Improving Tuberculosis Case Detection

A compendium of TB REACH case studies, lessons learned and a monitoring and evaluation framework

Stop TB Partnership

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Stop TB Partnership
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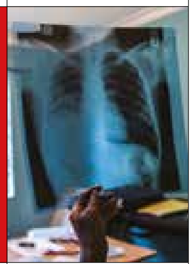


Stop TB Partnership

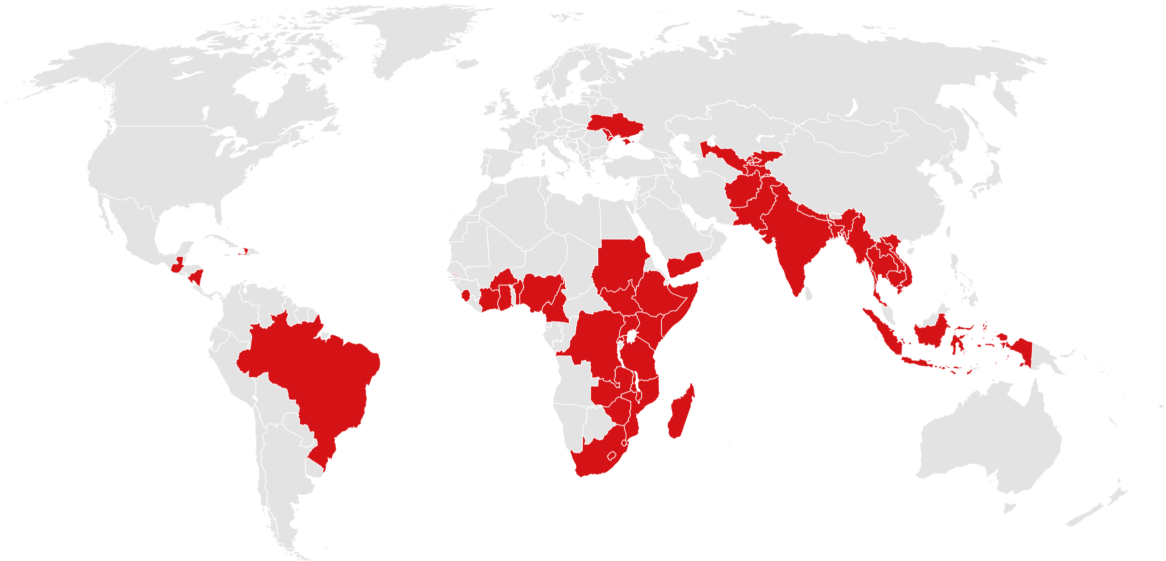
TB REACH

Foreword

After two decades of tuberculosis (TB) care expansion and strengthening, progress in the fight against the disease has stalled.

Every year we are not able to reach with proper diagnosis, treatment and care over three million of the nearly nine million people who become ill with TB. As a result, nearly one and a half million people die each year from this curable disease. To end TB as a global epidemic we must find and treat all of those who are sick, prevent transmission and prevent creation of multidrug-resistant TB.

To do so, we need to think of new ways to reach those we don't reach today. We must invest in expanding access to care for hard to reach and vulnerable populations, expanding screening and testing services and improving information flow for quality care. We need to adapt our minds and tools to the realities of 2015 and beyond.



It can be done. Many of our partners in the Stop TB Partnership are providing evidence on how to do it. Often these interventions are simple and they can be surprisingly effective, we just need to bring them up and have the courage to push things forward.

TB REACH was set up in 2010 to provide grants to innovative, experimental or pilot projects that bring TB detection and treatment to vulnerable or hard to reach populations. Over the past four years, it has provided over 90 million USD to 142 projects worldwide in 46 countries.

This document highlights the successes and lessons learned from TB REACH grantees across the globe in strengthening TB care, implementing novel approaches to detect TB, and increasing TB case notifications.

This is the work of engaged partners who have moved beyond the "business as usual" approach to try different things. And succeeded.

An important aspect of the document is the monitoring and evaluation framework to assess the impact of case detection activities. With increasing interest in impact for investments made, it is important to be able to document and evaluate how resources are spent.

Sharing the experiences of TB REACH can help all partners engaged in reaching the missing three million and will help us to move forward as a TB community to reach new goals in the post-2015 agenda.

There are many other successful projects that could not fit in these pages – we will do our best to document these ones as well.

Lucica **Ditiu**
Executive Secretary
Stop TB Partnership

Acknowledgements and Funding

TB REACH is made possible primarily through funding received from the Department of Foreign Affairs, Trade and Development Canada and we would like to thank the people of Canada for their generous support of this initiative. Without this contribution, the work described in this document would not be possible. TB REACH would also like to thank UNITAID and the UN Foundation for co-financing this initiative, and The Global Fund to Fight AIDS, Tuberculosis and Malaria for supporting the development of this document.

We would also like to thank our external monitoring and evaluation team at Mott MacDonald in London and the Royal Tropic Institute (KIT) in Amsterdam for the continuous support provided to both the TB REACH Secretariat and our grantees and partners.

TB REACH acknowledges all the individuals who participated as members of the Proposal Review Committees to help select interventions to fund. In addition, the Program Steering Group has provided valuable inputs and guidance in the development of the TB REACH initiative.

Finally, TB REACH recognises and thanks all of the grantees, only a small selection of whom have had their work highlighted in this document due to limited space, but all of whom have contributed to reaching the millions of people in need of better TB care.

Wave 1	
Country	**Grantee**
Afghanistan	Anti-Tuberculosis Association Afghanistan Program
	National TB Programme
Benin	National TB Programme
Burkina Faso	National TB Programme
Democratic Republic of the Congo	Catholic Relief Services
	National TB Programme - Province Equateur du Sud
	National TB Programme - Province du Katanga
	National TB Programme - Kasai Occidental
Ethiopia	Inter Aide
	Liverpool School of Tropical Medicine / REACH Ethiopia
Kenya	International Medical Corps UK
	Kenya Association for the Prevention of Tuberculosis and Lung Disease
Lao People's Democratic Republic	International Organization for Migration
	Population Services International
Lesotho	Foundation for Innovative New Diagnostics
Nepal	Family Health International
Nigeria	Catholic Relief Services
Pakistan	Bridge Consultants Foundation
	Provincial TB Control Programme Punjab
	The Indus Hospital
	National TB Programme
Rwanda	World Vision Canada
Somalia	World Vision International Somalia Programme
Sudan	Epidemiological Laboratory (Epi-Lab)
Uganda	AMREF Canada
	BRAC Uganda
United Republic of Tanzania	NIMR - Mbeya Medical Research Programme
Yemen	Liverpool School of Tropical Medicine
Zambia	Centre for Infectious Disease Research in Zambia
Zimbabwe	Harare City Health Department

Wave 2	
Country	**Grantee**
Burkina Faso	Programme d'Appui au Monde Associatif et Communautaire
Cambodia	National Centre for Tuberculosis and Leprosy Control
	International Organization for Migration
	Sihanouk Hospital Center of HOPE
Democratic Republic of the Congo	National TB Programme – Sud de Kivu
	University of North Carolina at Chapel Hill
Ethiopia	Amhara Regional Health Bureau
	International Organization for Migration
Gambia	Medical Research Council
Guatemala	World Vision
India	Johns Hopkins University
	International Union Against Tuberculosis and Lung Diseases
Kenya	Moi University School of Medicine/ Moi Teaching and Referral Hospital
Kyrgyzstan	National Center of Phthisiology
Madagascar	National Tuberculosis Programme
Malawi	Project HOPE
Mozambique	Health Alliance International
Myanmar	Population Services International
	International Organization for Migration
	International Union Against Tuberculosis and Lung Diseases
Nepal	The Britain Nepal Medical Trust
	International Organization for Migration
Nicaragua	Nicaraguan Ministry of Health
Nigeria	German Leprosy and Tuberculosis Relief Association
	NTBLCP/Liverpool School of Tropical Medicine
	KNCV Tuberculosis Foundation
Pakistan	Association for Social Development
Pakistan-Bangladesh	Interactive Research and Development / icddr,b
Republic of Moldova	Center for Health Policies and Studies
Somalia	London School of Hygiene and Tropical Medicine
South Africa	TB/HIV Care Association
Swaziland	National Tuberculosis Control Programme
Thailand	International Organization for Migration
Uganda	Foundation for Innovative New Diagnostics
	International Union Against Tuberculosis and Lung Diseases
	Infectious Diseases Institute
Ukraine	Labor and Health Social Initiatives
United Republic of Tanzania	University of Maryland Baltimore
Viet Nam	Nordic Assistance to Vietnam
	University of California, San Francisco / NTP
	Population Services International
Zambia	ZAMBART Project
Zimbabwe	Population Services International
	Biomedical Research and Training Institute

Wave 3	
Country	**Grantee**
Afghanistan	Afghan Community Research & Empowerment Organization for Development
Bangladesh	Centre for Woman and Child Health
	icddr,b
Cambodia	Cambodia Anti-Tuberculosis Association
Cote d'ivoire	ACONDA-VS-CI
Ethiopia	German Leprosy and TB Relief Association
	Liverpool School of Tropical Medicine
Ghana	International Organization for Migration
Haiti	University of Maryland Baltimore
India	Gramin Samaj Kalyan Vikas Manch
Indonesia	Resources Management and Development Consultants
Lesotho	Baylor College of Medicine Children's Foundation
	Columbia University
Mozambique	Associação de Desenvolvimento de Povo para o Povo
Nepal	Friends Affected & Infected Together In Hand
	Health Research and Social Development Forum
Nigeria	Ebonyi State TB and Leprosy Control Programme
	German Leprosy and Tuberculosis Relief Association
Pakistan	Interactive Research and Development
	National TB Control Program
Sierra Leone	Wellbody Alliance
South Africa	The Aurum Institute
	University Research South Africa
South Sudan	Arkangelo Ali Association-International
	Save The Children
Swaziland	Baylor College of Medicine Children's Foundation
Tajikistan	Republican TB Control Center
Uganda	Foundation for Innovative New Diagnostics
	Uganda Episcopal Conference
Ukraine	Program for Appropriate Technology in Health
United Republic of Tanzania	MUKIKUTE
	University of Maryland
	Klinikum of the University of Munich, Department of Infectious Diseases and Tropical Medicine
Uzbekistan	Foundation for Innovative New Diagnostics
Zimbabwe	City of Harare Health Department

Wave 4	
Country	**Grantee**
Brazil	National TB Programme
Cambodia	Health and Development Alliance
	Sihanouk Hospital Center of HOPE
Cameroon	National TB Program
Ethiopia	Inter Aide
	Program for Appropriate Technology in Health
Gambia	Health Promotion and Development Organisation
Ghana	AMPA Resource Organization
Guatemala	TEPHINET
Haiti	GHESKIO
India	Aajeevika Bureau
	Asha Kalp
	Asian Institute of Public Health
	REACH
	State TB Cell, Directorate of Health Services
Indonesia	Ministry of Health
	Yayasan Menara Agung Pengharapan Internasional
Kenya	Population Services International
Malawi	Project HOPE
Mozambique	Health Alliance International
Nepal	International Organization for Migration
	Japan-Nepal Health & Tuberculosis Research Association
	Naya Goreto
Nigeria	Annabelles Bogi Development Initiative
	University of Maryland Baltimore
Pakistan	The Indus Hospital
Republic of Moldova	Center for Health Policies and Studies
South Africa	Interactive Research and Development-FZC & The Aurum Institute
South Sudan	Stitchting BRAC International
Tajikistan	KNCV Tuberculosis Foundation
Uganda	International Union Against Tuberculosis and Lung Diseases
Viet Nam	Population Services International
Zimbabwe	International Organization for Migration

Abbreviations

ACF	Active case finding
BAC+	Bacteriologically-positive
CXR	Chest x-ray
DOTS	The basic package which underpins the Stop TB Strategy
HEW	Health extension worker
LED-FM	Light-emitting diode fluorescence microscopy
MTB	*Mycobacterium tuberculosis*
NNS	Number needed to screen
NTP	National TB [Control] Programme
PLWHA	People living with HIV/AIDS
SS+	Sputum smear-positive
TB	Tuberculosis
USD	U.S. Dollars
WHO	World Health Organization

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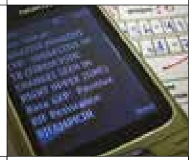
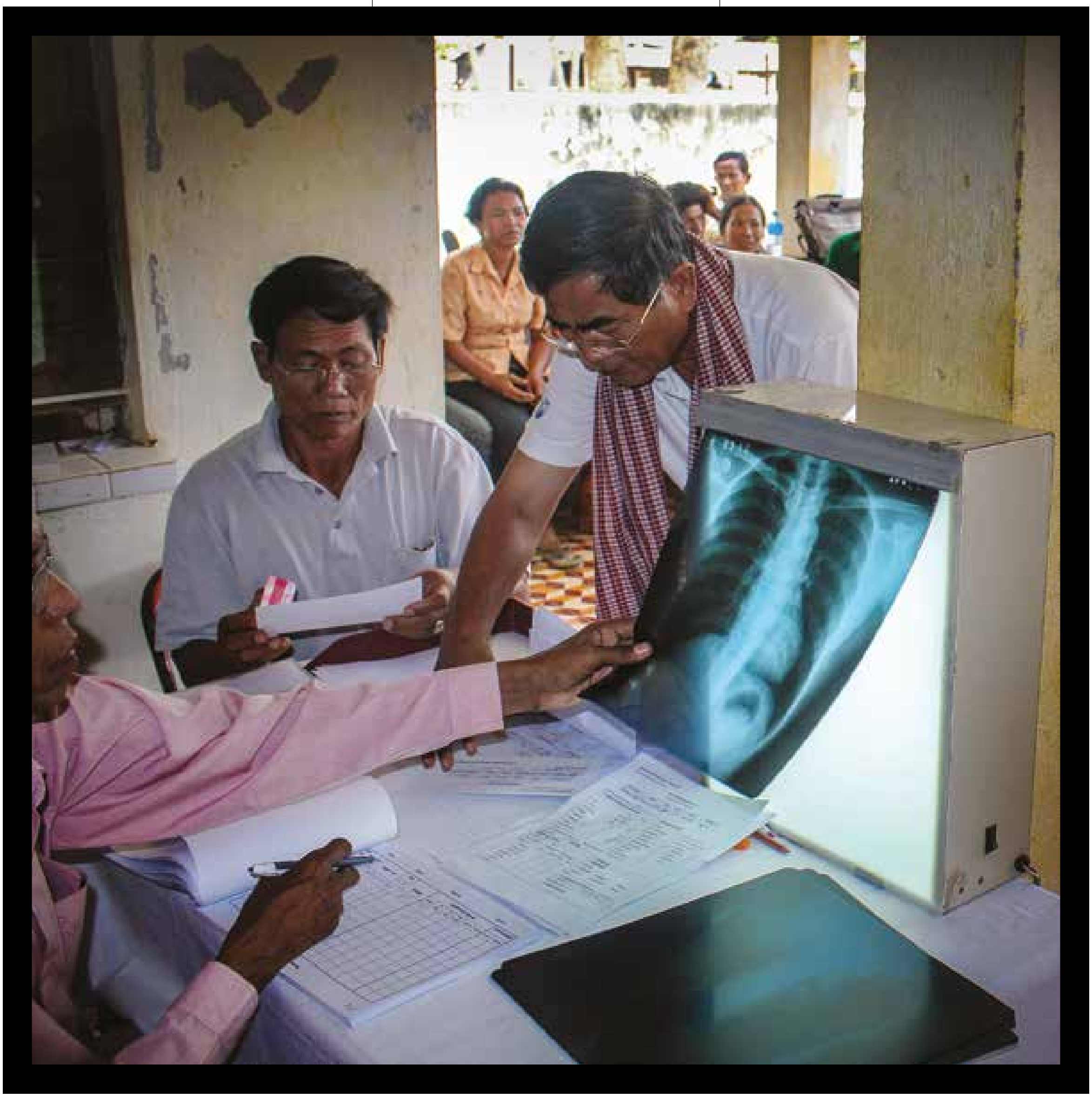


Reading chest x-rays for abnormalities as part of mobile outreach – CENAT, Cambodia.



Definitions

Screening test – An examination used to narrow down a population for further evaluation, usually with a diagnostic test. TB-specific examples include verbal screening for TB-related symptoms and CXR.

Diagnostic test – An examination which is used to confirm disease. TB-specific examples include smear microscopy, the Xpert MTB/RIF assay and culture.

Case notification rate – Cases of TB notified to the National TB Programme (NTP) for a given year, generally expressed per 100,000 population. These rates are ideally disaggregated by type of TB. Countries vary in quality of comprehensive reporting of case notification, so some may exclude TB cases diagnosed through the private sector, while others include them. Most countries notify patients when they are registered for treatment.

Case detection rate – The proportion of notified cases of TB (including new and relapse) among the WHO estimated incident cases in a country, reported as an annual figure. While previously smear-positive cases were used, WHO currently provides estimates for only all forms of TB. Case detection rates should only be used as a general guide for country-level data, and sub-national estimates should be avoided.

Passive TB case finding – In most countries this is the standard method of identifying people with TB. Passive case finding involves symptomatic individuals self-presenting at health facilities for diagnostic testing.

Active TB case finding (ACF) – These are special efforts made by the NTP or other partners that go beyond passive TB case finding at health facilities, in which communities or population groups that are underserved or at higher risk of TB are actively reached for providing access to care, including screening and testing.

Number needed to screen (NNS) – This is the number of individuals that should be screened to identify one TB patient.

Number needed to test – This is the number of individuals that should be tested to identify one TB patient.

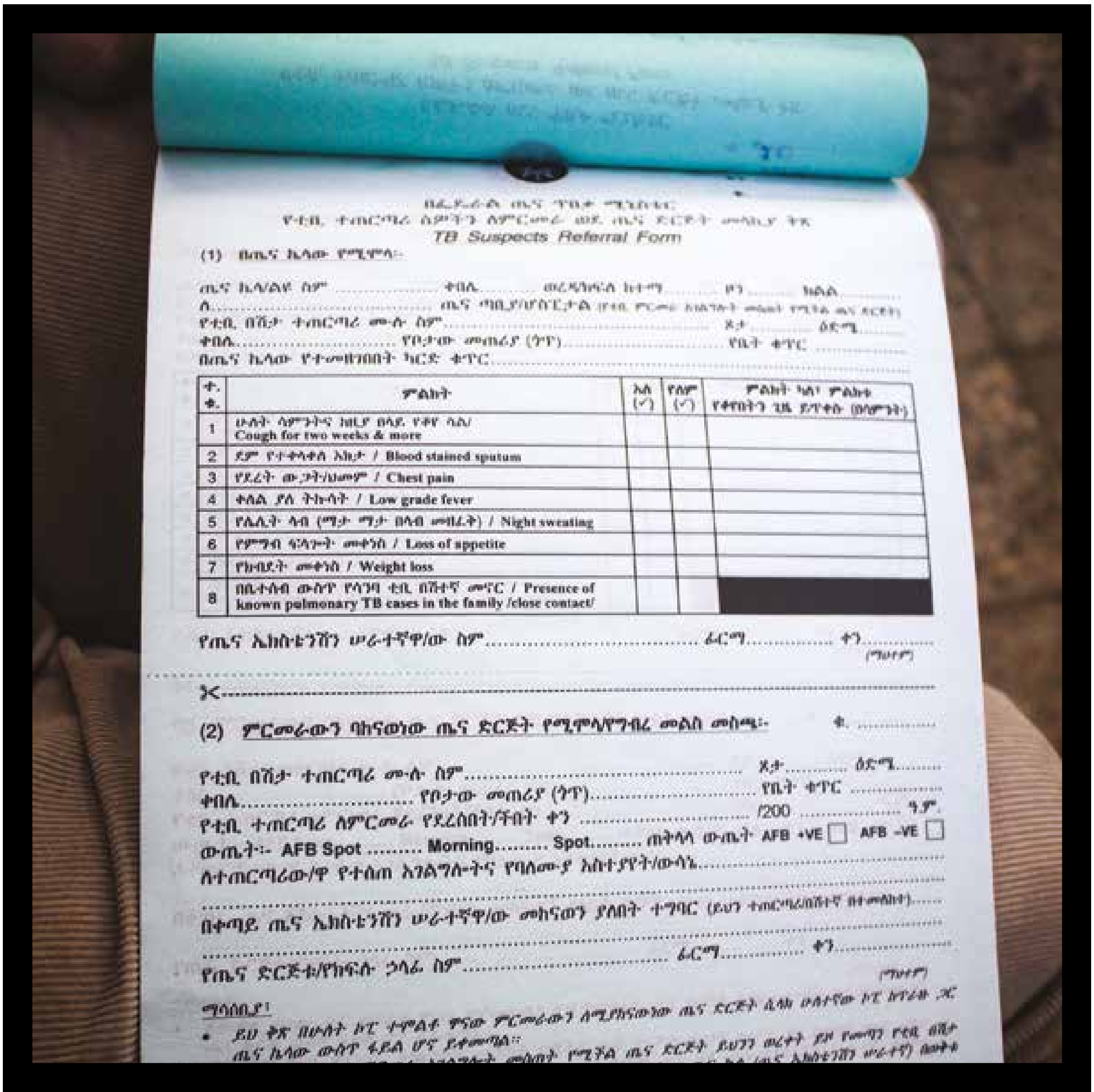
Key affected populations – Underserved, vulnerable populations who face barriers to access care, or who are more heavily affected by TB than the general population due to the presence of one or multiple risk factors, e.g. PLWHA, miners, incarcerated individuals, homeless individuals, poor rural populations, slum residents, etc. This is a highly contextual definition; these populations will vary by region or country.

Target population – This is the population which will receive screening, diagnostic and treatment services offered by an ACF initiative.

Intervention area – This refers to the larger population encompassing the target population which is used to evaluate the impact of the interventions and ACF activities on TB case notifications.

Control area – This is the population against which changes in TB case notifications in the intervention area are compared, in order to determine whether and to what degree gains or decreases can be attributed to the interventions and ACF activities, as opposed to a larger change occurring in both intervention and control populations.

Pre-intervention period – This is the period of time, which should be at least one year, immediately prior to the beginning of ACF activities, and against which TB case notifications during the intervention are measured.



An example of a sputum request form used by Health Extension Workers in Sidama Zone, Ethiopia

How to Use this Document

The wide and persistent gap in tuberculosis (TB) case detection is a cause for concern worldwide, particularly as global TB targets are being set ever higher. While a few countries have had great success in closing the gap between the estimated incident and notified patients, most have not. Millions of people are estimated to become ill with TB each year, and a large proportion of these are missed by National TB Programmes (NTPs). There are many reasons why patients are still missed after significant gains in DOTS coverage have been achieved. True access to high-quality care is still unavailable for many people, and numerous opportunities remain for people to slip through the cracks and die from this curable disease.

Outside of the BRICS countries (Brazil, Russia, India, China and South Africa) 35% of TB care funding in high-burden countries comes from international donors, and over 80% of all external funding comes from The Global Fund to Fight AIDS, Tuberculosis and Malaria. Consequently, it will be very important for countries to incorporate new approaches to TB case detection into their country dialogue for Global Fund Concept Note development. Numerous recent guidelines on different aspects of TB care delivery, such as active case finding, contact investigations, and Xpert MTB/RIF testing, can help to improve case detection.

