Draft Report

International Mini-Review of the Thailand National Tuberculosis Programme

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<thead>
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<th>Description</th>
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<td>ACF</td>
<td>Active case finding</td>
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<tr>
<td>aDSM</td>
<td>Active TB drug safety monitoring and management</td>
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<td>BMA</td>
<td>Bangkok Metropolitan Authority</td>
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<td>BTB</td>
<td>Bureau of Tuberculosis Control</td>
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<td>CBNAAT</td>
<td>Cartridge-based Nucleic Acid Amplification tests</td>
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<td>CCM</td>
<td>Country Coordinating Mechanism</td>
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<td>CDC</td>
<td>Centers for Disease Control and Prevention, US</td>
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<td>CSMBS</td>
<td>Civil Servants Medical Benefits Scheme</td>
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<td>DDC</td>
<td>Department of Disease Control, MOPH</td>
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<td>DRS</td>
<td>Drug-resistance survey</td>
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<td>DST</td>
<td>Drug susceptibility testing</td>
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<td>HPH</td>
<td>Health promotion hospital</td>
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<td>IC</td>
<td>Infection control</td>
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<td>IPT</td>
<td>Isoniazid preventive therapy</td>
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<td>JIMM</td>
<td>Joint International Monitoring Mission</td>
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<td>KAP</td>
<td>Key affected populations</td>
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<td>LPA</td>
<td>Line-probe assay</td>
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<td>MDG</td>
<td>Millennium Development Goal</td>
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<td>MDR-TB</td>
<td>Multi-drug resistant tuberculosis</td>
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<td>MOPH</td>
<td>Ministry of Public Health</td>
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<td>NHSO</td>
<td>National Health Security Office</td>
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<td>NSP</td>
<td>National Strategic Plan</td>
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<td>NTM</td>
<td>Non-tuberculous mycobacteria</td>
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<td>NTP</td>
<td>National TB Programme</td>
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<td>NTRL</td>
<td>National TB Reference Laboratory</td>
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<td>ODPC</td>
<td>Office of Disease Prevention and Control</td>
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<td>PLHA</td>
<td>People living with HIV and AIDS</td>
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<td>PMDT</td>
<td>Programmatic management of drug resistant TB</td>
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<td>PCR</td>
<td>Polymerase chain reaction</td>
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<tr>
<td>R</td>
<td>Rifampicin</td>
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<tr>
<td>RR</td>
<td>Rifampicin resistance</td>
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<td>RTF</td>
<td>Raks Thai Foundation</td>
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<td>SNRL</td>
<td>Supranational reference laboratory</td>
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<td>SSS</td>
<td>Social Security Scheme</td>
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<td>TB</td>
<td>Tuberculosis</td>
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<td>TBCM</td>
<td>Tuberculosis Case Management system</td>
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<td>TUC</td>
<td>Thailand US collaboration</td>
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<td>Z</td>
<td>Pyrazinamide</td>
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Executive Summary

The objectives of this Mini-Review of the National TB Programme of Thailand were more restricted than those of a full review, and were strategically focused on the key issues facing the control of TB in Thailand at the end of 2016. These were to:

- review overall progress since the 2013 Joint International Monitoring Mission;
- assess provision of care for multi-drug resistant (MDR) TB cases and the development of the TB laboratory network;
- evaluate the implementation of the National Strategic Plan (NSP), 2017-2021;
- review the sustainability of TB control efforts when the Global Fund support ends;
- assess the system of monitoring and evaluation, and
- update the epidemiological analysis of Thailand’s TB situation.

Three teams of international and Thai experts visited three Regions (Office of Disease Prevention and Control, ODPC) outside Bangkok — Ratchaburi (ODPC 5), Nakorn Ratchasima (ODPC 9) and Yasothon (ODPC 10) respectively, on December 8th and 9th. Three different teams also visited several facilities in the capital on December 7th, 12th and 13th.

Thailand’s recent achievements that impact on TB control are significant, namely, practically universal health coverage achieved through three health insurance schemes and a migrant health insurance programme; meeting the Millennium Development Goal (MDG) for TB (reducing incidence), although the Stop TB targets for 2015 (reducing by half the mortality and prevalence rates of 1990), were not met; treating 320,000 cases successfully since 2010; preparing a National Strategic Plan (NSP) for control of TB, 2017-2021; carrying out a prevalence survey in 2012/13 which revealed a significantly higher burden of TB than previously thought; significant improvement in case notifications from Bangkok 2007-2011; and developing a case-based, electronic recording and reporting system and now piloting it on-line. In consequence, and assisted by the decline in prevalence of HIV, the incidence of TB is probably in gentle decline.

However, the Review found that of 21 major recommendations from the 2013 JIMM Review, 4 were fully achieved, 13 were partly achieved, while 4 were not addressed at all.

The burden of TB in Thailand remains high with an estimated 117,000 new cases and 13,800 deaths in 2015. Approximately 50,000 cases were not notified to the NTP. Available evidence suggests 16,000 of these were most likely diagnosed, but not notified. As many as 35,000 cases may be neither diagnosed nor treated each year.

The major issues identified by the Review were firstly that case notifications were essentially flat and that treatment success was below the WHO target. The expected upswing of performance in reaction to the prevalence survey results has not happened. This is largely because the Bureau of Tuberculosis (BTB) has not provided the necessary leadership, nor had it received the human resources necessary to implement the 2013 recommendations fully. In addition the prevalence survey showed that the current diagnostic algorithm, using sputum smear microscopy, can only detect about 20% of prevalent cases. Second, a nationwide system of MDR-TB diagnosis and care had been established, but only 20% of MDR-TB cases had been notified as starting treatment. Third, the NSP, 2017-2021, is ready to be implemented, and includes using the new rapid molecular diagnostic tests routinely to diagnose both TB and MDR-TB. This NSP should, however, have been implemented earlier. One consequence of this is that the new diagnostic tools are underused, contributing to the persistent low efficiency of the diagnostic process in Thailand. Fourth, treatment success in many districts in 2016 was well below the 85% target set by WHO because follow up and
support of patients is over-centralized at the district hospitals. Fifth, a clear understanding of the national TB burden is limited by multiple data collection systems each requiring its own data entry - which is inefficient. The switch to electronic data capture has been slow and problematic, with multiple fragmented datasets used by different agencies for different purposes, and the TB case management (TBCM) system is significantly under-reporting cases. Lastly, if Thailand wishes to transition out of Global Fund support, it needs to plan now for full domestic funding of its End TB response.

Summary recommendations (the rationales for, and specific details of, these recommendations will be found in the relevant sections of the report)

1. The DDC, MOPH should support BTB with additional, appropriately trained staff of high calibre, commensurate with the needs to coordinate and collaborate with involved departments in MOPH, BMA, other involved ministries, and implement the NSP 2017-2021 (Sections 4, 7 & 9);
2. The DDC, MOPH should also establish a high level National TB Prevention and Control Committee to support BTB to strengthen health sector and inter-sectoral links, and to monitor the progress of implementation of the NSP;
3. BTB should revise the NTP manual by mid-2017 and carry out a major training initiative for front-line clinical workers to create awareness of the new directions of the NSP 2017-2021, and disseminate the concept that - “Failing to cure the patient is a failure of the system - not of the patient”;
4. To increase case finding the DDC, MOPH should:
   a. roll-out WHO recommended new rapid, molecular diagnostic tests (e.g. cartridge based Nucleic Acid Amplification tests, CBNAAT) as the first line test for TB detection (which will also increase MDR-TB detection), as recommended in the NSP 2017-2021, and ensure NHSO reimbursement;
   b. expand the number of diagnostic machines to at least 150 and introduce specimen transportation systems.
   c. enlist the help of FIND and other partners to negotiate the discount rate for cartridge-based tests to which high burden countries are entitled.
   d. use the new tests to expand active case finding, especially in household contacts and develop new strategies to find and treat TB in the elderly;
5. ODPCs, and the BMA, supported by BTB, should reduce TB case fatality and loss to follow up by strengthening patient centred care in low treatment success rate districts, especially in high prevalence areas such as the North East, through engaging village health volunteers to follow up cases; introducing sputum transport systems; strengthening collaboration with CSOs; and establishing working links with the hospitals, public or private, that do not report cases.
6. BTB should ensure agreement with all stakeholders, including BMA, on a unified surveillance and monitoring system for TB cases with single data entry, and have it working nationwide by 2018 producing high quality data.
7. MOPH/DDC and NHSO should plan for significant increases in their budget allocations for items currently covered by the Global Fund.
1. Background for the mini-review
   a. Overview

Thailand is one of the 30 countries identified by WHO as having the highest tuberculosis (TB) burden. The estimated incidence in 2015 was 172 per 100,000 and estimated mortality, including those dying of TB as a result of HIV infection, was 20 per 100,000. The result is a total of 13,800 people dying of TB in Thailand in 2015, and approximately 117,000 people developing the disease. Males were more than twice as likely as females to develop TB. Of these incident cases, it is estimated that 4,500 had serious drug resistance: TB resistant to rifampicin alone, or multi-drug resistant disease (RR or MDR-TB). Human immunodeficiency virus (HIV) co-infection was present in about 15,000 cases. Globally, Thailand has among the highest burdens of both multi-drug resistant TB (MDR TB) and HIV-associated TB. Supporting TB control in Thailand is, therefore, a global priority. In 2016, a total of 66,179 cases were notified. Almost all (98%) of these were tested for HIV and 13% were found to have been infected with the virus. Laboratory testing in 2015 found 466 patients who had RR/MDR-TB, and 506 were started on treatment (including some diagnosed in 2014 and patients who were not laboratory-confirmed), indicating massive under-diagnosis. Yet over 2,500 cases of MDR-TB were estimated among the total pulmonary TB cases notified.

Thailand has achieved full DOTS coverage, and since the last review of its TB control efforts, held in August 2013, it has made considerable progress in expanding and enhancing TB diagnosis and care, particularly among vulnerable populations (i.e. migrants, people living with HIV and AIDS, and populations in closed settings).

An important recent development was the announcement on December 16, 2016, that the United Nations General Assembly (UNGA) has agreed to hold a High Level Meeting on TB in 2018, as a result of efforts of a group of countries led by South Africa, and including Thailand, as well as Senegal, France, Norway, and Indonesia, among others. This meeting will address countries’ commitment to implementing the WHO’s End TB Strategy, which aims to bring the global incidence of TB down to only 10 cases per 100,000 people by 2035.

One of the keys to making this meeting happen was the recent realisation that MDR-TB is responsible for nearly 30% of the deaths caused by anti-microbial resistance, globally. Mr. Piyasakol Sakolsatayadorn, Minister of Public Health, Thailand, is quoted as saying, “Top political commitment is needed to turn around the serious TB epidemic. Thailand is proud to be one of the first supporters for the UN High-Level Meeting on TB. The UN High-Level Meeting will ensure a historic tipping point in the fight against the world’s leading infectious killer. Together, we can tip the situation.” Thailand’s performance in TB control will be under the international spotlight in the lead-in to the Meeting which is expected to take place around September, 2018.

b. Epidemiological update

With a population of 68 million, Thailand has achieved impressive economic, social, and health improvements in the past 20 years and moved from a low income country to an upper middle income country in 2011 (World Bank). The steady increase in the country’s gross domestic product, currently at 14,500 GDP (PPP$) per capita, has resulted in impressive poverty reduction, increased life expectancy and decrease in under-five mortality (11% living under the poverty line, 75 years and 12 deaths per 1000 live births in 2015, respectively). The country’s ageing population is afflicted by


high prevalence of non-communicable diseases (NCDs) estimated to account for 71% of total deaths of which cardiovascular disease is the leading cause (29%). Diabetes mellitus accounted for 4% of deaths in 2014. Tobacco use and alcohol consumption is noticeably higher among men; in 2011 46% of men reported current tobacco smoking compared to 3% in females. Age, diabetes and smoking all increase significantly the risk of developing TB.

The most recent Prevalence Survey, completed in 2013, revealed a prevalence of smear positive TB cases of 104 per 100,000 and the prevalence of bacteriologically confirmed TB cases of 242 per 100,000. These figures suggest the case notification rate is just 56%. Thailand therefore still has a relatively high burden of TB, and is only notifying just over a half of all the cases. Some of these cases will, however, be diagnosed and even treated, but not notified. Notwithstanding these high levels, the survey suggests a long term declining trend of TB in Thailand as shown by comparison with previous surveys and the increase in prevalence with age. Those aged 55 years made up two thirds of the TB cases. Most of the TB cases are therefore due to ‘remote’ infection rather than by recent infection. Though a higher proportion of elderly TB cases is a good sign, since it indicates a reduction of TB transmission in the community, it also poses a challenge in Thailand, since the population itself is surviving longer (getting older) and thus producing more TB cases. This makes the reduction of TB in the community slower.

In the national drug-resistance survey (DRS) in 2012, MDR-TB rates were 2.1% among newly diagnosed cases and 18.9% among previously treated cases.

