Tak Tuberculosis Initiative (TTBI)
Final External Evaluation (Years 1- 4)

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Conducted by Dr Paul Nunn MA, FRCP (UK), Global Infectious Diseases Consulting, Ltd, London, UK

Contact: nunnpp@gmail.com

Executive summary

Introduction of the TTBI

The Tak Tuberculosis Initiative (TTBI) is a DFID-supported project implemented by a consortium headed by the Shoklo Malaria Research Unit (SMRU) with Première Urgence Internationale (PUI) as the main sub-recipient, and the local health authority, the Tak Provincial Health Office (PHO) and the International Organization of Migration as partners. SMRU's stated objective is to provide quality health care to the marginalized populations living on both sides of the Thai-Myanmar border in the Mae Sot area of Tak Province through both humanitarian and research activities. SMRU is part of Mahidol University's Faculty of Tropical Medicine, and of its long-running collaboration with the University of Oxford, supported by the Wellcome Trust (The Mahidol-Oxford Tropical Medicine Research Unit (MORU)). SMRU has been present in Mae Sot since 1986, but its work on TB only began in 2009, instigated by a significant number of cases of TB among its staff, as well as among patients attending its clinics. TTBI itself began work in 2013 with a 3 years grant, followed by a costed extension in 2016, and a no-cost extension for the first half of 2017.

Review methods

This report aims to evaluate the work carried out by TTBI throughout this period. Background material included national TB data, DFID reports of projects in Myanmar and literature on recent Myanmar history. Source material included TTBI's proposals to DFID and its own annual activity and financial reports. The end of Q4 2016 log frame spreadsheet was the key source of project activity data. The annual cohort analyses for 2013 to 2016, generated at SMRU at the reviewer's request, were the key sources of data on results. The two interim evaluations were also helpful. During the review mission, 19 September to 2 October 2017, the reviewer visited SMRU, Wang Pha TB clinic/village, Mae Sot Hospital, Maela refugee camp and Mae Tao Clinic and held interviews with key stakeholders/informants, as well as two focus group discussions. Ten patients or ex-patients were interviewed.

The context in which TTBI has worked

SMRU is based in the town of Mae Sot, situated on the 2,000 km long Thai-Myanmar border near the busiest of the three official border crossings. The population of Mae Sot includes Thais, and non-Thai migrants of mainly Karen ethnicity from Myanmar, who have escaped fighting or political crackdowns, been dispossessed of their land, are seeking better economic or educational prospects, or are accessing health services. There are overlaps between these groups. Estimates of the size of the displaced migrant populations in the Mae Sot area vary between 200,000 and 500,000. The majority of the migrants lives in poor conditions, is undocumented and liable to deportation by the Thai authorities. Wage-earners are usually day labourers hired by farmers or local factories. These non-Thai migrants are a precarious and mobile population.

There are three refugee camps near Mae Sot – Maela, Umpiem and Nupoe – holding over 60,000 refugees, of which the largest is Maela with about 39,000. Although intended to be closed camps, some of the refugees work outside, or go out for trips. For some years, official statements from Myanmar and Thai authorities have implied that the camps will be closed soon. This will result in the population being dispersed, either going back to Myanmar, or becoming migrants in Thailand.

For many years, factories have been sited in Mae Sot to take advantage of the low cost of labour locally. The Thai Tak Special Economic Zone (2016) in Mae Sot, aims to attract more investment as well as migrants looking for work. While the Royal Thai Government (RTG) is making it slightly easier for migrants to obtain official status, in the past 6 months it has increased the penalties for illegal migrants and particularly for their employers.

Both Myanmar and Thailand have significant burdens of TB. Myanmar had an estimated incidence of 365/100,000 in 2015, and Thailand's was significantly lower at 172/100,000. The migrant population in Mae Sot comes mostly from Kayin State, which had a notification rate in 2013 near the average of

256/100,000 for Myanmar. However, the notification rate in the township of Myawaddy in 2015 was double this rate at 579/100 000. In 2015, IOM reported a TB prevalence of 479/100,000 among all refugees, of all ages, in Thailand screened by them for resettlement. In refugees from Maela Camp, however, TB prevalence has exceeded 1% in some years. Late presentation of advanced disease, HIV, and multi-drug resistant (MDR) TB are all known to complicate TB control in the border area.

Relevance of TTBI's strategies and approaches

SMRU and PUI undertook complementary activities with SMRU targeting the migrant population and neighbouring border communities in Myanmar attending its clinics, while PUI focused on refugees in the three camps. PUI's TB programme was handed over to SMRU on 1 September 2016 as a result of PUI's withdrawal from Thailand following the discontinuation of their main funding.

A mixture of both passive and targeted active case finding was deployed in the refugee camps and clinics involved in the Initiative. Passive case detection (PCD) is the detection of TB among presumed cases (suspects) that attend the facility. Targeted active case finding (t-ACF) was the screening for TB among specific groups. At all sites, these included the household contacts of diagnosed cases, people with HIV (PLHIV), and health care workers. At the camps, boarding school students, new arrivals and those with chronic diseases were also screened. Testing by GeneXpert was carried out for all presumed cases. For the costed extension in 2016, TTBI conducted mass screening of just over half the adult inhabitants of Maela camp, while PCF and t-ACF continued to be available at all sites.

Treatment was carried out with quality-assured WHO-recommended regimens for both drug susceptible cases and those with rifampicin resistant (RR) or MDR-TB. Patients who were not resident at one of the treatment centres were provided treatment through clinic-based DOTS or home-based DOTS (through a network of Home Visitors). For those cases, motivation and adherence on treatment was maximised by prior counselling. Data were collected on questionnaires and specific logbooks, and entered in Excel files.

Results achieved against the original aims

Overall, TTBI was well-managed, well-organised, and mostly successful. It met two-thirds of its targets in the log frame. Cohort results do not quite reach global targets (80-84% treatment success 2013-2016, against the target of 85%). A significant number of patients that were detected were not registered for treatment by TTBI - 273 (19.5%) among the displaced population – and 10% of these died, largely because of late presentation of severe disease, where even rapid treatment is insufficient to save the patient. Nevertheless, the initiative was undoubtedly a life-saving resource for migrant and refugee populations in the Mae Sot area. The mass screening was implemented well, achieving 88% of target, in spite of PU-AMI's departure in the middle of the programme. The epidemiological impact of TTBI, however, is very difficult to measure because the catchment population is neither measurable, nor stable, due to the constant mobility of the population.

TTBI has occupied a gap created (and maintained) by the two governments, but Government to Government collaboration in providing TB services is moving slowly, and there is little prospect in sight of the two governments arriving at provision of health services to the refugees and displaced persons.

Value for money

Using a rough but clear and logical calculation, TTBI achieved a cost of GBP 73.4 per DALY averted. The World Health Organization considers any intervention that costs less than the national gross domestic product (GDP) per capita to avert a disability-adjusted life year (DALY) to be very cost-effective. The 2016 GDP per capita was USD 5,908 and 1,275 for Thailand and Myanmar, respectively. This makes TTBI outstanding value compared to other possible health interventions.

What would it take to sustain the different project activities and what impact would they have?

Although the original proposal stated: "This proposal is primarily aimed at strengthening the coordination between the main actors and filling the existing gap until the national programmes of Myanmar and Thailand are in a position to tackle the disease in this displaced population", no specific activities were defined at the outset to bring the two national programmes together. The log frame contains no reference to any such target. As a result, given the absence of government attempts to fill the gap, sustainability depends essentially on further development agency funding. TTBI is aware of this and has contingency plans for a phased closure of assets to take effect from 31st December 2017, if no firm promise of funds is made by then.

Lessons learnt

The clinical network in Tak relies on TTBI (and others) for provision of TB services. Continuation of those services into the future will rely on continued funding for SMRU.

Future service provision should take into account some of the lessons learnt in the TTBI.

1. ACF is less efficient and less productive than PCF and should be discontinued except in the groups already recommended for screening (household contacts, PLHIV and front-line health workers) – unless a prevalence of $\geq$1% proven.

2. There is significant loss, and death, in those patients who were not registered for treatment in TTBI. Future projects should seek to minimise these losses, and maintain records for as long as possible for those treated elsewhere.

3. Treatment outcome targets should be more ambitious to align with new END TB strategy target.

4. Substantial improvements are required to the data management system so that programme performance can be better monitored, and, for example, cohort analyses can be easily generated. The case-based data system that is currently being introduced may respond to these needs, but this should be verified.

Recommendations to DFID

1. Continue support to this vulnerable population;
2. Simplify the log frame, eliminate cumulative data, insist on numbers for proportions, reduce the number of targets, encourage course corrections;
3. Aside from screening of household contacts, front-line health workers, and PLHIV (which are recommended by WHO), avoid ACF unless the prevalence is proven to be at least ~1%.