WHO guidelines generally focus on answering a set of specific questions: for example, should contacts of people with TB be screened? While the messages are clear – yes, all contacts should be screened – most guidelines do not provide insight on the 'how to' aspects of implementation. This document provides a selection of case studies, from different settings and key populations, illustrating how to operationalize interventions to improve TB case detection.

This document is not meant to be prescriptive and should not be used as a guideline. Instead, it provides ideas and context for various approaches that can be adapted, measured and evaluated. Its intended use is for NTPs and their partners who are interested in improving TB case notification and in benefitting from the lessons others have learned.

In Global Fund's new funding model, countries often identify low TB case detection as one of the most important barriers to improving TB care, but fail to propose interventions that would plausibly increase case detection. This document gives a collection of interventions and activities on TB case finding, the context in which they were implemented, and their externally validated results. It is hoped that these case studies encourage countries and partners to set more ambitious case detection targets in their Global Fund Concept Notes and to help them in selecting novel care delivery approaches and monitoring frameworks to achieve those targets.

Preparing
for community outreach activities
for TB case finding
in slum areas of Abuja, Nigeria.

The TB REACH Initiative

With support from international donors and domestic funding for TB care, the global TB community has been able to reverse the increase in TB which occurred during the 1990s. The number of notified TB patients has been falling slowly worldwide, and millions of lives have been saved through proper diagnosis and treatment over the past 15 years. However, the rate of reduction in new TB case notifications is slow, and there are signs that progress has stagnated over the past several years. A third of the nearly nine million people who are estimated to fall ill with TB each year are not reached with proper screening, detection, and treatment. That number of 'missing' patients – over three million – has stubbornly remained unchanged since 2007. The inability to find and treat these patients is hampering efforts to make further progress and is threatening to reverse many of the gains that have been made in TB care since 1995.

The post-2015 TB targets approved by the World Health Assembly in May 2014 reflect the desire of the global TB community to rectify this lack of success in detection and in providing quality care for all people with TB. In order to reduce the number of people falling ill with TB by 90% and TB deaths by 95% by 2035, all new patients need to be found and treated.

TB REACH is an initiative of the Stop TB Partnership which was created to test innovative solutions to improve TB case detection and reporting. It was launched in January 2010 in response to a call from partners and high-burden countries to support innovative approaches to achieving universal detection of TB patients. It funds promising, but untested methods for reaching and treating vulnerable populations – people who otherwise often go undetected or are only detected in a later state of disease, and therefore rarely receive good-quality treatment or any treatment at all. Through small, one-year grants, TB REACH finances innovative thinkers to test out their ideas on a largerscale, programmatic level, thereby giving plausible and well-informed ideas a chance to develop into well monitored projects implementing interventions which when successful have the potential to inform national policy and investment plans and country dialogue for Global Fund applications.

TB REACH:

» Offers one-year grants to TB programmes and partners for technically sound, innovative and cost-effective TB case detection interventions;
» Provides fast-track funding;
» Focuses on poor, vulnerable and marginalized groups, and populations with limited or zero access to TB care services;
» Encourages local innovation and bold solutions that may not be funded elsewhere;
» Requires detailed reporting on technical and financial progress and case notification data;
» Ensures external monitoring and evaluation of all projects; and
» Delivers rapid results for improved TB care.

TB REACH was set up with a multi-year grant from the Government of Canada and has later received co-funding from UNITAID for Xpert test equipment.

Gauteng and North West Provinces in South Africa have strong ties to the mining industry, where The Aurum Institute worked with local communities on TB case finding.

Choosing an Active Case Finding Intervention

Business as usual approaches are not improving TB case finding – expansion and strengthening of TB care services are needed. The selection of case detection activities for an active case finding (ACF) intervention should always be based on a careful assessment of the epidemiological situation, potential benefits and risks, costs, available resources, and relevant experiences. When developing an ACF intervention, it is always necessary to identify key populations with high numbers of undiagnosed TB, to understand the health seeking behaviours of those populations and to recognize the barriers they might face in TB diagnosis. These criteria are necessary for impact and critical to measure the effectiveness of any case finding intervention.

The first step towards improving TB case detection is an assessment to identify the gaps in existing case detection strategies, along with proposals for possible solutions. The existing TB care system should always be prioritized for improvement, as opposed to creating a parallel and often competing TB care system. There are usually a number of simple interventions which can improve detection among those symptomatic individuals who are already accessing care in a passive setting. For instance, in line with WHO guidance, the following risk groups should always be systematically screened:

- Contacts of TB patients,
- People living with HIV/AIDS (PLWHA) and
- People exposed to silica dust (such as miners).

The screening approaches for contacts of TB patients, PLWHA, or individuals exposed to silica dust will differ depending on the local setting. Developing an approach will involve consideration of the most appropriate testing strategies, human and financial resources, epidemiological data, and infrastructure needs and requirements.

Once a plan to strengthen the existing case finding approaches has been developed, a critical review can be made of the barriers which sick individuals face in accessing care and the possible solutions as additional activities to increase the numbers of people evaluated for TB.

Figure 1 shows a basic diagnostic and care pathway for TB, as well as gaps where people with TB may be 'missed'. There are five entry points for improving detection and notification:

1. Improved awareness/knowledge,
2. Increased access to care,
3. Better identification of people for testing,
4. More sensitive and rapid diagnostic tests, and
5. Stronger linkages for notification to NTPs.

The first four areas are entry points to increase case finding and treatment through reaching people with undiagnosed TB, while the last approach focuses on improving notification to the NTP. This last approach can be used when a sizable proportion of 'missed' cases are due to pre-treatment loss to follow-up or underreporting; for example, by linking the private sector to NTPs and improving recording and reporting within NTPs. For each of the entry points there are many possible interventions; how they are tailored will depend on local circumstances and needs.

Screening and testing algorithm considerations

The diagnostic algorithm for screening and testing must be considered when undertaking ACF interventions. Highly sensitive screening tests are preferred in combination with highly specific confirmatory tests. If screening activities in low prevalence settings, such as in house-to-house approaches, use diagnostic tests with relatively low specificity, a large number of falsely positive patients will be detected. The use of chest x-ray (CXR) as a screening, rather than diagnostic, tool is a highly sensitive way of identifying people needing further diagnostic testing. New WHO-recommended tests, such as the Xpert MTB/RIF assay, are more sensitive and more specific than microscopy, and should be given strong consideration when starting ACF activities.

Basic prerequisites for ACF interventions

ACF may often result in large increases in the number of people tested at laboratories, initiated on anti-TB treatment, and requiring treatment support. NTPs and their partners should ensure that high-quality diagnostic, treatment, and support services are available for patients, and that steps have been taken to prepare the services for an influx of demand. If the ACF approach will also be detecting drug resistant cases, parallel considerations must be made to ensure that there is adequate capacity for increased volumes of culture and drug susceptibility testing, and for the programmatic management of drug-resistant TB.

All interventions to improve TB case detection will attempt to identify and diagnose prevalent and incident TB and interrupt the cycle of transmission. A monitoring and evaluation framework will need to be carefully tailored, and should be based on the barriers addressed in the pathway to care, the intervention type, the population targeted, and testing procedures used.

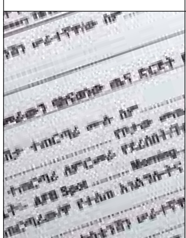
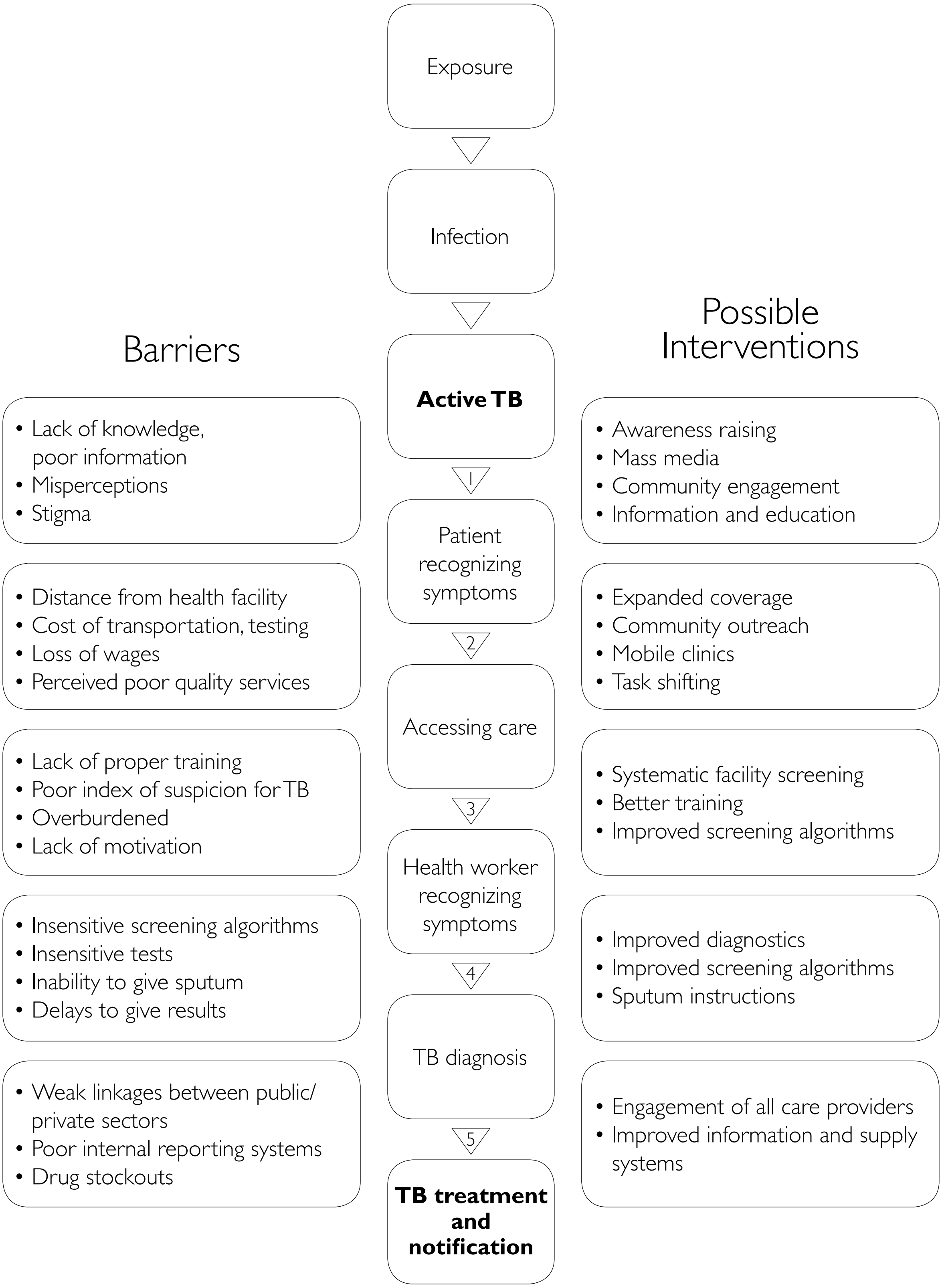
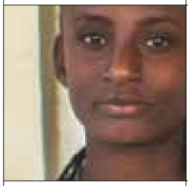


Figure 1. Pathway to care with barriers and possible interventions





A Monitoring and Evaluation Framework for Active Case Finding Interventions

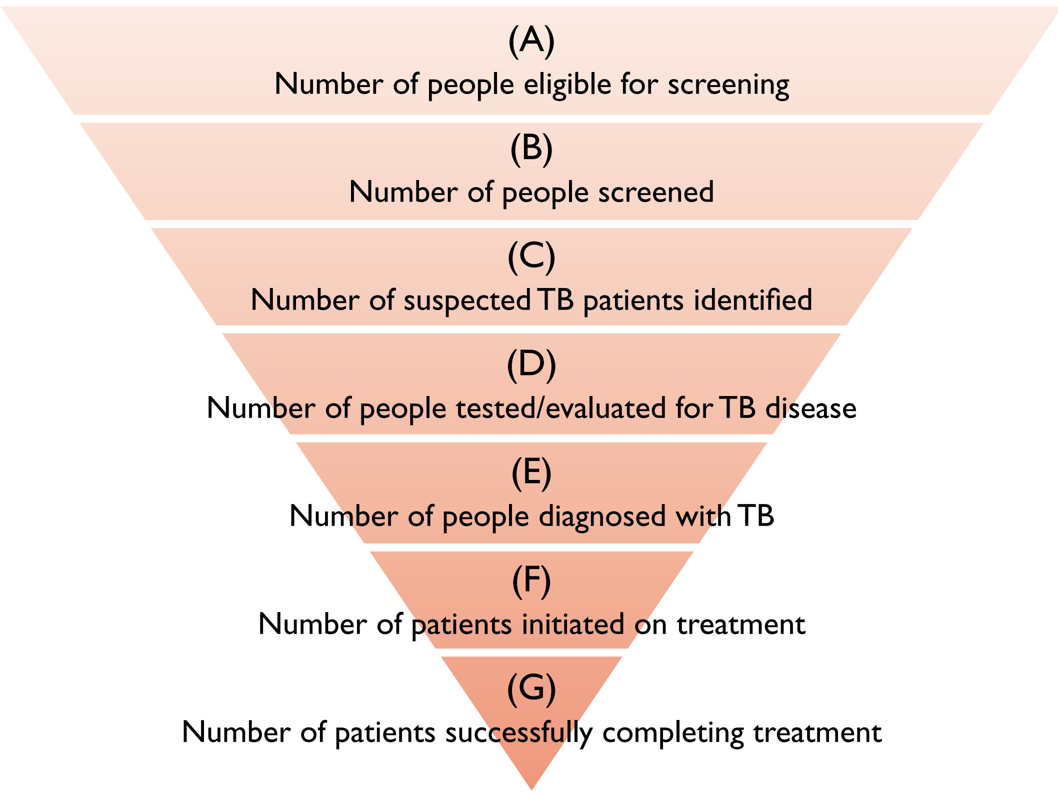
When introducing interventions aimed at improving case detection, program managers will want to know if cases are being detected earlier, but also that an intervention effectively targets cases that would otherwise have been missed. Thus, to evaluate the overall impact of a project, a monitoring and evaluation framework should analyse both intervention yield (cases found by the project) and TB case notification data from a larger population. The framework should also use historical and contemporary controls to evaluate the impact of a given intervention to improve TB case notifications. Outcomes of interest include:

- Testing data
- Yield of interventions
- Patients previously not reported

Intervention-specific measures

Intervention-specific indicators are chosen based on the approach used. Many ACF interventions are designed to measure the yield of screening efforts that are then used to predict the prevalence of active and undiagnosed TB in a population. People in a specific setting, a key affected population, or other at risk populations are screened (e.g. asked about the presence of TB symptoms). To identify individuals with TB, a diagnostic test is then applied to a subset of those screened who have met criteria for further evaluation. Direct yield of an intervention is then measured as the number of TB cases identified directly through efforts of the intervention. **Figure 2** illustrates this concept below.

Figure 2. Monitoring the pathway to TB care



ACF initiatives that implement TB contact investigations, screening of prisoners, PLWHA or other easily identified risk groups, are well suited for measuring direct yield. Interventions should attempt to collect a basic set of core data including the number of people: approached, screened, screened positive, tested, diagnosed, initiated on treatment and successfully treated. Reviewing the numbers of people passing through each step of the screening and testing process is essential to evaluate both dropout and inefficiencies and to identify strategies that minimize loss to follow-up.

Intervention-specific indicators are detailed in **Table 1**. The number of people needed to screen (NNS) to identify one case of TB can provide a reasonable estimate of the effort required in an ACF intervention; however, not all screening approaches are the same. Some screening efforts can be done at little or no cost, while others may require significant human and financial resources. Thus, interventions that only report yield or NNS without these other measures are of limited value when trying to use resources efficiently in planning scale-up. Similarly, while the number of people needed to test to identify one case of TB can help to prepare for needed laboratory resources, in practice, its value as a planning tool will be highly dependent on available resources, the screening algorithm used and diagnostic tests.

Measuring the number of TB patients detected, rather than actual treatment initiation and treatment completion, will provide an overestimation of an intervention's impact. Even during passive case finding, pre-treatment loss to follow-up can be an important concern. Without measuring both diagnosis and treatment initiation, it will be harder to draw useful conclusions about the intervention, as some interventions can detect many cases of TB, but fail to initiate them on treatment.

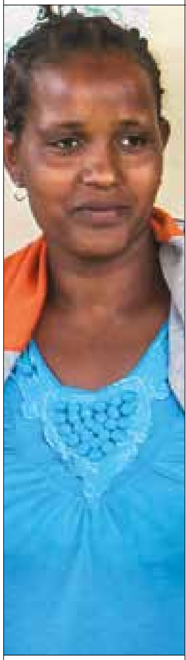
Measuring change in notification

To be successful, any intervention focused on case detection will need to achieve a significant direct yield. However, intervention specific indicators are insufficient to measure the impact of the activities on overall case notifications. Studies have shown that a sizable proportion of TB patients detected during ACF interventions (measured by direct yield and NNS) would find their way to treatment in the absence of the intervention. The concept of 'an additional TB patient' can be defined as a patient that would not have been notified in the absence of the intervention.

Table 1. Intervention level case detection indicators

Using the data collected in **Figure 2** (Monitoring the pathway to TB care) interventions should be able to calculate the following basic indicators. Others can be tailored depending on the specific interventions.

- Proportion of people screened among those eligible (B/A)
- Proportion of people with suspected TB identified among those screened (C/B)
- Proportion of people tested/evaluated for TB among suspected TB patients (D/C)
- Proportion of people diagnosed among those screened (E/B) and tested (E/D)
- Proportion of people initiated on treatment among those diagnosed (F/E)
- Proportion of people successfully completing treatment among those initiated (G/F)



An important step in setting up the evaluation framework to measure the impact of an intervention is the delineation of the target population and intervention and control areas. When choosing ACF activities, the target population (the group receiving the intervention) must be identified and well-described. Some populations, such as PLWHA or diabetics, are relatively easy to define. In other instances, the target population will be more dispersed (e.g. people living in slum areas with poor access to care), and therefore their population will have to be estimated. To show impact on TB notifications at a population level, the target population needs to contain a substantial number of people with TB who are unlikely to present with symptoms to health services (passive case finding) within a given future time period without the intervention.

The next step is to determine the larger population in which case notification and treatment outcome data will be monitored and evaluated (intervention area). To capture possible spill over effects in neighbouring sites, and to account for potential redistribution of cases (e.g. shifting patients from one health facility to another without increasing the total number of patients receiving care) case notification data will need to be monitored in an intervention area geographically larger and more populous than the target population alone. The selection of an adequate intervention area is a delicate exercise and should be carefully undertaken following an assessment of the epidemiological data in the area and mapping of diagnostic/treatment facilities. The intervention area needs to be large enough to capture all potential effects of ACF activities, but it should not be so large that the impact of ACF activities is diluted. In most instances, it is possible and desirable to make use of the existing NTP notification system and select one or more basic management units where patients in the target population would normally present for care and be notified. While this approach works well for most ACF interventions, small or dispersed target populations may require an adapted definition of the intervention area. For example, if ACF activities focus on improving case notifications among children, age-disaggregated case notification data should be analysed.

Furthermore, it is important to verify where cases (e.g. migrant labourers and prisoners) diagnosed in a different catchment area than that of their registered domicile, would normally be notified, to ensure consistency in the intervention's case notification approach.

The use of a control area is important to identify contemporary trends and other factors influencing case notification external to the influence of the project. Comparing year over year changes in case notifications in the intervention area, without taking into account both secular trends in case notifications and contemporaneous changes in control areas, can give a false impression of the impact of ACF activities. Currently, there is a steady decline in national TB case notification in a number of high burden countries (South Africa, Russia, Ethiopia, and Kenya), while others (Mozambique and Indonesia) have increasing trends. When two populations – one with a steady decrease in case notifications prior to an ACF intervention and another with historical increases – both show no change in case notifications post ACF activities, this similar failure to change case notification should be interpreted in the light of the pre-intervention trend.

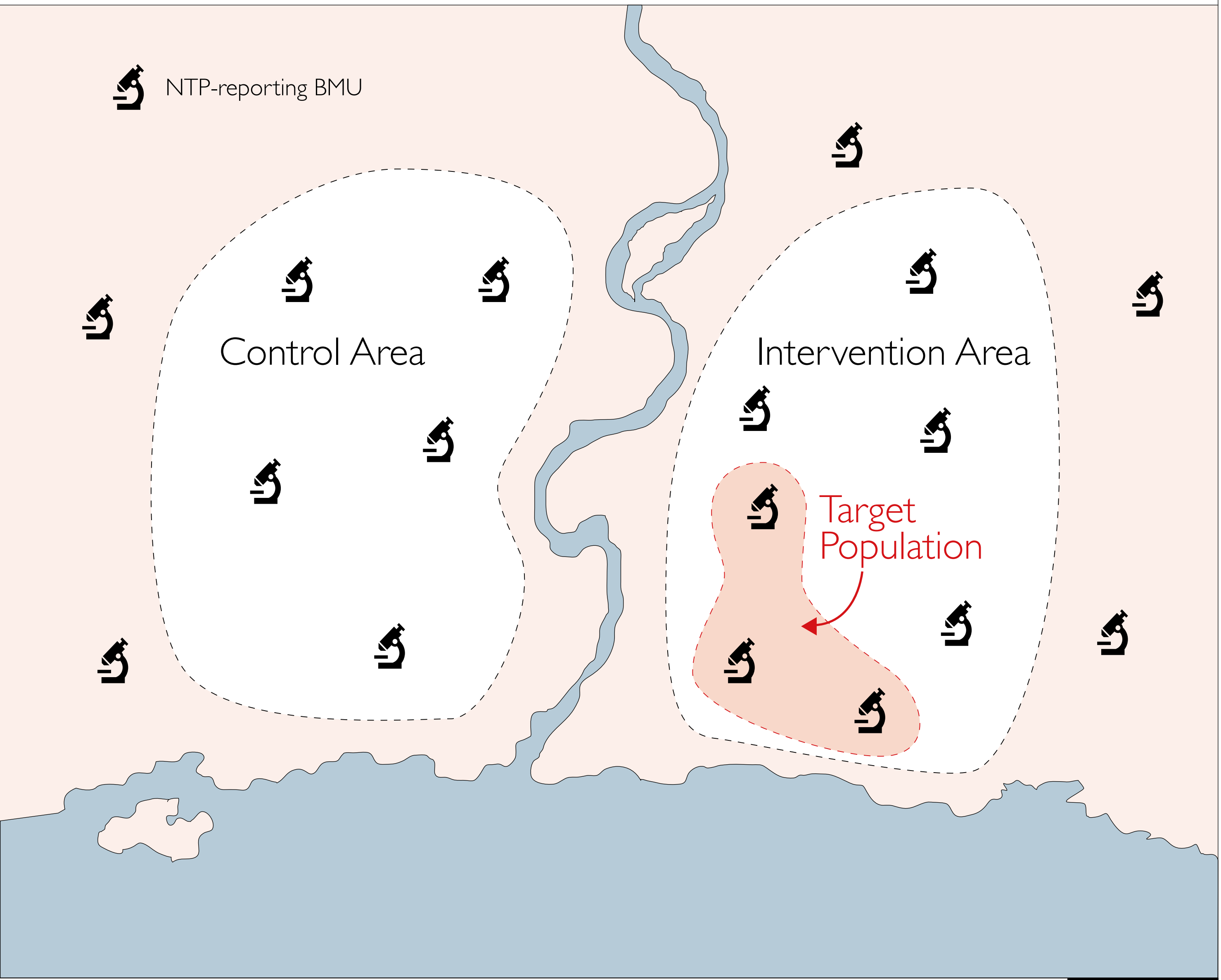
A control area should be comparable, but geographically isolated from the intervention area. They must share similar TB care services and case notification trends and ideally be similar in population size and demography. Similar case notification rates in both the intervention and control areas support the idea that these populations are comparable. External factors influencing case notification in the intervention and/or control area should be monitored before and during ACF activities, and their effect on case notifications should be estimated. Examples of such external factors include, but are not limited to:

- Contemporary trends and seasonal patterns;
- Political, security or natural disaster events;
- Initiation or discontinuation of other TB interventions;
- Change in national TB guidance, changes in TB funding;
- Changes in guidance on TB notification and health management information systems;
- Major health systems' related events and changes and
- Disruption of essential supplies.

