International Journal of Infectious Diseases 70 (2018) 93–100

Contents lists available at ScienceDirect

International Journal of Infectious Diseases

journal homepage: www.elsevier.com/locate/ijid

Evaluation of a tuberculosis active case finding project in peri-urban areas, Myanmar: 2014-2016

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ARTICLE INFO

Article history:
Received 1 July 2017
Received in revised form 3 February 2018
Accepted 13 February 2018
Corresponding Editor: Eskild Petersen, Aarhus, Denmark

Keywords:
Tuberculosis
Community-based active case finding
TB screening
Myanmar

ABSTRACT

Objectives: We assessed the effect of an active case finding (ACF) project on tuberculosis (TB) case notification and the yields from a household and neigbourhood intervention (screening contacts of historical index TB patients diagnosed >24 months ago) and a community intervention (screening attendants of health education sessions/mobile clinics).

Design: Cross-sectional analysis of project records, township TB registers and annual TB reports.

Results: In the household and neigbourhood intervention, of 56,709 people screened, 1,076 were presumptive TB and 74 patients were treated for active TB with a screening yield of 0.1% and a yield from presumptive cases of 6.9%. *In the community intervention*, of 162,881 people screened, 4,497 were presumptive TB and 984 were treated for active TB with a screening yield of 0.6% and yield from presumptive cases of 21.9%. Of active TB cases, 94% were new, 89% were pulmonary, 44% were bacteriologically-confirmed and 5% had HIV. Case notification rates per 100,000 in project townships increased from 142 during baseline (2011-2013) to 148 during intervention (2014-2016) periods.

Conclusions: The yield from household and neigbourhood intervention was lower than community intervention. This finding highlights reconsidering the strategy of screening of contacts from historical index cases. Strategies to reach high-risk groups should be explored for future ACF interventions to increase yield of TB.

Introduction

Tuberculosis (TB) remains a global public health crisis with an estimated 10.4 million new cases in 2016, of which only 6.3 million (61%) were diagnosed and notified to national programs (World Health Orgnization, 2017). The World Health Organization (WHO) goal to end the TB epidemic by 2035 will not be realized without finding these 4.1 million "missing" people.

The current WHO End TB strategy highlights the importance of early diagnosis, including universal drug susceptibility testing (DST) and systematic screening of contacts and high-risk groups to reduce the case-detection gap (World Health Organization, 2015). Active case finding (ACF) is defined as the systematic identification and screening of people with presumptive TB symptoms, in a predetermined target group, using tests, examinations or other procedures that can be applied rapidly (World Health Organization (WHO), 2013). This includes interventions from screening contacts of people with active TB to mass community screening of asymptomatic individuals.

Myanmar is one of the WHO 30 high TB burden countries with estimated incidence of 361 TB cases per 100,000 population and high mortality rate of 56 per 100,000 population in 2016 (World Health Orgnization, 2017). The national TB program (NTP) estimated a case detection gap of 29% in 2011 and commenced community-based ACF interventions with the support of local and international non-governmental organizations (NGOs). The NTP estimated that the case detection gap had dropped to 26% by 2014

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https://doi.org/10.1016/j.ijid.2018.02.012
1201-9712/

and accelerated ACF through community-based strategies – community mobilization, symptom screening and referral and routine contact tracing (National Tuberculosis Program (NTP Myanmar), 2015). The 2016-2020 National Strategic Plan has adopted the WHO end TB strategy and has a target of reducing TB incidence by 15% by 2020 (National Tuberculosis Program (NTP Myanmar), 2016).

A systematic review on the number of persons needed to screen (NNS) to detect TB in different populations revealed that variation depends on the risk groups screened, the TB incidence in that particular setting, the screening approaches and the population evaluated (Shapiro et al., 2013). There have been randomized trials to assess the impact of different ACF interventions on TB epidemiology. A cluster randomized trial of six rounds of ACF at 6-monthly intervals by either mobile van or door-to-door visit in neighbourboods of Harare, Zimbabwe (the DETECTB study) showed a higher yield in the mobile van intervention and an overall decline in TB prevalence from 6.5 per 1000 adults before ACF to 3.7 per 1000 after the interventions (Corbett et al., 2010). Another community randomized trial, the Zambia, South Africa Tuberculosis and AIDS Reduction (ZAMSTAR) trial, assessed the effect of two interventions (a household intervention with community mobilization and an enhanced case finding (ECF) intervention) and showed that the ECF intervention did not reduce the incidence or prevalence of TB (Ayles et al., 2013). A cluster-randomized controlled trial in Viet Nam showed that household-contact investigation plus standard passive case finding was more effective than standard passive case finding alone for the detection of TB at 2 years (Fox Greg et al., 2018). An ACF project in Cambodia that screened household and neighbourhood contacts of historical index cases in the past 2 years show a substantial increase in case notification (Morishita et al., 2016). There are few studies demonstrating the contribution of different community-based case finding projects in Myanmar (Maung et al., 2017; Soe et al., 2017), but there is limited evidence on the effectiveness of each of these interventions. Further evaluation of ACF interventions in Myanmar is needed to establish the most efficient and effective interventions to take to scale.