Recommendations to SMRU - Financial/political

1. Strengthen relationships with both NTPs and try and engage at NTP Director-level or higher in discussions on funding support.
2. Use SMRU's comparative advantage, for example its research-based laboratory and well-organised work force, to carry out tasks that both NTPs need, eg consider offering to lead (with others) on the introduction of the short-course treatment for MDR-TB, including implementation of the "MDRTB Plus" line probe assay (LPA).
3. Consider expanding TB research activities in the area – in recognition that this will require revisiting the MORU/Oxford University/Wellcome Trust arrangement whereby TB research is handled solely by the Vietnam unit.

4. Take further steps to engage Thai philanthropic organisations, seek out sources of CSR funding, eg from Chinese companies in the Tak Economic Zone.
5. Continue to explore low-cost health insurance options for migrants, such as the M-Fund.
6. Carry out a full risk analysis for the period 2017-2021, eg IOM may leave within 3-5years, and develop suitable contingency plans.

Recommendations to SMRU – technical

Aim to improve the quality of TB service provision through:

1. Analysing the causes of death (retrospectively and prospectively) and taking appropriate steps (if/when possible) to reduce the loss (of lives and cases) pre-treatment and during treatment, paying particular attention to the HIV-infected patients and the elderly;
2. Analysing the amount of treatment delay and its causes, and taking appropriate steps to reduce it (also key for IC in HCWs);
3. Reviewing the influence of co-morbidities in the elderly on unsatisfactory treatment outcomes, and taking steps to detect and manage such co-morbidities pro-actively;
4. Taking steps to improve follow up – by considering the use of new electronic approaches, such as SMS text messaging to patients and to health staff, including from the laboratory once a positive result is obtained, video-observed treatment (VOT), medication monitors etc.
5. Expanding use of isoniazid or other forms of preventive therapy, according to the 2012 WHO Guidelines;
6. Reviewing “diabetics in care” as a possible group for t-ACF
7. Use case based electronic data system for regular monthly review and take corrective action as needed;
8. Eliminate Cat II treatment (WHO recommendations, 2017).

Acknowledgements

The author would like to thank all the staff at SMRU for their friendliness to him, and for arranging a fascinating agenda with opportunities to meet all kinds of stakeholders in the TTBI. Particular thanks are especially due to Michele Vincenti-Delmas for her patience in the face of relentless questioning, and to Professor François Nosten for frank and open discussions on the origins of SMRU and the challenges of sustainability. My personal thanks also to Suphak Nosten for interesting discussions on the problems confronting the displaced populations, and for her translation for the patients at Wang Pha TB Village.

Abbreviations

ART	Antiretroviral therapy
BC	Bacteriologically confirmed
CXR	Chest X-Ray
DFID	Department for International Development, UK Government
DOTS	WHO's treatment strategy in the 1990s. (Directly Observed Treatment Short-course)
DST	drug susceptibility testing
HCW	Health care worker
GXP	GeneXpert
HIV	Human Immuno-deficiency Virus
IOM	International Organization for Migration
MDR TB	Multidrug resistant TB
M&E	Monitoring and Evaluation
MORU	The Mahidol-Oxford Tropical Medicine Research Unit
NGO	Nongovernmental Organization
NTP	National Tuberculosis Program
OPD	Out-patient department
PCF	Passive Case Finding
PHC	Primary Health Care
PHO	Provincial Health Office
PLHIV	People Living With HIV/AIDS
PU-AMI	Première Urgence-Aide Médicale Internationale
PUI	Première Urgence Internationale
RR	Rifampicin resistant
SMRU	Shoklo Malaria Research Unit
SSF	Single stream funding
t-ACF	targeted Active Case Finding
TB	Tuberculosis
TTBI	Tak TB Border Initiative
WHO	World Health Organization

1. Introduction

a) Implementing organisations

The "Tak Tuberculosis Initiative" (TTBI) was led by the Shoklo Malaria Research Unit (SMRU). SMRU has been present in Mae Sot since 1986, working mainly on malaria in the border areas, and currently has about 820 staff. Its presence in the border region originates from a long-term research interest in malaria. While most of this work has taken place in Thailand, the last few years have seen SMRU increasingly operate inside Myanmar where it now runs more than 1,200 village malaria posts, some of which, will gradually be converted to general health posts able to refer TB suspects to SMRU's TB clinics/villages.

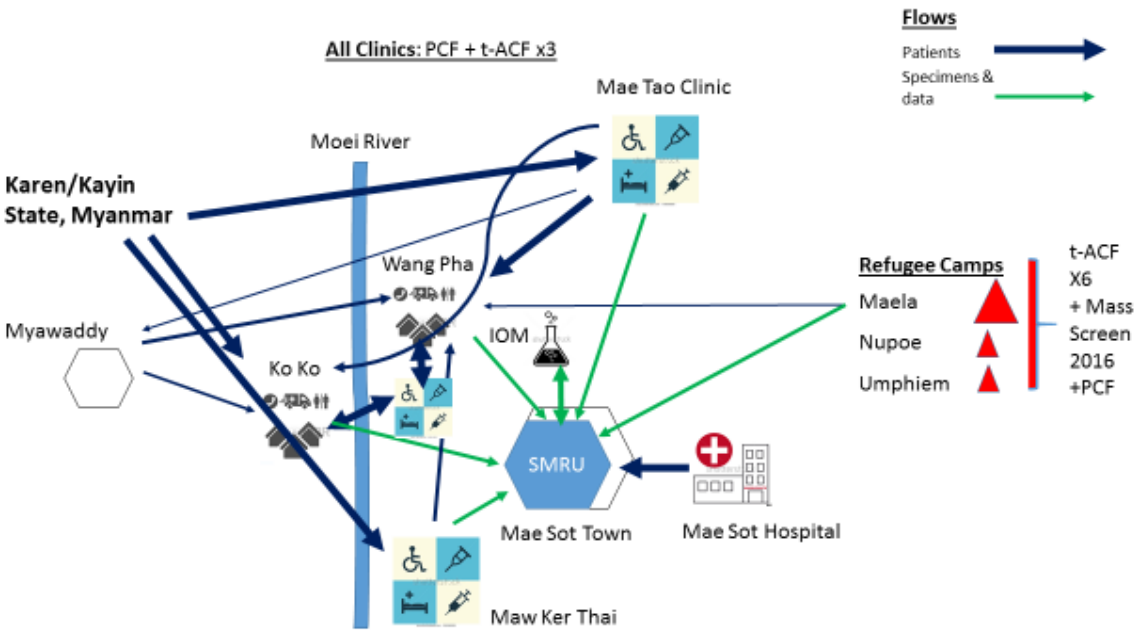
SMRU is a unit within Mahidol University's Faculty of Tropical Medicine, from which it derives its legal status. SMRU is part of a long running (35 years) collaboration between Mahidol University and the University of Oxford, supported by the Wellcome Trust ("Mahidol-Oxford Tropical Medicine Research Unit" – MORU). This collaboration ensures the SMRU conforms to rigorous international standards of financial and operational management.

SMRU has long experience of managing multi-million dollar contracts from large institutional donors including the Global Fund (Malaria: Round 7, Round 10, Single Stream Funding (SSF) and Regional Artemisinin Initiative. TB: receiving currently Myanmar NFM for 2017 TB activities and services, which includes a part for sustainability after the end of the DFID grant in June 2017), the European Union (Aid to uprooted people in Thailand – two projects valued at a total of more than Euro 4 million), UKAid (DFID) and the Bill & Melinda Gates Foundation (current year commitments of more than US$ 3.6 million). SMRU is currently a sub-recipient under Thailand's Global Fund Malaria SSF funding, with three sub-sub-recipients (for whom SMRU services and monitors all financial and programmatic elements).

SMRU started its TB programme in October 2009 with UKAid (DFID) funding (October 2009-December 2011) followed by European Union funding (2011- 2014). Both these grants supported activities related to passive case finding.

SMRU's TB programme has developed a close working relationship with district hospitals and Tak Provincial Health Office (PHO), including the provision of funds for the treatment of migrant patients in hospitals. Since January 2013 SMRU has partnered with Première Urgence – Agence Médicale Internationale (PU-AMI), the International Organization for Migration (IOM) and the Tak Public Health Office (PHO) to establish TTBI, funded by DFID.

Figure 1. Schematic diagram of inter-relations between TTBI's partners and the flows of patients, specimens and data.