The treatment success rate among new and relapse cases was 80% for the cohort of patients registered in 2014 – a fall from the 86% in the 2010 cohort – and well below the 90% target of WHO’s new End TB strategy. Increasing the treatment success rate will be made more difficult by the high death rates among HIV positive TB cases (13% in 2015) as well as the marked ageing of Thailand’s population, mentioned above.

c. Recent laboratory development and changes to MDR-TB management

Thailand has an extensive and well-developed laboratory network, and in the last year it has considerably scaled up its laboratory capacity, including for first-line drug susceptibility testing (DST) at selected regional laboratories. Newer molecular technologies for rapid DST, specifically HAIN Genotype MTBDR-Plus tests and cartridge based Nucleic Acid Amplification tests (CBNAAT), such as the Xpert MTB/RIF, have been introduced, and the cost of the molecular tests is now reimbursed by the National Health Security Office (NHSO) for smear-positive patients with a history of previous treatment and household contacts of MDR-TB. In 2015, as part of GFATM investments, over 44 Xpert MTB/RIF machines and 12 HAIN Line Probe Assays (LPA) were procured for the country with the explicit intention of supporting high burden HIV-TB provinces and improving the rapid diagnosis of drug resistant TB. However, uptake of these rapid technologies has been slow, and quality assurance systems are still being developed and rolled out.

In 2016, all 15 established DST facilities and all 65 culture facilities were quality assured. Capacity for liquid culture was available in 20 laboratories. For smear microscopy laboratories, quality control reached 90% of facilities and 98% of them showed acceptable performance. Laboratory strengthening is being mainly supported through domestic funding with additional funding from the Global Fund and the Thailand US collaboration (TUC) with the Centers for Disease Control and Prevention (CDC). The National Reference Laboratory (NRL) has capacity for second-line DST, including through LPA, and has been formally designated as the second SNRL in the South-East Asia Region. Culture and DST for both first and second-line drugs for eligible patients (failure of initial and
re-treatment regimens, contacts of MDR-TB cases, any patient commencing re-treatment regimen) are available free of cost for Thai citizens through the NHSO.

The NTP began implementation of MDR case management in 2008; national MDR guidelines were developed and recording and reporting mechanisms modified in line with international recommendations. There are an estimated 2,500 MDR cases in Thailand among notified pulmonary cases. At present, most patients with drug-resistant tuberculosis are diagnosed and managed by university, regional/provincial and some private hospitals. Second-line anti-TB drugs are procured using domestic funding via the Government Pharmaceutical Organization. In 2015, less than 100 patients were funded for MDR treatment from external sources.

Due to the limited experience of TB programme staff in training and supervision, frequent modifications of forms, non-reporting to the NTP from academic and private clinics, and delay in DST results, only 466 confirmed MDR-TB cases were reported to the NTP in 2015 and a total of 506 commenced treatment. The new drug, bedaquiline, has been donated to Thailand and other countries by Janssen, through USAID, for pre-XDR and XDR patients. So far, 13 patients have been started on therapy, while drugs were requested for 80 patients.

The shorter MDR-TB treatment regimen, based on the new guidance from WHO, will be introduced on a pilot basis. Thailand plans another DRS in 2017, and has requested WHO support with this activity and for technical guidance on the new and less familiar second line drugs.

Finally, reporting of programmatic management of drug-resistant TB (PMDT) has been a challenge. While a PMDT recording and recording system was implemented in 2013 as part of the NTP’s Tuberculosis Case Management system (TBCM), reporting remains incomplete and important bottlenecks still need to be addressed. Attempts to harmonize the requirements of both health insurance agencies and the NTP into TBCM are currently being piloted.

d. HIV-associated TB update

In the South-East Asia Region, Thailand has the highest HIV burden (estimated at just less than 1% of the total adult population infected with HIV). HIV transmission is still concentrated among the major at-risk populations, such as men who have sex with men, and injecting drug users, although the role of sexual transmission in heterosexual sero-discordant partners is significant. Treatment for HIV is free for about 98.7% of the Thai population who are insured by one of the 3 insurance agencies. National guidelines recommend that ART is initiated in TB patients irrespective of CD4 count, although in practice this recommendation is not always followed. Over 280,000 people are on ARV treatment and treatment coverage was about 64% in 2015 (based on treatment irrespective of CD4 count).

The estimated HIV prevalence among TB cases is 13% in 2015. Ninety-eight percent of new and relapse patients had a known HIV status in 2015, and ART coverage among HIV-positive TB patients has increased to 69%. Progress has been made in implementing TB–HIV collaborative activities throughout the country, although these are mostly the activities done by NTP staff. The policy of provider-initiated HIV testing and counseling (PITC) of TB patients has been integrated into national guidelines and, in theory, implemented throughout the country. Routine and periodic symptomatic screening for TB among HIV infected patients is undertaken at some hospitals during the initial diagnosis, on follow-up visits, and when the decision to initiate antiretroviral therapy is made.

Isoniazid preventive therapy (IPT) for HIV-infected persons was introduced some years ago in some health facilities as pilot and demonstration projects, but has been largely discontinued. Recently, MOPH has a strong effort to ensure a standardized policy for implementing IPT across the country.
under the leadership of the Director General, Department of Disease Control, but in the teeth of opposition from clinicians from the Thai HIV Society. There is an effort to synchronize guidelines between the HIV and TB programmes, but the real effect of this needs assessment.

Intensified case-finding for TB among newly detected HIV-positive patients, uninsured migrants, the elderly and prisoners has been initiated. This intensified case finding is using Xpert MTB/RIF. The yield from this activity, and which other groups may benefit from it, needs assessment.

e. Brief summary of the structure and organization of the Thai health system
f. Structure and organization of the National TB Control Programme

TB services are fully integrated within primary health care. Below ODPC level there are, therefore, no TB-specific staff. Thailand has made efforts in the past to involve NGOs (World Vision International, American Refugee Committee, Thailand Business Coalition on AIDS to Control TB, the Raks Thai Foundation and the National Catholic Commission on Migration) and the private sector (private hospital associations) by encouraging them to provide TB care according to International Standards for TB Control (ISTC), but progress has stalled in recent years.

Thailand’s TB programme is supported mainly by the government’s budget through the NHSO and other health insurance agencies. Additional support has been provided by funding under the New Funding Model of the Global Fund, and United States Agency for International Development (USAID) support through FHI 360. Total external funding is estimated to be around USD 7 million per annum. This support is currently directed towards PMDT, active case finding, unregistered migrants and uninsured populations.

During 2016, it was thought that, as a result of Thailand’s improving economic situation, and the potential withdrawal of Global Fund support over the next three years, the country should take on full domestic funding for TB control, with an expanded investment in order to meet the End TB Strategy Goals. This would require detailed financial planning to ensure sustainability of the response.

The bulk of TB care is now funded through the NHSO, which sets its own targets and makes its own plans for expansion of TB care activities. Diagnosis, treatment and care are largely organized and provided by hospitals and clinicians. BTB therefore needs to engage with this process and find a clear and useful role. As technology and the understanding of the TB epidemic in countries advance, there is a clear need for a body which precisely monitors the progress of the TB epidemic in Thailand, keeps in touch with all stakeholders in TB service provision, and provides clear policy guidance for all anti-TB activities, including guidance to the MOPH on how it should manage the TB epidemic, including the transition away from Global Fund support.

h. The End TB Strategy and implications for Thailand

Since the 2013 mission, the member states of the World Health Assembly have committed themselves to the End TB Strategy (Table 1). This new strategy takes over from the Stop TB strategy and differs from it in having a 20 year vision that puts the prime responsibility on governments to make bold policies and manage the process of ending TB. Governments should involve not only the health sector, but other sectors which manage such things as migration, prisons, social welfare,

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4 Ibid. p 14.
education, science and technology, and should include civil society organisations and communities, indeed all with a responsibility for people who may have TB. Research and development is essential to come up with new tools and new ways of addressing TB. The strategy suggests mechanisms to hold government to account.

**Table 1. The WHO’s End TB strategy at a glance.** Source: Global TB Programme, WHO, Geneva

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<th>VISION</th>
<th>A world free of tuberculosis – zero deaths, disease and suffering due to tuberculosis</th>
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<tr>
<td>GOAL</td>
<td>End the global tuberculosis epidemic</td>
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<tr>
<td>INDICATORS</td>
<td>MILESTONES</td>
</tr>
<tr>
<td>Reduction in number of TB deaths compared with 2015 (%)</td>
<td>2020</td>
</tr>
<tr>
<td>Reduction in TB incidence rate compared with 2015 (%)</td>
<td>20%</td>
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<tr>
<td>TB-affected families facing catastrophic costs due to TB (%)</td>
<td>Zero</td>
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### Principles

1. Government stewardship and accountability, with monitoring and evaluation
2. Strong coalition with civil society organizations and communities
3. Protection and promotion of human rights, ethics and equity
4. Adoption of the strategy and targets at country level, with global collaboration

### Pillars and Components

1. Integrated, patient-centred care and prevention
   A. Early diagnosis of tuberculosis including universal drug-susceptibility testing, and systematic screening of contacts and high-risk groups
   B. Treatment of all people with tuberculosis including drug-resistant tuberculosis, and patient support
   C. Collaborative tuberculosis/HIV activities, and management of co-morbidities
   D. Preventive treatment of persons at high risk, and vaccination against tuberculosis

#### i. Major challenges at the end of 2016

- Improving case detection for all forms of TB remains a key issue for the programme.
- Ensuring uptake of new molecular diagnostic techniques (including CBNAAT),
- Improving the detection, treatment and reporting of drug resistant TB.
- Ensuring programmatic and financial sustainability of the TB response as Thailand transitions away from Global Fund support, with a specific focus on access for migrants and other uninsured populations.
- Better management and regular supervision of programme activities.
- Improving surveillance, monitoring, reporting and recording and the roll out of electronic database systems.

#### 2. The Mini-Review, 2016

The terms of reference were based on the major challenges listed above, and were, therefore, more restricted than a full review.

#### j. Terms of reference

1. Review implementation of recommendations of the previous Review of the National Tuberculosis programme, 2013.
2. Review progress in implementation of the PMDT response and provide strategic advice for improvement.
3. Analyse achievements and constraints in efficient delivery of laboratory services for TB, including the roll out and uptake of new molecular diagnostic techniques; scale-up of DST access (phenotypic and genotypic); and laboratory information systems.
4. Assess the financial and programmatic sustainability of the TB response in the context of Thailand’s transition from Global Fund support, and identify actions to be pursued by the NTP and its implementing partners to ensure sustainability of the programme. Issues of equity and access for populations who do not have access to universal health coverage should be specifically considered.

5. Assess the specific progress on the recommendation on surveillance, monitoring and evaluation from the 2013 review, and update the epidemiological assessment of the TB situation in Thailand.

k. Mini-review organisation

Three teams of international and Thai experts visited three Regions (Offices of Disease Prevention and Control, ODPC) outside Bangkok - Ratchaburi (ODPC 5), Nakorn Ratchasima (ODPC 9) and Yasothon (ODPC 10), on December 8th and 9th. Three different teams also visited several facilities in the capital on December 7th, 12th and 13th.

**Figure 2. Regions and Provinces visited by the Mini-Review. Source: BTB**

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**Mini- Review sites visit , December 6 – 16 , 2016**

- **Kanjanaburi Province**
- **ODPC5 Ratchaburi**
- **ODPC9 NakornRatchasima**
- **ODPC10 UbonRatchathani**
- **Bangkok Province**
- **Yasothon Province**

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ODPC = Office of Disease Prevention and Control
3. Epidemiological analysis of the TB situation

3.1 The Prevalence Survey and the estimated TB burden

A national prevalence survey was conducted in Thailand in 2012/13 and yielded a prevalence of pulmonary TB of 242 (176-332) per 100,000 population\(^5\).\(^6\). This equates to an estimated incidence of 172/100,000 population or 117,000 incident cases.

This new, more accurate, picture does not mean that TB incidence is rising in Thailand. Rather, the evidence suggests that the TB burden is genuinely falling. For one thing, the estimates of the burden of TB from the surveys conducted in 1962 and 1991 are significantly higher than those of 2012 (the 2006 survey did not produce interpretable results), especially if one takes into account that the earlier surveys were less sensitive in detecting cases than in 2012. The largest fall between surveys, however, is in the smear positive cases, while there is much less reduction among the smear negative ones. This can be explained by the effectiveness of Thailand’s TB strategy – DOTS – introduced in the 1990s and used up to the present day, which has concentrated on finding and treating the smear positive cases.

Furthermore, 67% of cases found in the survey were over 55 years of age, indicating a concentration of disease among the elderly (Figure 3). This fits a TB epidemic where transmission has been falling over time, such that younger generations are less infected and hence less likely to breakdown to disease. Men had more than three times the rate of bacteriologically confirmed TB than females. There was also evidence of geographical localisation – the North East Region provided 57% of the cases in the survey, from only about 30% of the people surveyed. Urban regions had 1.8 times more smear positive TB than rural regions.

**Figure 3. Estimated number and prevalence rate of TB cases by age group for 2013.** Source: National Prevalence Survey, 2013 (unpublished).

Crucially, only 34% of the bacteriologically confirmed cases found in the survey had symptoms that would have identified them as presumed cases under the current national diagnostic algorithm. Two-thirds of the cases were found through chest X-ray. This drives home the necessity of making greater use of more sensitive diagnostic tests, such as CXR and CBNAAT tests in the diagnosis of TB, and of training health workers to do a TB test on many more people with respiratory symptoms, and not only on those with a cough for more than 2 weeks.