Through funding from the Three Millennium Development Goal Fund (3MDG), The International Union Against Tuberculosis and Lung Disease (The Union, Myanmar) launched a Program to Increase Catchment of Tuberculosis Suspects (PICTS) in collaboration with the NTP in July 2014. This project implemented an ACF strategy that included household and neigbourhood intervention and community-based screening intervention. In this study, we aimed to (1) assess the yield of ACF by intervention, (2) describe the demographic and clinical characteristics of diagnosed TB patients and (3) assess the effect of the ACF interventions on overall case notifications.

Methods

Study design

This was a cross-sectional analysis of project records, township TB registers and annual TB reports from 2011 to 2016.

Setting and program description

Myanmar is administratively sub-divided into 75 districts, 330 townships, wards, and villages. The Myanmar NTP provides tuberculosis care through township TB centers (TBC) in collaboration with local and international partners. The NTP introduced ACF activities widely with the support of the Global Fund since 2011. The ACF activities have included mobile screening teams with portable digital X-ray machines, setting up sputum collection centers (SCCs) in hard-to-reach areas, community-based TB screening and household contact screening.

The Union Office in Myanmar, in partnership with the NTP, has been implementing TB activities since 2005 with a focus on TB-HIV and TB case-finding in health facilities and communities. The PICTS project covers approximately 1.7 million people in six townships in the Sagaing, Magway regions and Shan state of Myanmar. The PICTS project aims to increase case detection and facilitate linkage to care for patients with TB via community-based interventions through community volunteers. Community volunteers were people residing in the project townships who were recruited and trained by the Union and NTP staffs and received an incentive for each presumptive TB case referred and for each activity. The project team, working in close collaboration with the township TB team (Regional officers, TB team leaders, nurses and health assistants), selects “TB cluster” sites within the township to conduct these activities based on case-spot maps. Two ACF interventions (a household and neigbourhood intervention and a community intervention) were implemented by Union field staff (nurses and health assistants) and community volunteers.

In the household and neigbourhood intervention, contacts of historical index TB cases >24 months ago were screened from July 2014 to December 2016. Project field staff and volunteers obtained addresses of bacteriologically-positive TB patients (diagnosed by smear microscopy or Xpert MTB/RIF) from the township drug-susceptible TB treatment registers from 2012 and 2013 (historical index cases). Index patients with drug-resistant TB were not included in this study. After obtaining permission from the township health authority, the volunteers visited the houses of the historical index TB patients and after obtaining consent, screened household members present at the time of the visit for TB symptoms. In addition, project staff extended the screening process to the people who were living in surrounding houses. The number of surrounding houses that they visited ranged from 10 houses to 30 houses.

In the community intervention, project staff or volunteers provided health education (HE) on TB, information on the location of diagnostic centers and where support could be obtained from the project. They distributed Information, Education and Communication (IEC) materials and included contacts of volunteers so that the community could get easy access to diagnosis. This was done as either a stand-alone HE session or in conjunction with the township primary health care mobile clinic.