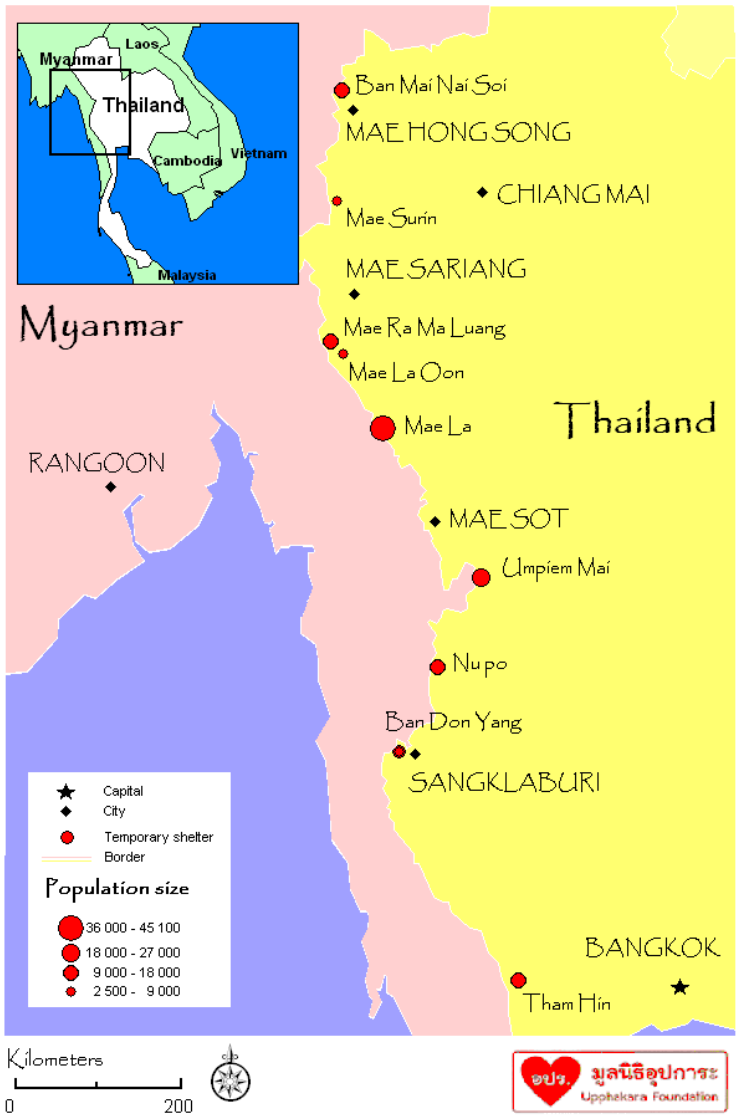
b) Context

TTBI's target populations are the refugees on the Thai side of the border and the undocumented migrants, who cross back and forth. There are more than 100,000 Karen, Mon, and Karenni ethnic minorities living in a string of refugee camps along the Thai-Myanmar border. Since the middle of the 1990s the population influx from Myanmar increased for both economic and political reasons. People from all ethnic groups (Shan, Karenni, Karen, Mon and Burman, but especially Karen in Tak Province) travel back and forth across the border in search of work[1], and sometimes for education. They are a very precarious and mobile population[2]. A minority is also crossing the border into Thailand in search of medical services that are more difficult to access in Myanmar. Documented migrants (i.e. those with a work permit), provided they also pay for health insurance, are eligible to receive low-cost public medical services in Thailand. Undocumented migrants can only receive such services if they pay out-of-pocket. The up-front payments for a work permit are too expensive for a day labourer.

The Thai-Myanmar border in Tak Province is more than 500 kms long, and is effectively unpoliced, enabling an easy crossing for migrants or those displaced from Myanmar. Estimates of the migrant population in Tak Province range from 200 – 500,000. Unlike refugees, they are highly mobile, and the majority does not have access to basic health care. Most are poor, ill-housed and targeted by the authorities: officially, being undocumented, they are liable to deportation, and unofficially they are often a target for law enforcement officers demanding a bribe to "turn a blind eye". Migrant workers are usually day labourers with few benefits provided by their work place and incapacity to work means no income for them, or for their families, if they are the bread-winner. Families are often split across the border. Industries have been sited on the Thai side to take advantage of the low-cost labour available. Since 2016 there has been a Thai Tak Special Economic Zone in Mae Sot[3], attracting traffic, trade, and construction as well as migrants looking for work. A 30 day visa has made it slightly easier

[1] SMRU website. http://www.shoklo-unit.com/humanitarian-activities Accessed 30 October, 2017.
[2] World Health Organization. Report of the Forum on international migration and health in Thailand: status and challenges to controlling TB. Bangkok, 4-6 June 2013.
[3] Tak Special Economic Zone. Wikipedia. https://en.wikipedia.org/wiki/Mae_Sot_District Accessed 30 October, 2017.

for migrants to be present legally in Thailand, and the upfront costs for legal migrants to obtain health insurance have been substantially reduced by the recent availability of insurance for 3 months. In the past 6 months, however, the Royal Thai Government (RTG) has increased the penalties for illegal migrants and particularly for their employers. Mae Sot is said to be quieter now as a result.



There are three refugee camps near Mae Sot – Maela, Umphiem and Nupoe – holding around 70,000 refugees, of which the largest is Maela with about 42,830 in 2014. Although intended to be closed camps, some of the refugees work outside, or go out for trips. For some years now, the support for the camps is being reduced, in terms of rations of food, stipends for workers, and building materials. For some years official statements from Myanmar and Thai authorities have implied that the camps will be closed soon. If and when this happens, it will likely result in the population being dispersed, either going back to Myanmar, or becoming migrant workers in Thailand.

Both Myanmar and Thailand have significant burdens of TB. Myanmar had an estimated incidence of 365/100,000[4] in 2015, and Thailand's was significantly lower at 172/100,000. The migrant population in Mae Sot comes mostly from Kayin State, which had a notification rate in 2013 near the average of

[4] World Health Organization (WHO). Global TB Control Report, 2016. WHO, Geneva.

256/100,000 for Myanmar[5]. However, the notification rate in the township of Myawaddy in 2015 was double this rate at 579/100 000. In 2015, IOM reported a TB prevalence of 479/100,000 among all refugees, of all ages, in Thailand screened by them for resettlement[6]. In refugees from Maela Camp, however, TB prevalence has exceeded 1% in some years[7]. Late presentation of advanced disease, HIV, and multi-drug resistant (MDR) TB are all known to complicate TB control in the border area.

While the Myanmar authorities are gradually expanding health care provision on their side of the border, and Thailand provides good quality services to those legally entitled to them, government-to-government coordination to improve service provision to the displaced population is "not working"[8]. While two initiatives are trying to foster cross-border collaboration in the delivery of health services, neither the Health Convergence Core Group, which in theory engages the two governments, ethnic health organisations and non-governmental organisations, nor the Health Systems Strengthening Group, is making substantial progress, according to senior staff at SMRU and the Mae Tao Clinic.

c) Methods of the review

This report aims to evaluate the work carried out by TTBI from 2013 to mid-2017. Source material includes TTBI's proposals to DFID from 2012, 2016 (for the costed extension) and 2017 (for the no-cost extension). TTBI's own annual activity and financial reports were reviewed. The end of Q4 2016 log frame spreadsheet was the key source of project activity data, especially the version amended during the review mission. The annual cohort analyses for 2013 to 2016, generated at SMRU at the reviewer's request, were the key source of data on results. The two interim evaluations carried out by Nicolas Durier were helpful.

Key stakeholders/informants were interviewed. These included:

Dr Michele Vincenti-Delmas	SMRU TB Programme Director, TTBI (multiple interactions during the review mission)
Prof François Nosten	Director, SMRU
Dr Witaya Swaddiwudhipong	Deputy Director, Mae Sot Hospital
Dr Sajith Gunaratne	Head of Health Assessment, IOM, Mae Sot
Dr Kittisak Amornpaisarnloet	Head of Laboratory, IOM, Mae Sot

Multiple staff during visits at Wang Pha TB Clinic/Village, Mae Tao Clinic and Maela Temporary Shelter/Refugee Camp, including Tharamu Shay Paw (health camp leader)

Dr Zay Yar Phyo Aung,	SMRU TB Programme Manager, Refugee Camps
Dr Banyar	SMRU TB/HIV doctor in charge, Ko Ko TB Clinic/Village
Dr Kyaw Soe Thant	SMRU Medical TB/HIV, Mae Tao Clinic, Mae Sot
Dr Clare Ling	Microbiologist and Director, SMRU Laboratory

Focus group discussions were held on 28 September, 2017 with the TB doctors at SMRU (Dr Banyar, Dr Kyaw Soe Thant, Dr Win Pa Pa, Dr Lei Lei Swe), and on the following day with staff of the Mae Tao Clinic led by Dr Cynthia Maung. Ten patients were interviewed: 3 at Wang Pha, 2 at Maela Camp Hospital, 4 at Maela Camp clinic and screening site, and one at Mae Tao Clinic.

A debriefing presentation to SMRU/TTBI staff was given on October 2, 2017, followed by discussion.

[5] 5th Joint Monitoring Mission for TB Care and Prevention in Myanmar, December 2014. WHO Country Office, Myanmar.
[6] International Organization for Migration (IOM). Migration Health Annual Review, 2015.
[7] Personal Communication from Michele Vincenti-Delmas, October 27, 2017.
[8] Dr Cynthia Maung. Interviewed Mae Tao Clinic, Mae Sot, 27 September, 2017.

2. The relevance of the project implementation strategy and its approaches

a) Strategies and approaches

The Project strategies were based on the traditional passive case finding (PCF), which relies on patients to bring themselves to health facilities when they have the symptoms of TB, and on targeted-active case finding (t-ACF). T-ACF was focused on the screening of household contacts of all cases of TB patients, patients known to have HIV infection, and health care workers in all sites. In the refugee camps, new arrivals, boarding students and those with chronic disease were also screened.