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\(^5\) BTB, 2016. Results of the tuberculosis national prevalence survey. Unpublished manuscript.

\(^6\) WHO. Unpublished draft of Thailand National Prevalence Survey, based on limited amount of data put into the WHO template.
Prevalence: notification ratios from the survey were low compared to other Asian surveys, suggesting that notification was reasonably efficient. However, they do suggest that men were less likely to get notified than women, and the elderly (over 55 years) were less likely to be notified than younger people. There is thus room for improvement in the speed of diagnosis and certainly of notification.

Unfortunately the full report is not yet published by BTB. Analysis of the health-seeking behaviour of those with symptoms in the survey is therefore not yet available, so we cannot yet understand where the 50,000 annual cases that are un-notified might be. This information will hopefully soon be available from BTB. However, from those in the survey who were already on treatment, 80% were treated in the public sector. The rest were treated elsewhere in the private and other sectors. The inference from this is that 20% of treated cases are diagnosed, but not notified. If this applies to the annual burden, then as many as 37,000 cases could be failing to get diagnosed as TB.

Table 2, while 66,347 TB cases of all forms were notified to www.tbthailand.org. This revised incidence is some 35,000 cases per year more than was previously thought.

This new, more accurate, picture does not mean that TB incidence is rising in Thailand. Rather, the evidence suggests that the TB burden is genuinely falling. For one thing, the estimates of the burden of TB from the surveys conducted in 1962 and 1991 are significantly higher than those of 2012 (the 2006 survey did not produce interpretable results), especially if one takes into account that the earlier surveys were less sensitive in detecting cases than in 2012. The largest fall between surveys, however, is in the smear positive cases, while there is much less reduction among the smear negative ones. This can be explained by the effectiveness of Thailand’s TB strategy – DOTS – introduced in the 1990s and used up to the present day, which has concentrated on finding and treating the smear positive cases.

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Figure 3. Estimated number and prevalence rate of TB cases by age group for 2013. Source: National Prevalence Survey, 2013 (unpublished).

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8 Phase II of the survey was aimed at Bangkok, but the participation rate was so low in the city that results were not interpretable. This was anticipated in the study design which was of sufficient size that Bangkok’s poor results did not invalidate the results from the rest of the country. In estimating the national prevalence and incidence it was decided to apply to the Bangkok population the same rates as were obtained in other urban centres. This does however increase the uncertainty of the results of the survey, particularly with reference to Bangkok.
Crucially, only 34% of the bacteriologically confirmed cases found in the survey had symptoms that would have identified them as presumed cases under the current national diagnostic algorithm. Two-thirds of the cases were found through chest X-ray. This drives home the necessity of making greater use of more sensitive diagnostic tests, such as CXR and CBNAAT tests in the diagnosis of TB, and of training health workers to do a TB test on many more people with respiratory symptoms, and not only on those with a cough for more than 2 weeks.

Prevalence: notification ratios from the survey were low compared to other Asian surveys, suggesting that notification was reasonably efficient\(^9\). However, they do suggest that men were less likely to get notified than women, and the elderly (over 55 years) were less likely to be notified than younger people. There is thus room for improvement in the speed of diagnosis and certainly of notification.

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Table 2. All forms of TB in Thailand as estimated by the Prevalence Survey (2013), WHO estimated incidence (2015); national notification data (2015)\(^{10}\)

<table>
<thead>
<tr>
<th></th>
<th>Number (95%CI)</th>
<th>per 100,000 (95%CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prevalence Survey</td>
<td>168,027*</td>
<td>242 (176-332)</td>
</tr>
<tr>
<td></td>
<td>(122,201-230,516)</td>
<td></td>
</tr>
<tr>
<td>Estimated incidence</td>
<td>117,000</td>
<td>172 (102-259)</td>
</tr>
<tr>
<td></td>
<td>(69,000-176,000)</td>
<td></td>
</tr>
<tr>
<td>Notified TB cases</td>
<td>66,347</td>
<td>96</td>
</tr>
</tbody>
</table>


\(^{10}\) Source: www.tbthailand.org
3.2 Case notifications

In 2015, 66,347 TB cases were notified in Thailand to [www.tbthailand.org](http://www.tbthailand.org). Of these, 94% were new cases, and 6% were re-treatment cases, while 84% were pulmonary cases. Among the pulmonary TB cases 64% were bacteriologically confirmed - mostly smear positive (Table 3 and Figure 4).

**Table 3. TB case notifications in 2015. Source: [www.tbthailand.org](http://www.tbthailand.org)**

<table>
<thead>
<tr>
<th>2015</th>
<th>number</th>
<th>per 100,000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>All forms of TB</td>
<td>66,347</td>
<td>96</td>
</tr>
<tr>
<td>New smear positive</td>
<td>31,734</td>
<td>46</td>
</tr>
<tr>
<td>New smear negative</td>
<td>17,147</td>
<td>25</td>
</tr>
<tr>
<td>EPTB</td>
<td>9,905</td>
<td>14</td>
</tr>
<tr>
<td>Retreatment</td>
<td>4,074</td>
<td>6</td>
</tr>
</tbody>
</table>

**Figure 4. New and re-treatment TB cases by form of TB in Thailand 2015. TAF = Treatment after failure; TAD = Treatment after Default.**

TB case notifications have been stable in 2009-2015 averaging about 67,000 TB cases per year according (Figure 5). While the bars indicate lower numbers in 2008 and in 2016 these are artefacts of [www.tbthailand.org](http://www.tbthailand.org) just starting in 2008 and closing in 2016. The notification trend available from other sources indicate lower total numbers, which could be due to variable coverage of the data reporting between TBCM and www.tbthailand.org but could also be due to duplication of data in [www.tbthailand.org](http://www.tbthailand.org) as this is an aggregated database. This indicates the need for Thailand to settle on a single, unified database.

**Figure 5. Case notification trends 2008-2016 and comparison of data from [www.tbthailand.org](http://www.tbthailand.org) (bars); data used in the 2013 Epi review (green line); and TBCM 2013-2016 (brown line).**
Notification rates from 2015 by ODPC (Figure 6) show that the highest rates occur in ODPCs in the North East Region, specifically ODPC 9, ODPC 1, ODPC 2, and ODPC 8.

Figure 6. Notified TB cases (all forms) per 100,000 population, 2015 by ODPCs, ranked in descending order of TB burden. National average was 98/100,000 in 2015 (red line). Source: www.tbthailand.org

Of all TB cases in 2015, 60% occurred in those of 45 years or older, while 20% were found in those aged 65 and above. The age groups of 25-64 years, probably the economically productive ages, constituted 71% of all TB cases (Figure ). Most disturbing, however, is the small number of cases in the youngest age group (0-14), in which only 425 TB cases (all forms) were notified across the entire country in 2015.

Figure 7. Age distribution of all TB in 2015. Source: TBCM
Seventy Percent (70%) of all notified TB cases in 2015 were male. The male:female (M:F) ratio was 2.2:1 among all forms of TB and 2.6:1 among smear positive TB cases. The 2012 prevalence survey showed that 69% of TB cases were men and that the M:F ratio was 2.4:1 for smear-positive TB and 2.2:1 for bacteriologically confirmed TB. This is consistent with other countries and Thailand’s M:F ratio has been stable since 2008 (data not shown).

In the paper-based system and www.tbthailand.org, data is not disaggregated below 15 years of age to enable analysis of childhood TB. In the electronic system (TBCM) a total of 427 notified TB cases were notified among those under 15 years of age in 2015. Of these, 151 were under 5 years of age, and 39 cases under 2 years. In Thailand, those <15 years old accounted for <1% of the total number of notified TB cases, whereas globally, about 5-10% of TB cases are found in this age group. It appears that clinicians are ordering very few tests to be done on children. The NTP is encouraged to increase case finding in children as global data suggests that TB case detection is 2-3 times higher amongst those under 5 than among those aged 5-15 years.

### 3.3 HIV-associated TB and Diabetes

In 2016, HIV prevalence in Thailand was 1.1% in the adult population. About 440,000 people were estimated to be living with HIV, of which 64% were on ART\(^\text{11}\). TB cases are routinely offered provider-initiated counselling and testing (PITC) for HIV, and HIV cases are tested for TB routinely.

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\(^{11}\) UNAIDS GAP report 2016.
but how frequently is unknown. While 98% of cases were reported to have undergone testing for HIV in 2015, 13% were found positive, but only 69% of these cases received ART. ART is a major intervention to reduce death during TB treatment and the goal should be 100%.

Diabetes increases the risk of TB two to three-fold, and is a growing public health challenge for Thailand\textsuperscript{12}. Among adults of 20-79 years, 8% has diabetes; but the risk increases with age, and 15% of 65-69 years olds in Thailand had diabetes in 2015\textsuperscript{13}. Globally, diabetes is also associated with poorer outcomes of TB, notably increased rates of relapse and death. However, a small study in to hospitals in Thailand did not find these associations\textsuperscript{14}. Diabetes patients are normally a vulnerable group and, ideally, should be regularly screened for TB, yet data on diabetes are not captured in TBCM.

### 3.4 TB in prisoners and migrants

Thailand captures information on TB in prisoners and in migrant populations (Thai and non-Thai). In 2015, 1,304 prisoners and 3,240 migrants were notified to have TB. Treatment success was higher among prisoners at 82.5%, compared to the general population 78.6%, and lower among migrants at 71.6%.

### 3.5 MDR-TB

Thailand has carried out four nationwide surveys of drug-resistance prevalence since 1997 using a randomly-selected, cluster design among TB patients presenting for care. The most recent survey in 2012 estimated that 2.2% of new TB cases and 24% of retreatment cases had at least rifampicin resistance. Based on the survey results, about 2,500 (range: 2,000-3,000) new TB cases would have been diagnosed with RR/MDR-TB in 2014 if all pulmonary TB cases notified in that year underwent DST. However only 506 RR/MDR-TB cases were reported to WHO as having been initiated on treatment in 2015. Associations of MDR-TB with HIV and with diabetes that have been found in other countries appear to be less obvious in Thailand\textsuperscript{15}.

There have been localized reports of a higher rate of MDR-TB than expected in certain settings, particularly Kanjanaburi province, which over the past decade has been identified as the region with an ‘MDR outbreak’. However, this province (and Region as a whole) has higher screening rates than the national average. The higher reported number of MDR TB cases in this region could be due to increased testing levels, or could be due to a higher burden of drug resistant TB per population. By comparing screening rates with notified number of drug resistant cases reported by region it would be possible to get a clearer understanding of the situation.

Nevertheless, in Makarak, a district of Kanjanaburi, an outbreak was first suspected after 15 MDR-TB cases were notified from Jan – June 2010. A retrospective case-control study was done among 148 MDR-TB and 585 DS-TB cases diagnosed from 2007-2008\textsuperscript{16} and 14 clusters identified through a social network analysis. MDR-TB was increasingly diagnosed over time among new cases, from 4% to 7%.

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\textsuperscript{13} International Diabetes Federation. \url{http://www.idf.org/membership/wp/thailand} Accessed 12.01.2017


\textsuperscript{16} Interestingly, diabetes was found among 50% MDR-TB cases in this investigation, suggesting a strong association.
and 9% (2007-2009). These data were interpreted as a community outbreak, and the retrospective case/control study was then followed up by two whole genome sequencing (WGS) studies in a subset of the original 148 MDR-TB cases. The genotypic data confirmed that the outbreak was clonal and identified 1242 single nucleotide polymorphisms in common among the isolates. It is possible that similar, unidentified, outbreaks are occurring elsewhere. In addition, while there has been no systematic assessment of MDR-TB in prisons, an unpublished study indicated that prevalence of MDR among new TB patients in prisons was 4%. This is twice the estimates of MDR-TB among new cases in general population.

Published drug-resistance data from Thailand show high proportions of resistance to ethionamide (E), para-amino salicylate (PAS) and pyrazinamide (Z) in various isolates. In one study, only 77% of isolates from new cases and 73% from previously treated cases were found susceptible to E, while 86% were found susceptible to PAS among retreatment cases. Another DST study indicated Z resistance in 6% and 49% of susceptible and MDR-TB isolates, respectively. However, these were hospital based studies. It is well recognised internationally that such studies introduce significant upward bias in resistance levels – difficult (i.e. drug resistant) patients tend to congregate in specialist hospitals with greater facilities for managing difficult cases. Studies based in hospitals, therefore, while valuable for illustrating an issue in that facility, cannot be used to extrapolate to the general population.

Another DRS is planned for 2017 with support from RIT.

### 3.6 Treatment outcomes

While treatment success in Thailand was reported as 80% in 2015, this disregarded those that were not evaluated. With the more rigorous approach recommended by WHO, and including those not evaluated, the treatment success was 71% in 2015 indicating that the NTP has still some way to go to achieve the End TB target of 90% treatment success among all notified TB cases (Figure). However, some of the category of ‘not evaluated’ were due to a lag in the data being updated and reported to the TBCM.

The high mortality (8%) among TB cases is disconcerting. It is strongly affected by the high death rate (10%) among re-treatment cases. The percentage of cases with successful outcomes of at least 85%, as per the previous Stop TB goals, were met in all patient categories without prior treatment. Among retreatment cases, the treatment success was 61%. Treatment outcomes have been relatively stable throughout the years 2008 – 2015.