Symptom screening was offered to all the eligible participants of both household and neighborhood intervention and community intervention by community volunteers. Presumptive TB was defined as presence of any one of the symptoms including cough for two weeks, blood stained sputum, weight loss, fever, night sweats and neck or axillary glands enlargement. In the event of identification of a presumptive TB case, community volunteers provided sputum cups to them, explained how sputum should be collected and returned the following day to collect the samples and transport it to the township TBC. Two sputum samples were examined for each presumptive TB patient, including one early morning sputum and one overnight sputum sample, using fluorescent microscope. The sputum results were given to presumptive TB patients on day 3 and if the result was positive, a volunteer then accompanied the patients to the township TBC for treatment. Those whose sputum smear was negative but remained symptomatic, or who could not produce sputum or children under 8 years of age were accompanied to the township TBC to obtain a chest radiograph (CXR). A Gene Xpert platform was present in two out of the six project townships and as per NTP guidelines, was used for presumptive TB in people with HIV, contacts of multidrug-resistant TB (MDR-TB) patients, and those with presumptive TB who were previously treated for TB. Diagnosis of TB was made by

NTP staff based on either sputum smear, Xpert MTB/RIF or CXR result. The same diagnostic algorithm was used for both interventions and is shown in Figure 1. TB treatment was provided free of charge by NTP at the township TBC and volunteers were responsible for linking the diagnosed TB patients to treatment.

Study sites

The six intervention townships (Sagaing, Monywa, Taunggyi, Kalaw, Yaesagyo and Myaing) were the townships that the PICTS project started in its two ACF interventions: household and neighbourhood intervention and community intervention in July 2014. The seven control townships (Kalay, Tamu, Shwe Bo, Pindaya, Muse, Gangaw and Pwint Phyu) which did not have PICTS projects were chosen based on the similarity of geographical areas and population demographics. Both intervention and control townships have routine passive case finding and public-private mix case finding activities in place during the study period.

Study population

The study population included: 1) people screened by either of the two ACF interventions (first objective), 2) TB patients diagnosed under the project (second objective) and 3) aggregated number of all registered TB patients in both intervention and control townships from 2011 to 2016.

Data variables and data source

The data variables included: number of people screened, number of presumptive TB patients examined, number of TB patients diagnosed and enrolled in treatment, among the diagnosed TB patients: age, sex, type of TB, site of TB, HIV status and presenting symptoms from six project townships, and TB case notification rate of both six intervention and seven control townships. Sources of data were the presumptive TB register, the township TB register, the monthly project report and the NTP annual report.

Analysis and statistics

Aggregate numbers of the reports were in electronic format and maintained by the PICTS project. Data from the presumptive TB register and township TB registers were single-entered by project staff into the Epi info^{TM} Version 7.1.5.2 and MS Excel respectively. Data were exported, combined and analyzed by using EpiData Analysis version 2.2.2.183. Frequencies and proportions were used to describe the screening cascade, demographic and clinical characteristics of TB patients. The screening yield of each intervention (%) was defined as the number of patients diagnosed with active TB from those screened. The number needed to screen (NNS) was used to describe the screening yield from different interventions and number need to test (NNT) was used to describe the diagnosis yield among presumptive TB cases from different interventions. The contribution was calculated by dividing the TB cases referred by volunteers with total registered TB cases in the township and the result was expressed in percentage. The average case notification rate was calculated by dividing total TB cases registered during the intervention period (2011-2013) or control period (2014-2016) by total population in the same periods and expressed in per 100,000 population.

In order to assess the effect of ACF on the TB notification rate, we used the following linear model. The expected average notification rate in intervention and control townships, at time period k ($rate_k$)

$$
\begin{aligned}
rate_k = constant &+ (\beta_1 * township_{[Intervention\ OR\ Control]}) \\
&+ (\beta_2 * period_{[Intervention\ OR\ Control]}) \\
&+ (\beta_3 * number\ of\ years\ since\ 2011) \\
&+ (\beta_4 * township_{[Intervention\ OR\ Control]} \\
&* period_{[Intervention\ OR\ Control]})
\end{aligned}
$$