If ACF activities are being carried out country-wide, it may be difficult to identify suitable contemporaneous control areas. In this case, historical controls will become more important.

TB case notifications in both the intervention and control areas should be collected historically and prospectively. In the absence of a local prevalence survey, pre-intervention TB case notifications by quarter need to be compiled. At least one year of pre-intervention case notification data should be obtained to account for seasonal variations, although obtaining data for additional years is ideal to improve control for secular trends. In many situations, a simple linear projection can be used to predict the standard passive system performance during ACF activities, while a logarithmic or exponential projection could be considered in other situations, depending on the best fit. An illustration of a target population and intervention and control areas for this framework is presented in **Figure 3**.

Figure 3.
Conceptual model of monitoring and evaluation efforts to improve TB case notification



Interpreting results

Evaluating ACF results must be based on where the entry point lies in the patient pathway for improving case detection (**Figure 1** on page 9). For some ACF interventions, an improvement will be shown through better notification systems; others will rely on greater sensitivity of diagnostic tests, while most of the interventions will focus on the initiative's direct yield of previously undiagnosed TB cases in the target population and intervention area.

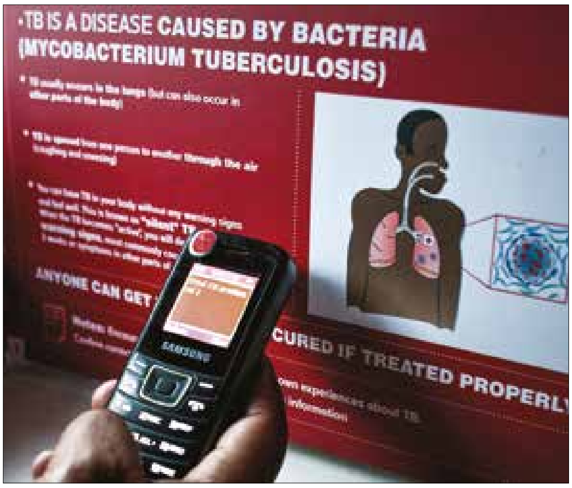
Interventions that can show direct yield of the ACF strategy with concurrent improvements in TB case notifications, controlling for secular case notification trends and changes in case notifications in the control area, can demonstrate that additional cases were detected and treated beyond what the passive case finding system would have contributed. However, a period of increased TB case notification may be primarily due to identifying cases earlier, causing notifications to return to pre-intervention levels as soon as the backlog of prevalent cases is cleared by the intervention. An intervention that is also successful in identifying cases that would otherwise not have reached any services is likely to show increased case notifications over a longer time period, until transmission and incidence are affected, and notifications begin to decline.

An increase in bacteriologically-confirmed TB cases in the absence of an increase in pulmonary TB notifications may suggest a shift from unconfirmed to confirmed diagnoses (smear-positive or bacteriologically-positive, SS+ or Bac+ respectively), rather than an increased number of people with treated TB. A rapid, sensitive test (like the Xpert MTB/RIF assay) could actually decrease overall notifications in settings where many people are being put on treatment without bacteriological evidence, since such a test could convince a clinician to rule out TB. Analysing the trends in bacteriologically-confirmed cases, all pulmonary TB, and the proportion of confirmed patients among all pulmonary TB will provide a better understanding of the impact of different interventions. Increases in TB case detection are unlikely to occur without substantial increases in laboratory testing. Tracking the number of tests performed historically and prospectively can provide a good indicator of efforts made to find more people with TB. It is important to ensure that national recording and reporting systems are tracking these new tests using the revised WHO recording and reporting guidelines to ensure that impact can be clearly measured.

Testing data

Most countries focus on the cohorts of patients registered for treatment and do not systematically collate and analyse laboratory testing data. This needs to change when implementing interventions to improve TB case finding. The number of people tested either with a screening or a diagnostic test is indicative of the efforts made by to detect TB cases, and this data needs to be collected, compiled and published regularly. Interventions additional to TB case finding, if implemented well, will increase the number of people tested for TB, and it is important to monitor this trend. On the contrary, a flat or falling trend in people tested for TB implies less effort made in detecting TB.

The use of surveillance data (TB case notifications and treatment outcomes) has limitations; data completeness, consistency and reliability can vary over time and may be influenced by changes in surveillance practice. For example, NTP data can be affected by changes from paper-based to electronic registration, changes in district boundaries, or changes in case definitions. As data outliers are not always easy to explain, these issues should be considered when analysing the results of interventions. Therefore, systematic monitoring of external factors influencing notification in the intervention and control population is crucial.



Other ACF intervention benefits

By definition, ACF interventions attempt to find people with TB earlier than they would have been detected (if at all) without the intervention, through resources and efforts that move beyond the passive case finding model. In addition to increased case notifications, a number of individual level benefits can be measured during ACF, including:

- Acceptability of screening,
- Lower out of pocket patient costs,
- Lower overall costs for the health system,
- Early case detection,
- Shorter test result turnaround time,
- Decreased pre-treatment loss to follow-up,
- Shorter time to treatment,
- Improved smear conversion rates and
- Better treatment outcomes.

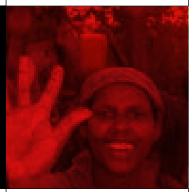
Treatment outcome data for individuals found directly through ACF interventions, as well as in the larger intervention area, should be monitored. There is no clear evidence that ACF activities alone will improve treatment outcomes, but they do not worsen them. A number of studies have shown that, among actively found cases, better treatment outcomes can be obtained by providing treatment support to the patient. Improved treatment outcomes through ACF may be mitigated by the possibility that people who delay or fail to seek care through passive case finding due to migration patterns, release from prison, substance abuse, and so on, may be harder to keep on treatment. In addition, if the initial situation assessment of the health system was not properly conducted, large increases in people tested and treated may cause systemic issues such as shortages in laboratory consumables, anti-TB medication, and human resources.

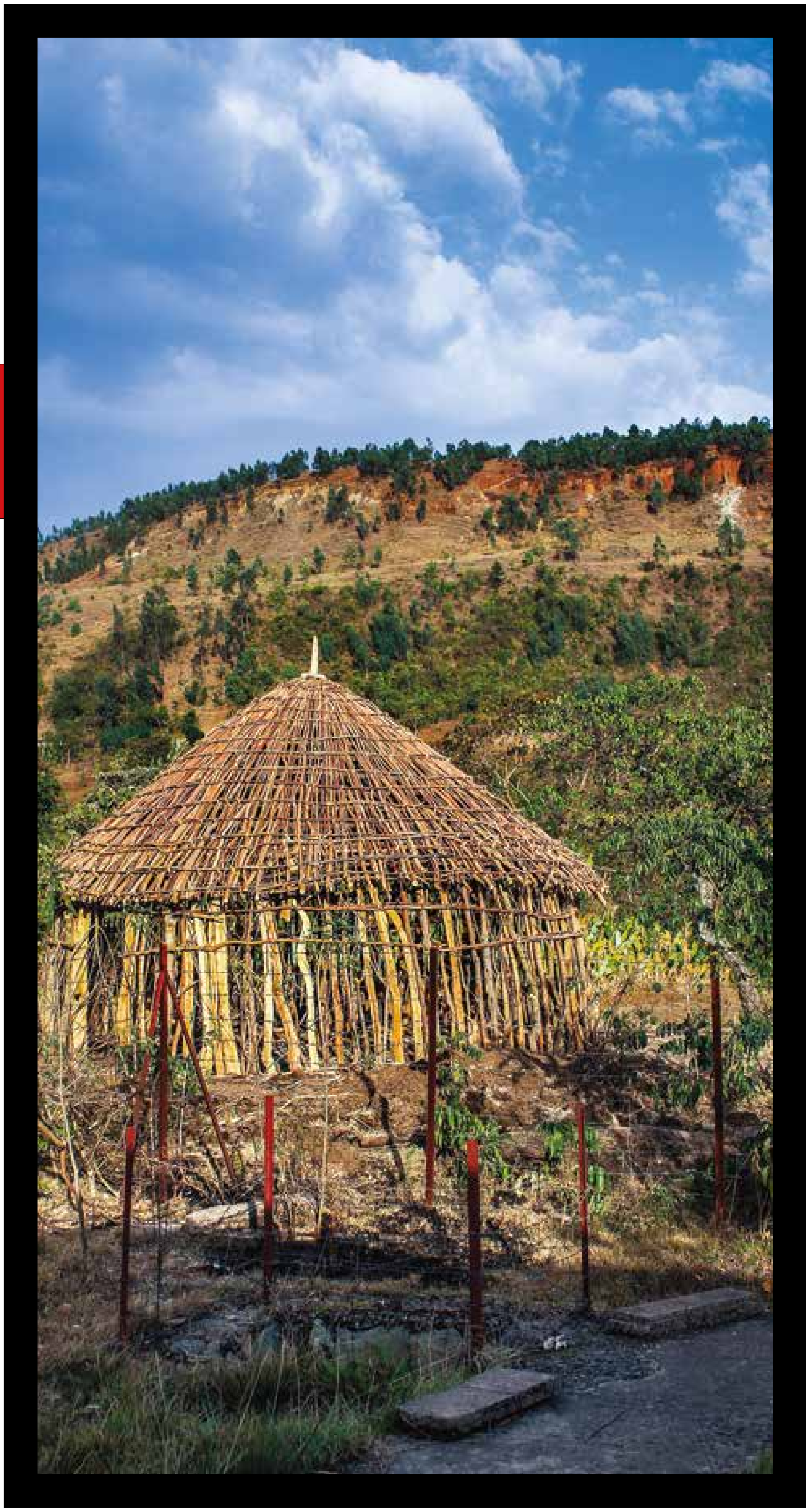
This section has been adapted from "A pragmatic approach to measuring, monitoring and evaluating interventions for improved tuberculosis case detection," by Blok L et al. Published in International Health 2014; available under a Creative Commons BY-NC 4.0 licence.

Further Reading:

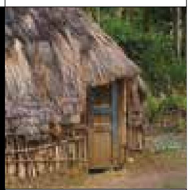
- Blok L, Creswell J, Stevens RH et al. A pragmatic approach to measuring, monitoring and evaluating interventions for improved tuberculosis case detection. Int Health 2014; 6(3): 181-188.
- Creswell J, Sahu S, Blok L, Bakker MI, et al. A Multi-Site Evaluation of Innovative Approaches to Increase Tuberculosis Case Notification: Summary Results. PLoS ONE 2014; 9(4): e94465.

Case Studies

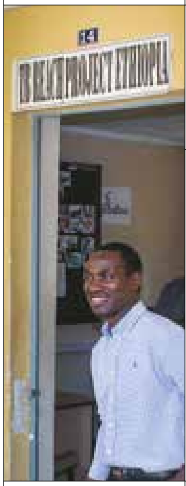




Rural, Migrant, and Indigenous Populations



Rural, migrant and indigenous communities are often hard to reach through routine passive case finding activities. In some settings, accessing TB diagnostic and treatment centres entails significant travel time and/or cost to patients and their families. In other cases, communities may be insular and people may not seek the care which is accessible, owing to a lack of awareness about the services, stigma, or mistrust/dislike of public health facilities. In all these instances, TB often goes undiagnosed, causing excessive morbidity and mortality. In the following case studies, we describe how TB REACH grantees in Ethiopia and Nigeria have been able to improve service provision in hard to reach communities and delineate the impact this has had on TB case notifications.



REACH Ethiopia and Liverpool School of Tropical Medicine

Country: Ethiopia
Key Populations: Rural populations
Key Strategies: Task shifting, Specimen transport, Community outreach
Intervention Period: October 2010 to present
Funding Provided: 2,236,983 USD (plus 144,950 USD from UNITAID TBXpert)
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 92; All Forms: 205

Setting

In the Sidama zone of Ethiopia (7.4 million population), an estimated 70% of people live more than 10 Km away from the closest health facility. This, in conjunction with widespread misconceptions about TB risk and transmission, results in significant delays in sick individuals seeking healthcare services and ultimately has sustained TB transmission in these communities.

Intervention

A package of interventions was designed to address these known gaps in the TB care pathway. Extensive advocacy and awareness raising activities were implemented to educate people about TB symptoms and to reduce stigma associated with the disease. Health extension workers (HEWs) and project supervisors were trained on methods to systematically identify people with suspected TB in the community. Barriers to accessing diagnostic services were reduced by the creation of a specimen transport system and the movement of anti-TB treatment initiation and follow-up into the community. Finally, all stakeholders involved with TB care in the region were engaged to ensure the success of these activities.

HEWs are female community health workers employed by the Ministry of Health to provide basic health services to their communities. In addition to their routine house-to-house visits, approximately 4,000 HEWs carried out systematic verbal screening activities. Individuals with a cough lasting two or more weeks were asked to provide sputum specimens, which HEWs then fixed onto slides. HEWs then coordinated with project supervisors, using airtime provided by the initiative, to coordinate the collection and transport of the fixed slides to the nearest laboratory. The transported slides were stained and examined using conventional smear microscopy or light emitting diode-fluorescence microscopy (LED-FM), depending on the laboratory. Supervisors collected laboratory results and returned them to patients. Smear-positive patients were initiated on treatment by supervisors in the same community, without the oversight of a presiding clinician. Supervisors also examined household contacts of diagnosed patients and initiated isoniazid preventive therapy for asymptomatic children. HEWs also provided treatment support; conducting follow-up visits, collecting sputum specimens to monitor treatment and reporting drug side effects and treatment outcomes. HEWs revisited individuals with smear-negative results who remained symptomatic, to collect further samples, and facilitated referrals to health facilities for further investigation (such as CXR and clinical exams). Given the large field of operation, the initiative had to build a robust and supportive supervision structure; regular project review meetings with HEWs and supervisors were organized to discuss progress of, challenges for and solutions to screening and treatment activities.

A GeneXpert system was procured to enable high risk patients, including PLWHA, symptomatic smear-negative individuals and child contacts of smear-positive TB patients to be tested with the Xpert MTB/RIF assay. However, given the large geographical area and population served by this one system, Xpert MTB/RIF coverage among those eligible for testing was low, despite the existence of a well-functioning sputum transport network.

Outcome

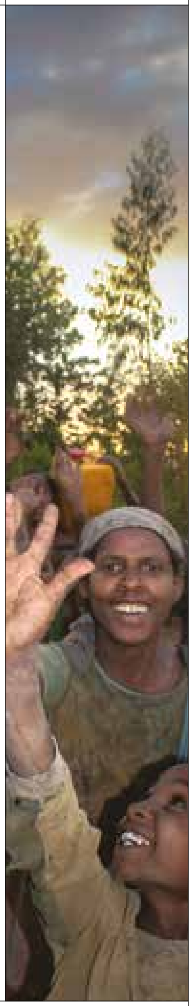
Despite some fears that additional TB screening activities would overburden HEWs, qualitative studies overwhelmingly showed the initiative to be a source of pride and motivation for HEWs, who were seen in their communities as providers of quality services. To date, HEWs have collected sputum specimens from 196,735 people with suspected TB and have detected over 17,200 smear-positive patients. These activities resulted in SS+/Bac+ TB case notifications increasing 110.8% compared with expected case notifications based on historical trends. Access to TB care services was significantly improved for females, resulting in equal numbers of male and female TB patients being reported during the initiative, compared to a 22% excess in male smear-positive patients in the pre-intervention period. Despite large increases in the number of people tested and treated for TB, the average patient load per HEW was only 3-4 a year.

Major Costs

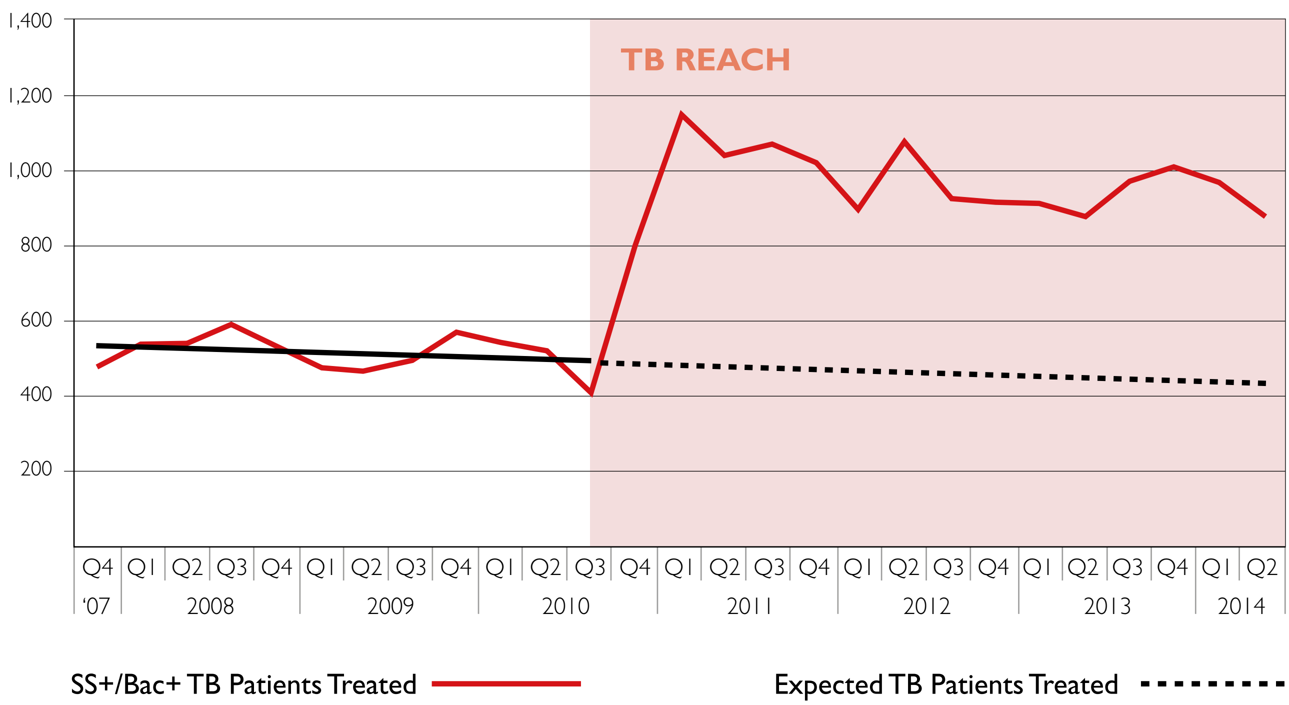
The major cost of this intervention was supporting the training, salaries and mobile phone credit of project staff, including supervisors and HEWs. Other major costs included supporting the laboratory tests, awareness raising activities, patient support and monitoring/review meetings.

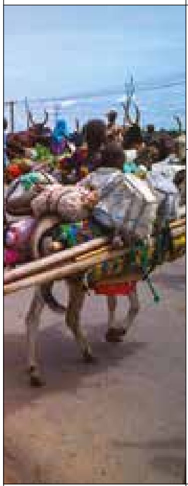
Further Reading

Yassin MA, Datiko DG, Tulloch O et al. Innovative Community-Based Approaches Doubled Tuberculosis Case Notification and Improve Treatment Outcome in Southern Ethiopia. PLOS One 2013; 8(5): e63174.



SS+/Bac+ TB Patients Treated





Adamawa State Tuberculosis and Leprosy Control Programme and KNCV

Country: Nigeria
Key Populations: Rural, migrant and indigenous populations
Key Strategies: Mobile care services, Community outreach, Media campaigns, Xpert MTB/RIF
Intervention Period: January 2012 to March 2014
Funding Provided: 492,955 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 36; All Forms: 80

Setting

Adamawa State has an estimated population of 3.7 million, of whom approximately 450,000 (12%) are nomadic pastoralists. Nomads are at significant risk of TB infection and disease due to factors such as poor access to healthcare, high rates of malnutrition, low immunization rates and overcrowded housing. However, given the mobility of these pastoralists, access to routine TB diagnostic and treatment services is limited.

Intervention

Three strategies were devised to improve access to and provision of TB care among nomads: awareness raising activities, ACF, and introduction of Xpert MTB/RIF testing. The initiative also invested heavily in improving the diagnostic capacity of existing TB health centres by procuring light microscopes and smear microscopy reagents, renovating a space at the referral hospital to house a GeneXpert system, and training program staff to improve TB care practices.

Radio messages intended to increase knowledge of TB symptoms and treatment services were produced in Fulfulde, Hausa and English, and were aired extensively. The English language jingles were targeted towards policy makers and were aired for a shorter period of time than the jingles directed at the community. The NTP manager appeared regularly on State television to discuss TB, and in particular the issue of TB among nomads. The initiative formed a committee which met with representatives from the Ministry of Health, other government bodies and local businesses to advocate on behalf of the project. The committee's lobbying was highly successful and resulted in several of the initiative's activities being co-financed.

Community leaders organized 378 screening days at nomad livestock resting stations, settlement areas, and market days where community volunteers could systematically screen attendees. People with suspected TB were asked to provide three sputum specimens which were transported to the closest microscopy laboratory for testing. Individuals with smear-negative results were asked to submit a fourth sputum specimen for Xpert MTB/RIF testing, but only 20% of those eligible were able to take advantage of this service due to difficult terrain, security threats and the repeated visits required for sputum collection. In addition to the screening activities, presentations and plays which focused on TB risks and knowledge were organized at public gatherings. Medicines for common conditions, such as worm expellers, multivitamins and anti-malarials, were often distributed at these gatherings to provide an additional incentive for community members to attend.

Outcome

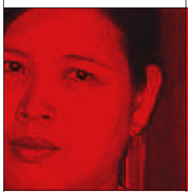
The initiative verbally screened 96,376 individuals, resulting in the detection of 9,890 suspected and 1,339 bacteriologically-positive TB patients. These activities led to a 41% increase in SS+/Bac+ TB case notifications in Adamawa State compared with expected case notifications based on historical trends. These gains in notifications were achieved despite ACF activities being focused primarily on nomads, who make up only 12% of the state's population.