TTBI introduced the rapid, new molecular test for the diagnosis of TB, the Xpert® MTB/RIF test, conducted on the GeneXpert (GXP) platform (Cepheid Laboratories, Sunnyvale, California, USA) to Tak Province. GXP tests were carried out on all presumptive cases, and culture and drug susceptibility testing (DST) on all bacteriologically confirmed (BC) cases. Patients that were still sputum smear positive at two months of treatment, re-treatment cases, failure cases, and contacts of MDR-TB cases were also given a GXP test. Culture and first-line DST were performed on samples from patients treated after default, failure cases and those still sputum positive after 3 months of treatment.

Treatment was according to WHO recommendations with drugs, paid for by DFID, supplied and quality-assured by the Government Pharmaceutical Organization in Bangkok. DFID also supported the provision of anti-retroviral treatment (ART), during the course of their TB treatment, for those TB patients infected with Human Immunodeficiency Virus (HIV), as well as tests and treatment for opportunistic infections and all auxiliary drugs for comorbidities. After the course of anti-TB treatment, the Initiative had to find another source of ART for the patient, which was usually the Myawaddy Hospital, supported by the Myanmar AIDS Control Programme.

Adherence to treatment was encouraged by provision of direct observation of treatment (DOT) through health workers based at the clinics within the SMRU TB villages (Figure 1), which opened as early as 05.00 to provide services to day labourers before they left for work. Supervision of ingestion was daily, 7 days per week. Where necessary, direct observation of treatment (DOT) was provided for patients at home, visited by motorbike, on the Myanmar side only. In less than 5% of patients, where there were no alternatives, family DOTS or self-administered treatment was provided, but only in those with no history of default. Transport subsidies were made available for those patients needing to travel to the SMRU TB villages for DOT.

Compliance with infection control measures, at least in the SMRU facilities, was ensured by the SMRU safety team. Movement of patients in clinics and around the TB villages was designed to avoid contact of drug resistant patients with drug susceptible patients and to keep TB patients apart from any susceptible groups such as young children (administrative controls). The TB village design maximises natural ventilation (environmental controls). Surgical masks were available for patients and N 95 respirators for staff and compliance with their use at all SMRU sites was monitored (personal protection). Bio-safety cabinets were used in the SMRU lab for manipulation of specimens.

b) Extensions and changes to management

A one year costed extension was agreed in 2016 to support full continuation of the TB control programme in both refugee populations of the 3 camps, and the migrant population, and to support a new activity, namely, mass population screening. This was carried out only at Maela Camp, with the aim of reducing the TB burden in the population that may have had to, or may still have to, disperse with little notice. A demographic survey of the camp population was completed and chest X-ray (CXR) and a symptom questionnaire were offered to all subjects of 10 years of age or above. Any

abnormalities on CXR suggestive of TB, or symptoms possibly due to TB, led to a GeneXpert test if sputum was available. This screening stopped in October 2016, and wound down to the end of 2016. The no-cost extension of 2017 was solely for the continuation of treatment for those cases already detected under the DFID supported project.

On 1 August 2016, due to changes in donor funding policy, PUI had to hand over all its health care activities in the 3 camps. Primary health care was taken care of by the American Refugee Committee (ARC). SMRU took over all TB programme activities in the refugee camps of Maela, Nupo, and Umpiem from 1 September 2016. Since 1 January 2017, SMRU has maintained some downsized TB activity in Maela camp in order to support the 2016 cohort of patients, but no further cases have been enrolled. This was done in collaboration with partners including Thai Public Health, and most of SMRU's TB work was transferred to the International Rescue Committee (IRC) on 30 June, 2017.

c) Relevance

The TTBI is responding to a significant health need in the migrant and refugee populations that other health providers are not adequately addressing. The target population of undocumented migrant workers is generally precarious (mobile, poor, ill-housed, under-nourished, subject to labour exploitation, targeted by authorities – officially for deportation, unofficially for bribes), stressed, and therefore vulnerable to TB. Access to health facilities is difficult, and even once arrived, language barriers and stigma can cause further problems. While there is some evidence that these populations have a higher prevalence of TB than the average in Myanmar (which is among the highest globally), definite measurement is impossible, at least in the displaced group, owing to the fluid nature of the population. There is also a smaller group of migrants deliberately seeking health care for TB in Thailand, which, without a work permit and health insurance, is not eligible for treatment by the Thai system. It is quite likely that after operating for some time, the reputation of the TTBI has spread and may actually be attracting patients from Myanmar.

The refugee population is rather more settled, with easier access to health care within the camps, where international NGOs have been providing services for more than 30 years. With their official refugee status they are less precarious than the displaced migrants. TTBI added an extra dimension to the quality of TB care available in the camps through provision of expert staff, GXP testing, culture and DST, and latterly, through the mass screening exercise at Maela Camp.

The TB case finding and treatment approaches and strategies used by TTBI were relevant, in the sense that they were mostly in line with international recommendations, the exception being the t-ACF strategies employed in the refugee camps, which will be addressed below.

3. Results and achievements

This section compares the results of the TTBI activities against the targets defined in the original log frame. It addresses, in other words, the question of whether the initiative did what it said it would. The section takes the logical approach of addressing each output, as defined in the original proposal, in turn. It therefore starts with screening and diagnosis, through treatment, community based management and finally addresses diagnosis and management of MDR-TB. This approach has been used because of problems with the sequence of the log frame, its targets, and the way in which the TTBI has used it over the course of the project. These problems will be summarized.

1. Output 1: Diagnosis of TB among refugee and displaced populations

In Years 1-3 the numbers screened by both active and passive case finding methods (output indicators 1.1 and 1.2 respectively) achieved the targets among both the displaced and the refugee populations (Table 1). As a result, in Years 1 to 3, the numbers of cases detected by the SMRU clinics serving the displaced population exceeded the target upper limit by 75%. In the refugee camps, however, case detection was significantly below target, suggesting that the burden of TB in the camp may have been over-estimated, the screening algorithm was insensitive, or its implementation was deficient.

In Year 4, the SMRU clinics achieved their screening target for both t-ACF and PCF, while this was not the case in the camps. However, the change of strategy to the mass screening of Maela Camp in 2016 (Year 4) achieved 88% of the screening target, and the case detection target in the camps was met. Failure to achieve the screening target of 21,000 was partly due to the larger than expected numbers of camp inmates who were, in fact, working outside the camp, and also the focus group discussions intended to explain the screening to the population may not have been fully successful in enabling the population to fully understand. Some camp inmates came for screening after it had finished.

An additional major problem was the financial collapse of PUI in mid-2016. It is greatly to SMRU's credit that they foresaw this occurring and moved rapidly to support existing staff and take over the management of the screening. This appears to have been done almost seamlessly, but PUI's departure may have contributed to not achieving the 21,000 screening target.

It seems likely that the mass screening activities attracted potential patients and were thus responsible for the failure to meet the ACF and t-PCF screening targets in the camps: the mass screening was well-advertised, the community brought on board, and the population likely realized that a chest X-ray (offered to all in the mass screening, but only to a minority in the ACF and PCF activities) was an advantage. The mass screening found a prevalence of all forms of TB of 836/100,000 people screened in Maela Camp, and a prevalence of 358/100,000 for bacteriologically confirmed cases. This suggests that the burden of TB was not overestimated in Maela Camp, although rates in the other camps were significantly lower[9]. Failure to meet the case detection targets in the camps therefore appears to be due to insensitive screening and this is probably due to a greater reliance on symptom screening than on chest radiography.

Overall, during the four years of case finding activity, 1,870 (3.8%) cases of TB were detected out of 48,968 members of high risk groups (t-ACF) and presumptive cases (PCF) screened. The cumulative target set for this activity was 1,700 – 2,190 cases and 47,000 - 54,600, respectively. Thus, the overall case finding target was achieved.

The relative yields from t-ACF and PCF are important for analysing the relative merits of the two strategies and making decisions about future directions. The yield from t-ACF accounted for just 13% of all cases found in all 4 years. The bulk of the cases found from t-ACF were found in contacts, PLHIV, and health workers – the three major groups recommended for ACF by the WHO. In fact, 64% of the total cases found by t-ACF were found by SMRU in just these three groups, among the displaced population (Table 2). This issue will be further addressed in Section 4.

[9] Pers. Comm. M. Vincenti-Delmas. Ibid.

Table 1. Targets and results of screening approaches and detection of TB in Years 1-3 and Year 4
T/A = Target/Achieved, N/A = not applicable. Results that are below target are in red.