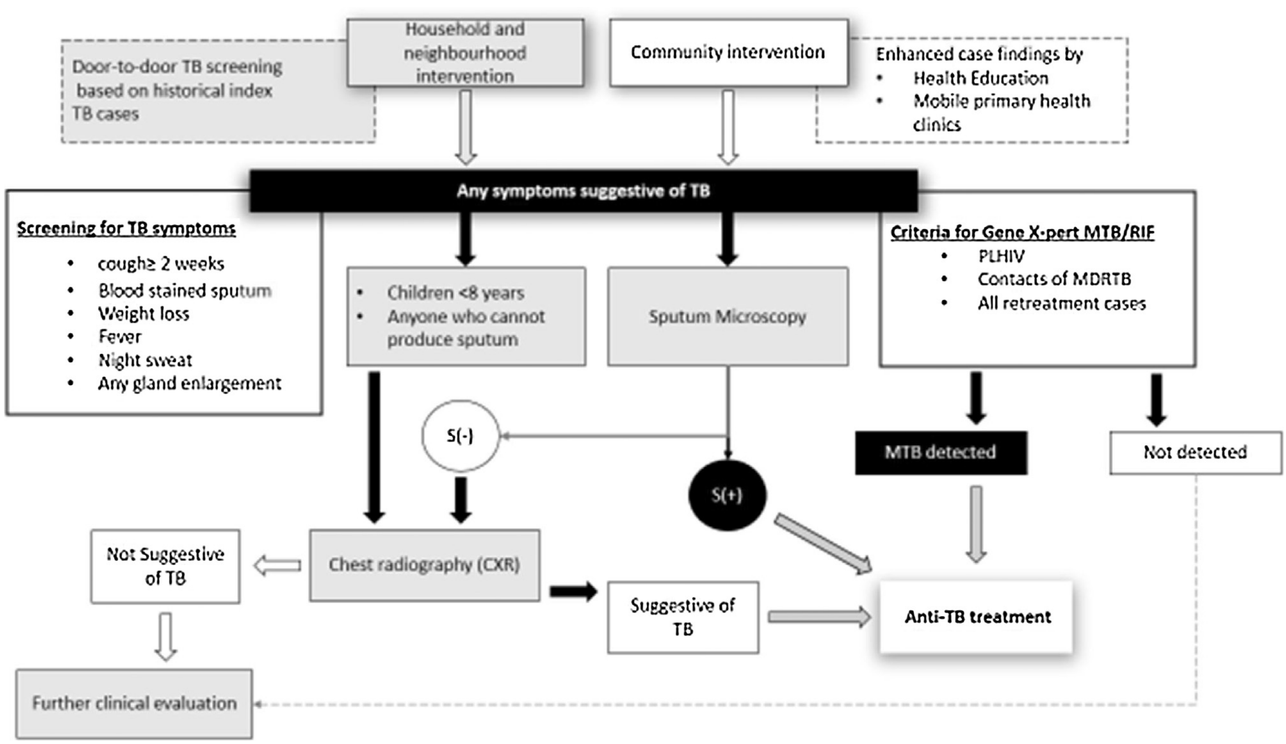

Figure 1. Flow of ACF intervention by community-based ACF project in six townships of Myanmar from 2014 to 2016.

Where

- β_1 indicates the expected difference in the average notification rates between intervention and control townships at baseline and throughout the study period,
- β_2 indicates the difference in the average notification rates between intervention and control periods,
- β_3 indicates the average change in the TB notification rates per year from 2011 ($k = 1$) to 2016 ($k = 6$) (indicating the underlying secular trend in the notification rates) and
- β_4 indicates the average change in the difference of the TB notification rates per year between the intervention townships and the non-intervention townships in the intervention and control periods (it's an interaction term between intervention/ control townships and intervention/control time periods after adjusting for secular trends).

We used a generalized estimating equation to assess the parameters of the model used to assess the effect of ACF activities on the population weighted average TB notification rates in the intervention and control townships. We assume exchangeable correlation structure within townships and used robust standard error estimates.

Assuming that notification rates followed a linear trend, that the intervention townships would have had a similar trend in the notification rates as that of the control townships had they not been exposed to the intervention and that whatever systemic changes (other than the ACF intervention) that have occurred in the intervention townships also happened in the control townships, the coefficient for β_4 can be interpreted as the effect of ACF on the TB CNR in the intervention townships.

Ethical approval

Ethical clearance was obtained from Ethics Review Committee, Department of Medical Research, Ministry of Health and Sports, Myanmar and from The Union's Ethics Advisory Group, Paris, France. Permission to conduct the study was obtained from the NTP, Myanmar.

Results

ACF screening and results

Between July 2014 and December 2016, a total of 219,590 people were screened for TB in the 6 project townships, in which, 5573 presumptive TB cases were identified. Among them, 1058 TB cases were diagnosed and enrolled for treatment. Table 1 displays the results of the 2 ACF interventions. *In the household and neighbourhood intervention*, of 56,709 people screened, 1076 (1.9%) were identified and examined as having presumptive TB and 74 patients with active TB were diagnosed and enrolled on treatment. On average, 49 people per index TB case were screened from the surrounding households. The screening yield for active TB was 0.1% (74/56 709) resulting in an NNS of 766. The diagnostic yield for active TB from presumptive cases was 6.9% (74/1076) and the number needed to test among presumptive TB cases was 15.