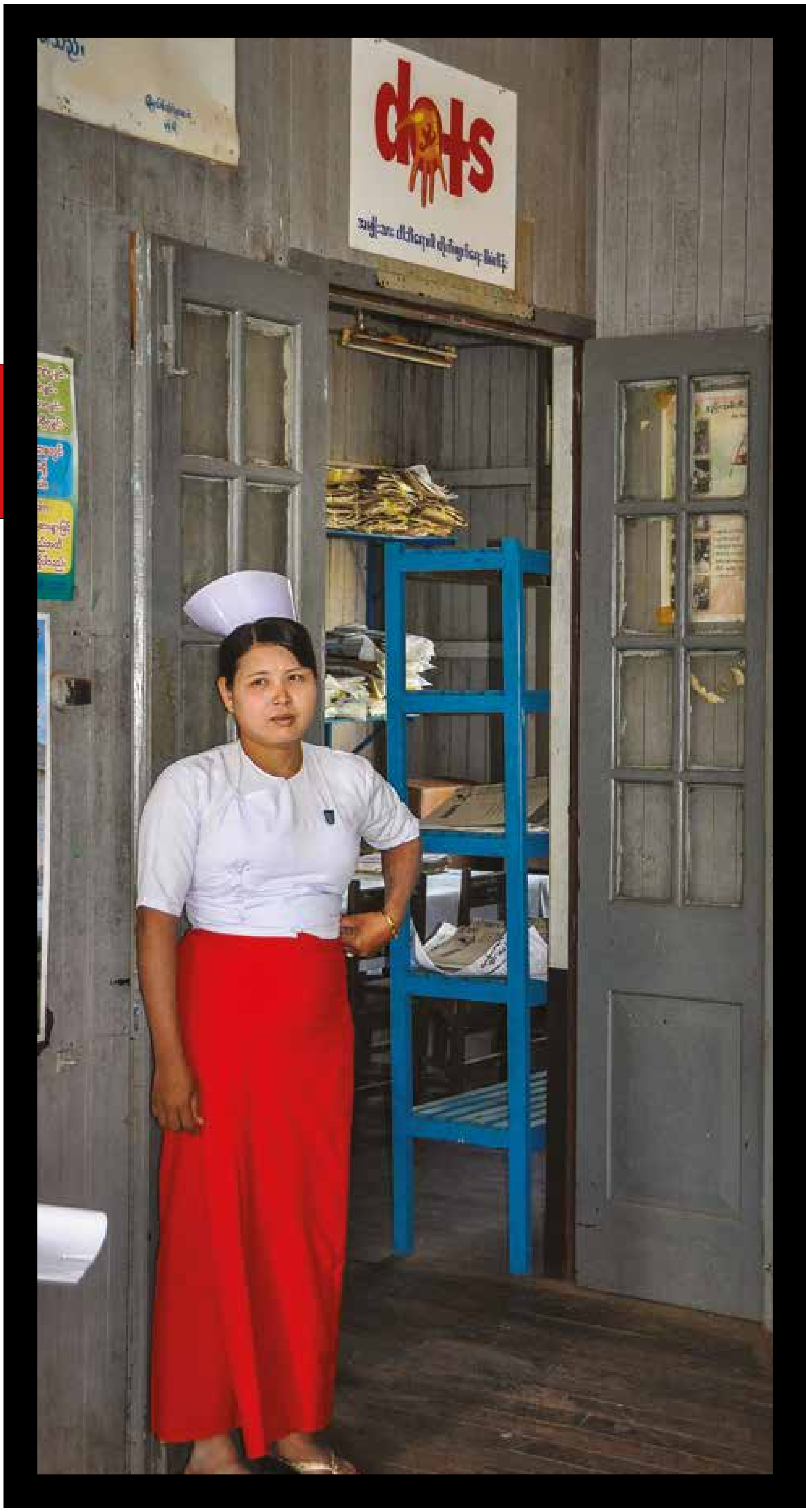
	2012	2013	Both Years
Number of community screening days	170	208	378
People verbally screened	20,907	75,469	96,376
People submitting sputum	4,433	5,457	9,890
Smear-positive patients detected	646 (14.6%)	504 (9.2%)	1,150 (11.6%)
Xpert MTB/RIF tests performed	654	1,031	1,685
MTB-positive patients detected	65 (8.4%)	134 (13.0%)	189 (11.2%)
Patients resistant to rifampicin	10 (15.4%)	19 (14.2%)	29 (15.3%)

Major Costs

The main cost associated with this intervention was for human resources to implement and monitor screening and treatment activities. The development and implementation of communication materials, retrofitting of laboratories and procurement of GeneXpert equipment, training of staff and maintenance and operation of project vehicles to reach screening sites were also significant costs.

The project used community market days to screen large numbers of nomads for TB–some in very remote parts of Adamawa State

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Systematic Screening at Public Outpatient Facilities

Despite impressive gains in DOTS coverage, there are still opportunities to further improve TB detection and treatment in many government health facilities. TB care programs often provide services within a vertical system and have little interaction with other specializations and departments in the same facility or with different health facilities. In many instances this vertical service delivery can result in delayed or missed diagnoses. For instance, when sick individuals, who often do not assume they have TB, access care at non-TB facilities they are often not evaluated for TB at all. In other settings, government health facilities are overwhelmed by the number of people accessing care and cannot evaluate everyone for TB symptoms. In this section, we describe the efforts of TB REACH grantees in Afghanistan and Tajikistan to systematically screen all individuals visiting public facilities and the surprising impact these activities can have on TB case notifications.

Anti-TB Association – Afghanistan Program (ATA-AP)

Country: Afghanistan
Key Populations: People attending public medical facilities, Internally displaced people, Household contacts of TB patients
Key Strategies: Systematic screening, Mobile care services, Incentives
Intervention Period: October 2010 to December 2012
Funding Provided: 950,040 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 34; All Forms: 83

Setting

In 2005, the Afghanistan NTP launched a plan to expand DOTS coverage to all comprehensive health centres, and upper level health facilities. Despite this scale-up, access to quality TB care services remains insufficient. Healthcare workers carry out all screening, diagnostic, and treatment activities, yet their limited training and experience with TB reduces their ability to perform these tasks. Forty-seven health facilities were targeted and five mobile TB teams were established in six provinces, covering a population of 4.4 million.

Intervention

ACF activities were implemented in three key populations: systematic screening of people visiting public health facilities, mobile screening services among internally displaced people and screening among household contacts of smear-positive index patients.

Systematic screening was conducted in 47 high-volume health facilities well stocked with drugs and lab consumables by the NTP. Healthcare workers verbally screened health facility attendees in the waiting areas. Supervisors provided on-the-job training to improve their awareness and knowledge of TB and to learn how to implement verbal screening activities. Anyone with a cough lasting two or more weeks was considered to be an individual with suspected TB and asked to provide a series of sputum specimens for smear microscopy. TB patients were then initiated on treatment by project healthcare workers and followed up through their treatment to ensure success. Performance-based incentives were provided to healthcare workers as a top-up to their existing salary. For every smear-positive patient detected, health facilities received 10 USD, which was divided among the staff: the physician, nurse, and lab technician received three USD each, while the healthcare workers providing TB education for patients in the waiting area received one USD.

Mobile teams consisting of a physician and a nurse conducted house-to-house visits in order to identify and screen internally displaced populations for TB. To ensure that no houses were missed, the mobile team met with the camp chief to map out the houses together. Individuals were then verbally screened, and anyone self-reporting a cough lasting two or more weeks was asked to provide sputum specimens at their home. Sputum specimens were then transported to laboratories for smear microscopy. The mobile teams were responsible for initiating the treatment of confirmed TB patients by supplying TB medicines to the camps; monitoring of treatment was overseen by volunteer treatment supporters.

Household contacts of smear-positive TB patients identified through the above two interventions were visited to ensure that they were screened and tested. Sputum from those with suspected TB was collected in the home and transported to laboratories. Either health workers or patients along with their families visited health facilities monthly to pick up medicines. For all three strategies (internally displaced populations' camps, contact investigation, and health facilities), treatment was administered under direct observation for the first two months.

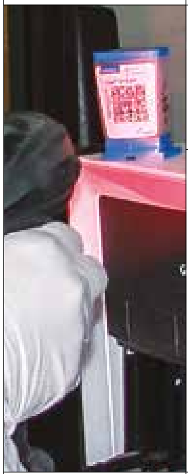
Outcome

Over two million individuals were verbally screened for symptoms of TB across the different screening strategies. Of those screened, 1.7 million (85%) were individuals already visiting public health facilities. These screening activities resulted in the detection of 47,558 suspected and 4,125 smear-positive TB patients. The screening of internally displaced persons and household contacts accounted for the remaining 322,850 screened individuals. Together these activities detected 921 smear-positive TB patients, with more than two thirds being detected among internally displaced people. In the first year of implementation, these ACF activities resulted in a 72.9% increase in smear-positive TB case notifications compared to the pre-intervention period. TB case notifications decreased in the second year of ACF activities, due to country-wide interruptions in TB care services, but were still 42.8% higher than the pre-intervention period.

	Health Facilities	IDPs	Household Contacts	All ACF Activities
Individuals verbally screened	1,699,277	306,205	16,645	2,022,127
People submitting sputum	46,7643	8,836	4,239	59,838
Smear-positive patients detected	4,125 (8.8%)	653 (7.4%)	268 (6.3%)	5,046 (8.4%)
Number needed to screen	62	469	412	–

Major Costs

Five rental vehicles used for mobile screening activities and two additional project rental vehicles were a significant cost. Despite the large number of individuals detected with TB, incentives did not account for a major proportion of the project's budget.



Republican TB Control Center

Country: Tajikistan
Key Populations: People attending public medical facilities
Key Strategies: Systematic screening, Xpert MTB/RIF, mHealth
Intervention Period: July 2013 to present
Funding Provided: 464,654 USD (plus 176,000 USD from UNITAID EXPAND-TB)
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 21; All Forms: 82

Setting

Multidisciplinary polyclinics are the first point of contact with the government health system for most individuals in Tajikistan. However, due to the country's vertical TB care services, there are often missed opportunities for screening and diagnosis when individuals present at non-TB services within a polyclinic. High rates of drug resistance further complicate accurate case detection and treatment success. This initiative implemented systematic verbal screening and Xpert MTB/RIF testing at 17 government polyclinics, which together serve a population of 1.4 million.

Intervention

Two health workers per facility were trained and incentivized to verbally screen all individuals visiting polyclinics for symptoms of TB, using a standardized questionnaire loaded onto mobile phones. Symptomatic individuals were then asked to submit at least two sputum specimens for testing with smear microscopy. A parallel Xpert MTB/RIF test was performed with one of the same specimens used for smear microscopy, regardless of the smear result. Sputum specimens collected at polyclinics with no GeneXpert system were transported to the closest testing facility on a daily basis.

Bacteriologically-positive, rifampicin sensitive patients were initiated on first line treatment at the polyclinic, and were supported in the community by 60 trained volunteers who provided daily DOT. TB patients with rifampicin resistant results on the Xpert MTB/RIF assay were initiated on a standardized second line drug regimen which was adjusted, if necessary, once drug susceptibility test results were available. The identification of people with TB symptoms, submission of sputum, provision of results and initiation of treatment were all monitored through electronic data collected on mobile phones to minimize delay and limit pre-treatment loss to follow-up. In order to increase the number of people screened at the polyclinics, volunteers from three local NGOs were trained to host information sessions about TB within the community.

In addition to implementing systematic verbal screening for symptoms of TB at polyclinics, the initiative set up verbal screening activities and a specimen referral network at a high-volume diabetes treatment clinic and a pre-trial detention facility (SIZO) in the capital, Dushanbe.

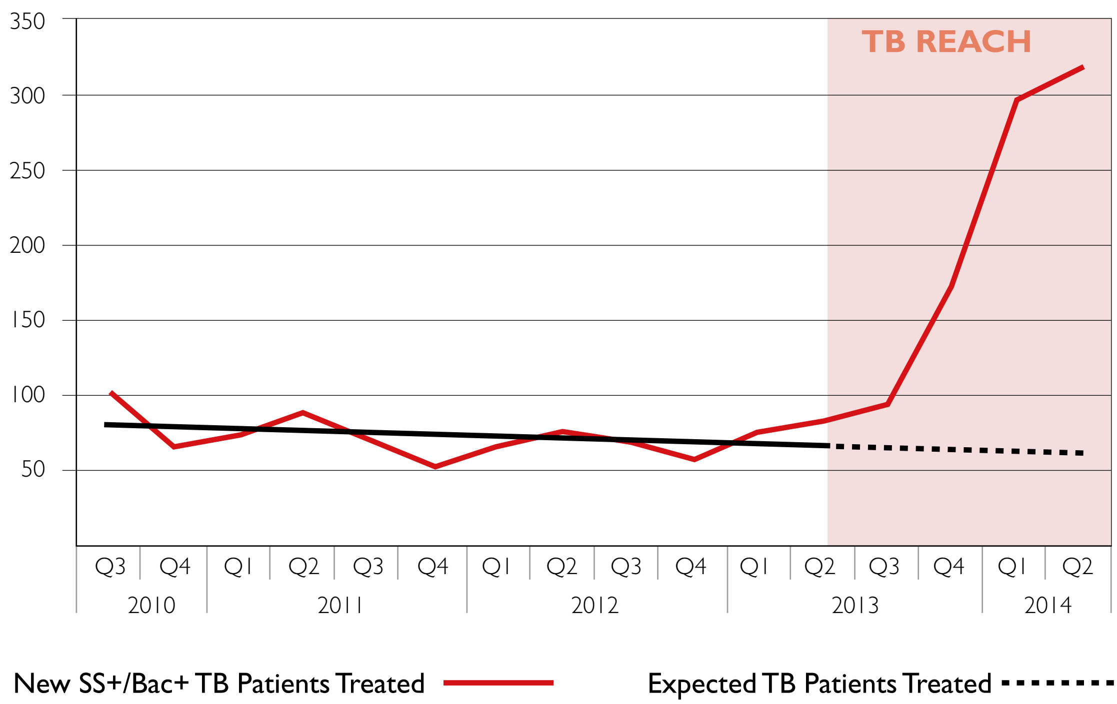
Outcome

Close to 850,000 individuals were verbally screened at polyclinics over the course of a year, resulting in the identification of over 9,700 suspected and 1,383 bacteriologically-positive TB patients. A further 555 TB patients were clinically diagnosed. Screening activities at the diabetes clinic and SIZO did not result in large volumes of people being screened or patients detected, and as a result these activities were closed down to focus on screening at polyclinics. These ACF activities resulted in a 201% increase in new SS+/Bac+ TB case notifications compared to the pre-intervention period. Xpert MTB/RIF testing identified 333 rifampicin-resistant patients significantly earlier than they would have otherwise been confirmed under pre-intervention algorithms.

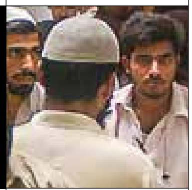
Major Costs

Procurement of GeneXpert systems and scale-up of Xpert MTB/RIF testing comprised the largest cost of this initiative. Human resource costs for health workers and the development and maintenance of the mobile phone-based data capture system and SIM cards with monthly data packages were additional major costs.

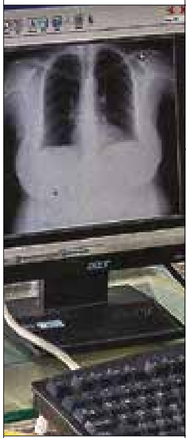
New SS+/Bac+ TB Patients Treated



People Attending Private Medical Facilities



In many settings, a patient's first interaction with a healthcare system is with a private provider. This is particularly true in South and Southeast Asia, where up to 80% of individuals choose to visit some form of private provider, owing to greater privacy, more convenient locations and hours of operation, and the perception of higher quality care. This presents a substantial challenge for TB prevention and care, as private TB care practices are often of unknown quality and patients may be given inappropriate diagnostic tests and may receive improper treatment. Drugs must be paid for out of pocket and may not be quality assured, resulting in poor treatment outcomes and the development of drug resistance. Even if patients are properly diagnosed and treated, they are not notified to NTPs. For all of these reasons, engaging the private sector is essential to strengthening TB care. In this section, we describe the experiences of TB REACH grantees in Pakistan and Uganda in engaging with private clinicians to diagnose and treat TB as well as the impact these activities have had on case notifications.



Indus Hospital

Country: Pakistan
Key Populations: People attending private medical facilities, Children
Key Strategies: Engaging private providers, Systematic screening, Media campaigns, mHealth
Intervention Period: January 2011 to June 2013
Funding Provided: 1,021,591 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 87; All Forms: 176

Setting

Karachi is Pakistan's largest city (estimated population of 21.2 million), yet just 64 basic management units report TB case notifications to the NTP. This inadequate coverage contributes to many TB patients accessing care at private sector facilities, including pharmacies, general practitioner (GP) clinics, laboratories and hospitals. This initiative engaged with 50 GPs (at any one given time) in a low-income neighbourhood of 2.5 million people to increase diagnosis, treatment and reporting of TB.

Intervention

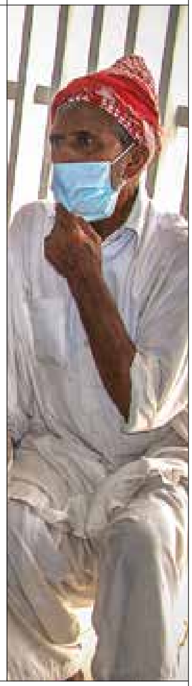
This initiative placed lay community members (screeners) in the waiting area at GP clinics to verbally screen all attendees for symptoms and risk factors of TB. People with suspected TB were identified according to the following criteria: 1) a cough lasting two or more weeks, 2) a prior history of TB or 3) contact with a family member with active TB. Two sputum specimens for each suspected patient were collected at the GP clinics and were transported daily to Indus Hospital by project supervisors for smear microscopy. Children with suspected TB were referred directly to a dedicated paediatric TB clinic at Indus Hospital for evaluation and treatment. Smear-positive adult patients were initiated on treatment at GP clinics with drugs provided by the NTP. Screeners provided treatment support and were paid performance-based incentives linked to complete form filling, specimen collection, case detection and treatment follow-up encounters.

Smear-negative patients were referred for evaluation to a mobile x-ray unit stationed at different locations throughout the community. Although these activities increased treatment among smear-negative individuals, the cost associated with operating

the mobile x-ray unit was high, and preventing over diagnosis of smear-negative TB proved difficult, as many GPs were willing to initiate anti-TB treatment based on a single abnormal CXR.

The initiative also established a mass communication strategy to increase self-referral to Indus Hospital and participating GP clinics through distribution of flyers, posters and banners, erecting billboards and GP signboards, and airing TV spots on a local cable channel - all of which highlighted TB symptoms and the locations of free TB care services. After initial implementation, the communication strategy was refined to include only approaches which had proven effective in increasing patient numbers; TV spots were aired on a second channel, four new billboards were designed and erected and additional GP signboards were installed.

Screeners were given mobile phones loaded with a custom-built data collection app which had question verifications, skip logic and range checks to minimize incorrect data collection. All data were securely transmitted to a server and analysed in real time to generate monitoring lists (e.g. suspected TB patients who had not provided sputum). Screeners then used these lists to self-direct their work, which in turn maximized their performance-based incentives.



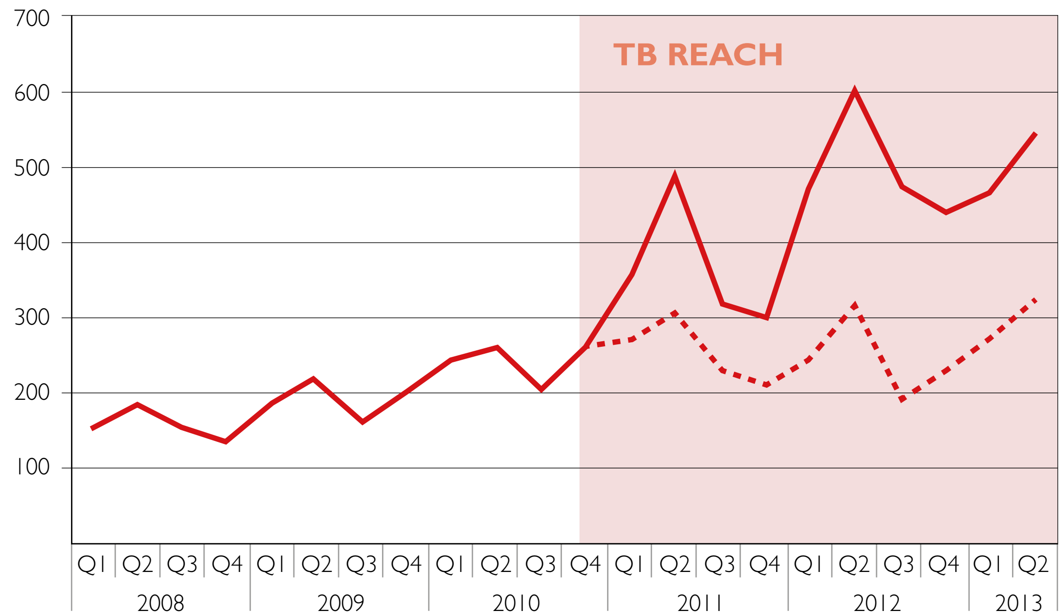
Outcome

Over 1.2 million individuals were verbally screened during two and a half years of implementation, resulting in the detection of 32,971 suspected and 3,668 all forms TB patients. These activities increased all forms TB notifications by 78.6% compared with historical trends in the pre-intervention period, while paediatric notifications increased 5.8 times. During the initiative, Indus Hospital became the second-highest TB reporting facility in Pakistan.

Major Costs

Support for field staff salaries/incentives and supervisor transport allowances constituted the bulk of monthly expenses. The mHealth app was another large investment, requiring salary support of app developers and procurement of a server, mobile phones for all field staff, and SIM cards with monthly voice and data packages. Additional laboratory technicians were hired to cope with increases in smear testing and the mobile x-ray unit had numerous one-time and fixed costs. Several components of the media campaign were donated and its cost was small relative to its scale.

SS+ TB Patients Treated



SS+ TB Patients Treated ——— SS+ TB Patients Treated (in absence of TB REACH) - - - - - - - -

Further Reading:

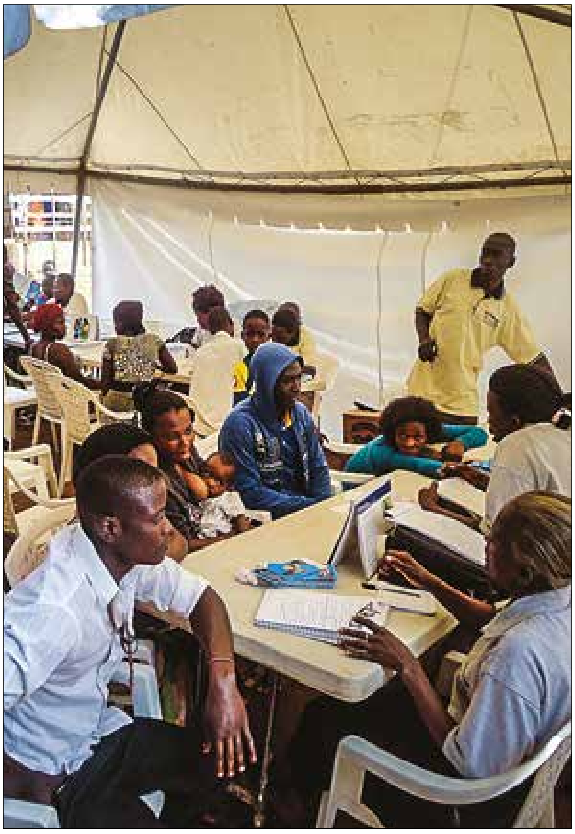
- Khan AJ, Khowaja S, Khan FS et al. Engaging the private sector to increase tuberculosis case detection: an impact evaluation study. The Lancet Infectious Diseases 2012; 12(8): 608-16.
- Dowdy DW, Lotia I, Azman AS et al. Population-Level Impact of Active Tuberculosis Case Finding in an Asian Megacity. PLOS One 2013; 8(10): e77517.
- Creswell J, Khowaja S, Codlin AJ et al. An Evaluation of Systematic Tuberculosis Screening at Private Facilities in Karachi, Pakistan. PLoS ONE 2014; 9(4): e93858.

