

STUDY POPULATION, DESIGN AND METHODS

Study design

The study design was quasi experimental to assess the increase in TB case notification by adopting an integrated intervention.

Setting

Sindh, one of five provinces of Pakistan, is divided into 23 districts. TB services are integrated into the primary health care system at district level, and are delivered by chest clinics in tertiary (public and private), district and subdistrict hospitals, rural health centres (RHC) and basic health units (BHU).[10] Health care is provided by both qualified and unqualified medical professionals. According to the Pakistan Medical and Dental Association, the total number of registered GPs in 2014 was 56 144 in Sindh, Pakistan.[11] All districts have urban slums, with the highest concentration in the largest city, Karachi. The health infrastructure is not developed in these slums and access to primary health care services is poor, although there are many private sector clinics.

We randomly selected four districts from among the 23 districts of Sindh: Dadu, Thatta, Larkana and Sanghar. We also randomly selected five towns (Jamshed, Gadap, Orangi, Baldia and Kemari) from the Karachi district. The estimated 2011 mid-year population of Karachi, Larkana, Dadu, Sanghar and Thatta was 2 993 800, 502 607, 687 307, 1 158 856 and 702 535, respectively. All areas have many lower-income households from all major ethnic groups of Pakistan. People from neighbouring districts may have used the services, but we have no information about this.

A mapping exercise was performed to identify sites for chest camps based on daily workload, distance from BMU, and location in the slum. GPs who agreed to participate in the intervention were trained and the slum area was divided into clusters, with 10 GPs around one laboratory for follow-up microscopy. At least one GP and one paramedic from each of the selected clinics were identified and trained using the NTP standard training package for private providers. Only GPs with medical degrees were allowed to participate. To keep the GPs motivated and to compensate them for their time, they received 1500 Rs (approximately US$15) per day for their chest camp activities.

The intervention, funded by the Stop TB Partnership through TB REACH, consisted of 1) the establishment of 1-day chest camps staffed by trained local GPs and encouraging the same GPs to refer TB presumptive cases to temporary laboratories in a nearby GP clinic; 2) the establishment of temporary laboratories using fluorescence microscopy (FM) with LED-FM smear microscopy equipment; 3) 3 days' training in the provincial TB control programme (PTP) office of the participating GPs in the diagnosis, recording and reporting of TB; and 4) promotional activities for the camps.

Procedures

The chest camp consisted of gathering the local community around selected clinics, which was arranged with prior preparation such as making announcements through loudspeakers the day before the camp, and displaying posters and banners in Urdu and in local Sindhi language with information about free general medicines. To attract the local community, health fairs were arranged that included street theatre, fun shows and stalls. The camps were promoted as opportunities to be screened for chest-related conditions, rather than TB specifically or more general complaints.

The camps were conducted by five different teams, one in each district, once a week at different sites, and a screening questionnaire was used to identify symptoms that required investigation for TB. All screening was performed by the local trained GP. Any person who reported cough of >2 weeks was referred to an onsite trained microscopist for LED-FM examination of sputum. Two sputum samples were collected on the same day to avoid any delay in collecting a second sample. All smear microscopy results were communicated to the medical officer in the chest camp. Confirmed TB cases were referred to the GP clinic situated nearest to their home and were recorded in routine TB registers supplied to the clinic. Treatment was provided by the provincial TB control programme and followed by field officers under the DOTS-based system. After the activities of the chest camp were completed, the trained GPs were responsible for managing any presumptive TB cases visiting their clinic. These were registered separately, with a record of results in the TB registers kept by the same GPs responsible for managing TB cases.

Project-trained GPs maintained separate records for the cases investigated and detected in their practices from those from the chest camps so that there was no duplication of cases; the field officers

were responsible for collecting data from both interventions.

Data collection and analysis

Two sources of data were used for the analysis: 1) data from the laboratory registers, which consisted of numbers of persons attending the facility, numbers referred for sputum smear examination and numbers found sputum smear-positive; and 2) data from the treatment registers, which comprised information on age, sex, site of the clinic and type of TB. Pre-intervention notification rates were collected from routine surveillance data for 18 months before the project (1 October 2009–31 March 2011) and for the 18-month duration of the project (1 April 2011–30 September 2012). Field officers were trained before the start of data collection. The project was implemented from 1 April 2011 to 30 September 2012. The number of chest camps in Karachi was initially 12 per month as an accelerated effort to achieve the project target, but was reduced to 6 per month from 1 April to 30 September 2012. Following completion of the project, all study data were collected and analysed from January to August 2013.