Indicator	Risk Group	T/A	Years 1-3	Year 4
Output indicator 1.1 **No. screened by t-ACF**	Displaced Refugees	T A T A	2,700 – 3,300 (45-55% f) 2,944 (61% f) 12,500-16,000 (45-55% f) 16,512 (53%)	900-1,300 (45-55% f) 1101 (56% f) 3,500-5,500 **1961** (54% f)#
Output indicator 1.2 **No. screened by PCF**	Displaced Refugees	T A T A	1,000 – 1,100 (45-55%f) 2,325 (42% F) 3,000 -3,300 (45-55%f) 3,250 (49% F)	1,200-1,600 (45-55% f) 1,624 (47% F) 1,200-1,500 (45-55% f) **823** (49% F)
Output indicator 1.3 **No. people screened by mass screening, Maela Camp, 2016**	Displaced Refugees	T A T A	N/A	N/A N/A 21,000 18,428 (88% of target)
Outcome indicator 1.1 **No. of TB cases detected**	Displaced Refugees	T A T A	350-450 (30-40% f) 789 (37% f) 730-930 (30-40% f) 473 (38% f)	450-550 (30-40% f) 382 (36 % F) 170-260 226 (43.11 % F) {including 154 (68%) cases from Maela mass screening (47.06%F)

To illustrate the relevance of TTBI's contribution to the TB control activities in Tak Province, the 527 cases, from among the displaced population and the refugees, put on treatment by the TTBI in 2016 exceeded the 481 cases registered by the Thai health authorities among Thais and non-Thais from all 5 border districts.

Table 2. Results of t-ACF in high risk groups in the displaced population (migrants).

Target groups	No. of screened	No. of TB detected	TB yield rate
Contacts	1878	129	6.9%
Health workers	1950	19	1.0%
HIV	207	8	3.9%
	4035	**156**	**3.9%**

2. Output 2: Treatment of TB (including HIV-associated TB)

The results around the initiation of treatment (Table 3) show a significant gap between those detected and those actually registered for treatment (outcome indicator 1 and output indicator 2.1, respectively). A total of 1,588 patients started on treatment in all 4 years of the project, which is 85% of those detected. In all, 273 (19.5%) of the 1,398 diagnosed with TB from among the displaced population (including those diagnosed in 2013 and 2014 by the EU and Global Fund projects[10]) were not treated by TTBI. The reasons for this are that 28 (10%) died prior to treatment, and 89 (32%) were lost to follow up. The remainder (156) were referred elsewhere, at their request, and the majority of these were attendees at the Mae Tao Clinic (MTC). Among refugees, 13/43 (30%) died, 23 (53%), were lost to follow up and 7 were referred elsewhere.

Rates of HIV testing were extremely high throughout the project, so the apparent failure to meet the target of numbers of HIV-positive patients treated is due to a lower than anticipated HIV prevalence in the population, since the total number of patients registered achieved the overall target. Of the total 1,588 patients that started treatment, 233 (15%) were HIV infected.

Rates of provision of co-trimoxazole (CTX) and anti-retroviral treatment (ART) were generally very high, compared to other programmes internationally, but ART provision in the camps fell short of the 90% target in Years 1 to 3. This was largely due to a reluctance on the part of PUI staff to start ART two weeks after ATT, as recommended by WHO, mostly because of fears about the consequences of immune reconstitution inflammatory syndrome.

Table 3. Targets and results of indicators of activities surrounding patient registration, Years 1 to 3, and Year 4. T/A = Target/Achieved. Results that are below target are in red.

Indicator	Risk Group	T/A	Years 1-3	Year 4
Output indicator 2.1 **Number of patients treated (registered) for TB**	Displaced	T	450 - 550 (30-40%f)	360-440 (30-40% f)
		A	617 (36% f)	313 (36.1% f)
	Refugees	T	730-930 (45-55%f)	170-260
		A	444 (39.2 % f)	214 (43.7% f)
Output indicator 1.4 **Proportion of enrolled patients receiving testing & counselling for HIV**	Displaced	T	≥90%	≥90%
		A	98.6%m, 98.7%f	99% (98% F)
	Refugees	T	≥90%	≥90%
		A	100% m, 100%f	100% m, 100%f
Output indicator 2.2 **Number of HIV-co-infected patients treated for TB**	Displaced	T	70- 100 (20-30% f)	75-125 (20-30% f)
		A	129 (41.5% f)	56 (64% M, 36% F)
	Refugees	T	56-74 (50-60% f)	15-30 (50-60% f)
		A	40 (35 % f)	8 (50% f)

[10] Some loss of classification of whether patients were treated under the DFID or EU/Global Fund projects occurred in the 2013 and 2014 cohorts. This has meant that treatment outcomes are recorded on the entire population of TB patients treated by SMRU in those years, and not just those supported by DFID. This was also reported in the interim evaluation of 2016[10]. About 16% of the patients were included in EU and Global Fund supported project, and it is no longer possible to disentangle these case records from the overall results.

Output indicator 2.3 **Proportion of patients diagnosed with TB who start treatment**	Displaced Refugees	T A T A	≥80% (m & f) 79% for m & f) ≥80% (m & f) 89.5 % (m), 98% (f) (94% total)	≥80% (m & f) 82% ≥80% (m & f) 93% m, 97% f
Output indicator 2.4 **% of HIV/TB cases receiving ART or co-trimoxazole (CTX)**	Displaced Refugees	T A T A	≥90% (m & f) CTX 93% ART 90% (m & f) ≥90% (m & f) CTX 100% ART 84% (m) 87% f	≥90% (m & f) CTX: 93%, ART: 91% ≥90% (m & f) CTX 100%, ART 100 %

Treatment outcome results (Table 4) yield a treatment success rate (TSR) that is generally slightly below the 85% target, except for the refugees treated in 2016 (the majority of whom were identified in the mass screening). By way of comparison, the TSR among the non-Thais in the Tak provincial TB programme ranged from 72-78%, 2013 to 2016, and in Myawaddy, Myanmar, it was 74% in 2015.

Both the case fatality rate (impact indicator 1) and the default rate (output indicator 3.2) targets (≤10% for both) were easily met. The remaining patients were either transferred out, failed (still sputum positive at month 5 of treatment) or were found on bacteriology to be rifampicin resistant (RR) or multi-drug resistant (MDR) TB, and were moved on to second-line drug treatment. Most, if not all of those transferred out, were transferred out at the patient's request, usually to Myawaddy, but several patients to further afield in Myanmar. Overall, 48% (38/80) of the deaths among the displaced population were associated with HIV infection. This is consistent with the finding that all HIV-associated TB cases had CD4 counts <50/mm^3 at presentation.

Table 4. Targets and results of treatment outcome indicators in Years 1 to 3 and Year 4. T/A = Target/Achieved. Results that did not achieve the target are in red.

Indicator	Risk Group	T/A	Years 1-3	Year 4
Outcome indicator 3 **Treatment success rate**	Displaced Refugees	T A T A	≥85% (m & f) 82% (m & f) ≥85% (m & f) 82% (86.1% f, 78.9% m)*	≥85% (m & f) 82% (m & f) ≥85% (m & f) 93% (m & f)
Impact indicator 1 **Case fatality rate**	Displaced Refugees	T A T A	≤10% (m & f) 7% ≤10% (m & f) 5%	≤10% (m & f) 7% ≤10% (m & f) 1.4%
Output indicator 3.2 **Default rate**	Displaced Refugees	T A T A	≤10% (m & f) 4.5% ≤10% (m & f) 7%	≤10% (m & f) 3.5% (4% m, 2.7%f) ≤10% (m & f) 4.7% (4.2% m, 5.3% f)

3. Output 3: Management of cases in "TB treatment centres", the community and at home.

A target of 50%/50% was initially set for those displaced persons treated in the community and "TB villages", respectively. The intention was to promote treatment in the community, presumably as a less expensive way of receiving treatment, and to raise the proportion to 70%/30% by 2015. Similarly a target of 60% /40% was set for the refugee population, that is, 60% or more were to be treated in the community within the camp, and 40% or less were to be treated in the Maela camp "TB village".

Because of the change in indicator only Year 3 is shown in Table 5 below, when neither the displaced nor the refugee populations met the target of the proportion to be treated in the community. In Year 4 (2016), however, treatment in the community (within the camp) became more feasible, as the patients diagnosed in 2016 by the mass screening were diagnosed earlier, with less severe disease and less sputum positivity, and the target was easily achieved. In contrast, almost all the displaced patients were treated at the TB villages.

Table 5. Target and results for the management of TB in the community, Year and Year 4. T/A = Target/Achieved. Results that did not achieve the target are in red.

Indicator	Risk Group	T/A	Year 3 only*	Year 4
Output indicator 3.1 **Proportion of TB patients managed in community/ TB villages**	Displaced	T	30%/ 70% (m & f)	30%/ 70% (m & f)
		A	21%/ 79% (m); 33%/67% (f)	7%/93% (f); 10% /90% (m)
	Refugees	T	60% /40% (m & f)	60% /40% (m & f)
		A	58 % /42% (m); 55 % /45 % (f)	84%/16% (f), 74%/26% (m)

*No absolute numbers available for Years 1-3, and results for Year 3 only are shown as the indicator changed between Years 2 and 3.