International Union Against Tuberculosis and Lung Diseases (The Union)

Country: Uganda
Key Populations: People attending private medical facilities
Key Strategies: Engaging private providers, Community outreach
Intervention Period: October 2011 to June 2014
Funding Provided: 1,016,270 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 216; All Forms: 508

Setting

Despite the poor quality of TB services provided by private health facilities in Kampala, they are often preferred over public health services because of their local proximity and shorter waiting times. Although initiatives engaging the private sector are quite common in Asian settings, they have not been widely developed in many African countries. The Union aimed to improve access to early and high-quality diagnosis of TB through engagement with private clinics covering a population of 1.6 million.



Intervention

One hundred private clinics located in or adjacent to slums were chosen to participate and were identified as SPARK clinics with signboards endorsed by the NTP, enabling community members to recognize which clinics were offering quality TB care services. People with TB symptoms who visited the SPARK clinics were asked to provide sputum specimens for smear microscopy testing. These individuals paid the established rate of 2-8 USD for smear microscopy testing during the initiative, so as not to disrupt the existing business models of the private clinics. Those who were unable to pay these fees were referred to nearby NTP facilities where diagnostic services are offered free of cost. PLWHA who had smear-negative results were referred for Xpert MTB/RIF testing. Newly diagnosed patients were treated at the SPARK clinics with free, quality-assured medication provided by the NTP. To increase interest in the SPARK clinic services, the project established village health teams (VHTs) to carry out a number of awareness-raising activities regarding the TB care being offered.

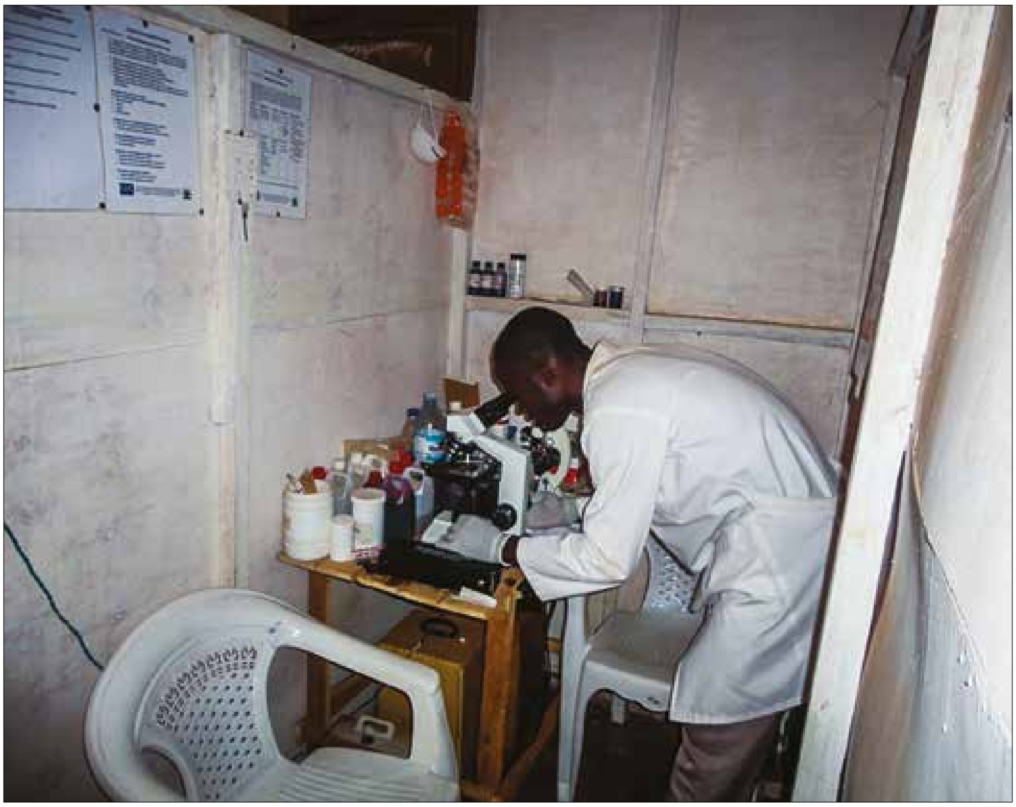
Physicians, nurses, clinical officers and laboratory personnel working at SPARK clinics were given training in all aspects of TB diagnosis and care according to NTP guidelines. High rates of clinic staff turnover and the generally minimal knowledge of TB care practices at the clinics prior to the initiative meant the process of capacity building was more challenging than initially anticipated. Regular supervision and repeated trainings were needed to maintain improvements in TB care. Several SPARK clinics voluntarily joined the national external quality assurance scheme for smear microscopy, ensuring sustained monitoring of diagnostic services.

Outcome

This initiative's private sector engagement and community outreach activities resulted in the detection, treatment and reporting of 2,141 additional smear-positive TB patients. Compared with the pre-intervention period, these newly treated patients represent a 24.0% increase in reporting to the NTP. Despite the implementation of well-conceived and well-run case detection activities, TB patients in late 2012 and early 2103 were unable to access the free TB medications provided by the NTP due to nationwide interruptions in drug supply; these interruptions adversely affected TB case notifications. Although there were stock outs at the national level, the project staff managed to obtain drugs from other districts, with support from the NTP manager. During this period, the project staff spent more time looking for drugs than supporting the clinics, negatively impacting case finding activities.

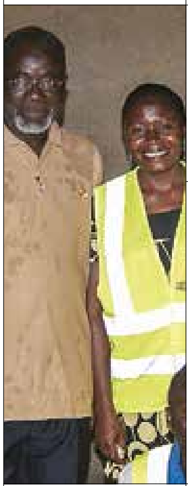
Major Costs

The highest costs for this initiative included supporting project staff to identify and engage with private clinics, to develop and run trainings, to monitor clinic practices and to supervise treatment initiation and follow-up. Expenditures for the design and printing of outreach materials and SPARK clinic sign boards were relatively small.



Residents of Urban Slums

The densely populated areas of urban slums present unique challenges in delivering TB care, as they exhibit prime conditions for TB transmission. Often, there are many individuals living in small, poorly ventilated homes which may have high levels of indoor air pollution generated by burning organic material in cooking fires, increasing the risks of pulmonary infections. Residents of slums are also likely to be poor, with concomitant high rates of malnutrition. Compounding these problems is the easy access to private facilities where patients often receive substandard TB care and are frequently not reported to NTPs. These combined factors increase the likelihood that TB will be rampant in many urban slums. This section describes the activities implemented by two TB REACH grantees in Nigeria and Cambodia which focused efforts on residents of urban slums, and the ability of these activities to improve case notifications.

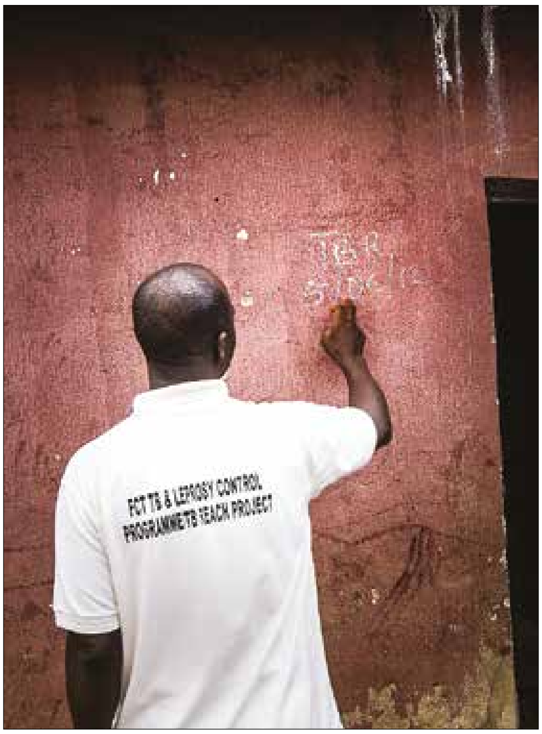


National TB and Leprosy Control Program Nigeria and Liverpool School of Tropical Medicine

Country: Nigeria
Key Populations: Residents of urban slums
Key Strategies: Community outreach, Specimen transport, Xpert MTB/RIF
Intervention Period: April 2012 to December 2013
Funding Provided: 936,250 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 39; All forms: 85

Setting

Nigeria has the lowest TB case detection rate among the 22 high burden countries, with less than 17% of incident cases being notified each year. Public TB care services are largely inadequate, and are further weakened by a growing HIV/AIDS epidemic and Nigeria's rapidly growing population. Abuja, the country's capital, has seen its population grow 15-fold since 1976 to five million people, with most of the new residents settling in urban slums. This initiative aimed to increase the number of people evaluated and treated for TB in five slum areas of Abuja (population 2.2 million) by addressing barriers related to delays in health- seeking behaviour.



Intervention

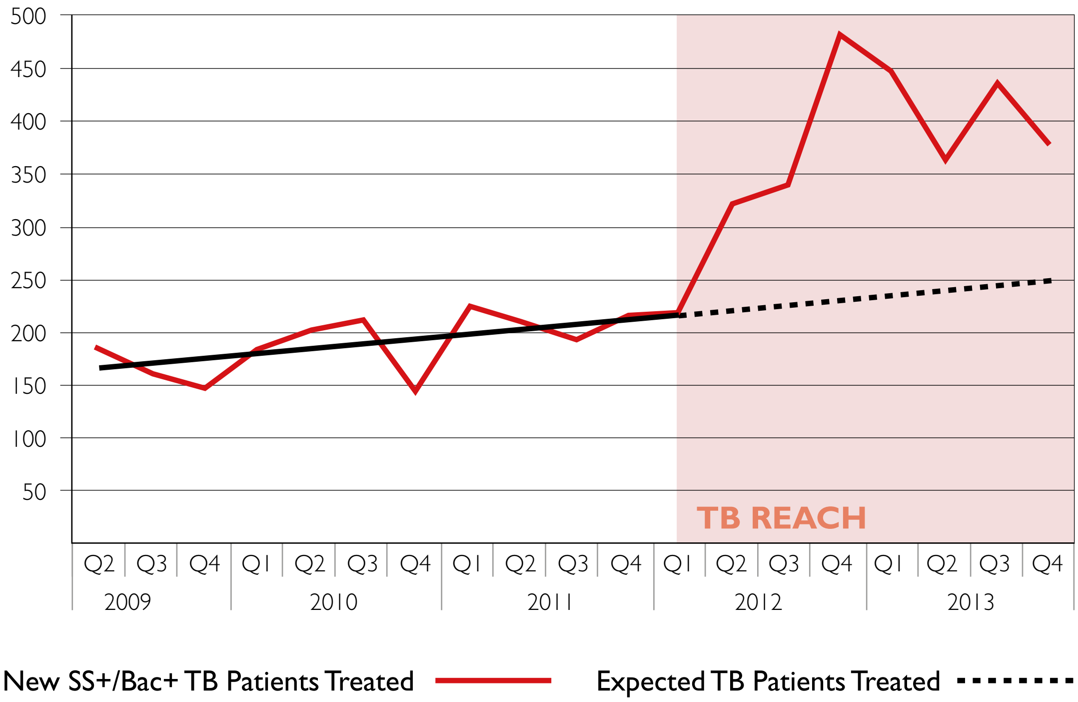
The initiative trained HEWs to conduct house-to-house visits to verbally screen individuals for symptoms of TB. Initially, screening activities were carried out on weekdays during the day but, to accommodate work schedules of the population being screened, HEWs later began working on weekday evenings and during the weekend. Community leaders and local organizations were engaged to increase residents' participation in screening exercises. People with a cough lasting two or more weeks were asked to produce two spot specimens (frontloading) that were then transported by motorbikes to one of five selected diagnostic facilities for testing with smear microscopy. If smear results were negative, an Xpert MTB/RIF test was performed using the best quality specimen already submitted. HEWs were responsible for ensuring treatment initiation of bacteriologically-positive patients and for referring TB patients with rifampicin resistance for further evaluation, including drug susceptibility testing.

The initiative was the first to implement routine Xpert MTB/RIF testing for case detection in Nigeria and faced numerous operational challenges when testing began. Generators and uninterrupted power supply (UPS) devices were procured to ensure that GeneXpert systems had a steady supply of power throughout working hours. Since the additional equipment could not be accommodated within existing laboratory facilities, the initiative procured cargo containers which were converted into laboratory and office spaces. An Xpert MTB/RIF cartridge inventory and management system was also established to monitor the number of cartridges distributed to and used at the testing sites to ensure that no cartridges expired.

Outcome

The initiative visited over 150,900 households located in slum areas, resulting in the detection of 9,892 suspected and 1,218 bacteriologically-positive TB patients. These ACF activities resulted in a 68.5% increase in new SS+/Bac+ TB case notifications compared with historical trends. During the same period, new SS+/Bac+ TB case notifications in the control area decreased by 15.9%.

New SS+/Bac+ TB Patients Treated



Major Costs

The most significant cost associated with this intervention was the procurement of GeneXpert systems and Xpert MTB/RIF cartridges as well as the upgrading of laboratories, including power supply. Transportation of sputum specimens and human resource support for HEWs and supervisors comprised the initiative's other significant costs.

Sihanouk Hospital Center of HOPE

Country: Cambodia
Key Populations: Residents of urban slums
Key Strategies: Systematic screening, Specimen transport, LED-FM, Xpert MTB/RIF
Intervention Period: January 2012 to present
Funding Provided: 538,434 USD (plus 43,133 USD from UNITAID TBXpert)
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 129; All forms: 265

Setting

Aside from active screening of household and neighbourhood contacts of TB patients (see page 46), TB care in Cambodia is entirely passive. This initiative aimed to increase the numbers of people evaluated for TB in in Phnom Penh (population 1.2 million). After mapping exercise indicated high concentrations of overcrowding, large numbers of displaced individuals, and high levels of poverty, 372 communities spread throughout four operational health districts were targeted for ACF activities.

Intervention

Healthcare workers and community volunteers trained by this initiative conducted house-to-house visits in slum areas of Phnom Penh to verbally screen individuals for symptoms of TB including a cough of any duration, unexplained weight loss, fever, night sweats and/or haemoptysis. People with suspected TB were asked to submit three sputum specimens (spot-spot-morning) after receiving instructions on how to cough up a good-quality specimen. The two spot specimens were collected approximately one hour apart during the same visit (frontloading) and healthcare workers returned to the suspected patient's home the following day to collect the morning specimen. All specimens were transported to the nearest laboratory for LED-FM unless the symptomatic individual was living with HIV/AIDS, had a history of TB, or had contact with a known TB or multidrug-resistant TB patient. In such cases, sputum specimens were sent directly to the Sihanouk Center of HOPE laboratory for Xpert MTB/RIF testing. Individuals with negative smear results were provided broad-spectrum antibiotics at their local health centre as per the national protocol; if their TB-related symptoms did not improve, an Xpert MTB/RIF test was performed.

Laboratory test results were relayed to the healthcare workers and community volunteers via SMS so they could ensure that bacteriologically-positive, rifampicin sensitive patients were put on first line treatment at the nearest NTP facility. TB patients with rifampicin resistance were clinically reviewed and referred for the standardized second line regimen which was adjusted, if necessary, when drug susceptibility test results became available. Healthcare workers and volunteers acted as treatment supporters to ensure that loss to follow-up was minimized. Initiative staff received a travel allowance and small incentives (15–30 USD per month) to compensate for their increased workload. To maintain high-quality microscopy services, the initiative provided on-site support and retraining for laboratory technicians and reread a selection of slides each month.

Outcome

The initiative verbally screened over 612,800 individuals for symptoms of TB, resulting in the detection of 21,868 people with suspected TB, and 1,301 bacteriologically-positive TB patients. These activities resulted in a 20.2% increase in bacteriologically-positive TB notifications compared with the pre-intervention period. Despite routine use of the Xpert MTB/RIF test on people with suspected drug resistance, just 19 (4.5%) of the 421 MTB-positive patients detected had rifampicin resistant TB.

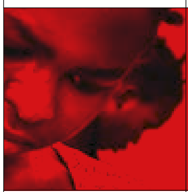
Major Costs

Community-based screening activities (including salary/incentives and transport allowance for field staff) and specimen transport constituted the bulk of initiative expenses. Significant resources were allocated for procuring diagnostic equipment, including LED-FM microscopes and reagents, GeneXpert systems, and Xpert MTB/RIF cartridges.

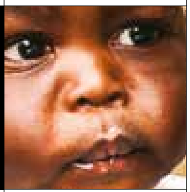
	2012	2013	Both Years
Individuals verbally screened	247,464	365,339	612,803
People with TB symptoms	10,237 (4.1%)	11,631 (3.2%)	21,868 (3.6%)
People submitting sputum	8,539 (83.4%)	9,530 (81.9%)	18,069 (82.6%)
Smear-positive patients detected	489 (5.7%)	604 (6.3%)	1,093 (6.0%)
Xpert MTB/RIF tests performed	1,568	3,096	4,664
MTB-positive patients detected	120 (7.7%)	301 (9.7%)	421 (9.0%)
Patients resistant to rifampicin	8 (6.7%)	11 (3.7%)	19 (4.5%)
All bacteriologically-positive patients detected	562 (6.6%)	739 (7.8%)	1,301 (7.2%)
Patients initiated on treatment	540 (96.1%)	733 (99.2%)	1,273 (97.8%)

Further Reading

Lorent N, Choun K, Thai S, Kim T, Huy S, 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.



Contacts of Tuberculosis Patients



Contacts of TB patients are at increased risk of becoming infected with TB and intensified/active screening of these individuals can be an efficient way to interrupt the spread of disease. Although contact investigation is almost universally included in NTP guidelines, it is often implemented passively by educating index patients to encourage symptomatic family members to visit health facilities. However, sick individuals face numerous barriers to accessing care, including stigma and the costs of travel and lost wages. Additionally, TB registers at health facilities are not designed to keep records for contact investigations. The end result is that sick individuals often access care only after a significant delay and investigations do not completely evaluate all contacts. In this section we highlight the experiences of TB REACH grantees in Pakistan and Cambodia who have taken very different approaches to actively screening contacts of TB patients.

Bridge Consultants Foundation & Ojha Institute of Chest Diseases

Country: Pakistan
Key Populations: Contacts of TB patients
Key Strategies: Patient transport, Incentives
Intervention Period: January 2011 to December 2011
Funding Provided: 151,150 USD

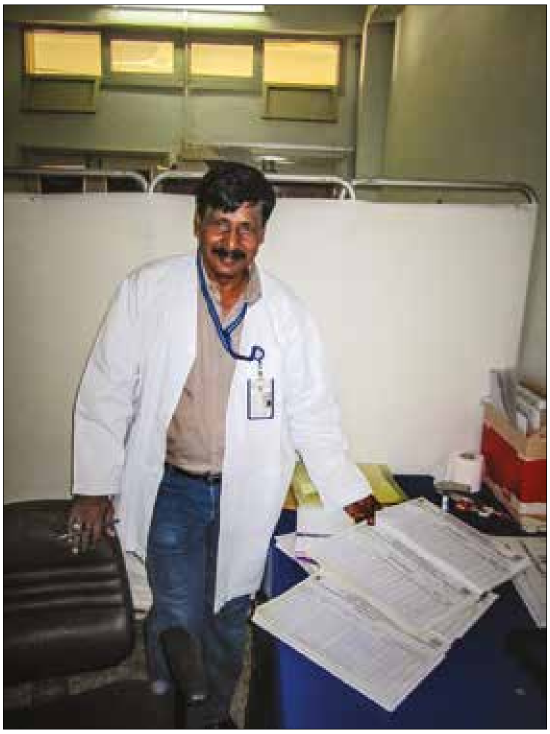
Setting

Contact investigation is not well described within Pakistan's NTP guidelines, with the result that the TB care programs rely on passive contact investigation methods to detect TB among contacts of index cases. This strategy has yielded very low response rates from contacts and missed opportunities for early diagnosis and treatment. Twenty-two NTP facilities, covering a population of nine million, were selected to implement active household contact investigation of smear-positive index patients. Seven health facilities were located in urban Karachi and the remaining 15 were located in rural districts of Sindh province.

Intervention

Lay health workers already employed at NTP facilities were recruited to participate in this initiative and were paid incentives to implement the screening activities. Roughly six months after the index patient was initially registered for treatment, household contacts of smear-positive index patients were verbally screened for symptoms of TB. This approach allowed households to be identified and grouped into small clusters, so health workers could visit multiple homes in a day. It can also be presumed that this approach increased the chances of household contacts being symptomatic at the time of screening. Any individual with a cough lasting three or more weeks or showing any symptoms associated with TB was offered free transport to the closest NTP centre for further evaluation. In rural areas, the provision of transport was a key activity, as it removed one of the main barriers to accessing TB care. In order to reduce the number of visits to NTP facilities, patients were asked to provide two spot specimens over the course of two hours (frontloading). Patient diagnosis and treatment data were kept in dedicated registers, allowing for improved record keeping and follow-up of contacts.

In addition to the active screening of household contacts, several activities were implemented to reduce loss to follow-up while on treatment. During the initial screening visit, health education materials aimed at increasing TB knowledge and acceptability of treatment were presented to individuals with suspected TB. Index patients were also trained to act as informal treatment support workers, largely because they were already familiar with the clinic teams and treatment regimens. SMS reminders were sent to patients in advance of scheduled appointments; if appointments were missed, health workers followed up with phone calls and a house visit within one week to ensure patients continued taking treatment. Transportation to NTP facilities was also provided for all follow-up clinical and microscopy appointments. Finally, TB patients identified through contact investigation were provided with a monthly food basket which consisted of one kilogram of sugar, five kilograms of flour, and one litre of cooking oil.



Outcome

The initiative visited the households of over 3,000 smear-positive index patients, resulting in the verbal screening of over 19,000 household contacts and detection of over 490 smear-positive TB patients. Rural households had higher rates of smear-positive TB (4.0%) than urban households (1.5%).

Assessing the impact of this initiative on TB notifications proved challenging. Although 12% of TB case notifications in the intervention area were notified through active contact investigations performed by the initiative, TB notifications only rose modestly compared to the pre-intervention year. The verbally screened population comprised only 0.2% of the intervention area's population (19,000 of 9 million); consequently the observed increase could have been caused by random variations in TB notifications. It is very likely that the more active approach to screening household contacts resulted in these patients receiving treatment earlier in their disease course, although this was not measured. Activities focused on improving treatment adherence were extremely effective, as success rates (cured and treatment completed) have been reported at 98%.