Figure 9. Treatment outcomes for 2015 by patient category among cases notified. Source: TBCM.

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18 Jirarut Jonmalung, Therdsak Prammananan, Manoon Leechawengwongs, Angkana Chaiprasert. Surveillance of PZA susceptibility among MDR-TB isolates from Siriraj Hospital, Thailand. BMC Microbiology 2010, 10:223
Treatment success for MDR TB using a (20 months minimum duration of treatment) standardized regimen ranged between 58-66% in the 2012 – 2014 treatment cohorts (Table 4).

Table 1. Treatment outcomes for RR/MDR-TB. Source: Global Fund project sites through the Green Light Committee monitoring programme

<table>
<thead>
<tr>
<th>Year</th>
<th>Diagnosed and notified</th>
<th>Cohort Size</th>
<th>Success</th>
<th>Failure</th>
<th>Died</th>
<th>Lost to follow up</th>
<th>Not evaluated</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>161</td>
<td>159</td>
<td>105 (66%)</td>
<td>5 (3%)</td>
<td>23 (14%)</td>
<td>21 (13%)</td>
<td>7 (4%)</td>
</tr>
<tr>
<td>2013</td>
<td>289</td>
<td>279</td>
<td>170 (61%)</td>
<td>8 (3%)</td>
<td>53 (19%)</td>
<td>35 (13%)</td>
<td>10 (8%)</td>
</tr>
<tr>
<td>2014</td>
<td>436</td>
<td>414</td>
<td>240 (58%)</td>
<td>4 (1%)</td>
<td>70 (17%)</td>
<td>50 (12%)</td>
<td>22 (17%)</td>
</tr>
</tbody>
</table>

3.7 Trends in TB mortality

TB mortality is emphasised as an indicator in the post 2015 WHO strategy. Though Thailand has a vital registration system this is not linked with the case based TB data recorded in TBCM nor with medical coding for cause of death, and therefore there is a degree of uncertainty surrounding TB mortality (Figure 10).

Figure 10. Mortality rates from TB in Thailand by year, 2000-2015, excluding deaths from HIV associated TB (which are classified under HIV deaths), and with associated uncertainty levels (shaded area). Source: WHO.
3.8 **Determinants of TB incidence or mortality (if new and relevant)**

The 2013 JIMM report identified changes in the economy, the efficiency and quality of health services provision, HIV and the ageing of the population as the key determinants of TB outcomes. With respect to the economy, GDP per capita has nearly trebled since 2000, but appears to have peaked in 2013 (Figure 11), probably as a result of social disturbances as well as poorer performance in the global economy. Unless there is a rapid upswing, the economy may have noticeable negative impact on TB control in future years.

**Figure 11. GDP per capita in Thailand, 1960-2014. Not adjusted for purchasing power parity.**

*Source: the World Bank.*

Expenditure on the health services has continued to rise steeply until 2014, when it flattened in line with the economy. Continued expansion of the Universal Health Care scheme so that over 98% of Thailand’s population is now covered by health insurance is a major contributor to population health. Under 5 mortality, which is used by many agencies as the best indicator of general health service quality, and maternal mortality have both continued to fall, although both were at low levels for some time compared to other countries in the region. HIV in Thailand peaked around 2000 and has been declining since, with now about 7,000 new infections per year, mostly in the risk group of men-who-have-sex-with-men.

As previously discussed, it is ageing of the population that is currently having one of the biggest effects on TB epidemiology, brought about by falling fertility and increased survival of the elderly as a result of better health and, presumably, medical care (Figure ).

3.9 The implications of epidemiology for future TB control.

The prevalence survey has shown that the diagnostic algorithm that is mostly in use in Thailand today will only diagnose about one third of cases with TB. Greater sensitivity of the diagnostic process is urgently needed. Therefore the NSP, 2017-2020 is timely in proposing a newer, more sensitive diagnostic algorithm based on CXR and CBNAAT tests. The NSP, however, has been too slow in its implementation and too ambiguous in its wording.

In addition to newer, more sensitive tests, many more suspects need to be tested. The prevalence survey also showed that two thirds of cases do not report a cough for more than 2 weeks. The 2 week criterion for testing a patient for TB must therefore be relaxed. This will require significant retraining of the front-line clinical workforce.

Modelling exercises by many centres have shown that case-finding and treatment alone will have limited effect on the future TB epidemic. In the theoretical scenario below (Figure 13) reductions in TB incidence can be obtained by mitigating risk factors, such as reducing HIV prevalence with condoms, PrEP, behavioural interventions etc, by reducing the prevalence of diabetes mellitus, and so on, but the effect are small. Note the logarithmic scale. Preventing infection control in health facilities and in homes also has a small effect. A larger effect can be obtained by more efficient treatment of active TB, such as by testing more presumed cases, using more sensitive diagnostic tests, and ensuring treatment completion. None of these interventions however, addresses the large pool of people that is already infected. If this pool is not reduced in size, in fact, the interventions mentioned above will be able to reduce the current TB burden down to not less than about 100 cases per million, and not until around 2040. Further, or more rapid, reductions in the TB burden will require eradication of the infection in the population of people already infected, but without disease. This requires either treatment of latent TB infection (LTBI), or a post-infection vaccine, which is a rather theoretical concept at present. Best results, not surprisingly, come from a combination of all approaches.

LTBI can be achieved with 6 months of daily isoniazid, or with a 3 month regimen of weekly isoniazid and rifapentine which requires only 12 doses19.

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4. Response to recommendations of 2013
The main recommendations of the 2013 review were discussed by all review team members, Thai and non-Thai, and the consensus that developed is summarised in Table 5.

Table 5. Response to the recommendations of the 2013 Review. Source: discussions with BTB staff during the mini-review

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Address the gaps in notification with the goal of finding all TB cases:</strong> The Ministry should accord greater priority to TB control. Specifically, it should</td>
<td><strong>Not done</strong></td>
</tr>
<tr>
<td>1. Strengthen PPM through a high-level conference early in 2014 of the MOPH and BMA staff, leaders of private, military and university hospitals, and international partners.</td>
<td><strong>Partly done</strong></td>
</tr>
<tr>
<td>2. repair and strengthen the notification system (for all notifiable diseases, as TB is unlikely to be the only disease underreported) in order to achieve mandatory reporting to the BTB of all cases from all institutions that treat TB;</td>
<td><strong>Partly done</strong></td>
</tr>
<tr>
<td>3. new rapid diagnostic tests as the first-line test throughout the country by 2015,</td>
<td><strong>Done</strong></td>
</tr>
<tr>
<td>4. hold discussions with the BMA to (re-)establish clear regulatory control over non-BMA facilities with respect to TB reporting and case management.</td>
<td><strong>Partly done</strong></td>
</tr>
<tr>
<td><strong>B. Implement a single TB electronic recording and reporting system for all cases:</strong></td>
<td><strong>Not done</strong></td>
</tr>
</tbody>
</table>

PMID:27243774
1. The MOPH should ... set up, by the beginning of 2015, a unified, nationwide, case-based, electronic, web-based, recording and reporting system for all facilities based on further development of the TBCM recording and reporting system. Can be linked with the data collection system of the NHSO.

2. The MOPH should provide training to enable local use of data for analysis and corrective action, in line with decentralization of the upcoming health reform.

C. Ensure maximal chance of treatment success:
   1. The MOPH should mount a campaign among both patients and health staff to improve treatment outcomes based on DOT, which should include:
      1. patient-centred care with a careful conversation between health staff and patients to arrive at an agreement on the roles and responsibilities of each;
      2. focusing of DOT resources to include all high-risk patients (HIV, the elderly, uninsured, marginalized, etc.) with monitoring of the quality of care provided;
      3. proper management of co-morbidities;
      4. provision of enablers to poor patients;
      5. better data flow between health workers involved in care;
      6. adequate financial resources.
   2. In Bangkok, the BMA should take responsibility for setting up a monitoring unit and outreach service that follows up cases using DOT providers/peer educators and supports private practitioners to follow their patients, such as in many cities in the United States of America.

D. Provide suitable care for all migrants in need:
   The MOPH should promote the principle that to safeguard the health of all people in Thailand, TB care should be offered to all migrants, regardless of documentation status. In particular,
   1. promoting active TB case-finding, migrant-sensitive TB health service delivery, and coordinated approaches with NGOs and CBOs;
   2. innovative measures should be developed to identify unregistered non-Thais in the unified electronic data management system recommended above, perhaps through a unique ID number;
   3. local initiatives should be expanded to establish cross-border referral mechanisms,
   4. an application, with inputs from all partners, should be prepared for the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund) to support a comprehensive multinational effort to address gaps in TB control in border areas.
   5. The MOPH should further explore innovative financing approaches to ensure migrants' universal health coverage, including the removal of financial barriers to TB care.

E. Moving forward:
   Thailand is undergoing a transition to an industrialized economy with universal health care, which already covers the costs of treatment for all types of TB, including MDR-TB. The current NTP, led by the BTB, therefore needs to keep pace with these changes. The review team therefore recommends that
1. a debate be started on the future strategy to be adopted by Thailand and its NTP,  
2. the MOPH urgently expand the BTB’s analytical, financial and management capacity, while also strengthening its technical capacity;  
3. the BTB should urgently prepare and submit its Phase II application to the Global Fund for its current grant and, start developing a National Strategic Plan, in preparation for an application under the new funding model of the Global Fund.  

The reasons for failure to complete the response to the recommendations are varied. The NSP took nearly 3 years to be completed, and thus, there has been little time to implement the new interventions in it. Behind this lies a lack of human resources in the BTB, which is addressed in more detail in Section 9.

5. Laboratory management and improving detection of TB

Findings
The laboratory infrastructure available at different levels of the health systems in non-metropolitan areas appeared good, especially when compared to the sub-optimal facilities seen in some large hospitals in Bangkok. TB diagnostic services are fairly well distributed across all twelve peripheral ODPCs. There are 1,248 Microscopy Centres, and 66 culture labs, including 24 labs performing liquid culture and DST for first-line drugs using the MGIT 960 (Becton-Dickinson, USA). Twenty one laboratories conduct solid culture and DST. Five Labs including NTRL are carrying out second line DST. In addition, there are 58 GeneXpert systems (Cepheid, USA) deployed across the country, Line Probe Assay by Hain Life Sciences (Tubingen, Germany) is available at 17 laboratories and REBA (Yongin-Si, South Korea), another LPA test, in two; Seegene Real Time polymerase chain reaction (PCR, Seoul, South Korea) is in use in another 11 sites to differentiate TB and non-tuberculous mycobacteria (NTM) and in one site, the Army Hospital of Pramongkutkhao, an in-house PCR is used. There is therefore an abundance of laboratory support.

The NTRL, also functions as one of the WHO supranational reference laboratories (SNRL) of this region, and is the only specialised TB Reference Laboratory in the country. 13 ODPC labs offer broad based diagnostic services to major communicable diseases with a dedicated TB section.

Challenges
The review observed the following:

1. Molecular diagnostics: 3,800 GeneXpert tests were carried out in the year prior to the review, and mostly for the diagnosis of MDR-TB among those already diagnosed with TB (Table 6). Given that over 50 machines were present in the country by December 2016 this is an important under-utilization. Relatively low numbers of line-probe assays (LPA) were also carried out, compared to the capacity. There was also sub-optimal utilization of culture.

2. Management: There was a disconnect and lack of coordination between BTB and TB laboratory services. There was no uniform national policy for all laboratory methods including training. There was no laboratory strategic plan and no functional National Laboratory Committee to formulate policies and to provide guidance to the NTP. There was a lack of awareness of SOPs and knowledge of policy guidelines issued by the WHO, such as optimal utilization of laboratory systems, and lack of understanding about national guidelines and the NSP. BTB is responsible for developing and disseminating lab policies, and ensuring they are followed, but they are providing insufficient support for the ODPC labs. All these issues yield results below expectations, and causes delay in correcting errors.
3. **Staffing**: To provide the strategic leadership to the NTRL and plan for the country’s requirements and future expansion, the Head of the NTRL needs to be trained in public health as well as in routine laboratory techniques. At ODPC level, the supervisor supervises all lab services. There may be many technicians but only one or two do TB Lab work. It is likely that in the event of other emergencies, TB services are either ignored or delayed. Usually the technicians at these settings are utilized as multi-purpose laboratory staff from ODPC downwards. Lab technicians are not trained in processing paucibacillary samples from extra-pulmonary TB and childhood TB by GeneXpert.

4. **Monitoring and evaluation**: While data are available from the National TB Reference Laboratory (NTRL), which is responsible for monitoring and supervising all national TB diagnostic activities, nationwide data were not available. Data management consists mostly of collecting paper-based results from the laboratories.

5. **Infection control** is below international standards: Although TB cultures are put up in TB containment lab sections (Biosafety Labs BSL2+) in ODPC labs and the NTRL, with adequate air exchange to minimise contamination, and with maintenance contracts, in other sites, TB culture and DST are carried out in a biosafety cabinet in the general laboratory area with no negative air-pressure. This is a dangerous practice which has the potential to infect other lab staff, and should be curbed by creating WHO recommended TB containment facilities at these sites.