4. Output 4: Diagnosis, treatment and management of MDR-TB

The proportion of smear positive cases tested for drug resistance could not have been higher, and the number of RR/MDR-TB cases found in Years 1-3 (75) was at the upper bound of the overall target, although less cases (20) were found than anticipated in 2016. The majority of cases was found among the displaced population, and relatively few (13) in the refugee camps, while 7 patients were referred in from various sources. Overall, 95 patients were detected, and 75 were started on treatment, by the Initiative, with 83% TSR for the first two years. The remaining patients are still undergoing treatment and full results will not be available until the end of 2018.

Of the 20 patients that were detected but not treated, 4 died before treatment began, 6 were lost to follow up, and 10 were referred back to Myanmar for treatment at their request.

The RR/MDR-TB rate among all those detected with TB over the 4 years was 95/1,870 (5%). Rather fewer cases of RR/MDR-TB were diagnosed than expected in Year 4. However, only bacteriologically positive cases underwent culture and DST, which may not only under-estimate resistance rates, but also increase case fatality and failure rates (because of unrecognised resistance).

The MDR-TB rate among new cases was 1.8% (range 1.2-2.4%), and among previously treated cases was 29.5% (range 17.2- 40%), with an apparent downward trend.

Indicator	Risk Group	T/A	Years 1- 3	Year 4
Output indicator 4.1 **Proportion of TB smear positive cases tested for drug resistance**	Displaced Refugees	T A T A	100% 100% 100% 100%	100% 100% 100% 100%
Outcome indicator 2 **Number of RR/MDR-TB cases detected per annum**	Displaced & Refugees Combined	T A	48-75 75	44 - 61 (30-60% f) 20
Output indicator 4.2 **Number of drug-resistant TB cases diagnosed and managed (SMRU) RR/MDR**	Displaced & Refugees Combined	T A	49-54 59	30-35 16
Output indicator 4.3 **Proportion of drug-resistant TB cases treated successfully (SMRU)**	Displaced & Refugees Combined	T A	60% 83% (Years 1&2)	Ongoing

No cases of extensive drug resistance (XDR) were detected. Nine cases of pre-XDR-TB were detected: 7 with resistance to levofloxacin, and two with resistance to kanamycin. To date, treatment of MDR-TB cases is going well, with the first two years well above the target for successful treatment. Twice as many RR/MDR-TB cases were diagnosed by TTBI as in Tak Province, 2013-2016.

5. Cohort results

When outcome data are organised according to the WHO guidance on cohort analysis, comparison is easier between the two populations in the Initiative (as well as with other programmes, nationally and internationally). Both the displaced (Figure 1) and the refugee (Figure 2) populations, show treatment success rates below the international standard of 85%, until 2016 in the refugee population, when it achieved 93%. This most recent result was probably due to the relatively less extensive disease found among the cases detected by the mass screening activity in Maela camp that year.

As discussed above, case fatality rates vary by year, but are significant. Loss to follow up (default) is generally greater in the refugee population than among the migrant cases, which probably relates to the permeable nature of the camps – people can come and go – and to the effectiveness of the TB villages for the displaced populations. Cross border situations rarely achieve such high rates of follow up, eg India-Nepal and Cambodia-Thailand.

According to Initiative staff, the "not-evaluated" category in the displaced population is in effect, "transfer out". These are patients who wished to be referred elsewhere, usually back in Myanmar, for further treatment.

Figure 1. Treatment outcomes, 2013-2016, of TB cases among the displaced population, treated by TTBI.

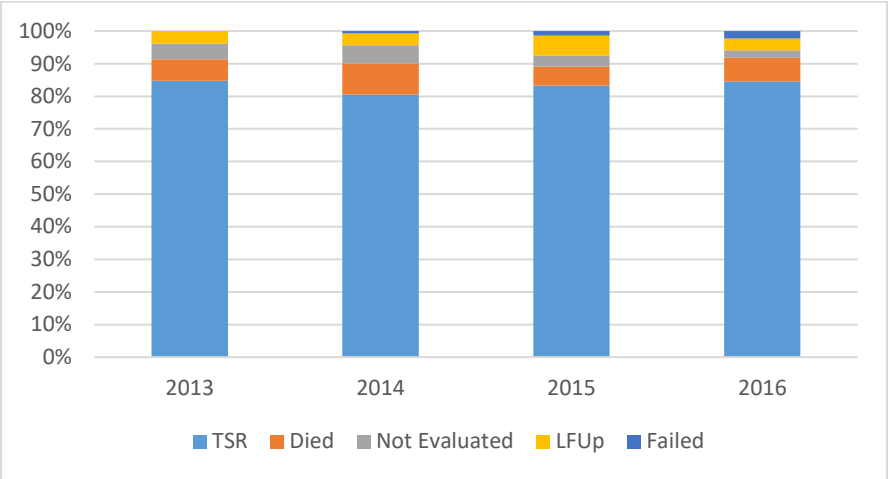
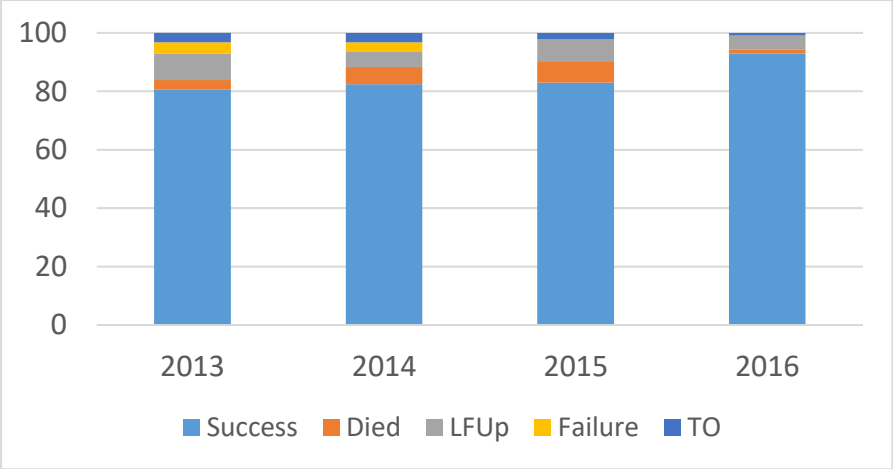


Figure 2. Treatment outcomes, 2013-2016, of TB cases among the refugee population, treated by TTBI.



6. Discussion of results

Achievements

Overall the Initiative reached the targets for screening and putting patients on treatment. The SMRU clinics were able to make up the shortfall in patients detected in the refugee camps. The mass screening of Maela camp detected more patients than anticipated, in spite of screening less patients than it targeted. Passive case finding, however, was significantly more effective at finding cases than t-ACF. T-ACF does, though, offer the possibility of finding cases early, as the Maela screening appears to have done, and perhaps preventing transmission.

Overall, 15% of the patients detected did not start on treatment. While the outcomes of those who were registered for treatment were impressive in these mobile populations, the results would be significantly less good if those dying or defaulting before the start of treatment were included. The risk factors for death and default pre-treatment, as well as during treatment, have not yet been

analysed. HIV infection is one obvious risk factor for death that already comes out of existing data. Late presentation is very likely another risk factor, according to SMRU staff. This would fit with the many barriers to access to care that the patients interviewed for this report described.

The Initiative should, however, be commended for keeping as much outcome data as possible on those cases that were not treated by them, and these data should facilitate any future analysis of risk factors for poor outcomes. Unsuccessful attempts were made by SMRU to obtain results of the patients who referred themselves to Myawaddy.

Data Management: Log Frame

The final log frame was one of the key data sources for this evaluation. It is arranged in order of impact, outcomes and outputs, and thus does not follow the logical order for a TB project (screening, diagnosis, treatment, outcomes, and impact). It included proportions without absolute numbers and a mixture of cumulative and non-cumulative data, which was generating some confusion. Some targets were pointless, eg the numbers of HIV infected patients treated. (As long as HIV testing levels are high (which they were), the apparent failure to meet the target of numbers of HIV-positive patients treated, is in fact, a function of the total number registered (which achieved the overall target) and their HIV prevalence, which is beyond the control of the Initiative.)

The Initiative focused on supplying data for the log frame, and did not routinely carry out the WHO recommended cohort analysis of their patients. This method of analysing the effectiveness of control programmes is simple, effective, less prone to error than alternative methods, and points the way to corrective actions required to improve performance. It has the further advantage of enabling comparisons with TB control programmes in other places and times, and is generally understood by those working in TB.

Efforts were made, however, to reduce the number of patients lost to follow up, through telephone calling, mapping home addresses and tracing patients where possible. Non-enrolment fell from 20% to 15% in 2016.

Targets

More importantly, the set of pre-arranged targets in the log frame appears to have distracted attention away from careful consideration of whether the targets were appropriate for the conditions found in the Initiative, and in particular, whether mid-course corrections would have been appropriate. For example, the targeting of ACF focused on new arrivals, chronically ill patients and boarding students, as well as “others”, in the refugee camps. In all these groups the yield of cases was well below the 1% recommended by WHO as the cut-off point for ACF being cost-effective (Table 6). These activities therefore continued to consume resources when it would have been appropriate to use them in more productive activities. For example, the yield of contact investigations was clearly greater in the SMRU clinics than in the camps. This appears to be related to the greater use of chest X-rays in SMRU. It might have been wiser to intensify the ACF in contacts in the camps, rather than continuing broad screening among new arrivals.