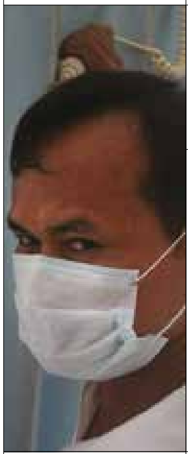
Major Costs

To be effective, active contact investigation initiatives require significant investments in transport infrastructure. This initiative's major costs were associated with health workers visiting households, transportation incentives for symptomatic individuals traveling between patient homes and health facilities, and nutritional support for TB patients. All laboratory diagnosis and treatment costs were paid for by the NTP.

	Urban	Rural	Both Sites
Index patients investigated	1,869	1,168	3,307
Contacts verbally screened	11,426	7,765	19,191
Contacts with presumed TB	1,244 (10.9%)	2,234 (28.8%)	3,478 (18.1%)
Contacts submitting sputum	1,119 (90.0%)	1,041 (46.6%)	2,160 (62.1%)
Smear-positive patients detected	176 (15.7%)	314 (30.2%)	490 (22.7%)
Smear-positive TB prevalence among contacts (per 100,000)	1,540	4,044	2,553

Further Reading

Shah SA, Qayyum A, Abro R, et al. Active contact investigation and treatment support: an integrated approach in rural and urban Sindh, Pakistan. The International Journal of Tuberculosis and Lung Disease 2013; 17(12): 1569-74.



National Centre for Tuberculosis and Leprosy Control (CENAT)

Country: Cambodia
Key Populations: Contacts of TB patients
Key Strategies: Mobile care services, CXR, Xpert MTB/RIF
Intervention Period: January 2012 to present
Funding Provided: 965,873 USD (plus 62,863 USD from UNITAID TBXpert)

Setting

Passive case finding has been the mainstay of case finding activity in Cambodia with the exception of a few ACF pilot projects. This project implemented a novel approach to active contact investigation in 15 operational districts covering a population of 2.9 million.

Intervention

This initiative expanded greatly upon traditional approaches to contact investigation, using lessons learned from Cambodia's implementation of two prevalence surveys. Both household and neighbourhood contacts of smear-positive index patients were investigated for TB. The initiative also eliminated smear microscopy as a diagnostic test; instead individuals were evaluated using CXR and the Xpert MTB/RIF assay. Finally, existing health facilities hosted ACF screening days in order to provide one-stop TB diagnosis and treatment services to reduce pre-treatment loss to follow-up.

Two weeks prior to scheduled ACF days, initiative staff visited intervention sites to train existing health facility staff on the initiative's enhanced TB screening, diagnosis and care procedures. All smear-positive patients who had been registered for treatment during the preceding two years were considered index patients. Health workers visited the homes of these patients to verbally screen their household contacts for symptoms of TB. Neighbourhood contacts were also included in screening efforts when possible, as in rural areas these individuals may have been as likely as household contacts to be exposed to infectious index patients. Any person who self-reported having one or more TB symptoms (cough of any duration, fever, weight loss, and/or night sweats) was invited to attend the scheduled ACF days for further evaluation by CXR, as were asymptomatic household contacts (but not asymptomatic neighbourhood contacts).

At the ACF screening days, CXR films were developed immediately and scored by a project radiologist as either 'abnormal (submit sputum)' or 'normal (no sputum needed)'. To facilitate clinical diagnoses, abnormal CXRs were then scored more finely to specify active TB, suspected TB, healed TB or other abnormalities. All individuals with an abnormal CXR were asked to provide a sputum specimen for Xpert MTB/RIF testing. Individuals who had a normal CXR, but self-reported one or more TB symptoms were also asked to provide a sputum specimen. This latter practice was eventually stopped due to very low patient yields. MTB-positive patients were immediately initiated on treatment, while MTB-negative individuals who had an abnormal CXR were sent for further clinical evaluation. Health facility staff provided treatment support to diagnosed patients.

Outcome

The initiative investigated 105,351 household and neighbourhood contacts of 12,631 smear-positive index patients. Xpert MTB/RIF testing identified 1,745 bacteriologically-positive patients, of whom just 11 (0.7%) were found to be resistant to rifampicin. A further 1,980 bacteriologically-negative and extrapulmonary TB patients were identified and initiated on anti-TB treatment.

As with all active contact investigations, this intervention's impact on case notifications is challenging to quantify, because the target population was small relative to the intervention area population of the participating health facilities. Further complicating evaluation, the ACF days were hosted at different health facilities and districts, requiring that the project's intervention area be constantly redefined. Analyses of district-level notification data show an increase in patients treated in the quarters when ACF days were hosted, followed by a decrease to below pre-intervention levels the following quarter. This could be an indication of early detection, as patients who would have self-presented at health facilities in the subsequent quarter had already been identified and reported through ACF activities.

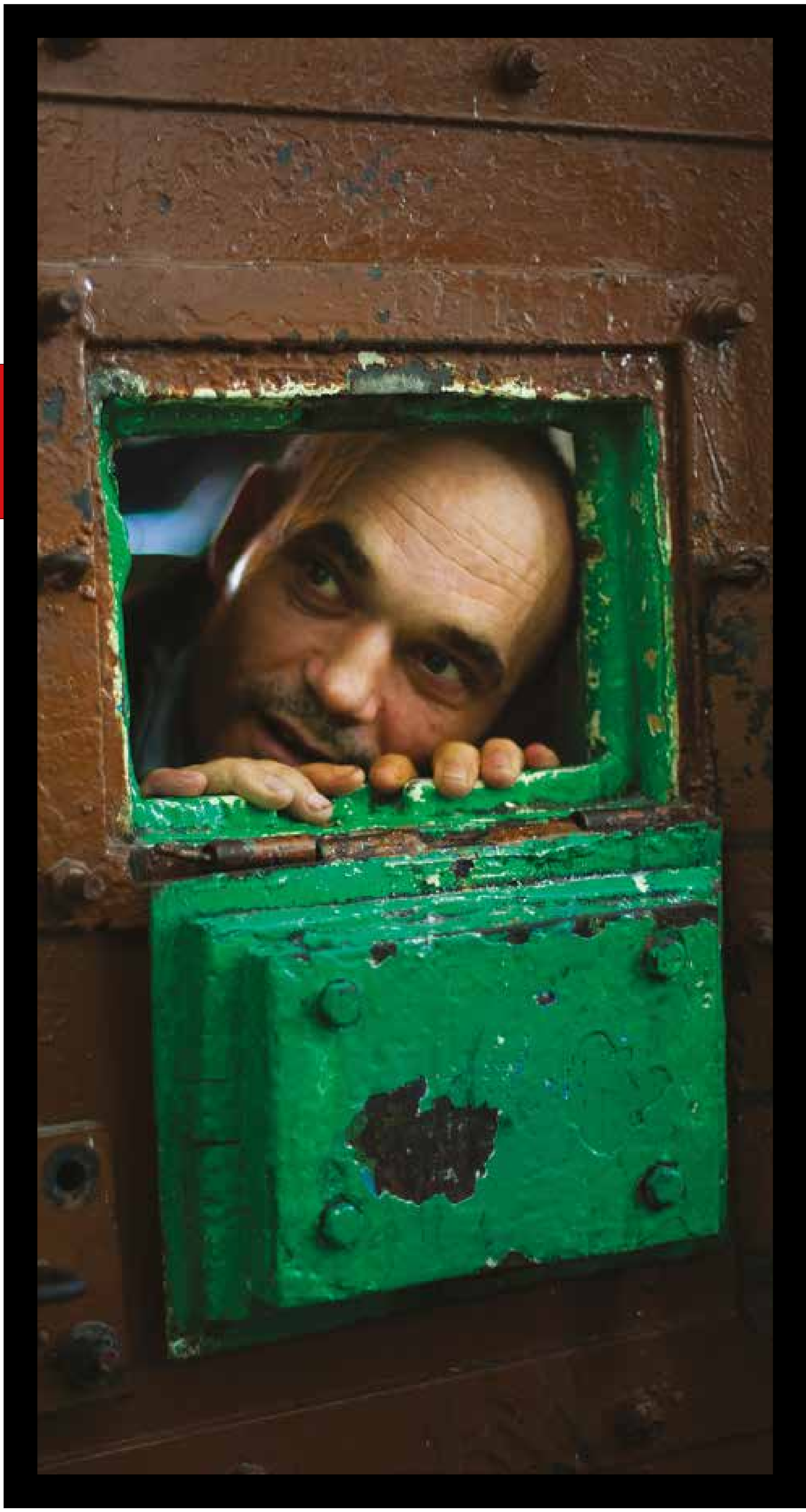
	2012	2013	Both Years
Index patients investigated	11,520	5,807	17,327
Individuals screened (for TB symptoms and/or by CXR)	38,360	39,005	77,365
Xpert MTB/RIF tests performed	3,650 (9.5%)	3,953 (10.1%)	7,603 (9.8%)
MTB-positive patients detected	807 (22.1%)	938 (23.7%)	1,745 (23.0%)
Patients resistant to rifampicin	1 (0.1%)	10 (1.1%)	11 (0.7%)

Major Costs

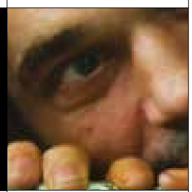
The major costs associated with this initiative were for supporting staff and procurement. The initiative supported program staff to perform ACF days in remote districts, hired new lab technicians and radiologists and paid incentives to health facility staff to carry out additional activities. Two project vehicles were procured to support site visits and medical equipment (CXR films and GeneXpert systems) were bought to support the enhanced diagnostic algorithm.

Further Reading:

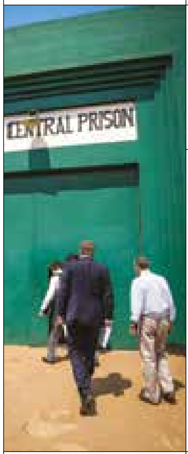
- Eang MT, Satha P, Yadav RP, Morishita F, Nishikiori N, van-Maaren P and Lambregts-van Weezenbeek C. Early detection of tuberculosis through community-based active case finding in Cambodia. BMC Public Health 2012; 12: 469.
- Yadav RP, Nishikiori N, Satha P, Eang MT and Lubell Y. Cost-effectiveness of a tuberculosis active case finding program targeting household and neighborhood contacts in Cambodia. American Journal of Tropical Medicine and Hygiene 2014; 90(5): 866-72.



Prison Populations



Prisons often present ideal conditions for the development and spread of TB disease. Studies have shown the TB prevalence among prisoners to be many times higher than that of the surrounding civilian communities. Prisoners are often housed in overcrowded wards; they are also malnourished, suffer from high rates of other infectious diseases which increase the risk of TB, and have poor access to healthcare services, including diagnostic testing for TB and HIV. Prisons may also act as TB transmission hot spots, helping to perpetuate TB infection in the community due to high turnover rates without adequate follow-up once prisoners are released.
In this section we describe the experiences of TB REACH grantees in Zambia and Pakistan who have implemented screening services in prisons, as well as the outcome of their activities.



Centre for Infectious Disease Research in Zambia (CIDRZ)

Country: Zambia
Key Populations: Prisoners
Key Strategies: Systematic screening, CXR
Intervention Period: October 2010 to September 2011
Funding Provided: 1,000,000 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 38; All Forms: 185

Setting

Within Zambia's prison system, provisions for systematic TB screening of new and current inmates were inadequate to non-existent. Restricted access to diagnostic and clinic-based treatment services results in delayed or missed diagnoses and poor treatment outcomes. The lack of training and awareness on TB by both prisoners and prison staff further complicates efforts to tackle the disease in this population. Six prisons across Zambia, which houses an estimated 7,700 inmates at any one time, were selected to participate in a systematic TB screening initiative.

Intervention

This initiative focused on building diagnostic infrastructure and training prison staff and a cadre of inmate peer educators to assist with ACF through systematic screening. A semi-mobile containerized laboratory containing a digital x-ray machine and fluorescent microscopes was procured and utilized during screening. Permanent laboratories were constructed at three prison sites Once these facilities were functional, systematic screening of inmates at three distinct time points during their stay in prison began: 1) as inmates entered prison, 2) one-time mass screening of inmates already present in the facilities, and 3) before inmates were released from prison (exit screening). All inmates were asked to submit two spot specimens for testing by LED-FM regardless of TB symptoms. One of these specimens was then sent for culture and drug susceptibility testing. Inmates also received a physical exam, CXR and opt-out HIV testing and counselling. Confirmed TB patients were started on treatment by physicians at nearby Ministry of Health clinics.

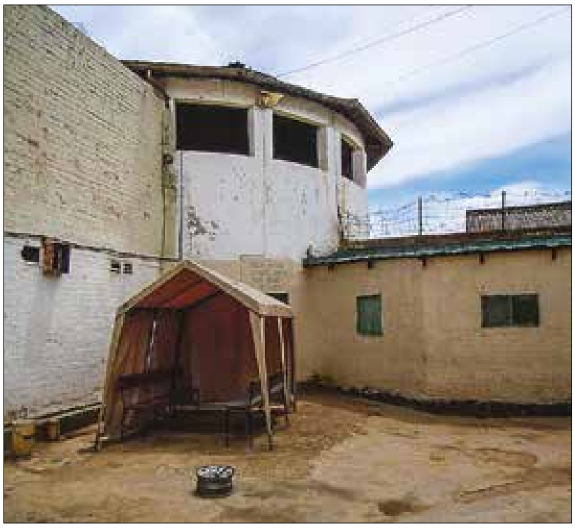
Two additional strategies were employed to identify TB in the prisons and their surrounding communities. Selected inmates were trained as peer educators to identify symptomatic individuals missed by the other screening strategies. The peer educators went cell to cell on a daily basis, identifying symptomatic inmates who were then referred for testing. Community-based screening was also conducted among the population living next to the prisons - primarily prison staff and their families.

The loss of patients between diagnosis and treatment was a persistent concern. The provision of TB care for inmates was undermined by systemic factors unique to the prison environment, including unexpected release of inmates and frequent transfers to other prisons. As the prisons serve a wide catchment population, it was not possible for the initiative to successfully follow-up with all released inmates, and the delay in results from TB cultures meant many patients were lost to follow-up before their TB status was confirmed.

Outcome

ACF activities resulted in a 371% increase in bacteriologically-positive and 132% increase in all forms TB case notifications at the six participating prisons. The prevalence of TB in the screened population was extremely high, at 2.2% for bacteriologically confirmed TB and 5.4% for all forms TB. Exit screening had the highest yield, indicating that the conditions in the prison likely activated latent infections. The long-term, high-security prison had the lowest yields of the six prisons, possibly due to its better facilities, which included more outdoor space and larger ventilated indoor spaces.

	Screening Strategy				
	Upon Entry	One-time Mass	Symptoms Referral	Upon Exit	Community
Individuals screened	2,231	3,929	–	297	1,308
Inmates with TB symptoms	1,232	2,281	170	189	681
Bacteriologically-positive patients detected	34 (2.7%)	111 (4.9%)	5 (2.9%)	19 (10.1%)	10 (1.5%)
Prevalence among those screened (per 100,000)	1,523	2,825	–	6,397	765



Major Costs

The major cost of this intervention was equipment procurement and building laboratories at the prisons. Other costs included salary support of the large team required to conduct the mass screening activity.

Further Reading

Henostroza G, Topp SM, Hatwiinda S, et al. The High Burden of Tuberculosis (TB) and Human Immunodeficiency Virus (HIV) in a Large Zambian Prison: A Public Health Alert. PLoS ONE 2013; 8(8): e67338.

TB Control Programme Punjab

Country: Pakistan
Key Populations: Prisons
Key Strategies: Systematic screening
Intervention Period: April 2011 to December 2012
Funding Provided: 500,000 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 72; All Forms: 249

Setting

Punjab is Pakistan's most populous province and has the largest prison population in the country. However, health services in the province's prisons are poor and not well integrated into the existing provincial TB care infrastructure. In order to ensure that early diagnosis and prompt treatment was available to prisoners and prison staff, Punjab's TB Control Programme implemented a screening program in the province's 32 prisons. The prisons house approximately 55,000 inmates at any given moment and up to 200,000 annually due to high turnover rates, while the population of the intervention area is approximately 20 million.

Intervention

Reporting basic management units were set up and laboratories were built and equipped at all of the participating prison sites. All new inmates were verbally screened upon entry into prison and periodic mass screening campaigns were conducted to detect missed and incident TB patients. Individuals with suspected TB were asked to provide sputum specimens which were then tested using conventional ZN staining and light microscopy. As obtaining microscopy results sometimes required more than one day, prisoners were at times released before the prison was able to initiate treatment. For this reason, a prison DOTS mechanism was developed to ensure proper recording, reporting and treatment continuation when prisoners were transferred or released.

Once a smear-positive patient was detected, he/she was isolated in a separate ward during the intensive phase of treatment. Four colour-coded referral forms were developed for this purpose. Educational activities were conducted and hygiene kits and gift packs were distributed among prisoners. Once contacts of smear-positive TB patients were identified, contact investigation was carried out both in prisons and among household contacts in the communities. Activities in the prisons were conducted by prison staff, and incentives for each step of the screening, diagnostic and treatment process were distributed among doctors, paramedics, and microscopists. The District TB Control Program employed Lady Health Workers in the communities to find contacts and initiate treatment for detected TB cases.

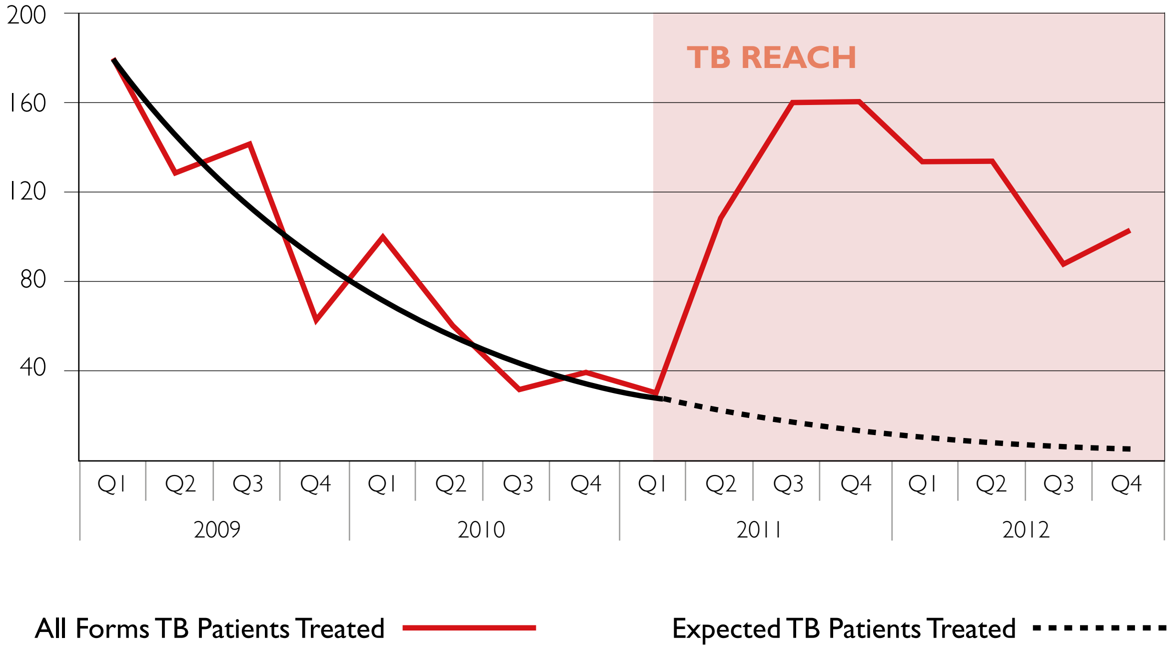
Outcome

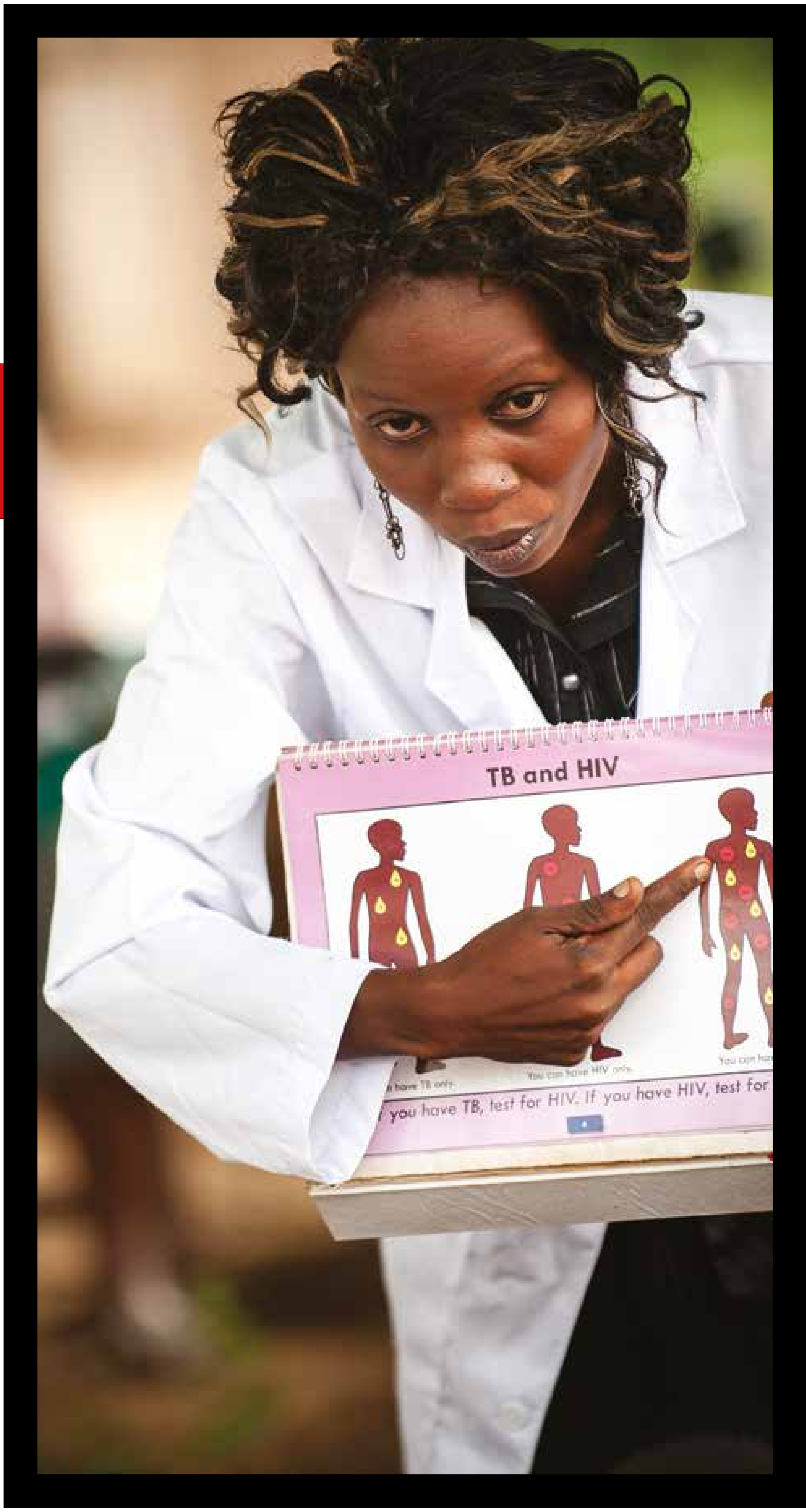
Over the course of the initiative, 373,729 prisoners and prison workers were verbally screened for TB, resulting in the detection of 12,893 suspected and 883 all forms TB patients. This represents a nine-fold increase in case notifications in the prisons compared with the pre-intervention period. Further, notifications in the prisons during the intervention were two times higher than the case notification rate in the civilian population. Further refinement of these activities to include a more sensitive diagnostic algorithm will provide a good model for the scale up of TB services in prisons.