In the community intervention (which included conducting 2,301 health education sessions and providing 389 mobile clinics), of 162,881 people screened, 4497 (2.8%) were identified and examined as having presumptive TB and 984 patients with active TB were enrolled on treatment. The screening yield for active TB was 0.6% (984/162881) resulting in an NNS of 166. The diagnostic yield for active TB from presumptive cases was 21.9% (984/4497) and the number needed to test among presumptive TB cases was 5.

Altogether, the ACF project contributed 5% (122/2267), 18% (455/2585) and 18% (481/2602) to the total township TB cases in 2014, 2015 and 2016 respectively. These were considered additional cases.

Characteristics of diagnosed TB patients:

The demographic and clinical characteristics of TB patients enrolled in treatment are displayed in Table 2. Cough for two weeks accounted for the major presenting symptom and half of the patients reported fever and night sweats. Forty two percent of patients were sputum smear positive, and 44% were bacteriologically confirmed (smear positive or MTB detected by Xpert MTB/RIF) with an additional 2% diagnosed with Xpert MTB/RIF. Most patients enrolled were new cases of pulmonary TB and 28% had

Table 1
Screening cascade and yield of TB from two community-based ACF interventions in six townships of Myanmar between 2014 and 2016.

ACF intervention	Population	Number of people screened A	Number of presumptive TB cases referred and examined B (%)	Number of TB enrolled in treatment C (C/A %)	NNS (A/C)	NNT (B/C)
Household and neighbourhood intervention	1696972	56709	1076 (1.9)	74 (0.1)	766	15
Sagaing	300900	10163	297 (2.9)	19 (0.1)	535	16
Monywa	339142	20397	220 (1.1)	16 (0.1)	1275	14
Taunggyi	382534	6501	141 (2.2)	14 (0.2)	464	10
Kalaw	165571	5707	190 (3.3)	14 (0.3)	408	14
Yaesagyo	240883	5170	108 (2.1)	2 (0.1)	2585	54
Myaing	267942	8771	120 (1.4)	9 (0.1)	975	13
Community intervention	1696972	162881	4497 (2.8)	984 (0.6)	166	5
Sagaing	300900	19805	1138 (5.7)	189 (0.9)	105	6
Monywa	339142	23794	557 (2.3)	152 (0.6)	157	4
Taunggyi	382534	39669	1314 (3.3)	228 (0.6)	174	6
Kalaw	165571	20945	385 (1.8)	57 (0.3)	367	7
Yaesagyo	240883	27569	492 (1.8)	148 (0.5)	186	3
Myaing	267942	31099	611 (2.0)	210 (0.7)	148	3
total		219590	5573	1058	208	5

NNS-number needed to screen to detect one TB case.
NNT- number needed to test among presumptive TB cases to detect one TB case.

Table 2
Demographic and clinical characteristics of diagnosed TB patients from community-based ACF project in six townships of Myanmar between 2014 and 2016.

Demographic and clinical Characteristics	total n (%)	Household and neighbourhood intervention n (%)	Community intervention n (%)
Total	1058	74	984
Sex			
Male	708 (67)	49 (66)	659 (67)
Female	350 (33)	25 (34)	325 (33)
Age			
0-4 years	83 (8)	4 (5)	79 (8)
5-9 years	159 (15)	13 (18)	146 (15)
10-14 years	53 (5)	3 (4)	50 (5)
15-44 years	413 (39)	22 (30)	391(40)
45-64 years	253 (24)	25 (34)	228 (23)
65 years and above	96 (10)	7 (9)	89 (9)
Missing	1(0)	(0)	1 (0)
Type of patient			
New	993 (94)	66 (89)	927 (94)
Retreatment	65 (6)	8 (11)	57 (6)
Site of TB			
Pulmonary	946 (89)	70 (95)	876 (89)
Extra-pulmonary	112 (11)	4 (5)	108 (11)
HIV status			
Negative	958 (90)	70 (95)	888 (90)
Positive	48 (5)	1 (1)	47 (5)
Unknown	52 (5)	3 (4)	49 (5)
Sputum smear result (number tested)	859 (81)	63 (85)	796 (81)
Positive	449 (42)	34 (46)	415 (42)
Negative	348 (33)	26 (35)	322 (33)
Not recorded	62 (6)	3 (4)	59 (6)
not done	199 (19)	11 (15)	188 (19)
Gene Xpert result (number tested)	462 (44)	39 (53)	423 (43)
MTB Not detected	341 (74)	25 (64)	316 (75)
MTB detected	97 (21)	12 (31)	85 (20)
Rifampicin resistance	2 (0)	0 (0)	2 (0)
Not recorded	22 (5)	2 (5)	20 (5)
Chest X-ray result (number tested)	752 (71)	55 (74)	697 (71)
Normal	48 (6)	6 (11)	42 (6)
Abnormal	704 (94)	49 (89)	655 (94)
Not recorded	306 (29)	19 (26)	287 (29)
Proportion of patients with following symptoms			
Cough	873 (83)	56 (76)	817 (83)
Blood stained sputum	50 (5)	2 (3)	48 (5)
fever	484 (46)	27 (36)	457 (46)
Weight loss	475 (45)	37 (50)	438 (45)
Night sweat	236 (22)	8 (11)	228 (23)
Lymph node enlargement	126 (12)	8 (11)	118 (12)
Other symptom	164 (16)	15 (20)	149 (15)