6. **Quality control**: The NTRL carries out external quality assurance (EQA) of smear microscopy employing lot quality assurance sampling (LOAS). Twice a year EQA is being planned for the GeneXpert Labs. Detailed analyses and action taken, including retraining based on the outcome of smear EQA and Proficiency testing for culture and DSTs are not documented. Usually NTRL experiences an inordinate delay in obtaining any feedback from the field. It looks as if NTRL’s EQA is conducted mostly to fulfil requirements, and without proper follow-up. About 320 microscopy centres still use Kinyoun’s cold staining technique – against WHO recommendations. Quality of the sputum provided for examination is low. This adds to the low yield from sputum smear microscopy. Low work load in the culture and DST labs at ODPC level reduces proficiency. In certain sites more than 10% contamination in culture is observed and a large percentage of NTM is reported – a sign of contamination. Forty two out of 66 culture labs still use Ogawa medium which might obviate the aerosol spread, but does not yield a sensitivity equivalent to that of conventional Lowenstein-Jensen (LJ) medium. There was no evidence of smear microscopy EQA in urban settings.

7. **Commodities and procurement**: Although national level specifications are available, most of the reagents below ODPC level are procured locally. This means standards of laboratory consumables and reagents are not uniform across the country. For example we observed in ODPC 10 and in the hospitals visited in the Bangkok urban area that information about the concentration of AFB reagents was missing. LJ slopes contained less medium than they should, which leads to faster drying of the slope and inadequate support for growth, and reporting environmental contaminants as NTM responsible for infection or disease.

### Table 6. GeneXpert testing nationwide, October 2015 to September 2016. Source: NTRL

<table>
<thead>
<tr>
<th>KPs</th>
<th>TB Suspected</th>
<th>Xpert MTB/RIF result</th>
<th>MTB detected</th>
<th>% (MTB detected/TB Suspected)</th>
<th>MTB detected with RIF</th>
<th>% (MTB detected with RIF)</th>
<th>MTB detected with No RIF</th>
<th>% (MTB detected with No RIF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category</td>
<td>Number</td>
<td>GeneXpert</td>
<td>GeneXpert</td>
<td>MDR-TB detected</td>
<td>Resistance/MTB detected</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----------------------------------</td>
<td>--------</td>
<td>-----------</td>
<td>-----------</td>
<td>-----------------</td>
<td>-------------------------</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prison</td>
<td>3,131</td>
<td>358</td>
<td>11%</td>
<td>19</td>
<td>5%</td>
<td>339</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Migrant</td>
<td>2,213</td>
<td>320</td>
<td>14%</td>
<td>19</td>
<td>6%</td>
<td>301</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DM</td>
<td>1,304</td>
<td>384</td>
<td>29%</td>
<td>21</td>
<td>5%</td>
<td>363</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HHC- M+</td>
<td>2,872</td>
<td>476</td>
<td>17%</td>
<td>24</td>
<td>5%</td>
<td>452</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HHC- MDR-TB</td>
<td>569</td>
<td>136</td>
<td>24%</td>
<td>22</td>
<td>16%</td>
<td>114</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B24</td>
<td>1,488</td>
<td>360</td>
<td>24%</td>
<td>37</td>
<td>10%</td>
<td>323</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EP suspected</td>
<td>219</td>
<td>44</td>
<td>20%</td>
<td>1</td>
<td>2%</td>
<td>43</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chronic Disease (CXR abnormal)</td>
<td>2,617</td>
<td>357</td>
<td>14%</td>
<td>38</td>
<td>11%</td>
<td>319</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CXR abnormal &amp; smear negative</td>
<td>1,396</td>
<td>233</td>
<td>17%</td>
<td>12</td>
<td>5%</td>
<td>221</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>4,883</td>
<td>1,198</td>
<td>25%</td>
<td>102</td>
<td>9%</td>
<td>1096</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20,692</strong></td>
<td><strong>3,806</strong></td>
<td><strong>19%</strong></td>
<td><strong>295</strong></td>
<td><strong>8%</strong></td>
<td><strong>3571</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Recommendations**

1. To strengthen laboratory support, DDC/MOPH should make the NTRL contributions to the NTP more effective by:
   a. recruiting 2 to 3 more qualified and experienced medical microbiologists to NTRL with the funding support from BTB/ NHSO. They should lead the development of a national laboratory plan and guidelines, and form a vital link between the NTRL and the NTP, especially the Chiefs of the TB Lab at the ODPCs.
   b. creating competent teams under the Head of NTRL to expand national and regional training, monitoring and supervision, and implement EQA for all laboratory techniques in use at various levels. The supervisory visits should bridge the gap between the NTP and the NTRL.
   c. ensuring strict adherence to Lab SOPs at all levels and periodically analyse mandatory quality indicators on the tests performed, and take corrective actions, retraining whenever any deficiencies are noticed; ensuring quality of lab output.

2. To facilitate handling more diagnostic samples at the lower level of health system, the BTB/DDC should increase the number of GeneXpert sites to 150\(^{20}\) (at least one GeneXpert (usually GX4) at the district level (both in urban and rural settings) to screen all symptomatics including contacts in line with the NSP. This will also serve to increase MDR-TB detection and use the existing stock of cartridges. The MOPH should enlist the help of FIND and other partners to negotiate the discount rate for cartridge-based tests that high burden countries usually receive.

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\(^{20}\) Estimated annual incidence of TB is 117,000 cases. Assume 5 presumed cases per actual case diagnosed. This yields about 600,000 presumed cases which, according to the current NSP, each require 1 GeneXpert test (further assume this also applies to extrapulmonary cases, who should where possible receive a GeneXpert test). Capacity required is therefore 600,000 tests annually. Each GX4 machine can carry out 16 tests per working day (4 per port). Assume 250 working days. Ultimate requirement is therefore 150 GX4 machines. Further consideration should be given to the machines’ siting and likely load, and a detailed plan per district developed which will likely require a selection of GX2, GX4 and GX16 machines.
Collation of the data from this expanded number of machines will be difficult, but Cepheid has developed an automated way of storing and organising the data, known as GeneXpert Alert, which should be considered for Thailand. The NTRL should ensure its new guidelines are in line with the diagnostic algorithms of NSP 2017-2021 on when to use molecular diagnostic methods, including for the diagnosis of pauci-bacillary conditions, and in children.

3. NTRL and ODPCs should put in place laboratory management and information systems without any further delay, and ensure they are linked with the TBCM to ensure all diagnosed cases are captured.

4. A core TB lab team is required at the regional level, or at least a key person responsible for transmission of knowledge, to monitor TB lab activities, ensure optimal utilization of lab services, monitoring and supervision; trouble-shooting and for bridging the gap between the NTP and the regional lab.

5. The NTRL should lead the conversion of all culture and DST laboratories in the country to TB biosafety containment facilities as prescribed by WHO in the ‘Biosafety Guidelines. Laboratory staff should be retrained on bio-safety practices and infection control procedures at all levels, as per WHO guidelines nationwide and NTRL Head should consider employing biomedical engineers to maintain all air handling units and lab equipment.

6. MDR-TB treatment and follow-up

Findings

The epidemiological findings relating to MDR-TB are in section 3.5.

Diagnosis and treatment of rifampicin resistance (RR)/MDR-TB is available throughout the country. There has been an attempt to widen the screening criteria for drug-resistance using the “Re-On-Pre” algorithm (retreatment cases, non-converters on treatment and high risk groups, before the start of treatment). The national guidelines recommend testing of patients who were diagnosed as TB patients and are at high risk for MDR-TB, including previously treated patients, patients with sputum still positive after the third month of treatment, and new patients who have history of contact with MDR-TB patients, as well as PLHA who are suspected of TB. Other risk groups also include TB patients living in areas with high MDR prevalence (e.g. prisons, refugee camps, migrants), or with comorbidities (e.g. HIV). However, only rapid tests among MDR contact, retreatment and non-converters after 3 months of treatment are currently reimbursed by the National Health Security Office (NHSO).

Regarding treatment, WHO recommends that if R resistance is detected, this mostly likely indicates MDR-TB and treatment should be with a regimen suitable for MDR-TB, with high quality DOT to ensure drugs are taken regularly.

Challenges

- Only ~20% of estimated RR/MDR-TB patients among notified pulmonary TB cases are being detected and initiated on treatment. This can be attributed to low screening rates for drug resistance. Even the retreatment cases are not being fully tested (Table 4).

Table 4. Proportions of cases of different types of TB that were tested by DST and found to have MDR-TB, 2015. Source: TBthailand.org

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21 Regional Advisory Committee on MDR-TB SEAR (r-GLC) Secretariat, WHO South East Asia Regional Office. PMDT Monitoring Report, Thailand, December, 2016.
 Serious underutilization of available molecular tests, specifically GeneXpert machines and LPA (Table 5). This is generally due to lack of awareness of the national guidelines for usage of these tools among clinical and lab staff in government facilities, and even more so in private hospitals. The country is purchasing cartridges for the GeneXpert machines at a much higher price than is available through the price system negotiated by the Foundation for New Innovative Diagnostics (FIND). There is therefore a concern about the cost of testing and there also seems to be an unfounded lack of trust in the GeneXpert technology.

 Treatment success rates among patients being initiated on second line drugs are low. In one of the Regions visited (ODPC5) the treatment success rates have declined to 50% for the most recent cohort after being as high as 76% for the 2011 cohort. For this Region, the decline was attributed, anecdotally, to increasing death due to old age group, HIV infection and diabetes. A high loss to follow-up of DR-TB patients on treatment was also observed by the review in other ODPCs, especially among migrants.

 Although there is an in-principle agreement to offer financial/ material support to RR/MDR-TB patients, enablers were not always available through the government system because of lack of clarity, or their misinterpretation by the Regional/ Provincial governments for the purpose. Enablers are essential to ensure treatment adherence as most of the patients are poor and cannot work, so they lose whatever earnings they normally get.

 NGOs, and specifically CBOs, can play a vital role in complementing MDR-TB services. There are certain activities that are difficult for the government system to perform but can more easily be undertaken by CBOs. However, as of now, the main role of NGOs is perceived by the MOPH as only in delivery of care to migrants, and specifically un-registered migrants.

 Very low treatment success rates are being observed among patients on treatment in some of the private sector hospitals because of lack of DOT and of an effective mechanism for retrieval of lost patients in the private sector. The review team noted the establishment of the TB Referral Centre in Bangkok to assist with follow-up of patients from private hospitals, and this may help in future, but it only started work in November, and appears to lack the resources for following up patients who do not attend the facility near their home. Generally at the end of 2016, resources were lacking for crucial activities like home visits for those started on treatment, or those who miss their doses for various reasons.

 Discrepancies in data for PMDT (Table 6). This is discussed in detail in Section 7, but is raised here to highlight the uncertainties in the numbers of patients treated for MDR-TB.

 The provision of screening and second-line treatment by hospitals varies significantly, apparently because of lack of clarity in national guidelines, or their misinterpretation by the NHSO, e.g. the team learnt at one of the hospitals that the reason for not starting diagnosed RR-TB cases immediately on second-line treatment, is because MDR-TB needs to be confirmed even after RR diagnosis due to NHSO’s policy of reimbursing only for MDR-TB patients.

<table>
<thead>
<tr>
<th>New Registered in TB07</th>
<th>DST MDR-TB</th>
<th>Relapse Registered in TB07</th>
<th>DST MDR-TB</th>
<th>TAF of New Registered in TB07</th>
<th>DST MDR-TB</th>
<th>TAF of previous treatment Registered in TB07</th>
<th>DST MDR-TB</th>
<th>After loss to follow-up Registered in TB07</th>
<th>DST MDR-TB</th>
<th>Other Registered in TB07</th>
<th>DST MDR-TB</th>
</tr>
</thead>
<tbody>
<tr>
<td>35749</td>
<td>19%</td>
<td>2009</td>
<td>42%</td>
<td>268</td>
<td>57%</td>
<td>102</td>
<td>48%</td>
<td>469</td>
<td>58%</td>
<td>6119</td>
<td>8%</td>
</tr>
</tbody>
</table>

Table 5. Utilization of available GeneXpert machines, 2012 to 2016. Source: BTB
Table 6. Discrepancies in RR/MDR and XDR-TB patients identified and started on treatment in TBthailand.org and those reported to WHO. Source: TBthailand.org and WHO 2016 Global TB Control Report, collated by Review Team.