Data were analysed using SPSS version 18 (IBM Corp, Armonk, NY, USA). Our outcome measurement was the number of cases detected. The variables analysed in the study were age, sex, type of TB case, source of case detection, location and diagnosed TB case. After data entry and cleaning, proportions were computed and group differences were analysed using the χ^2 test. For purposes of comparison, the project areas were divided into those inside and outside Karachi, and for comparison of trends in case detection into project and non-project areas.

Ethical considerations

TB REACH funded this project through the Stop TB Partnership. The sponsor had no influence on study design or data collection; they were informed of the progress through routine quarterly reports. The project was approved by the Research Unit of the NTP. All those with access to any patient records in the study were involved in the implementation of the project. Summary statistics were used without patient identifiers. One member of TB REACH executed the data analysis, interpretation and reporting. The corresponding author had full access to all the data from the project and was responsible for undertaking the study. As the study involved the retrospective analysis of routine information from the project, individual patient consent was judged not to be required.

RESULTS

Table 1 shows the comparison of TB patients in the pre-intervention and intervention period. During the pre-intervention period, a total of 10 374 TB cases (all types) were notified to the PTP office; this increased significantly during the intervention period, with 14 140 TB cases reported. The age and sex distribution remained similar in both periods. All districts reported increased case finding, with Dadu and Karachi recording the highest increase. The proportion of smear-negative cases was significantly higher during the intervention.

Figure 1 shows the flow of clients in the selected districts in the intervention project: a total of 3117 smear-positive TB cases were detected in the camps and in the GP practices combined. In the camps, 165 280 clients were screened and 13 481 (8.2% of all attendees) were examined by sputum smear microscopy (Table 2). Among these, 1707 (12.6% of those examined) were sputum smear-positive (Figure 1). In addition to those examined in the camps, 7747 individuals were sent from GP practices for sputum smear examination in the same areas. Of these, 1410

Table 1 Characteristics of tuberculosis patients reported in the pre-intervention and intervention period of the project in Pakistan

		Pre-intervention (Oct 2009–March 2011) *n*	Intervention (April 2011–September 2012) *n*	Increase in TB case detection %
Total TB cases		10 374	14 140	36
Districts	Karachi	7 064	9 760	38
	Larkana	774	1 046	35
	Dadu	816	1 171	44
	Sanghar	854	1 048	23
	Thatta	866	1 115	29
Age, years	0–24	3 005	3 944	31
	25–44	3 634	5 083	40
	⩾45	3 735	5 113	37
Sex	Male	5 257	7 216	37
	Female	5 117	6 924	35
Type of case	Pulmonary smear-positive	8 933	11 392	28
	Pulmonary smear-negative	543	1 766	225
	Extra-pulmonary	898	982	9

TB = tuberculosis.

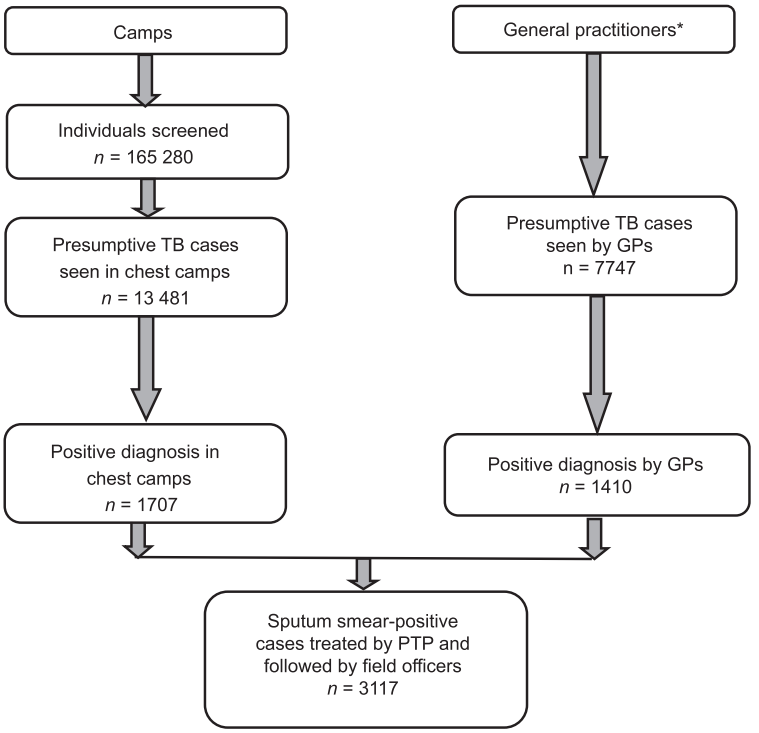

Figure 1 Flow of clients in selected districts of Pakistan involved in an intervention project for detection of tuberculosis, 2011–2012. * General practitioners (GPs) maintained the data for presumptive TB cases only. TB = tuberculosis; PTP = provincial TB control programme.