Some targets were unambitious, eg case fatality and default rates set at $\leq$10%. More ambitious targets might have focused attention on ways to reduce these further. For example, the time taken to start treatment on each patient was not routinely recorded, but was estimated to be over one week in patients referred from Mae Tao clinic. Staff emphasised the severity of disease among patients at presentation, so reducing this treatment delay might have reduced fatalities.

The last recommendation of the July 2016 evaluation of TTBI was “to revise and strengthen the program management data system” to make programme monitoring less time-consuming and

difficult. The approach taken by TTBI has focused on obtaining funding for a case-based data system. Such systems do offer significant advantages in generating more detailed analyses of programme performance. Funding has now been obtained and the system is being developed, but there had been essentially no effective changes in this area between the review of July 2016 and this review. The new case-based system appears to conform to the WHO requirements for such systems, but this was not verified by the current reviewer.

Table 6. Results of t-ACF, Years 1 to 3, from the interim evaluation, 2016.

	Cases Detected/People Screened	
	SMRU Clinics	**PU-AMI Camps**
Contacts of patients	92/1315 **(7%)**	24/1740 **(1.38%)**
Health care workers (HCW)	13/1505 (0.9%)	13/1617 (0.8%)
HIV patients	8/124 (6.5%)	16/343 (4.66%)
New arrivals (camps only)	.	2/2593 (0.08%)
Chronically ill patients	.	1/479 (0.2%)
Boarding students	.	1/3714 (0.03%)
Others	1	8/6026 (0.13%)
ALL	114/2944 **(3.9%)**	65/16512 **(0.39%)**

PCF v ACF

For some decades the international consensus has been that passive case finding is significantly more effective at finding cases than active case finding. TTBI's results would appear to bear this out, and raise the question of whether ACF justifies the resources it consumes. The initial proposal, however, made clear that t-ACF was a deliberate attempt to provide a new service to this precarious population of displaced people in the border region and the refugees in the camps. Data from IOM suggested that TB prevalence was approaching 1% in the refugee groups assessed for resettlement – which justifies starting the Initiative.

The recent emphasis on TB elimination, encapsulated in the END TB strategy, has raised the issue of ACF again at the global level, since ACF offers the possibility of finding cases earlier, preventing transmission and thus reducing the TB burden in the population. WHO has addressed systematic screening for TB in two recent publications[11,12]. These emphasize that ACF with low sensitivity (such as using only a symptom questionnaire) has no effect on TB epidemiology, while there is low quality evidence that more sensitive screening techniques can reduce TB in a community. However, screening is unlikely to be effective unless the prevalence in the target population is more than 1%. The question can be raised, therefore, whether ACF (outside of the well-known risk groups of household contacts, PLHIV and health care workers) should have been continued in so many groups in this population, particularly among boarding students, new arrivals and those with chronic diseases, once the prevalence was found to be well below 1%.

The mass screening in the Maela Camp followed the logic that dispersion of the population could be imminent, and their presence in the camp offered a golden opportunity to find, treat and cure any cases of TB present, before they could transmit further, either in the camp or their future destinations. In the event the prevalence of all forms of TB of 836/100,000 people screened in Maela Camp is very close to 1%, although only 43% of the cases were bacteriologically confirmed.

[11] WHO. Systematic screening for active tuberculosis: principles and recommendations. WHO, Geneva, 2013.

[12] WHO. Systematic screening for active tuberculosis: an operational guide. WHO, Geneva, 2015.

Role of TB Villages

Treatment success, although it did not achieve the 85% standard, compares favourably with other cross-border situations such as Nepal/India and Thailand/Cambodia. The TB villages, which provide a stable place to stay for patients during their treatment, and even, if necessary their families, offer an original solution to prevent the high losses from follow up that normally plague such mobile, precarious populations. The villages also offer psychosocial support and health education to patients, to help them understand their disease, and, especially for MDR-TB patients, to overcome the side effects, which are a major reason for loss to follow up. Staying in the TB village relieves patients of having to find the money for transportation to the clinic, which is another potent reason for abandoning treatment.

4. Efficiency and cost-effectiveness

The key questions that a full cost-effectiveness analysis would address are these:

1. Was the TTBI good value for money in terms of the cost of treating each case?
    a. Was it good value for drug sensitive cases?
    b. Was it good value for MDR-TB cases?
2. What was the relative value of t-ACF and PCF?

A full cost-effectiveness analysis of the TTBI is beyond the scope of this consultancy (and this consultant), largely because the actual costs of TTBI in the financial documents available are divided into cost areas such as salaries, travel, accommodation, training, equipment, evaluation, and indirect costs, and are not separated out into the costs of t-ACF v PCF, or drug sensitive TB vs MDR-TB. Costs can be separated out, or could be so separated in future if desired, by a costing analysis which would take a further week or two on site, and, through discussion with SMRU staff, divide out the different activities according to the analysis desired.

The available data however do enable some conclusions to be drawn. With some reservations that will be addressed shortly, the total cost of the TTBI can be taken as the income from DFID. This amounted to GBP 3.265 million over 4.5 years[13]. The main achievements with these funds were the treatment of 1,588 cases of presumed drug-sensitive TB, and of 75 cases of RR/MDR-TB. The cost of treatment of MDR-TB is significantly higher than that of treating drug sensitive disease – the costs of the drugs alone can be 100 times higher for an MDR-TB case, depending on the degree of resistance. (Drugs for drug-sensitive disease cost around USD 25, while those for an average case of MDR-TB would be about USD 2,500[14].) Studies that directly compare the overall costs of treating drug sensitive TB vs MDR-TB are few. Overall costs include staff time/salary costs, hospitalization, transport, and even fixed costs such as depreciation of buildings etc. as well as diagnostic procedures and the costs of drug treatment. One study that directly compared the costs of drug sensitive TB to MDR-TB[15] showed that MDR-TB treatment costs were 7.88 times those for drug sensitive TB. This was an

[13] The Q11 budget gives actual costs for 2013 and 2014 of GBP 427,632 and GBP 627,314 respectively. It further provides an estimate for 2015 of GBP 789,724. The Q18 budget document has many blank cells, but the total direct and indirect costs for 2016 to June 2017, were THB 59,451,170. I have converted that to October 2017 GBP of 1,354,642. This is probably rather less GBP than the original figure since the fall in the GBP in June 2016. However, the precise impact of the fall in GBP will depend upon when the transfers were made from London to Thailand, as well as movements in the Thai Baht. For our purposes a rough figure is adequate as will be seen in the main text.

[14] The Stop TB Partnership Global Drug Facility. http://www.stoptb.org/gdf/drugsupply/pc2.asp?CLevel=2&CParent=4 Accessed 31 October 2017.

[15] M. Marks, Jennifer Flood, Barbara Seaworth, et al. Treatment Practices, Outcomes, and Costs of Multidrug-Resistant and Extensively Drug-Resistant Tuberculosis, United States, 2005–2007. May 2014 Volume 20, Number 5. https://wwwnc.cdc.gov/eid/article/20/5/13-1037_article Accessed October 30, 2017.

American study and thus costs and especially salaries were higher than usual elsewhere. The ratio might be significantly higher in a lower-income country.

Nevertheless this ratio allows us to calculate the "cost per drug sensitive equivalent (DSE) case" (1,588 + (75x7.88))/3.199 million, which comes out at GBP 1,468 per DSE case. If the ratio of the costs of MDR-TB treatment to drug sensitive treatment is much higher in Thailand than in the US, then this cost per DSE case falls further.

If we take the conservative view that TB treatment benefits solely the patient and ignore the subsequent rounds of transmission that many studies take into account[16] then the treatment of a case of drug-sensitive TB will avert about 20 disability adjusted life years (DALYs) lost. This approach makes allowance for the age structure of the treated population and treatment success rate which differ in different populations. TTBI therefore achieved a cost of GBP 73.4 per DALY averted. The World Health Organization considers any intervention that costs less than the national gross domestic product (GDP) per capita to avert a disability-adjusted life year (DALY) to be very cost-effective. The 2016 GDP per capita was USD 5,908 and 1,275 for Thailand and Myanmar, respectively.

This is very good value indeed compared to other possible health interventions and is on a par with the International $ 226 per DALY provided by a full programme of treatment for all drug sensitive and resistant cases in the high burden countries of South East Asia[17].

Ideally, a similar, separate, analysis should be carried out for the RR/MDR cases since costs are significantly greater than for the drug susceptible cases.

The relative yields from t-ACF and PCF are important for analysing the relative merits of the two strategies and making decisions about future directions for TB control in the area of Mae Sot (Table 7). Leaving aside the results of mass screening, the ratio of cases found by t-ACF and PCF was 235:1,483 or 1: 6.3. The question is then whether the costs of t-ACF were more or less than one seventh of those of PCF. Again, the available budget data do not allow this comparison without significant further work.