Major Costs

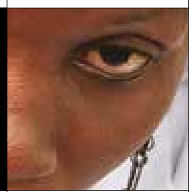
Upgrading of prison facilities to incorporate smear microscopy laboratories constituted a major cost to this initiative. The incentives paid to prison staff for each step of the screening, diagnosis and treatment process was also a substantial part of the overall cost. Airborne infection control measures, such as installation of exhaust fans and procurement of surgical masks, were additional expenses.

All Forms TB Patients Treated

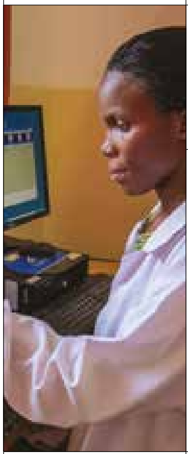



TB and HIV
you have TB, test for HIV. If you have HIV, test for

People Living with HIV/AIDS



A third of the estimated 40 million people living with HIV/AIDS (PLWHA) worldwide are co-infected with TB, and without appropriate treatment for both diseases, TB mortality can be as high as 90%. Unfortunately, testing PLWHA using conventional smear microscopy often results in missed opportunities for diagnosis because of the paucibacillary disease presentation. Though culture testing has a significantly higher sensitivity compared with smear microscopy, it is not a good diagnostic alternative for smear microscopy due to the long turnaround time for results. Therefore, the use of the Xpert MTB/RIF assay to accurately diagnose TB has been rolled out in many settings to improve detection and treatment of TB among PLWHA. Below we describe two TB REACH grantees from Uganda and South Africa who have established initiatives to improve case detection among PLWHA.



Foundation for Innovative New Diagnostics (FIND)

Country: Uganda
Key Populations: People living with HIV/AIDS
Key Strategies: Xpert MTB/RIF, Specimen transport
Intervention Period: October 2011 through December 2012
Funding Provided: 602,965 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 68; All forms: 132

Setting

In Uganda, an estimated 50% of notified TB cases are co-infected with HIV, but diagnostic algorithms which use smear microscopy and clinical exams to detect TB among PLWHA can result in both over and under diagnosis. To begin addressing this problem, this initiative scaled-up access to the highly sensitive Xpert MTB/RIF assay for PLWHA across 24 districts in Uganda (population 8.6 million).

Intervention

Six districts across Uganda were selected to receive laboratory upgrades to enable installation of a GeneXpert system in their regional reference hospitals. A sputum specimen transportation system was then established, expanding access to Xpert MTB/RIF testing to the health facilities in 18 additional intervention districts. All PLWHA with smear-negative results were eligible for Xpert MTB/RIF testing, and health centre staff was trained to collect an additional specimen from these patients when they returned to collect their initial smear results. Some health facilities used conventional ZN staining and light microscopy, while others used the more sensitive LED-FM, but all laboratories were part of a robust external quality assurance program to ensure the quality of smear microscopy. Sputum specimens were transported with motorbikes and a paper form system was developed to ensure that all transported specimens were logged and tested and that results were returned to the sending facility.

Upgrading the power supply at each laboratory was a significant undertaking, as all sites suffered from heavy voltage fluctuations and power interruptions for hours at a time. Before the project was started, an energy audit of all laboratory equipment was conducted to determine how much power was needed per hour. If the laboratory was already connected to the electricity grid, a locally-procured UPS was installed to power the GeneXpert system and other essential equipment, such as a CD4 counter and microscope, for up to 8 hours. When the laboratory sites were not connected to the power grid, locally-procured solar panels were installed in addition to the UPS.

The initiative also piloted XpertSMS, automated GeneXpert result-reporting software to send test results to a server via SMS message or the internet, allowing for real-time analysis of results for machines which were dispersed across the country. This helped to identify which sites had higher than expected failed test rates, which facilitated targeted site visits and technician retraining.

During the planning phase, it was assumed that all MTB-positive patients would be treated through the existing TB care infrastructure, as the initiative was fully embedded within the NTP. In reality, unwillingness of some NTP staff to recognize Xpert MTB/RIF results (despite trainings hosted prior to the roll-out of Xpert) and severe shortages of TB medications limited treatment initiation. These challenges were addressed by encouraging laboratory technicians to actively work with the treatment workers at their health facilities, by providing summaries of the Xpert MTB/RIF laboratory registers to district level treatment supervisors, and by assessing the issue of loss between diagnosis and treatment at each quarterly NTP reporting meeting.

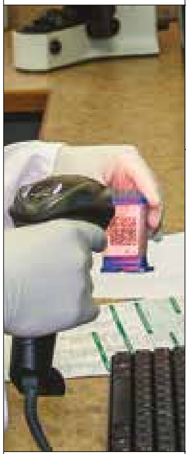
Outcome

The initiative tested 7,551 smear-negative specimens from PLWHA using the Xpert MTB/RIF assay, resulting in the detection of 1,043 MTB-positive individuals, just nine of whom were resistant to rifampicin. As this initiative was implemented before the publication of new WHO recording and reporting guidelines, MTB-positive patients were inconsistently reported to the NTP (some as smear-positive and others as smear-negative), making an assessment of the initiative's impact on TB notifications a challenge.

	Xpert MTB/RIF Tests	MTB-Positive Patients Detected	Patients Resistant to Rifampicin	Failed Tests
Fort Portal	1,609	224 (13.9%)	0	85 (5.3%)
Entebbe	1,486	185 (12.4%)	1 (0.5%)	46 (3.1%)
Soroti	1,281	161 (12.6%)	1 (0.6%)	105 (8.2%)
Masaka	1,260	151 (12.9%)	0	198 (15.7%)
Lira	1,195	223 (18.7%)	2 (0.9%)	101 (8.5%)
Jinja	720	99 (13.8%)	5 (5.1%)	70 (9.7%)
All Sites	7,551	1,043 (13.8%)	9 (0.9%)	605 (8.0%)

Major Costs

The most significant cost associated with this intervention was the procurement of GeneXpert systems and Xpert MTB/RIF cartridges. Significant time and resources were spent making this new diagnostic technology operational. The remaining costs were associated with human resources and training of NTP staff on Xpert MTB/RIF roll out.



TB/HIV Care Association

Country: South Africa
Key Populations: People living with HIV/AIDS
Key Strategies: Xpert MTB/RIF, Mobile care services, Systematic screening
Intervention Period: January 2012 to June 2013
Funding Provided: 1,000,000 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 319

Setting

Sisonke is a poor rural district located in the KwaZulu-Natal province of South Africa, with a population of over 500,000. This area has high rates of TB-HIV co-infection, yet health facilities do not have sufficient capacity to systematically screen for TB.

Intervention

TB/HIV Care established four mobile HIV counselling and testing laboratories consisting of a professional nurse and three lay health counsellors. The counsellors verbally screened people accessing these HIV services and identified individuals with suspected TB based on the presence of any TB-related symptom (cough lasting two or more weeks, weight loss, night sweats and/or fever). The mobile lab teams then collected sputum specimens from these individuals and sent them to one of three nearby health facilities for same day Xpert MTB/RIF testing. The same systematic verbal screening and testing activities were implemented in the waiting areas of these three health facilities by community health facilitators.

A community health facilitator based in the health facility laboratory was responsible for reviewing Xpert MTB/RIF results and contacting MTB-positive patients to initiate treatment. Community care workers acted as treatment supporters, screened household contacts for TB and offered HIV counselling and testing if anyone in the family was living with HIV/AIDS. Symptomatic contacts were referred to laboratories for Xpert MTB/RIF testing, and symptomatic children under the age of five were provided isoniazid preventive therapy.

The community care workers also conducted house-to-house visits in the Sisonke district to verbally screen not only household contacts, but also community members, for TB and refer symptomatic individuals for Xpert MTB/RIF testing. Sisonke was the first district in South Africa to have full coverage of direct Xpert MTB/RIF testing for people with suspected TB due to the project's activities.

Outcome

The initiative verbally screened over 900,000 individuals, resulting in the detection of 52,640 suspected and more than 2,500 MTB-positive patients during the intervention. These case detection activities resulted in a 61% increase in TB case notifications compared with the expected case notifications based on historical trends. Verbal screening at health facilities had the lowest number needed to screen to detect one bacteriologically-positive patient of TB (NNS=353), while screening at the mobile HIV counselling and testing clinics had the highest (NNS=717).

Major Costs

The major costs of this initiative were in supporting the salaries of community health facilitators and care workers, as well as travel support for the mobile HIV counselling and testing clinics.

	Health Facilities	Mobile HIV Counselling & Testing	Contacts	Total
Individuals verbally screened	773,763	58,116	140,878	914,641
People with TB symptoms	27,723 (3.6%)	1,774 (3.1%)	23,143 (16.4%)	52,640 (5.8%)
MTB-positive patients detected	2,193 (7.9%)	81 (4.6%)	289 (1.2%)	2,563 (4.9%)
Number needed to screen	353	717	487	–

Improved Diagnostics

The technique used for Ziehl Neelsen staining and light microscopy is over 130 years old and has changed little since it was developed. Conventional smear microscopy can detect approximately 60% of culture positive, pulmonary TB, but because the test is highly user-dependent, its sensitivity varies greatly in programmatic settings. This presents an immense challenge when endeavouring to improve case detection rates, particularly among children and PLWHA who suffer from paucibacillary disease. Fortunately, a host of new diagnostic techniques are becoming increasingly common, such as LED-FM and the Xpert MTB/RIF assay. LED-FM, a derivation of the Ziehl Neelsen staining and light microscopy technique, can significantly improve positivity rates with minimal infrastructure upgrades and technician retraining. The Xpert MTB/RIF assay is highly sensitive and can identify drug resistance in just two hours; however, this technology often requires significant upgrades to laboratory infrastructure (See the Uganda FIND study on Page 56) and training. In this section we describe the roll-out and scale-up of these two novel diagnostic approaches through TB REACH initiatives in Nepal and India.

International Organization for Migration (IOM)

Country: Nepal
Key Strategies: Xpert MTB/RIF
Intervention Period: January 2012 to present
Funding Provided: 820,072 USD (plus 106,040 USD from UNITAID TBXpert)
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 129

Setting

In 2010, WHO recommended the Xpert MTB/RIF assay as an initial test for PLWHA and those at risk of having drug-resistant TB infections, as well as conditionally following smear microscopy. These guidelines have since been updated to recommend that Xpert MTB/RIF testing replace smear microscopy when resources allow. This initiative procured seven GeneXpert systems and conducted testing at government microscopy centres serving a population of 6.6 million.

Intervention

GeneXpert systems were installed in seven of the sixteen districts of the Eastern Development Region. Health facilities in the remaining nine districts were able to refer patients to one of the seven GeneXpert sites for testing. At one GeneXpert site, a specimen transport network was established to increase testing from neighbouring non-GeneXpert districts. To ensure quality of electrical supply to the GeneXpert systems, each testing facility was provided with a generator, voltage stabilizer and a UPS. Prior to the intervention, staff at laboratories and health facilities in the intervention area participated in orientation workshops and trainings on TB and Xpert MTB/RIF testing and a short brochure on the assay was produced and distributed in the community to help improve awareness of the new testing service.

Routine screening, testing and treatment procedures continued at more than 130 government health facilities in the intervention area. Anyone with a cough lasting two or more weeks was asked to submit three sputum specimens (spot, morning, spot) for testing with smear microscopy and anyone with a single smear-positive result (inclusive of scanty readings) was initiated on anti-TB treatment. Patients with smear-negative results were referred for a CXR, which was paid for by the patient out of pocket (1-2 USD). Medical officers graded CXRs and those with a grading suggestive of TB were referred for testing with the Xpert MTB/RIF assay. An additional sputum specimen was collected from each eligible patient at one of the seven GeneXpert testing sites (or participating sputum transport site). Any individual thought to have drug-resistant TB (treatment failures, contacts of multidrug-resistant TB patients, treatment after loss to follow-up and relapse patients) or PLWHA suspected of having TB were eligible for direct Xpert MTB/RIF testing.

Individuals with MTB-positive, rifampicin sensitive results received first line treatment. Individuals with rifampicin resistant results were referred to a reference laboratory in Kathmandu for confirmatory testing with line probe assay, solid culture and drug susceptibility testing. Confirmed resistant cases were eligible for initiation on a standard second line treatment, while patients with discordant results were referred to the Technical Working Group of National TB Centre for clinical decisions.

Outcome

The initiative performed 9,723 Xpert MTB/RIF tests, resulting in the detection of 1,553 rifampicin sensitive and 109 rifampicin resistant TB patients. Most of these newly confirmed TB patients would otherwise have received a smear-negative result. Though Xpert MTB/RIF testing was implemented for just half of the 2011/2012 reporting period, annual SS+/Bac+ TB case notifications increased 8.6% compared with the pre-intervention period. A full year of Xpert MTB/RIF testing in the 2012/2013 reporting period saw SS+/Bac+ TB case notifications increase 21.9% relative to pre-intervention notifications.

Improving the sensitivity of diagnostic testing did not result in an increase in the total number of pulmonary TB patients (both bacteriologically-positive and -negative) treated in this setting, due to high rates of empiric treatment in the pre-intervention period. In fact, total pulmonary TB case notifications decreased 11.6% compared with the pre-intervention period, likely indicating that clinicians were ruling out TB diagnosis based on a negative Xpert MTB/RIF test.

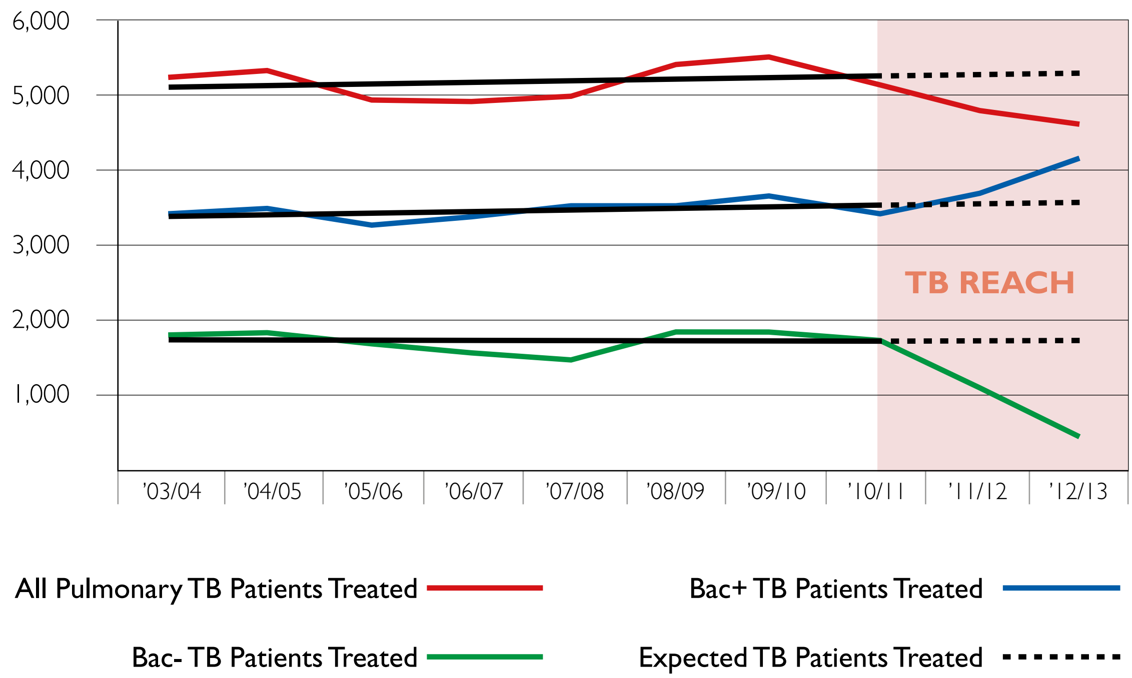
Major Costs

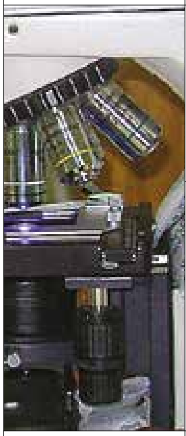
The largest cost associated with this initiative was related to procurement of GeneXpert systems and Xpert MTB/RIF cartridges. Other significant costs of this initiative were related to human resources and activities monitoring.

Further Reading

Creswell J, Codlin AJ, Andre E, et al. Results from early programmatic implementation of Xpert MTB/RIF testing in nine countries. BMC Infectious Diseases 2014; 14(2).

Pulmonary TB Patients Treated





International Union Against Tuberculosis and Lung Disease (The Union)

Country: India
Key Strategies: LED-FM
Intervention Period: April 2012 to March 2013
Funding Provided: 1,069,204 USD

Setting

In 2011, the WHO recommended that, due to an estimated 8-10% increase in sensitivity, LED-FM be phased in as an alternative to conventional Ziehl Neelsen staining and light microscopy. This Union initiative procured and installed fluorescence microscopes in 190 (54%) of the medical colleges in India, which perform over 350,000 smear tests annually.

Intervention

Rather than trying to identify more patients through increasing the number of people submitting sputum specimens testing, this initiative relied solely on the incremental gain in sensitivity of LED-FM over Ziehl Neelsen staining and light microscopy. After the fluorescence microscopes were installed, microscopy technicians participated in a three to four day training session hosted at either the national or an intermediate TB reference laboratory to learn new staining techniques and use and maintenance of new equipment. Technicians were certified after successfully reading a panel of slides with different smear gradings and passing a written exam.

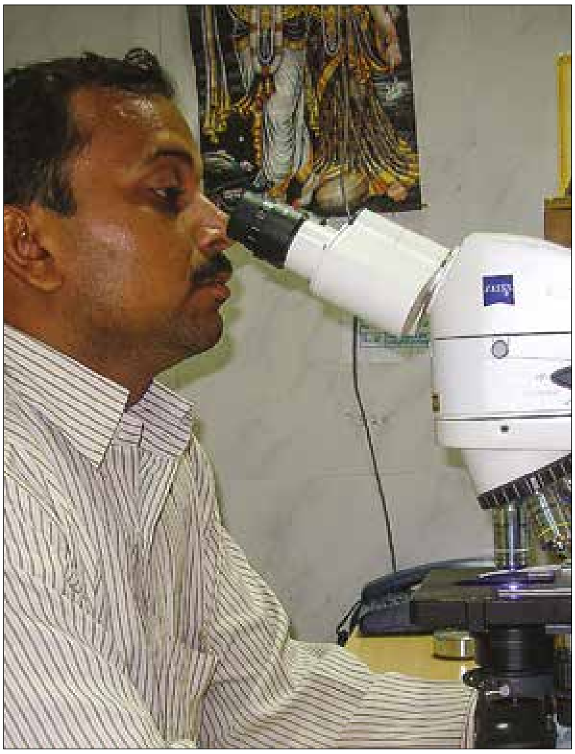
Individuals with suspected TB continued to follow existing sputum submission guidelines (one spot and a second early morning specimen) during the initiative. A single positive slide of any grade was sufficient to classify a patient as smear-positive and to initiate treatment.

All 190 laboratories involved in this initiative were included in the external quality assurance program for sputum smear microscopy. Site visits were carried out by lab supervisors each month to inspect equipment and technician technique, and ten slides prepared by each technician (five positive and five negative) were reread by the supervisor to ensure reported results were accurate. Additionally, batches of slides were sent to district laboratories once a month for blind rechecking.

Outcome

The number of people evaluated by smear microscopy during the implementation period increased by just 1.2% compared with the pre-intervention period. The improved positivity rate on LED-FM resulted in a 19.2% increase in the number of smear-positive patients detected - 8,636 patients who would have otherwise received smear-negative results. Although this initiative was unable to document the impact of the intervention case notifications due to the large numbers of medical colleges and patient numbers, smear-positive TB case notifications likely increased considerably due to better test sensitivity. This initiative has since been taken up by the government of India to expand the number of LED-FM microscopes considerably.

	Individuals Tested for TB	Smear-Positive Patients Detected	Smear Positivity Rate
Pre-Intervention Period April 2011 - March 2012	356,603	45,006	12.6%
Intervention Period April 2012 - March 2013	360,770	53,642	14.9%
Incremental Gain	4,167 (+1.2%)	8,636 (+19.2%)	+17.8%

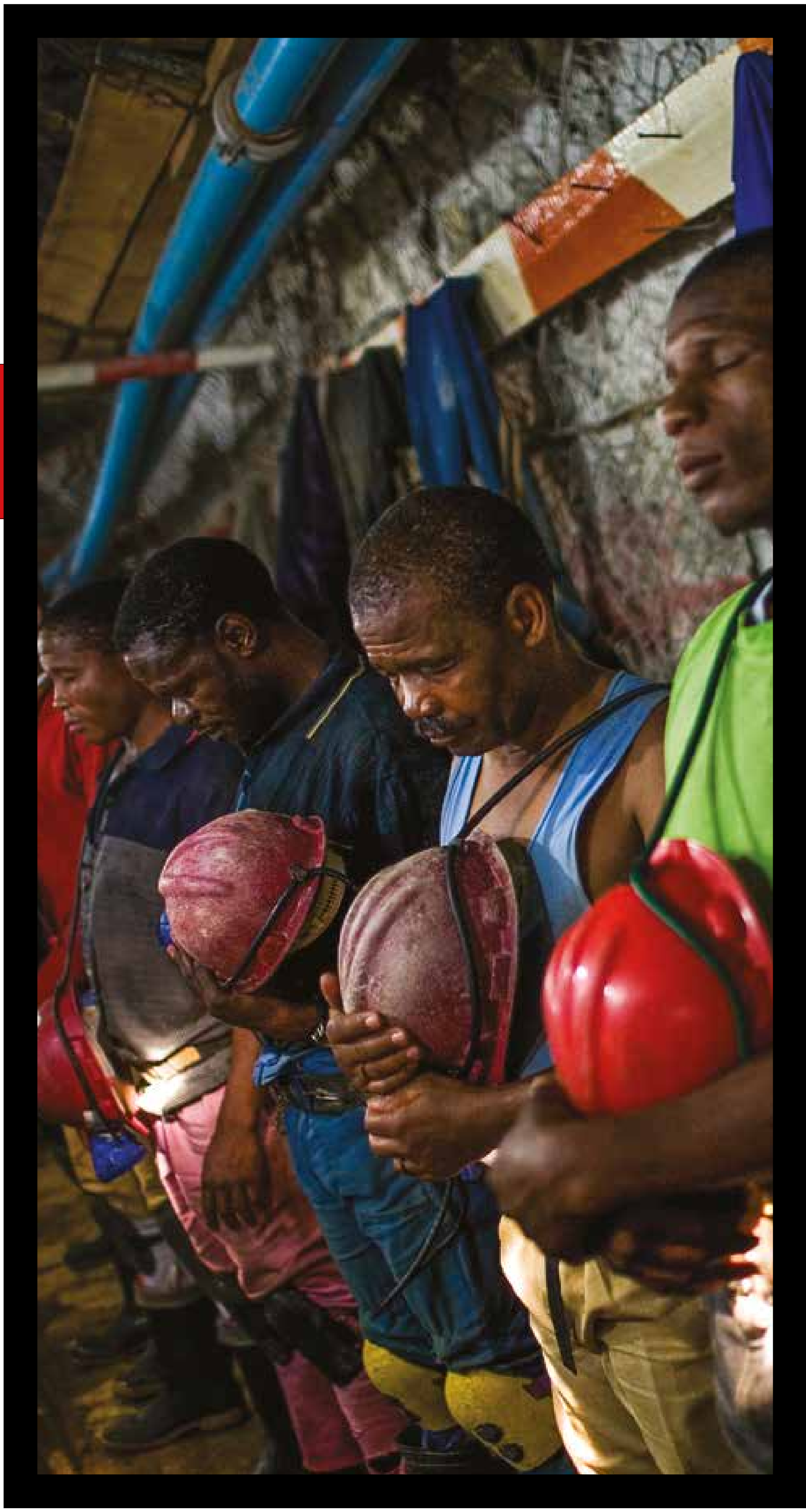


Major Costs

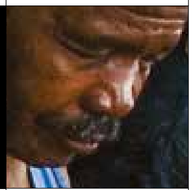
The initiative's largest expense was the procurement of fluorescence microscopes and the microscopy reagents. Training sessions comprised the second largest expense. Additional funds were required to support the supervision and reporting of activities.