<table>
<thead>
<tr>
<th>Year</th>
<th>Lab confirmed RR/MDR</th>
<th>Initiated on treatment</th>
<th>Treatment outcome</th>
<th>Lab confirmed XDR</th>
<th>Initiated on treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NTP*</td>
<td>GTBR**</td>
<td>NTP</td>
<td>GTBR</td>
<td>NTP</td>
</tr>
<tr>
<td>2013</td>
<td>194</td>
<td>230</td>
<td>171</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>2014</td>
<td>425</td>
<td>506</td>
<td>320</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>2015</td>
<td>497</td>
<td>466</td>
<td>525</td>
<td>506</td>
<td>NA</td>
</tr>
</tbody>
</table>

*NTP – TBthailand.org  
**GTBR – 2016 WHO Global TB Report

**Recommendations**

1. **Early and complete detection of drug-resistance among notified pulmonary TB cases**
   a. BTB should urgently begin to train front-line staff to follow the guidance contained in the NSP, 2017-2021, on universal DST, and ensure that all cases initiated on TB treatment should undergo a test for resistance using at least one of the WHO approved rapid, molecular tests – with an immediate focus on screening for drug resistance among populations at risk for drug resistance because of close contact with resistant cases, and those at risk of dying due to co-morbidities or age. Molecular methods include LPA or CBNAAT, such as Xpert MTB/ RIF. If, for some reason, these are not possible, or no resistance is detected but it is still suspected, then culture and DST must be applied.
   b. By the end of 2021, as outlined in the NSP, all suspected cases of TB should undergo a molecular test, (which, in the case of CBNAATs includes testing for drug resistance). Those found resistant to first line drugs should also undergo testing for resistance to second-line drugs, as is currently done at the NTRL.
   c. BTB should intensify case finding among contacts of DR-TB cases using chest X-ray, and those with abnormalities should undergo diagnostic testing using WHO recommended rapid molecular tests, even when the contacts are asymptomatic, because of a high risk of having been infected with the resistant bacillus. Contacts include household contacts, workplace contacts and inmates in close, congregate settings like prisons. Contacts who are infected, but without disease, should be informed of their situation and advised to seek care if they develop symptoms, so that appropriate treatment is rapidly started should disease develop.
d. Taking this approach outlined in the three bullet points above will increase the screening for MDR-TB and will, therefore, furnish the data to show whether Kanjanaburi is an exception, or the rule.

2. **Ensure quality treatment for all RR/ MDR-TB cases to improve treatment success rates**
   a. The MOPH should strongly recommend that DOT should be ensured in all RR/MDR-TB cases as one way of supporting the patient. Self-administered treatment is unacceptable for these cases – because it is often ineffective and may result in the death of the patient. Family DOT may also not be effective and should only be a last resort e.g. in children where one of the parents could be a DOT provider.
   b. Update MDR-TB treatment guidelines by mid-2017 to include WHO’s recent recommendations\(^{22}\), which regroup the second line drugs and, specifically, PAS, which is now classified as an ‘add-on’ drug. This has a major impact on the current regimen because PAS is one of the mainstay drugs. The guidelines should also recommend:
      a. Wider use of bedaquiline (or delamanid) in all RR/MDR-TB cases where an effective regimen cannot be constituted with the newly classified core second line drugs, including when there are serious adverse effects with other drugs;
      b. Registration of all drugs required for RR/MDR-TB treatment
      c. That RR cases be treated as MDR-TB cases since their outcomes, if not so treated, are poor.
   c. BTB should prepare a transition plan for the introduction of the shorter regimen (recommended by WHO) guided by SLD-LPA and supported by active TB drug safety monitoring and management (aDSM). The Review Team recommends starting with two provinces in the beginning of 2017, expanding to five by the end of the year and completing country coverage in 2018. The shorter regimen will not only reduce treatment duration, and improve treatment adherence and hence outcomes, but will also reduce the drug costs.
   d. The programme may also benefit from conducting a review of cause of deaths among MDR-TB patients in Kanjanaburi. This could be in the form of a death audit and would help programme improve its services in future.

3. **Ascertain drug-resistance pattern through a nationally representative sample**
   a. BTB should use molecular techniques and also undertaking testing for pyrazinamide, fluoroquinolones and second-line injectable drugs for at least all confirmed MDR-TB cases in the DRS planned for 2017. The survey protocol should be in accordance with WHO’s methodology. A repeat survey, should not, however, hold back introduction of the shorter regimen.

4. **Mainstream support for patients on second-line treatment to improve treatment adherence**
   a. The MOPH should insist on adequate budgetary provisions being made at Regional and Provincial level to support patients on second-line drugs
   b. BTB should engage with the Office of the Inspector General in each ODPC, and ensure that the Ministry of Social Security and Human Welfare provides a regular and adequate grant to MDR and XDR patients as the first priority.
   c. ODPCs should ensure that Provincial Health Offices devise mechanisms for patient rehabilitation – psychosocial and specifically vocational after patient is fit to return to work – and that sub district health promotional hospitals (SHPH) carry them out.

5. **Sort out NHSO reimbursement issues to clear any potential impediments to scale-up of PMDT**
   a. The following areas may need to be discussed with NHSO for reimbursement (after appropriate revision of national guidelines)

\(^{22}\) WHO. WHO treatment guidelines for drug-resistant tuberculosis: 2016 Update.
i. Sputum transportation for screening as well as follow-up when patients cannot visit the hospital
ii. Use of molecular tests for expanded screening criteria
iii. Treatment of RR-TB with second line drugs (and not waiting for confirmation of MDR-TB). This is already part of the existing PMDT guidelines
iv. Use of newer and repurposed drugs for MDR-TB treatment (like clofazimine, linezolid, bedaquiline, and delamanid)

7. Surveillance, monitoring and evaluation system

Findings

Data sources

Data sources used for this assessment include:

- Routine TB notification data and TB treatment outcomes reported to the BTB 2005-2015 sourced from the following datasets:
  - Tuberculosis Case Management (TBCM) (www.tbcmthailand.org)
  - Web TB Thailand (www.tbthailand.org)

Since 1997, paper based TB registers have been used, and aggregated data from them collected and collated at national level, through quarterly report forms or in excel spread sheets. Although these systems were inconsistent and error prone, they were implemented in the public sector (like in most developing countries) and in about 10% of non-public hospitals in Bangkok.

Since 2007 a number of stakeholders have developed different electronic recording and reporting systems for TB to support their various needs, i.e. Bureau of TB (BTB) for the purpose of keeping national level data and making it available at local level (Web TB Thailand) and for TB case management and programme management (TBCM); NHSO for financial reimbursement of medical services (SMART TB™/ TB Data Hub); the Health Data Centre (HDC) for Hospital Information Systems using International Classification of Diseases (ICD) for recording and drug supply management (which is also utilised to report TB data to the Bureau of Epidemiology for disease surveillance); Global Fund for monitoring specific programme activities, including childhood TB, MDR TB and intensified case finding (Figure 14 ).

Figure 14. Implementation of the variety of electronic TB recording systems in Thailand since 1997.
Source: Mini-review team.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TB paper based register</td>
<td>Phase out</td>
<td>Paper based registers used but data not reported</td>
<td><a href="http://www.TBThailand.org">www.TBThailand.org</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2007 →</td>
<td>Data hub (NHSO)</td>
<td>HDC (Health Data Centre)</td>
<td>TBCM</td>
<td>TBCM 2010</td>
<td>TBCM online</td>
</tr>
</tbody>
</table>

An assessment of these electronic surveillance systems and data sets showed that data at national level are fragmented and incomplete. None of the data sets available on its own, or in combination, gives the completeness or accuracy of data required for a reliable epidemiological assessment of TB
in Thailand. For this review, the dataset from Web TB Thailand (www.tbthailand.net) seemed the most comprehensive and consistent source of TB data available for the past decade, although it is based on aggregated data collected from paper based TB registers (Figure 15).

**Tuberculosis Case Management (TBCM) system**

Since 2013, the major change is the implementation and expansion of electronic TB recording systems - the TBCM database - which was developed by staff in Chiang Mai and since 2016 is being enhanced by BIOPHICS, funded by the Global Fund. TBCM is case based and designed to operate on- and off-line. Data so far has been mostly entered at local level and uploaded quarterly to the central data base at national level. TBCM is currently used in 78% of all MOPH facilities and 90% of MOPH hospitals. Under the BMA, 98% of its hospitals use TBCM. However, the academic, military and private hospitals do not use it, and nor do they notify TB cases and treatment outcomes to BTB.

Personal ID numbers are included as unique identifiers. TBCM data entered at hospital level are available at district, provincial and national level. Data from TBCM is also exported to other stakeholders, e.g. NHSO which uses it for financial reimbursement to hospitals for TB related services. There are plans for laboratory results to be integrated into TBCM.

The plan is to develop an online version in which all data is entered into a cloud-based server. This is already being piloted in two areas. The TBCM is supported by the MOPH and the goal is to transfer ownership from the academic partner developing it to the IT centre within the Department of Disease Control, and have it ready for nationwide use in 3 years. Technical and administrative support for TBCM will also be transferred to the IT centre.

Work is also in progress to make the TBCM increasingly user-friendly as well as operationally stable and automated. Other measures aim to increase stake holder buy-in by including access to, and visualization of, data that was not available to stakeholders previously, and by developing a simplified system to encourage data entry by the private sector.

**Figure 15. Comparison of TB data sets in Thailand.** *Source: Mini-review team.*

![Comparison of TB data sets in Thailand](image)

**Staffing**

At national level the BTB staff responsible for surveillance and monitoring of the NTCP consist of one Deputy Chief Programme Officer, and one Programme Officer.

**Challenges**

- **Fragmentation of data sources.** There are multiple systems for multiple purposes, giving inconsistent results. Overall, data collection for TB is fragmented. The BTB, PR-DDC and
Global Fund favour the TBCM, while NHSO prefers its own Data Hub, and complains of the quality of data submitted by the TBCM to the DATA Hub. The Data Hub reports are preferentially completed because they lead to financial reimbursement from NHSO. IT support to the TBCM is available through the developers during working hours only, while Data Hub has round the clock support. Attempts to obtain NHSO data to link with that of TBCM have been turned down by NHSO because of concerns of confidentiality. It is understood, however, that the NAP has been able to do this, and thus there seems to be a precedent.

- **Data quality concerns.** Though it is understood that TBCM may take time for data to be uploaded to national level (uploads occur monthly or quarterly) as many as 5,952 (12%) cases in the 2015 cohort and registered on the 6-months regimen are still reported as ‘on treatment’ in December 2016 (5 months after the last registered case would have completed treatment). Data are entered by nurses at hospitals without systems for quality assurance (QA) or quality control (QC). The result is that data are often incomplete, sometimes inaccurate and contradictory. Currently, review of the quality of data occurs only superficially every quarter, at the time of upload of the TBCM offline to the cloud based server. Data for monitoring initial treatment default or effective screening activities is not available at the facilities we visited.

- **Development of TBCM, intended to take 3 years, is too slow.** Nor does it currently have the mandate to have nationwide reach. A simpler version of TBCM is considered for development to increase the palatability for use in the private, military and academic sector, and this needs to be accelerated. TBCM is not fully aligned with WHO reporting framework and definitions. There is a risk of losing historical data of comparable quality during the transition of legacy systems to TBCM.

- **Insufficient qualified staff at BTB** to collect, collate, analyse, discuss and report routine data. BTB is therefore not optimally utilizing the data to monitor the NTP programme or make evidence- based decisions with regards to interventions and resources required to control TB or, more specifically, to develop the strategies necessary to end the TB epidemic by 2035. BTB is therefore unengaged in setting appropriate targets and planning resource allocations. Instead NHSO is filling the vacuum by setting its own targets. BTB is thus missing the opportunity to provide the evidence required for further resource mobilisation to TB control, and hence to create transparency and accountability on TB control efforts within the MOPH. BTB does not produce an annual report, regarded as an essential indicator of surveillance quality by WHO.

**Recommendations**

1. **To reduce the fragmentation of data and of TB control efforts,** MOPH/DDC/BTB and NHSO should collaborate to coordinate TB control activities and set targets. They should also settle on the main TB data system for analysing the burden of TB, performance of the NTP and following the management of cases. The sustainability of TBCM will be enhanced by linking it, or even merging it, with the NHSO’s Data Hub. This review’s and NHSO’s concerns about the quality of the data in TBCM need to be addressed. Linkage of the two systems would increase motivation for stakeholders to collaborate in the development process and for users at all levels (from data entry to leadership) to work towards ensuring completeness and accuracy of data.

2. **To accelerate development of TBCM,** NHSO, BTB and DDRP should collaborate to have the on-line version of TBCM fully functional and stable by end 2017. To this end, MOPH/DDC should:
   a. In collaboration with the developers, plan to transfer ownership and responsibility of TBCM to the MOPH as quickly as possible. The plan needs to include activities and
timelines for transfer and adequate costs for the ongoing improvement and maintenance needs. The plan needs to be endorsed by the MOPH with a commitment to take on funding responsibilities as support from Global Fund ends.

b. Ensure close collaboration between data programmers at TBCM and NHSO to ensure that all variables are included and available for the various users of the system and align with WHO revised framework\(^\text{23}\). Access to TBCM should be open for all end users to extract data from necessary variables.

c. Increase technical and administrative support for the growing demands of a fully developed and improved TBCM. 24/7 technical support should be considered to provide the capacity required for a highly functional system.

3. **To improve data quality and coverage**, The MOPH/DDC/BBT should increase coverage, completion and usage of TBCM by:

a. reconsidering enforcing compulsory notification of TB data through the Communicable Disease Law

b. commissioning an inventory study to be conducted in the non-public sector, including private, academic and military (as recommended in 2013). The inventory study should quantify the number of TB cases diagnosed and treated outside the public sector, and produce recommendations to facilitate the implementation of TBCM (or a skeleton version thereof) across the country and in all sectors.

c. Strengthening QC and QA systems by ensuring that Standard Operating Procedures are available and implemented at every point of data entry, e.g.

   i. cross referencing of data between paper records and electronic records (where applicable)

   ii. Developing computer generated cross checking, e.g. for entry of MDR TB treatment regimen, the patient must be registered as an MDR TB patient;

   iii. Including system generated flagging of data that is overdue or missing

d. Dedicating data managers to routinely monitor and ensure adequate and accurate implementation of QC and QA protocols at district level and data entry level.

e. Increasing motivation among staff to ensure complete and accurate data entry, e.g. by minimizing multiple data entries and providing automatic, relevant and regular feedback reports to point of data entry and patient care.

f. Linking TBCM with vital registration of the Ministry of Interior for capturing of deaths.