(18.2%) were found to be sputum smear-positive (Figure 1).

Table 2 shows a comparison of the chest camps and GP contributions in TB case detection in the five intervention areas. The yield of smear-positive cases among clients in the camps suspected of having TB varied among the districts from 9% to 14%, but among the GPs the yield in each district varied much more, to as high as 69% in Dadu.

The total number of cases reported in the districts who were from the project areas (Figure 2) rose steadily for each calendar quarter over the project period in both Karachi, from 194 rising to 402, and other locations (from 150 rising to 261), with a decline when the number of chest camps was reduced.

DISCUSSION

The aim of this study was to detect undiagnosed TB cases in the peri-urban slums in Sindh Province. The notification rate increased, suggesting that additional TB cases can be identified using community-based active case detection through specialised chest camps. Other studies on active case detection have found yields of TB cases among those referred ranging from 4% in South Africa to 13% in Ethiopia.[12,13] One study in Pakistan[14] involving a private care setup with a tertiary care hospital, 54 family clinics and community workers to increase TB case detection, found that among 469 896 screened individuals, 2416 (0.5%) had TB, compared to 1.9% in our study. In this project, we tried to screen people with chest

Table 2 Tuberculosis cases reported in intervention areas from chest camps and general practitioners, Pakistan, 2011–2012

	Detection in camps					Detection by GPs		
	Camps	Attendees	Presumptive cases	Smear-positive cases		Presumptive cases	Smear-positive cases	
District	*n*	*n*	*n*	*n*	Yield %	*n*	*n*	Yield %
Karachi*	199	55 253	3 370	467	13.9	6 741	1 261	18.7
Larkana	129	34 797	3 589	426	11.9	598	56	9.4
Dadu	115	26 592	3 753	566	15.1	130	90	69.2
Sanghar	117	29 241	1 790	154	8.6	124	0	0.0
Thatta	92	19 397	979	94	9.6	154	3	1.9
Total	652	165 280	13 481	1 707	12.7	7 747	1 410	18.2

* Karachi represents five towns (Jamshed, Gadap, Orangi, Baldia and Kemari).
GPs = general practitioners.

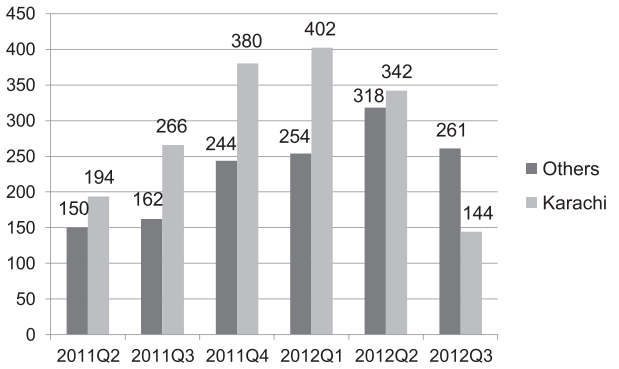

Figure 2 Tuberculosis case finding during the intervention, by quarter, in Sindh, Pakistan. Q = quarter

symptoms, while the other project screened every single attendee in the GP clinics.

LED fluorescence microscopy is more useful in detecting smear-positive TB cases in low-income, high-TB-burden settings.[15–17] In our study, we chose to use fluorescence microscopy to screen sputum samples at chest camps, a more sensitive alternative to light microscope, because smear-positive patients are by far the most infectious, and decentralised LED microscopy is already well supported globally and has low unit costs.

Active case finding has been an integral part of TB control in industrialised countries since the 1920s.[18] Early programmes used radiological screening of otherwise presumptive TB cases in the early 1930s.[5,17] The policy in the 1970s recommended targeted screening of close contacts of patients with TB, recent immigrants, prisoners, homeless people and people with infected with the human immunodeficiency virus, but not of the general population.[19] In these high-prevalence groups, active case detection can affect TB incidence through prevention of secondary cases.[20,21]

Various studies from other parts of world provide evidence of improved case detection through camps.[22,23] The results of our study also support the evidence for the chest camps as an effective intervention to detect additional TB cases in our setting. Many factors are involved in contributing to active case detection as a successful tool of the project; for example, many people are not aware of TB symptoms. By the time they develop symptoms and seek health care, often from private providers, their initial symptoms may have improved a little and they may go undetected, while with active case detection symptomatic patients can be properly examined earlier. Another factor is publicity before the camps, such as announcements regarding time and place, and information about free general medicines, including antibiotics, increasing the attraction for the local community. The active participation and training of local GPs was another key factor.