Further Reading:

- Reza LW, Satyanarayna S, Pandey A, et al. LED fluorescence microscopy increases the detection of smear-positive pulmonary tuberculosis in medical colleges in India. Public Health Action 2013; 3(3): 240-42.
- Reza LW, Satyanarayna S, Enarson DA, et al. LED-Fluorescence Microscopy for Diagnosis of Pulmonary Tuberculosis under Programmatic Conditions in India. PLoS ONE 2013; 8(10): e75566.



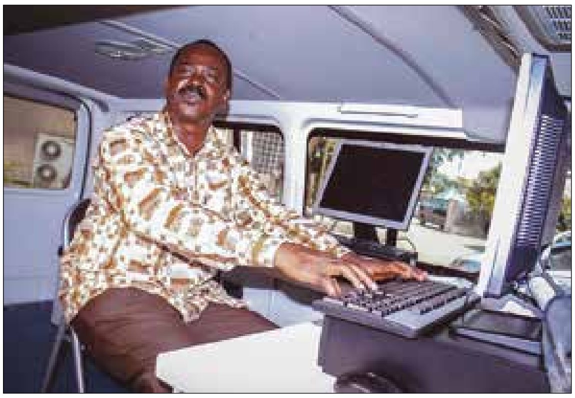
Mining-Affected Communities



TB in mining-affected communities is a complex and multifaceted problem, requiring coordinated collaboration between miners, mining agencies, and local NTP to understand the setting-specific TB epidemiology. The physical nature of mines frequently contributes to the development of active TB, with crowded and closed mine shafts, poorly ventilated conditions and the presence of silica dust exacerbating the problem. As sex workers are often located in close proximity to the mines, HIV is also a risk, which further heightens the risk of developing and subsequently transmitting active TB. Healthcare policies of mining agencies often do not provide comprehensive coverage for all miners with TB. Miners often travel long distances from their homes to find work, and in many cases miners diagnosed with TB are let go and forced to repatriate. When they return home their family members are at an increased risk of TB infection. For these reasons, and due to stigma associated with TB, miners are often reluctant to disclose their TB status to family and co-workers. The case studies presented below highlight the initial successes and lessons learned through ACF activities in diverse mining-affected populations in Ghana, South Africa and Lesotho.

International Organization for Migration (IOM)

Country: Ghana
Key Populations: Mining-affected communities; People living with HIV/AIDS; Migrants
Key Strategies: Mobile care services, Xpert MTB/RIF, Community outreach
Intervention Period: April 2013 to September 2014
Funding Provided: 497,998 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 52; All forms: 83



Setting

Ghana has large deposits of precious metals, including gold and manganese; as a result, mining activities have contributed to large-scale migration and a growing economy in regions where mineral deposits are located. Health facilities are ill-equipped to combat the high rates of TB (and HIV/AIDS) due to the limited health infrastructure in these regions, chronic underfunding and lack of qualified health professionals. This initiative provided mobile diagnostic services in five districts of Western Ghana, covering a population of approximately one million.

Intervention

This initiative equipped a van with two GeneXpert systems in order to screen and test mine workers, their communities and refugees living in mining-affected communities. Community volunteers conducted house-to-house visits, screening for symptomatic individuals who were then referred to the mobile diagnostic van – usually parked outside existing health facilities. The van also visited active mining sites, both legal and illegal, to screen mine workers. All screened individuals in the community and at mines were eligible for testing if they 1) had a cough lasting two or more weeks; 2) had a cough lasting less than two weeks, but combined with either fever, weight loss, or night sweats; or 3) were living with HIV/AIDS with or without a cough. A spot sputum specimen was collected at the mobile diagnostic van and tested with the Xpert MTB/RIF assay. MTB-positive, rifampicin sensitive patients were referred for first line treatment at their nearest health facility, while patients found to be resistant to rifampicin were referred to the regional hospital for further clinical assessment and treatment. Announcements were aired on local radio stations and projected from speakers mounted on the mobile diagnostic van to raise awareness of TB symptoms and advertise free diagnostic and treatment services.

Outcome

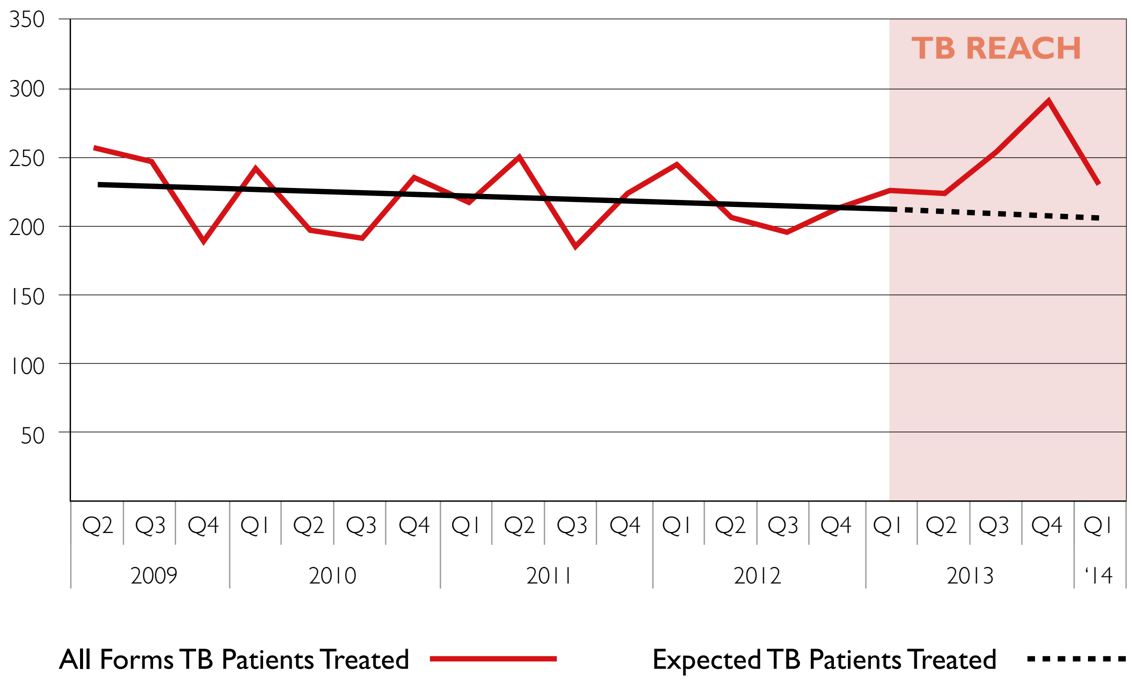
Among its screened population, the initiative did not detect the extremely high rates of TB documented in the TB-mining literature. The open pit nature of the mining in this region likely meant that individuals were not at the increased risk of TB documented among closed pit miners. Fewer suspected TB patients were identified than anticipated, and 26% of those referred to the mobile diagnostic van were lost to follow-up. Miners were reluctant to be tested for TB because of the fear of losing their jobs.

Despite these challenges, the initiative was able to detect over 230 MTB-positive patients, and screening activities resulted in a 19.3% increase in all forms TB case notifications compared with expected case notifications based on historical trends. However, among the 230 individuals diagnosed with TB, only 15 were among informal miners.

Major Costs

Procurement and maintenance of GeneXpert systems and Xpert MTB/RIF cartridges was the most significant expense, followed by the retrofitting and operational costs of the mobile diagnostic van. Incentives were provided to the community volunteers to conduct screening and referral activities.

All Forms TB Patients Treated



The Aurum Institute

Country: South Africa
Key Populations: Mining-affected communities, People living with HIV/AIDS, Contacts of TB patients
Key Strategies: Xpert MTB/RIF, Community outreach
Intervention Period: July 2013 to June 2014
Funding Provided: 600,000 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 308; All forms: 600

Setting

The Bojanala and West Rand districts (population 2.2 million) accommodate hard to reach, peri-mining communities containing formal and informal housing settlements. In many of these unplanned communities, access to many basic services, including healthcare, is poor. Overcrowding leads to increased disease transmission and the marginalization of illegal miners leads to insecurity and further TB transmission.

Intervention

This initiative conducted household contact investigation in peri-mining communities, using MTB-positive individuals who were treated at health facilities funded by mining companies (and located adjacent to the mines themselves) as index patients. Community health workers interviewed each index patient to obtain permission to contact household members and to obtain a household location/address. Health workers would then visit each index patient's household to identify contacts with a chronic cough and to collect a one spot specimen from those found to be symptomatic. Sputum specimens were transported to the nearest laboratory for direct testing with the Xpert MTB/RIF assay. MTB-positive patients and MTB-negative individuals with persistent symptoms were followed-up. Project staff also conducted house-to-house screening for cough in these communities, using the same testing and follow-up procedures as for contacts of index patients, except that those with MTB-negative results were not followed up.

Outcome

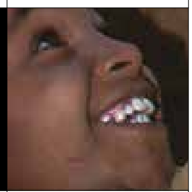
The initiative detected fewer TB patients among household contacts of miner index patients than expected. This may have been due to several factors: houses were visited at times when people were not at home, and there were fewer contacts per household than expected, which led to a time consuming process to follow-up those who were missed. Household members were screened based only on the presence of cough, and as noted by laboratory personnel, poor-quality sputum specimens were submitted for testing. These findings are in contrast to community screening activities, which showed prevalence higher than national estimates (778 per 100,000 population).

	Project Yield
Index patients investigated	455
Contacts verbally screened	16,663
Contacts with presumed TB	11,478 (68.9%)
Contacts submitting sputum	9,972 (86.9%)
MTB-positive patients detected	114 (1.1%)
Patients initiating treatment	101 (88.6%)

Major Costs

The purchase of a vehicle, required by the significant community outreach involved, constituted the largest single expense. The intervention received significant support from two mining companies, both in kind and in cash. A large proportion of the budget was expended on human resource needs.

Children



Paediatric patients comprise up to 20% of incident TB in some high burden countries, yet this cohort is historically underrepresented in TB case notifications owing to the difficulty of diagnosing TB in children. TB in children has a diverse disease presentation, often with atypical symptoms and frequently in the form of extrapulmonary TB, which can be difficult to diagnose. Collecting a sputum sample and other specimens of sufficient volume and/or quality for testing is challenging with children and often necessitates invasive, uncomfortable and expensive techniques of specimen collection. Furthermore, even when specimens can be collected, smear microscopy results are often negative because of the paucibacillary nature of paediatric TB disease. Diagnosing TB in children living with HIV/AIDS is also a challenge, as HIV infection complicates the interpretation of Mantoux tests and CXRs which are important tests in paediatric diagnostic algorithms. Despite the difficulties, there are ways of improving TB care for children. The following projects in Afghanistan, Swaziland and Nepal address paediatric TB through improved diagnostics, integration of private and public care, and the provision of mobile screening in communities with a high burden of HIV.

Afghan Community Research & Empowerment Organization for Development (ACREOD)

Country: Afghanistan
Key Populations: Children
Key Strategies: Engaging private providers, Patient transport, CXR
Intervention Period: April 2013 to present
Funding Provided: 324,713 USD
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 48; All forms: 255

Setting

An assessment of 15 hospitals in Kabul showed that just 2,300 (0.6%) children were suspected of having TB among the more than 386,000 who presented at hospital outpatient departments (OPDs). These findings do not reflect the high risk that children, and particularly young girls, face in developing TB in Afghanistan. A case detection program was established at each of these 15 hospitals and an additional 30 private paediatric specialist clinics, serving a population of approximately 1.5 million children under the age of 15 to improve diagnosis and treatment of TB.

Intervention

This initiative recruited heavily from the pool of existing health facility staff at public hospitals and private facilities to increase the awareness and capacity for screening, diagnosing and treating paediatric TB. Kabul's central referral hospital, Indra Gandhi Institute for Child Healthcare (IGICH), was provided with a digital x-ray machine and LED-FM microscope to serve patients referred from the other participating facilities.

Female health educators interviewed children's parents at IGICH waiting areas to identify which children would be evaluated for TB infection. Awareness posters highlighting TB symptoms, services and prevention were designed and displayed to increase the acceptability of systematic screening in these settings. Any child with TB compatible symptoms (fever, weight loss, night sweats, cough of any duration, and/or contact with a TB patient) was considered to be symptomatic for TB, referred for CXR and asked to give sputum specimens for testing with LED-FM at IGICH. A transportation incentive (three USD) was provided to families to minimize loss to follow-up between screening and CXR. Those with two smear-positive results or a CXR that indicated TB were initiated on anti-TB treatment. If the CXR did not show abnormalities, a Mantoux test was administered in conjunction with a two-week antibiotic trial. In instances where the Mantoux test was positive and no symptom alleviation was observed, patients were diagnosed with TB and started on anti-TB medication. An incentive of two USD per TB patient treated was provided to clinicians to encourage screening, diagnosis and treatment activities.

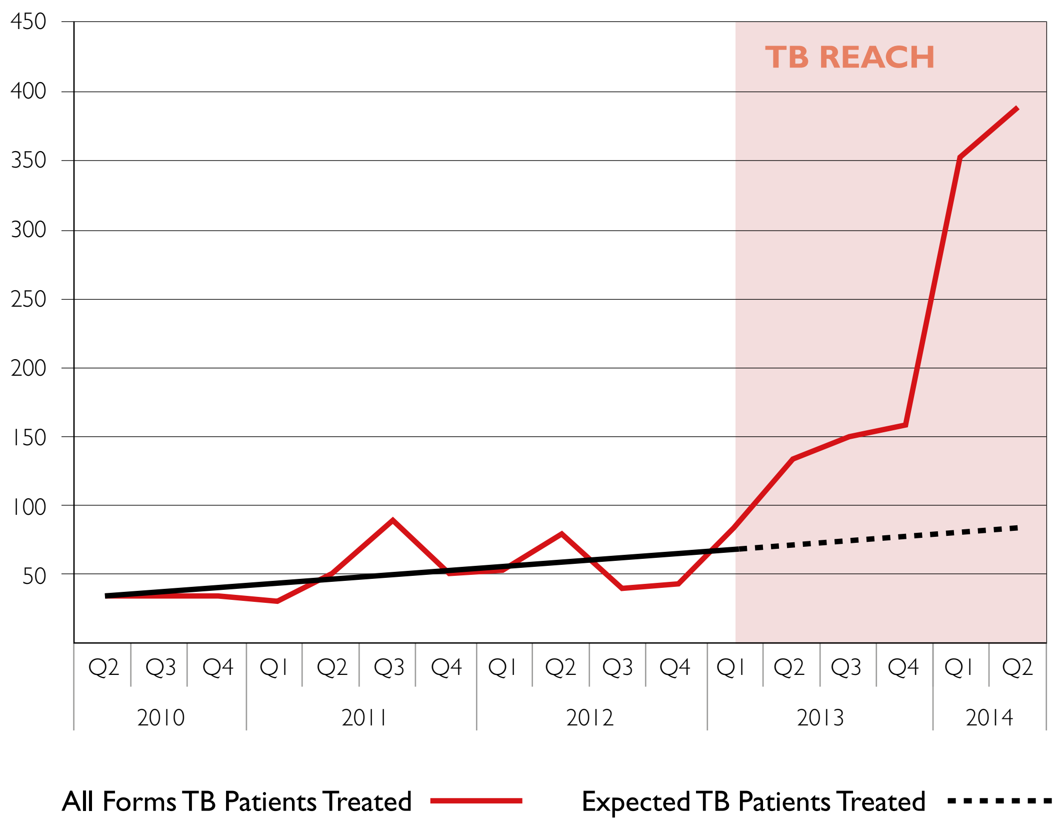
Outcome

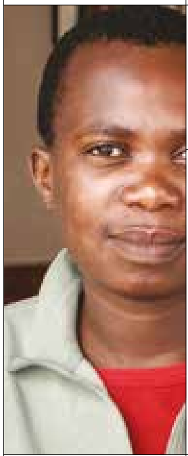
The initiative screened 412,158 children, resulting in the detection of 1,171 all forms paediatric TB patients. Just 39 (3.3%) of these patients were smear-positive, owing to the difficulty in collecting sputum specimens. However, these activities resulted in a 205.6% increase in all forms TB case notifications compared with expected notifications based on historical trends. Yields from ACF activities at hospital OPDs were ten-fold higher than at the private paediatric specialists (0.35% vs 0.03%, confirmed/screened), showing this to be a more efficient strategy for increasing case notifications.

Major Costs

Procurement of equipment and training of staff were significant costs. However, the majority of project expenses were related to the distribution of transport incentives for children with suspected TB and for case detection incentives for clinicians.

All Forms Paediatric TB Patients Treated





Baylor College of Medicine Children's Foundation

Country: Swaziland
Key Populations: Children, Contact of TB patients, People living with HIV/AIDS
Key Strategies: Systematic screening, Xpert MTB/RIF, CXR
Intervention Period: April 2013 to present
Funding Provided: 227,046 USD (plus 49,784 USD from UNITAID TBXpert)
Pre-Intervention Notification Rates per 100,000: SS+/Bac+: 233; All forms: 923 (all ages)

Setting

Swaziland has the highest incidence of TB worldwide (1,349 per 100,000), driven in large part by the epidemic of HIV/AIDS. An estimated 32% of Swazi children are currently orphaned and in the care of extended family or orphanages. Due to the high rates of TB in the community, many children have been exposed to the disease. Baylor College of Medicine implemented a paediatric ACF intervention using improved diagnostics in seven health facilities serving a population of approximately half a million people, 44% of whom are children under the age of 15.

Intervention

In seven health facilities, household contact investigations were conducted for each newly diagnosed TB patient, prioritizing the identification of children with suspected TB. The initiative developed a standardized data collection tool to compile a list of household contacts with the index patient while he/she was at the health facility. The index patients were then asked to bring their contacts to the facility for screening; when this was not possible cough monitors conducted household visits. CXR was done for patients with symptoms other than cough and for patients unable to produce sputum, and was free of charge for children under 14 years of age.

Additionally, PLWHA of all ages presenting at the Mbabane's Baylor clinic were verbally screened for TB symptoms. Cough monitors conducted this verbal screening and assisted in collecting sputum specimens from individuals self-reporting any symptom of TB. Adults who were not able to produce a sputum specimen were clinically assessed and referred for CXR if necessary. For children who could not produce a sputum specimen, attempts were made to collect nasopharyngeal or gastric aspirate specimens for testing free of charge.

One GeneXpert system was procured and installed at Baylor's HIV clinic to supplement systems already procured and installed by the NTP. All contacts were eligible to receive a direct Xpert MTB/RIF assay for diagnostic testing when a good quality specimen was provided.

The initiative also established a toll-free phone line which healthcare workers across the country could use to consult with paediatric TB/HIV specialists. This telemedicine service was operational during working hours of government health facilities and was an additional service to Baylor's well-established paediatric HIV hotline.

Outcome

The initiative verbally screened 8,365 children for symptoms of TB, resulting in the detection of 2,631 suspected and 156 all forms paediatric TB patients. Just 29 children were diagnosed with bacteriologically-positive TB due to difficulties collecting good-quality specimens for testing. These activities resulted in a 38% increase in all forms paediatric TB case notifications compared to expected notifications based on historical trends. In addition to the paediatric ACF activities, 10,740 adults were verbally screened and 209 all forms TB patients were identified.

Major Costs

Funding a diagnostic algorithm based on Xpert MTB/RIF testing and CXR was a major cost for this initiative, with the free vouchers for x-ray comprising a significant component. Additional costs were incurred for upgrades in the laboratory in order to accommodate these systems, and human resource costs, such as the salaries for cough monitors, were an additional large expense.

	Children		Adults	
	HIV Clinics	Contact Tracing	HIV Clinics	Contact Tracing
Individuals verbally screened	5,280	3,085	7,224	3,516
People with TB symptoms	1,423 (27.0%)	1,208 (39.2%)	1,169 (16.2%)	1,495 (42.5%)
People submitting sputum	550 (38.7%)	836 (69.2%)	500 (42.8%)	1,295 (86.6%)
Bacteriologically-positive patients detected	8 (1.5%)	21 (2.5%)	17 (3.4%)	84 (6.5%)
All forms patients detected	43 (3.0%)	113 (9.4%)	53 (4.5%)	156 (10.4%)

A clinician from a community outreach project in Rift Valley, Kenya, Moi University School of Medicine and Moi Teaching and Referral Hospital

Implications for National TB Programmes and their Partners

In summary, any ACF intervention will require more resources than the existing passive case finding system. Given this necessary investment in additional resources, programme managers will want to know if, through any given intervention, patients are detected earlier, and also whether it effectively targets patients who would not have been notified under the system currently in use.

The first step to conduct an initiative to improve case detection is to identify the barriers to case detection and the possible key affected populations to target, followed by a determination of how the intervention could be operationalized. The above case studies provide some lessons learned and ways to help track outcomes, but all settings will vary and the local circumstances must be accounted for in any intervention design.

In most cases, ACF will increase demands on the overall TB programme. Careful planning should be done to ensure that increased human resource and supply capacity is available for expected increases in diagnostics, medications, transportation, reporting and supervision. Other cost issues to consider are the ease of access to the population that is to be screened, the testing algorithm to be used, data monitoring, and the periodicity of the interventions – whether they should be repeated or one-off events. Sharing resources such as vehicles, laboratory staff, and outreach workers from different disease programmes may provide an opportunity to improve case detection without huge cost implications.

Working on properly documenting the effect of ACF interventions can be helpful to NTPs in other ways as well. Continuous monitoring of both project and notification data during the intervention can help in fine-tuning the case finding strategy to improve TB case detection. In addition, utilisation and improvement of the TB notification system, including regular reporting of data on people tested for TB for M&E purposes will improve evidence-based reflection and decision-making skills among those supporting TB programmes, and its continual application will increase the relevance of NTP data. Continuous monitoring will be critical to any ACF intervention and will always be required to keep the strategy appropriate and impactful.

It is hoped that the case studies will motivate countries and partners to be ambitious in their case detection targets and match them with bold plans to improve case detection by implementing new and innovative interventions to overcome barriers to access, provide outreach to underserved communities and screen and test large numbers of people.

Further Reading

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