4. **To provide essential human capacity** on M&E at BTB, at least two fully qualified staff, skilled in data management and epidemiology should be recruited. They can then lead:

a. Production of an annual NTP report and make it available to all stakeholders and collaborators. It should include a critical analysis of the data at national and sub-national level to assess trends and geographical distribution of case finding and treatment outcomes by age group and sex as well as risk groups (prisoners, migrants, health care workers, PLWHA, diabetics). The report should also describe the relevant accomplishments of the NTP in relation to the data such as the roll out of molecular testing in certain areas thereby influencing TB case finding or diagnosis of drug resistant TB in those areas.

b. The data manager should work closely together with the IT technical support department of TBCM to ensure that necessary variables are collected in TBCM and that data is interpreted correctly. S/he should also ensure that comparative, historical data is preserved.

c. To finalise the 2012 Prevalence Survey and publish and distribute the report.

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8. Financing and programmatic sustainability

Funding for TB service provision comes from three main sources, namely the health insurance schemes of which the UCS, managed by the NHSO, is the largest, the Global Fund, and the MOPH.

**National funding of TB control efforts**

Of the three national insurance schemes, only the NHSO lists TB as a diagnosis related group (DRG) category for which a specific reimbursement channel is in place. The NHSO covers about 70% of the Thai population, and within certain more or less clearly defined categories, covers the costs of TB diagnosis, treatment care and prevention for their population. For both the Social Security Scheme (SSS), and the Civil Servants’ Medical Benefits Scheme (CSMBS) there is no TB specific reimbursement programme. The SSS covers about 15% and the CSMBS about 10% of the national population. For about 25% of the population, therefore, there are no available data on the costs incurred by them for TB-related interventions (or on their outcomes).

The NHSO has a TB Disease Management Program which monitors the NHSO’s expenditure on TB and also plans for the year ahead, including the application of targets for all cost categories. Communication with BTB appears minimal. Through its own TB Data Hub, NHSO obtains information on all patients treated, with a focus on the interventions delivered, the costs of those interventions, and reimbursement to the relevant authorities. As mentioned in Section 7, the Data Hub can receive data from BTB’s TBCM. The NHSO has provided training on national guidelines for the treatment of TB in order to encourage clinicians to provide the correct diagnostic procedures and the right treatment. It also monitors the treatment regimens used in most cases.

The TB specific budget is for Thai nationals only under the UCS and covers the costs of treatment of TB, both first and second line, including preventive treatment for child contacts (Table 7). The capitation fee for out-patients covers the cost of initial diagnosis. The laboratory costs for the follow-up of all cases are covered, as well as the diagnosis of MDR-TB and follow-up cultures for MDR cases. However, these services are only for those already identified as TB patients and do not cover the cost of CBNAAT tests used for simultaneous initial diagnosis of TB and rifampicin resistance. The costs of follow-up care are also provided.

**Table 7. The UCS package for TB patients in 2017. Source: NHSO.**
In the fiscal year (FY) 2016, the NHSO budget for TB care services was over THB 267 million and assumed a target of 56,900 cases (Table 8). For FY 2017, the budget is over THB 434 million – a massive increase of 61% for 83,453 cases. The bulk of the funding in 2016 (66%) was for drugs – both first and second line. DOTS activities were the next largest budget line at about 16% of the total. Yet, case finding in the general population and in prison were both behind target in 2016, with 44% and 41% of the target achieved, respectively (data not shown).

**Table 8. Budget of the NHSO’s TB Management Programme, 2016-2017.** *Source: NHSO*

The NHSO data show a very slow take up of laboratory tests for MDR-TB, especially in follow-up cultures for MDR-TB cases. This is because few MDR-TB patients are diagnosed and because either
those needing follow-up cultures do not get them, or the follow-up tests are not captured by the NHSO system. MDR-TB diagnoses would be increased significantly if the CBNAAT tests were used for initial diagnosis as the NSP recommends.

The NHSO data are a rich source of information that is under-used. Better understanding of the context and meaning of the data would help both NHSO and BTB. Cooperation between the two agencies in making future plans is crucial to align their two bodies of work and would generate synergies. For example, if they set case finding targets together, BTB could then plan more precisely how to meet those targets, and focus its efforts on poorer performing regions, while encouraging more accurate collection of data which would benefit NHSO (the NHSO staff expressed concerns that the TBCM data that are uploaded to their Data Hub contain too many errors). The current BTB Manager is making efforts to redress the previously weak relations between BTB and NHSO.

The other two insurance schemes do not provide any TB specific data, so it is not known what their expenditures are on TB treatment efforts. It was assumed by experts we met (none of whom worked for either the SSS or CSMBS) that the bulk of these two agencies’ TB expenditures would be in treatment and diagnosis of individual patients. They assumed that the costs of public health efforts such as active case finding (including greater use of the new molecular diagnostic tests), careful follow-up of patients, financial support during follow-up where necessary, contact tracing, IPT for latent TB infection, and DOTS would not be covered. HIV data, however, has been made available by these schemes, as a result of intense lobbying by the HIV programme, so a similar approach should be possible for TB data.

With respect to TB control, the differences in coverage, as well as knowledge, reporting and data, among the three insurance systems, stand in the way of equitable provision to a high standard of prevention, diagnosis, care and treatment, as well as a better understanding of the TB epidemic in Thailand through more complete monitoring and surveillance of those affected.

**Budget of the Bureau of Tuberculosis Control (BTB)**

Although it is relatively insignificant compared to NHSO’s, the Bureau of Tuberculosis Control (BTB) has its own budget (Table 2), which enables it to remain rather independent of other structures. Its government funding has been the most reliable and regular, in spite of a significant cut after 2012, which has been more or less maintained since. In overall amounts, BTB’s budget from the Global Fund is larger, but it comes more erratically. The reasons for this vary, but for example, recently there was a delay of some months in the agreement to waive customs charges for GeneXpert machines. Other sources of funds are the Thai-US Collaboration (TUC) with CDC, Atlanta, which mostly funds research projects, and the WHO, as well as relatively small amounts from the NHSO. The annual budget therefore ranges from about USD 1.5 million to 5.5 million. The volatility of the annual budget ought to cause significant management problems, but does not seem to.

Although BTB is responsible for TB control policy development, it is not engaged in monitoring national TB budgets, funding or expenditure.

**Table 2. Annual budget by source and year of BTB, MOPH.** *Source: BTB, but it is unclear if these represent budget or expenditure figures.*

<table>
<thead>
<tr>
<th>FISCAL YEAR</th>
<th>GOV. BUDGET (THB)</th>
<th>NON-GOV. BUDGET (THB)</th>
<th>TOTAL (THB)</th>
<th>TOTAL (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GF</td>
<td>TUC</td>
<td>WHO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(34 THB per USD)</td>
<td></td>
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</tbody>
</table>
### International financial support

The Global Fund has provided USD 58.96 million for TB control efforts in Thailand over the past decade, mostly focused on high risk and vulnerable populations and empowering communities. All these TB grants are now complete, with grades of B1 to A1. Two TB/HIV grants are still active, one through DDC, MOPH and one through the Raks Thai Foundation. The former was signed for USD 21.5 million and the latter, USD 22.2 million, with USD 13.2 and 11.6 million disbursed, respectively. Since disbursement is running at about half the expected rate for both grants, no-cost extensions have been agreed until the end of 2017. In 2016 approximately USD 6 million was provided by the Global Fund.

While it was originally believed that Global Fund support would stop at the end of 2017, it has recently been understood that it could potentially continue beyond 2017 for perhaps as long as 10 years. However, the allocation for Thailand will be significantly less than currently and will drop to about USD 4 million annually by 2018, and is likely to keep getting smaller. For a high burden country like Thailand, the funding provided by GFATM is already a relatively small amount and will fall further, but it is supporting key activities, such as drugs for MDR-TB in migrants and uninsured patients. As Global Fund support falls, therefore, the issue arises of whether the MOPH will step in to compensate for the reduced funding. Meanwhile, the Government is pondering whether to transition out of Global Fund support. This, and when it might do so, is now being debated by MOPH staff, and the CCM. Civil society has made it clear that it wishes to apply to the next round.

In 2015, BTB’s income was approximately $5 million from MOPH, Global Fund, TUC, and WHO, combined. Assuming similar amounts for 2017 as in the 2016 budget or BTB, the total estimated national budget for TB control in 2017, is about $21 million (excluding staff costs). The Global Fund makes up about 28% of the total known allocations for TB control in the country, which supports active case finding and diagnosis using the new molecular tests, patient support and latent TB management using IPT.

Transition planning will look at financing as one aspect, programme sustainability of active case finding, and all other aspects of Ending TB which are not health facility based – including registration of new drugs, higher cost of procurement in Thailand due to its upper middle income status etc. also need to be discussed.

### Recommendations

1. Between 2017 and 2019, the MOPH should consider a transition away from the Global Fund for TB control to avoid duplication and distortion of systems at PR-DDC and within BTB, but any such move should be accompanied by a Government commitment to fund its End TB response fully, as expressed in the NSP, 2017-2021.

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<table>
<thead>
<tr>
<th>Year</th>
<th>TB Control</th>
<th>HIV Control</th>
<th>TB Services</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>75,590,760</td>
<td>99,457,646</td>
<td>2,561,572</td>
<td>5,223,823</td>
</tr>
<tr>
<td>2013</td>
<td>46,318,076</td>
<td>893,758</td>
<td>2,424,331</td>
<td>1,459,887</td>
</tr>
<tr>
<td>2014</td>
<td>46,683,355</td>
<td>667,100</td>
<td>1,308,585</td>
<td>1,431,148</td>
</tr>
<tr>
<td>2015</td>
<td>45,002,791</td>
<td>114,922,080</td>
<td>14,503,366</td>
<td>5,171,030</td>
</tr>
<tr>
<td>2016</td>
<td>52,880,290</td>
<td>65,287,836</td>
<td>2,830,331</td>
<td>3,558,778</td>
</tr>
</tbody>
</table>
2. The MOPH should press for TB-related expenditure and programme performance to be tracked across all 3 health insurance agencies, as is the case with HIV – including by having TB as a DRG. The International health policy programme (IHPP) should carry out a national TB spending assessment as part of the National Health Accounts. BTB, as part of its policy development mandate, should develop mechanisms to monitor national TB budgets, funding and expenditures over time.

3. The MOPH should make maximum use of the currently available, but limited, Global Fund resources to ensure that innovations in TB diagnosis and treatment are introduced, health and information systems are fully aligned, and partnerships with the public/private sector and CSOs are strengthened.

4. The DDC/MOPH should engage with NHSO to ensure that the costs are covered for using the new, rapid molecular diagnostic tests, e.g. CBNAAT tests, for initial diagnosis of TB and simultaneous rifampicin resistance testing, and in expanded active case finding, as planned in the NSP, 2017-2021. This will require the collaboration of BTB and NHSO so that the NHSO appreciates what the NSP aims to achieve, be fully convinced of the vision, and plan its resources to support that vision.

9. Programme management
The Review Team observed some major achievements in TB control, but also some surprising gaps. While Thailand has achieved almost universal health coverage, as a result of making low-premium health insurance available to all the Thai population (the UCS), and has met the Millennium Development Goal for tuberculosis, namely reducing incidence, it did not meet the Stop TB Goals of halving by 2015 the TB prevalence and mortality rates of 1990. Treatment success for new smear positive cases has increased from 76% in 2007 to 80% in 2015, but this is still well below the WHO target of 85%. The review concludes that leadership of the NTP needs significant strengthening and the quality of TB case management needs to be significantly improved. BTB is key to the former under the current structure, but other agencies need also to play their part.

BTB’s role in managing the national TB programme – findings and challenges
The remit of the Review did not directly address the role of BTB, but the “analysis of achievements and constraints” in delivery of PMDT, the organisation of the lab network and the response to the recommendations of 2013, which are in our terms of reference, all require a focus on BTB.

Leadership
The key issue is leadership. BTB has in recent years not led the changes required to set up and manage a modern approach to control of TB, nationwide. BTB staff expressed to the Review Team a reluctance to engage in discussions with clinicians about TB diagnosis and treatment because they are mostly public health staff, trained only in public health. Furthermore, BTB is mostly unengaged in policy debates on the directions of future TB control, e.g. in the regulation of TB activities in academic and private hospitals and in the need for IPT in people living with HIV and AIDS (PLHA). As mentioned in section 3.1 and Section 7. there have been serious delays in producing essential analytical work and policy guidance for which BTB is responsible.

Already, as TB care is largely provided by the hospitals and funded by NHSO, the public health elements of TB control, which cannot be carried out by hospitals, need to be maintained. These include contact tracing, active case finding, provision of IPT (or newer forms of preventive treatment that are becoming available), monitoring and evaluation, and often, training of clinical staff in TB
service provision. As the support from the Global Fund diminishes, BTB should be championing the cause of TB control and ensuring that government provides support in the priority areas currently covered by the Fund, as well as the public health elements of TB control. BTB should therefore be leading by advocating for TB within the MOPH, working on multi-sectoral engagement and across other relevant ministries, and ensuring programmatic sustainability.