TB = Tuberculosis; MTB = Mycobacterium Tuberculosis.

childhood TB (<15 years). There were twice as many males as females among TB patients. The HIV co-infection rate was 5% among those tested for HIV.

Difference in CNR before and after interventions

Average case notification rates per 100,000 population in project townships increased from 142 during baseline (2011-2013) to 148 during intervention (2014-2016) periods.

Comparison of the intervention and control townships

The TB CNR per 100,000 population of both intervention and control townships across six years are shown in Figure 2. The coefficients of the model to assess the effect of ACF on notification rates between the intervention and control townships is given in Table 3. Based on the output from the model, the average difference in the case notification rate between intervention and control townships declined by 50.9 cases per 100,000 population (95% CI: -10 to 112 cases per 100,000 population per year) during the intervention period from 97 cases per 100,000 population before the intervention period. And this could be the effect of ACF interventions on the TB CNR although not statistically significant since the p-value is >0.05.

Discussion

Our study found that the community-based ACF intervention in the townships based on symptom screening in the community resulted in increased case notifications compared to the baseline periods, although the NNS was 166. However, in the household and neighbourhood interventions where the contacts of historical TB

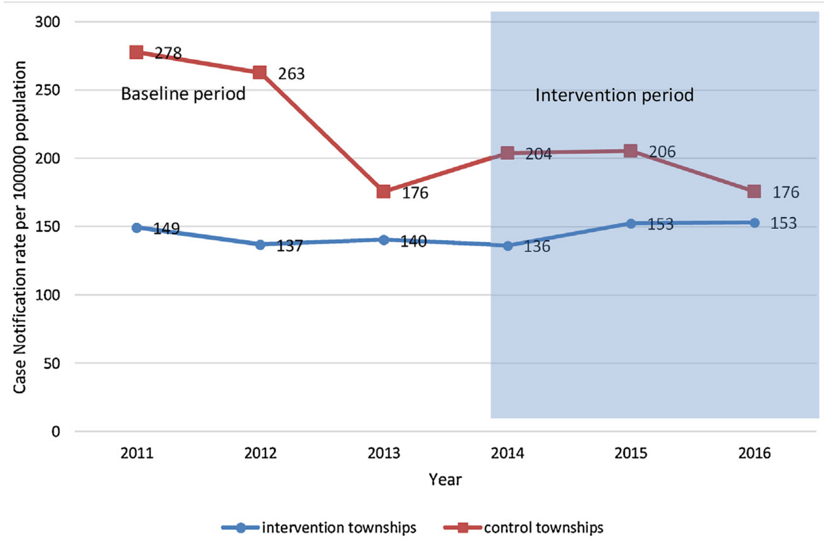

Figure 2. TB case notification per 100,000 population (CNR) in six townships of Myanmar implemented by PICTS project during 2014-2016 compared with a different period 2011-2013 in the same townships with no active TB screening and with control townships.
The intervention township (blue line) includes both community and household and neighbourhood interventions.

Table 3
Parameters of the linear model used to assess the effect of Active case finding on the TB notification rates in intervention and control townships.