The difference between Karachi and the other districts, both for the chest camps and for the GP practices, is difficult to explain. One possible explanation is that those living in Karachi may have had greater access to the private sector (as indicated by the smaller number in the camps and correspondingly higher number in GP practices in Karachi).

The study has several strengths. It included a large number of participants, and it involved the NTP from the start of the project. It also focused on issues of high priority in the NTP. Some limitations are also noted. As an operational study, the information collected has all the weaknesses of routine data registers. The study was also conducted as an externally funded project and not as routine NTP practice. Incentives were given to 366 GPs, and 35 health workers were involved in the intervention. The cost-effectiveness and the time investment from the local health department and NTP need to be evaluated. Additional cases were detected both during the chest camps and also by the local GPs, independently of the chest camps. This fact needs to be taken into account in other projects evaluating the yield from community interventions. The lessons learned from the project to increase case detection by integrated intervention of chest camps and GP involvement provided good evidence to scale up the PPM approach in the country. The same model has been adopted with support from the Global Fund for AIDS, Tuberculosis and Malaria to replicate the activities; scale-up is planned in the National Strategic Plan Vision 2020 (National TB Control Programme. Draft national strategic plan 2014: Vision 2020, unpublished).

In conclusion, engaging private GPs and using LED-based fluorescence microscopy at community-based chest camps in for TB control was associated with a significant increase in notified TB cases in the slums of Sindh, Pakistan.

Acknowledgements

We gratefully acknowledge the support from the TB REACH secretariat of Stop TB Partnership for funding the study and the Provincial TB Control Programme Pakistan and all the field staff who showed dedication in achieving the targets set by the project.

Conflict of interest: none declared.

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RESUME

CONTEXTE : Au Pakistan, les patients présentant des symptômes suggérant une tuberculose (TB) sollicitent des soins auprès d'un grand nombre de prestataires de soins de santé, dont la majorité ne déclare pas les cas au Programme National de TB.

OBJECTIF : Evaluer une intervention de détection active de cas dans cinq districts sélectionnés au hasard et comprenant des bidonvilles urbains dans la province pakistanaise de Sindh.

SCHÉMA : Etude transversale de la détection des cas de TB associée à un projet d'intervention intégrée dans des camps de dépistage.

RÉSULTATS : Entre avril 2011 et septembre 2012, le nombre de total de clients vus dans ces camps a atteint 165 280. Parmi eux, 13 481 (12,7%) ont eu un examen microscopique de frottis. La proportion de frottis positifs a été significativement plus élevée parmi les patients vus par des praticiens privés recrutés par le projet que parmi ceux référés des camps de dépistage (OR 1,54 ; IC95% 1,42–1,66). Pendant la durée du projet, le nombre total de notifications de cas de TB à frottis positifs est passé de 5158 à 8275.

CONCLUSION : La détection active des cas grâce au recrutement de prestataires privés et à des camps de dépistage peut accroitre significativement le nombre de notifications de cas de TB à frottis positif.

RESUMEN

MARCO DE REFERENCIA: En Pakistán, los pacientes que presentan signos indicativos de tuberculosis (TB) buscan atención ante una gran diversidad de profesionales de salud, muchos de los cuales no notifican los casos al Programa Nacional contra la TB.

MARCO DE REFERENCIA: Se analizó una intervención de detección activa de casos de TB en cinco distritos que cuentan con zonas urbanas de viviendas precarias, escogidos de manera aleatoria en la provincia de Sindh en Pakistán.

OBJETIVO: Evaluar el aumento en la notificación de casos de TB con baciloscopia positiva mediante la detección activa en campamentos comunitarios de atención médica y con la participación de profesionales del sector privado.

MÉTODO: Se llevó a cabo un estudio transversal de detección de casos de TB en el contexto de un proyecto que comportaba una intervención integrada y campamentos de atención en medicina respiratoria.

RESULTADOS: Entre abril del 2011 y septiembre del 2012 se atendieron en los campamentos 165 280 personas. Se practicó el examen microscópico del esputo a 13 481 de las personas que acudieron (12,7%). La proporción de baciloscopias positivas fue significativamente mayor en las personas remitidas por los profesionales del sector privado participantes, que en las personas referidas de los campamentos (OR 1,54; IC95% 1,42–1,66). Durante el período de ejecución del proyecto, aumentó de 5158 a 8275 el número total de notificaciones de casos de TB con baciloscopia positiva.

CONCLUSIÓN: Se puede aumentar de manera considerable la detección activa de casos de TB con baciloscopia positiva notificados mediante la participación de profesionales del sector privado y la prestación de atención en campamentos de medicina respiratoria.