What is clear, however, is that had decisions been taken early on to abandon ACF among boarding students, new arrivals and those with chronic disease, when the prevalence of TB found in these groups was clearly low, then t-ACF could have been made more efficient, and could thus, be more efficient in future.

Table 7. The relative yield from the three main interventions applied by TTBI.

Intervention	Nos. screened	Nos. TB cases identified	Yield (%)
t-ACF	22,508	235	1.04
PCF	8,064	1,483	18.4
Mass screening	18,428	154	0.84

[16] Rob Baltussen, Katherine Floyd, Christopher Dye. Cost effectiveness analysis of strategies for tuberculosis control in developing countries BMJ, 2005. doi:10.1136/bmj.38645.660093.68 (published 10 November 2005) Accessed 30 October, 2017.
[17] Ibid.

5. Conditions of sustainability of the different project activities and their impact at the community level

The TTBI proposal assumed that the Thai and Myanmar national authorities would address TB in the local migrant and refugee population earlier than is actually happening. In the original proposal it is stated: "This proposal is primarily aimed at strengthening the coordination between the main actors and filling the existing gap until the national programmes of Myanmar and Thailand are in a position to tackle the disease in this displaced population." However, it was not defined at the outset that the TTBI should do anything specific to bring the two national programmes together (over and above delivering TB care and management to the migrant and refugee populations) to address the common problem of TB in the migrant population with the prospect of their providing some of the necessary inputs once the TTBI stopped providing them. In other words, there was no "theory of change" applied to this issue - TTBI has mostly focused on achieving the outputs, outcomes and impact in the log frame of the original agreement with DFID, and apart from (successfully) maintaining good relations with the authorities on both sides of the border, it has not created a platform where the responsibility for provision of care to this border population is being discussed and issues are being resolved. This may partly be due to the "lack of wider political momentum in establishing durable solutions for refugee and internally displaced person (IDP) return."[18]

The current status is that DFID funds are now finished. A contingency plan for this period exists, in which SMRU is applying for funds through the Global Fund's Country Coordinating Mechanism in both Thailand and Myanmar. SMRU is also exploring the possibilities of corporate social responsibility (CSR) type funding with the Chinese conglomerate engaged in the town planning and construction in the Koko area in Myanmar. SMRU management has identified 31 Dec 2017 as the date by when a controlled, phased closure of project elements (starting with the closing down of the Wang Pha TB clinic/village) will have to begin, if by then there is no real further prospect of funding.

In spite of the lack of a complete agreement on responsibility for these populations by local authorities, SMRU management has negotiated that the national health authorities on both sides of the border will provide the necessary drugs for TB treatment. ARVs for HIV-infected patients with TB are already being obtained from Myawaddy since early 2017. SMRU has also identified that donor funds are largely moving inside Myanmar, to where the need is perceived to be the greatest. In comparison to other parts of Myanmar, the conditions in the Myawaddy region of Kayin State may be better, but are still far from adequate. A shift of SMRU resources northwards to less well provided-for parts of the border region is being considered.

Another innovative way of increasing provision of medical care for migrants, including TB services, is a low-cost health insurance option for migrants, subsidised by external agencies. Such a scheme, known as the M-Fund is being developed by Nicolas Durier and SMRU was involved in its conception. SMRU could consider becoming a recognised service provider within this scheme, although this would likely only provide partial financial support for SMRU's service provision activities.

Over and above financial security for the services offered by SMRU, another necessary condition for sustainability would appear to be the officially approved employment of SMRU staff, many of whom are ethnic Karen of Myanmar nationality without official work permits to operate in Thailand. To resolve this, SMRU is applying for Foundation status in Thailand.

[18] Buckley J and Morris R. Evaluation of DFID support to conflict-affected people and peace building in Burma. Oxford Policy Management, May, 2017.

In conclusion, in the absence of a conclusive arrangement on the part of the Thai and Myanmar authorities to undertake provision of health services to the displaced and refugee populations in the Mae Sot area, sustainability requires that existing partners remain engaged unless and until new funding agencies are found. In the meantime, if existing partners cannot remain engaged, then service provision to these populations will inevitably have to be reduced.

6. Conclusions, lessons learnt and practical recommendations

Overall, TTBI was well-managed, well-organised, mostly successful - and unique in its way of providing cross-border services to displaced and refugee populations. It met two-thirds of its targets in the log frame. Cohort results do not quite reach global targets (80-84% treatment success 2013-2016), but are high relative to other cross-border settings. Six times more cases were found by PCF than by t-ACF, which suggests that efforts should be made to make ACF more efficient if this strategy is continued. There is some evidence that interventions were carried out more effectively among the migrant populations than among the refugees, however, there were significant numbers of patients diagnosed among the migrants that were not treated by the Initiative. The majority of these chose to be treated elsewhere, but 10% of them died before treatment was made available. The mass screening was implemented well, achieving 88% of target, in spite of PU-AMI's departure in the middle of the programme. A rough cost-effectiveness calculation suggests that the value for money achieved by the Initiative was very high.

The initiative was undoubtedly valuable, and a life-saving resource for migrant and refugee populations in the Mae Sot area, who without the TTBI, would have been deprived of clinical services for TB.

The epidemiological impact, however, is impossible to measure. The "impact indicator" in the log frame is not, in fact, a measure of impact but rather the case fatality rate among those who started treatment, presumably because the log frame designers realised that population TB-specific mortality would be impossible to measure. The basic problem in measuring the impact is that the catchment population is neither measurable, nor stable. This is because of the constant mobility of the population, responding to shifts in security on either side of the border, mostly ethnic strife on the Myanmar side and deportation crackdowns on the Thai side.

TTBI has occupied a gap created (and maintained) by the two governments, but Government to Government collaboration on this issue is "not working", and there is no prospect in sight of the two governments arriving at provision of health services to the refugees and displaced persons.

Lessons learnt

The TB services provided by TTBI responded to the needs of the migrant/refugee population. However, the clinical network in Tak relies on TTBI (and others) for provision of TB services. Continuation of those services into the future will rely on continued funding for SMRU.
Future service provision should take into account some of the lessons learnt in the TTBI.

1. ACF is less productive than PCF and should be discontinued except in the groups already recommended for screening (household contacts, PLHIV and front-line health workers) – unless a prevalence of $\geq$1% is proven, which could be done by a cross-sectional survey.
2. There is significant loss, and death, in those patients who were not registered for treatment in TTBI. Future projects should seek to minimise these losses, and maintain records for as long as possible for those treated elsewhere.

3. Treatment outcome targets should be more ambitious to align with new END TB strategy target.
4. Substantial improvements are required to the data management system so that programme performance can be better monitored, and, for example, cohort analyses can be easily generated. The case-based data system that is currently being developed may respond to these needs, but this should be verified.

Recommendations to DFID

1. Continue support to this vulnerable population
2. Simplify the log frame, eliminate cumulative data, insist on numbers for proportions, reduce the number of targets, encourage course corrections
3. Aside from screening of household contacts and PLHIV (which are recommended by WHO), avoid ACF unless prevalence proven to be ~1%.

Recommendations to SMRU - Financial/political

1. Strengthen relationships with both NTPs and try and engage at NTP Director-level or higher in discussions on funding support.
2. Use SMRU's comparative advantage, for example its research-based laboratory and well-organised work force, to carry out tasks that both NTPs need, eg consider offering to lead (with others) on the introduction of the short-course treatment for MDR-TB, including implementation of the "MDRTB Plus" line probe assay (LPA).
3. Consider expanding TB research activities in the area – in recognition that this will require revisiting the MORU/Oxford University/Wellcome Trust arrangement whereby TB research is handled solely by the Vietnam unit.
4. Take further steps to engage Thai philanthropic organisations, seek out sources of CSR funding, eg from Chinese companies in the Tak Economic Zone.
5. Continue to explore low-cost health insurance options for migrants, such as the M-Fund.
6. Carry out a full risk analysis for the period 2017-2021, eg IOM may leave within 3-5years, and develop suitable contingency plans.

Recommendations to SMRU – technical

Aim to improve the quality of TB service provision through:

1. Analysing the causes of death (retrospectively and prospectively) and taking appropriate steps to reduce the loss (of lives and cases) pre-treatment and during treatment, paying particular attention to the HIV-infected patients and the elderly;
2. Analysing the amount of treatment delay and its causes, and taking appropriate steps to reduce it (also key for IC in HCWs);
3. Reviewing the influence of co-morbidities in the elderly on unsatisfactory treatment outcomes, and taking steps to detect and manage such co-morbidities pro-actively;
4. Taking steps to improve follow up – by considering the use of new electronic approaches, such as SMS text messaging to patients and to health staff, including from the laboratory once a positive result is obtained, video-observed treatment (VOT), medication monitors etc.
5. Expanding use of isoniazid or other forms of preventive therapy, according to the 2012 WHO Guidelines;
6. Reviewing "diabetics in care" as a possible group for t-ACF
7. Use case based electronic data system for regular (?monthly) review and take corrective action as needed;
8. Eliminate Cat II treatment (WHO recommendations, 2017).