Parameter	Value	SE	95% CI	p-value
Constant	269.1	47.8	175.4 – 362.8	$<$0.001
β_1	-97.3	48.2	-191.7 – -2.8	0.04
β_2	1.1	26.7	-51.2 – 53.5	0.97
β_3	-15.2	6.9	-28.8 – -1.6	0.03
β_4	50.9	31.4	-10.7 – 112.4	0.11

SE- standard error; CI- confidence interval.

cases were screened, there was a very low direct yield of TB with an NNS of 766. These findings urge reconsideration of the strategy and algorithm used for screening of contacts of historical index TB cases diagnosed over 24 months ago.

The main strength of this study is that this is one of the few studies describing ACF activities in Myanmar and the first study assessing the yield of investigating contacts of historical TB patients. The project procedures and algorithm for TB diagnosis were all standardized so that the same practices were implemented at the township level. We also used the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines and sound ethical principles for the conduct and reporting of this observational study (Elm von et al., 2014).

The major limitation of the study is the accurate ascertainment of the effect of the intervention given the real-world operational conditions and difficulty in identifying a comparison group (control). First, there was a potential for effect bias from concurrent ACF activities conducted in the intervention townships by the NTP (mobile chest X ray team and contact tracing) and other NGOs (public-private mix, community-based TB care). Therefore, we cannot clearly state that the increase in case notifications was due to the project intervention alone. Whatever be the effect bias, the direct yield was low and the NNS was high. Second, there was a potential for overlap between household and neighbourhood intervention and community intervention within the project townships, making comparisons difficult. Third, there was heterogeneity in the household and neighbourhood intervention throughout the project, with variation of the screening area around the index case. Finally, the data reported were not complete and thus we could not properly evaluate the gaps between each step of the screening cascade including referrals, examinations, diagnoses, enrolment to treatment and most importantly, treatment outcomes.

How do the results of our study compare with other published studies? A large community based awareness raising and active case finding approach in India demonstrated an increase in case detection of smear positive TB by 11% in that country (Calcagno et al., 2014). Studies in Myanmar have shown that the contribution of community based ACF can vary between projects ranging from 15% to 52% but decreasing overtime from 6% to 4% (Maung et al., 2017; Soe et al., 2017). The systematic review showed that the NNS in various risk groups in high TB incidence settings (>300 cases per 100 000) ranges between 17 in household contacts to 100 in the general population (World Health Organization (WHO), 2013). Compared to these published studies, the yield of TB from ACF activities in our study is lower.

The reasons for the low yield of ACF activities in our study, especially in household and neighbourhood interventions, can be either attributed to a suboptimal selection of a screening population (risk stratification) or the diagnostic algorithm. Previous studies have shown a steep reduction in the yield of contact tracing after 1 year from diagnosing the index case (World Health Organization, 2012). A study assessing the yield of community-based "retrospective" tuberculosis contact investigation in a high burden setting in Ethiopia showed that the rate of active TB was 1.8 times higher among contacts whose index cases registered for treatment within the previous 12 months compared with contacts who had been exposed 24 or more months earlier (AOR: 1.77 95% CI 1.42–2.21) (Gashu et al., 2016). The household and neighbourhood intervention in our study may therefore have been more effective if household contact tracing is conducted on recent diagnosed or active TB index cases as recommended by the WHO (World Health Organization, 2015). The strategy of extending contact tracing beyond the index case household may also be a reasonable one. A study in Pakistan that extended contact tracing to the community within a 50 meter radius of the index household and using Xpert MTB/RIF for diagnosis of smear negative presumptive TB resulted in a 19.1% yield among presumptive community contacts, translated into 0.5% yield among total people screened (Fatima et al., 2016).

A systematic review, which included 108 studies in high income countries and 98 studies in low and middle income countries, found that among contacts of smear-positive index patients in low and middle income countries the prevalence of TB was 3.3% in household contacts, 22% in PLHIV and 10% in <5-year-old children (Gregory et al., 2013). Another systematic review noted that diabetes mellitus increases the risk of developing active TB by approximately 3 fold (Jeon and Murray, 2008), so this might be another high risk group to target. Based on WHO guidance, but limited national data, the Myanmar National Strategic Plan for Tuberculosis 2016-2020 (NSP) suggests targeted ACF in several high risk groups, with evaluation of the yield. These include health care workers, the elderly, prisoners, urban and rural poor, ethnic minorities, miners, migrants, people who use drugs, pregnant and lactating mothers, children under 5, people living with HIV and persons with diabetes (National Tuberculosis Program (NTP Myanmar), 2016).

The diagnostic algorithm in our study used symptom screening, followed by sputum microscopy and Xpert MTB/RIF (in certain groups) to diagnose TB. The Myanmar National TB prevalence survey conducted in 2009 showed that 20% of smear positive and 38% of culture positive cases were asymptomatic (National Tuberculosis Programme (NTP), 2010). These asymptomatic individuals could be diagnosed by using chest x-ray as the upfront screening test. The WHO has recently released chest radiography (CXR) guidelines that recommend it as the preferred TB screening tool because of its high sensitivity (87% to 98%, depending on how the CXR is interpreted). However, it can be expensive and logistically challenging to use (World Health Organization (WHO), 2016). Enhanced utilization of Xpert MTB/RIF, a more sensitive test than smear, in the algorithm (e.g. as a front line test) may obtain additional yield and increase the bacteriologically confirmed cases (World Health Organization (WHO), 2013).

The high yield of childhood TB may be due to the use of CXR in children under 8 years resulting in an over-diagnosis of TB. The WHO judges that there is risk of doing more harm than benefit by screening children who are younger than 10 years with CXR, except to identify children who are known to be HIV-positive or have had recent contact with someone who has TB (World Health Organization, 2012).

In addition, household contact investigation without consideration of diagnosis and treatment of latent TB infection is a missed opportunity. A systematic review found that among contacts of smear-positive index patients in low and middle income countries the prevalence of latent TB infection (LTBI) was 45% among household contacts, 54% among PLHIV and 36% among child contacts (<5 years) (Gregory et al., 2013). Young children have a higher risk of exposure to the TB organism and greater propensity to develop active disease compared with the general population (World Health Organization, 2012). The Myanmar NSP recommends the treatment of LTBI in PLHIV and child contacts <5 years (National Tuberculosis Program (NTP Myanmar), 2016). However, as with many high burden countries, systematic implementation is not occurring. The major barriers include knowledge gaps, human and financial resources (Hill et al., 2011). The scaling up of preventive therapy (starting with high risk groups) is an essential pillar of the End TB strategy aimed at eliminating TB (World Health Organization, 2015). In fact, modeling studies have suggested that treating LTBI beyond these groups, such as adolescent and adult household contacts and contacts of MDR-TB, may have greater impact on case-notification and transmission in high-burden settings (Houben et al., 2016).

Conclusions

Several ACF interventions have been introduced in Myanmar since 2011 and the PICTS project has implemented community based ACF since 2014 to support NTP's case finding activities. Our study found that the screening of contacts of historical TB patients diagnosed >24 months ago (household and neighbourhood intervention) had a lower yield of TB than screening attendants of health education sessions/mobile clinics (community intervention). This finding suggests re-consideration of the algorithm and strategy of the household and neighbourhood intervention implemented in the PICTS project. To be in line with WHO recommended screening of active TB and to increase yield of TB cases, contact investigation focusing on household contacts of active current TB case using more sensitive screening tools such as CXR and Xpert MTB/RIF should be considered. Furthermore, strategy to reach high-risk groups for screening and for treatment of latent TB infection for contacts who are PLHIV or children (<5 years) after complete evaluation to rule out active TB should be explored. Ongoing assessment of programmatic ACF strategies in Myanmar is needed along with rigorous evaluation of their cost and impact.

Acknowledgement

This research was conducted through the Structured Operational Research and Training Initiative (SORT IT), a global partnership led by the Special Programme for Research and Training in Tropical Diseases at the World Health Organization (WHO/TDR). The model is based on a course developed jointly by the International Union Against Tuberculosis and Lung Disease (The Union) and Medécins sans Frontières (MSF/Doctors Without Borders). The specific SORT IT programme which resulted in this publication was jointly organized and implemented by: The Centre for Operational Research, The Union, Paris, France; The Department of Medical Research, Ministry of Health and Sports, Myanmar; The Department of Public Health, Ministry of Health and Sports, Myanmar; The Union Country Office, Mandalay, Myanmar; The Union South-East Asia Office, New Delhi, India; the Operational Research Unit (LUXOR), MSF Brussels Operational Center, Luxembourg; Burnet Institute, Australia. The author would like to thank the data assistant and manager from Union Myanmar office for their contributions in data entering process and Dr. Saw Saw from Department of Medical Research, Ministry of Health and Sports, Myanmar for her critical review and comments on this article.

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