The BTB’s Programme Manual/Treatment Guidelines is the key document for BTB to take the lead in TB control. It should incorporate new technical advances or system approaches and disseminate them to the clinical services. The current manual needs revision - which is already underway. BTB has, with external support, prepared its NSP, 2017-2021, which lays out the new directions needed for TB control in the coming years and it has been endorsed by MOPH. However, the Review Team found that it is not well known or understood among key stakeholders and not yet being acted upon by frontline health workers.

BTB’s isolation in its purpose-built compound in South Central Bangkok militates against its timely engagement with the policy issues of the day in the MOPH in Nonthaburi, and its collaboration with other agencies.

**Staffing**

As mentioned in Section 3, the BTB is comparatively large, with some 120 staff in Bangkok alone, yet some key units are seriously understaffed e.g. the Surveillance and Data Development Unit (Section 7), and the Laboratory Unit (Section 4). In spite of the 5th JIMM’s recommendations in 2013 to address the gap, the capacity of BTB to carry out analytical work and policy development remains limited. Furthermore, there is a relatively large unit which monitors the flow of money from the Global Fund and records the expenditures and resultant outputs and outcomes – duplicating routine monitoring and evaluation systems.

**Processes and linkages**

Supervision visits are the vehicle for BTB staff to meet clinicians and expose them to modern thinking and international recommendations, but these visits are too limited. The review team observed that clinicians were reluctant to use the new CBNAAT tests. While BTB staff visit all ODPCs twice per year, they concentrate mostly on drug supplies and related issues. They rarely go beyond the provincial level to visit hospitals and health centres. Their understanding of what is going on in the field is therefore limited.

In future, TB control efforts will require not only technical advances, but also much more social support to patients who will increasingly have more drug resistance, more comorbidities and are likely to be older. Social support to TB cases will require collaboration of the NTP with the social protection and social welfare mechanisms, such as all the health insurance agencies. BTB will need, more and more, to engage with these social and economic issues if TB patients are to get the benefits to which they are entitled.

**Patient-centred care and DOT**

The review team is also concerned about the quality of the day to day management of patients within the care system for cases of TB. Treatment success was well below the recommended 85% in many districts, and only 80% nationwide, in new and relapse cases, in the most recent cohort of patients who have completed treatment. In the Regions visited it appeared that self-administered treatment and family DOT were associated with high death and default rates. In some regions (e.g. ODPC 9), patients were usually supervised at hospital level.
Patient-centred, effective, DOT is therefore not being provided everywhere. One of the review teams met a patient who had defaulted three times before finally completing treatment, but not before he had sustained severe damage to both lungs. This patient’s course was complicated by alcohol abuse, but, until the final course of treatment, he was provided with self-administered treatment because he lived some distance from the district hospital, which he had to attend to renew his prescription. Yet he lived 60 metres from a sub-district health promotion hospital (HPH), which had four community health assistants working in the local community. Only when starting his fourth course of treatment was it decided that a practical solution to his adherence problem was that someone from the HPH could supervise his treatment.

The review team observed hospitals providing “DOT” at the hospital 5 times weekly, or once per week, or even just once per month. This is not DOT. Hospitals insist the patient comes for sputum testing, rather than transporting the sputum. This is not patient-centred care either, rather it is “hospital-centred” care. While we were informed of village health volunteers providing DOT for some patients—usually the evening dose for MDR-TB cases, and mostly in the intensive phase – this is not consistently done throughout the country, nor through the whole treatment course. Community-based organisations are infrequently used to provide DOT.

A study in ODPC 9 showed that defaulters were generally not made aware of the need to complete 6 months treatment, and had not been informed of the importance of doing so, even when they started to feel better. In spite of high rates of default in some districts, there was no systematic method to prevent initial default, such as TB suspect/presumed case registers for those sent from OPD or clinics to the laboratories for sputum (or other) examinations. Because of how reimbursement from NHSO is focused on specific facilities, patients with comorbidities, such as HIV or diabetes mellitus had to attend different facilities at different times for their care – in direct opposition to the WHO TB/HIV guidelines24.

Infection control
The review team were greatly concerned at the number of health workers reported with TB, especially in the large hospitals visited in Bangkok. For example, there were 6-8 TB cases reported among health care workers every year at Klang Hospital with 1552 staff (including administrative staff), yielding a rate of TB probably greater than 500/100,000 health staff, or three times the national incidence rate. And health workers often do not report their illnesses to their place of work for fear of stigmatization, so this could be an under-estimate. More worryingly, these rates were seen AFTER infection control (IC) measures were implemented in 2012 (e.g. establishment of a TB ward with mechanical ventilation). Vajira hospital had similar high rates of occupational TB. TB patients are admitted in general wards, where they may sit for several days while investigations are done (unnecessarily slowly) until a positive sputum smear result comes back. It is therefore usually the nursing and ancillary staff on general wards and in emergency departments that are most at risk — not to mention other patients.

ACF and public-public mix approaches
With many districts notifying less than the national incidence rate, the review team found that the need for active case finding (ACF) was well understood, and ACF efforts appeared to increase

notifications in some Regions visited - and ACF is crucial for achieving Thailand’s End TB Strategy goals. However, districts with low success rates need, as a priority, to increase their success rates.

The private and military hospitals visited by the Review Team were diagnosing and treating TB, but they were mostly uninvolved in the public health aspects of TB control, namely ensuring follow-up and DOT of patients, providing social support where necessary, assessing household contacts for infection and disease, and provision of IPT, and active case finding. The staff in these hospitals appeared committed and very competent and were interested in providing more services for TB, yet they had not seen anyone from BTB for 3 to 4 years. The Review Team found very little evidence of collaboration of public sector TB control with NGOs and community based organisations, even when there were clearly difficulties in ensuring DOT and high treatment success rates.

**Limitations to what BTB can do**

In the paragraphs above, several shortcomings in Thailand’s recent response to its TB burden have been described, mostly from the point of view of BTB. BTB, however, is not the sole agency responsible. As stated previously “TB care is largely provided by the hospitals...”, therefore the hospitals, and the agencies responsible for public hospital performance, namely, the Office of the Permanent Secretary and, in the case of other health facilities, the Department of Medical Services, are also responsible, especially for initiating change in care facilities. BTB should work to bring the issues to the attention of these offices and departments, and help with implementing solutions and monitoring results. BTB should therefore be developing constructive relationships with its “colleague agencies” within the MOPH, and vice versa.

With the establishment of the NHSO to run the UCS, the authority of the MOPH to make changes is reduced, since power and authority is closely linked to funding. When a funding agency has large amounts of funding to support an activity, it can easily, often by default, set policy, eg UNICEF in the 1960s and 1970s. NHSO has financial control in TB and, presumably, in other diseases. Therefore BTB cannot be alone in trying to address how to work with NHSO jointly to set policy and targets and make plans. BTB should explore with DDC and other disease control programmes how best to work with NHSO to achieve implementation of the right policies. The review team observed an openness on the part of NHSO to work with BTB, which deserves a response from BTB. See recommendation 8.4 above, for the example of laboratory testing policy.

With respect to Bangkok, the recommendation from 2013 to “hold discussions with the BMA to (re-) establish clear regulatory control over non-BMA facilities with respect to TB reporting and case management”, may have taken place, but these discussions do not appear to have resulted in any major change to improve the performance of non-MOPH, non-BMA hospitals in TB control. Again, BTB cannot be alone in trying to address performance problems in Bangkok, and should look for support from DDC and above in the MOPH.

**Recommendations**

1. The DDC should
   a) establish the National TB Prevention and Control Committee to support BTB to strengthen links within the health sector, e.g. with National AIDS Programme, NCD programmes, and inter-sectoral links e.g. with Ministry of Justice and the military, and use it to drive improved collaboration with the private sector and to monitor progress of the NSP.
   b) DDC should also prepare a plan, in consultation with all stakeholders, to support BTB sufficiently to carry out this role, including additional staff and finances commensurate with the needs to implement the NSP 2017-2021, including sufficient senior clinical staff to enable BTB to engage with clinicians especially in large hospitals;
c) coordinate with the Office of the Health Inspector and ODPCs to increase case notifications by screening (and reporting) more patients in the routine system, in particular by introducing new rapid diagnostic tests as the first line test for TB detection (which will also increase MDR-TB detection and use the expanding stock of cartridges) as stated in the NSP, 2017-2021,

d) ban routine admissions so as to reduce the infection risk for clinical staff, ancillary workers and other patients; carry out infection control assessments of hospitals / health care centres, e.g. IC assessments should be carried out in all Bangkok hospitals that have not had one in the past 5 years, and install mechanical ventilation and UVGI systems as necessary.

2. BTB should
   a) revise the NTP manual/treatment guidelines by mid-2017 through consultations and discussion, but ensuring that BTB maintains control over the process; increase dissemination of this manual to increase awareness of the private sector, specifically in the screening and use of new diagnostics for DR-TB and monitoring them through appropriate national/ sub-national administrative bodies. The BTB should pursue improved DOT and retrieval of lost patients in the private sector through coordination with ODPCs and, in Bangkok, the BMA.
   b) carry out a major training initiative for front-line clinical workers to create awareness of the NSP 2017-2021, and thoroughly disseminate the concept that - “Failing to cure the patient is a failure of the system – not of the patient”;
   c) Improve treatment monitoring and follow-up (DOT) by following WHO guidelines, banning self-administered treatment, expanding health worker DOT, introducing lay-provider DOT, and investigating alternative methods to face-to-face DOT, e.g. video DOT.
   d) expand its work on the “Public-public mix” to ensure good treatment practices are supported in the non-MOPH government hospitals such as the police and military facilities by assisting them with ways to provide better DOT and retrieval of lost patients;
   e) coordinate with village health volunteer networks and NGOs and CBOs, and define the roles they can play as partners in supporting care for the Thai population, as well as migrants, and actively involve them in advocacy, counselling, patient support – DOT and patient retrieval in case of missed doses – and palliative care, e.g. through WHO’s “Engage TB” initiative. BTB should draw up a plan in collaboration with NGOs and CBOs to expand the latter’s involvement in TB care, prevention, diagnosis and treatment in the context of the NSP. The plan should form a key part of the proposal to the Global Fund in 2017;
   f) monitor infection control activities by tracking IC assessments of key facilities and the numbers of health workers developing TB; implement internationally recommended guidance on infection control

3. ODPCs should reduce TB case fatality and default by
   a) Ensuring that there are regional and provincial TB officers, with clearly demarcated responsibilities for TB activities in their areas;
   b) strengthening patient centred care in low success rate districts (before expanding active case finding);
   c) establishing collaboration with the private hospitals that do not report cases, and
d) strengthening collaboration with CSOs, (e.g., through WHO’s “Engage TB” initiative) to enhance both case finding and treatment success.

10. Limitations of this Review

Organization of the Review
- Only one day was allotted to issues in Bangkok, which for such a major centre, is insufficient, and did not allow the review team enough time for detailed examination of TB control performance there.
- The agenda did not allow sufficient time to address the term of reference: “Issues of equity and access for populations who do not have access to universal health coverage should be specifically considered.”
- Only a tiny proportion of the laboratories doing TB work could be visited.
- A finance expert would have been useful for addressing the funding issues.

Data systems
Data collection systems were fragmented between different databases collected by different agencies for different purposes.

- A detailed comparison of all datasets was beyond the capacity of this review.
- Similarly, time did not allow for a detailed comparison of province/ODPC performance.
- Monitoring and evaluation data were unavailable from SSS and CSMBS.
- More attention could have been paid to subsets, such as Thais/non-Thais, had this been made clear it was wanted at an earlier stage.
Annex 1
Main Messages from the International Mini-Review of the Thailand National Tuberculosis Programme, December 6-16, 2016, for His Excellency, The Minister of Public Health

Objectives of the Mini-Review
- To review overall progress since the 2013 review
- To assess provision of care for multi-drug resistant (MDR) TB cases and the TB laboratory network.
- To evaluate the implementation of the National Strategic Plan (NSP), 2017-2021,
- To review the sustainability of TB control efforts when the Global Fund support ends,
- To revise the epidemiological analysis of TB, and the system of monitoring and evaluation.

Organization
Three teams of international and Thai experts went to 3 Regions outside Bangkok, and several facilities in the capital:

Recent achievements in TB Control
- Achieved almost universal health coverage
- Met the MDG for TB (reducing incidence)
- 320,000 cases treated successfully since 2010
- Prepared an NSP for control of TB, 2017-2021
- Developed a case-based, electronic recording and reporting system and now piloting it online
- Of 21 major recommendations from the 2013 Review, 4 were fully achieved, 13 were partly achieved, while 4 were not done at all.

Major findings of the Mini-Review
- Burden of TB in Thailand is still high (119,000 new cases and 11-12,000 deaths in 2012)

Major issues identified by the Mini-Review
1. BTB has not received the human and financial resources necessary to implement the 2013 recommendations fully.
2. Nationwide system of MDR-TB diagnosis and care has been established, but only 20% of MDR-TB cases have been notified as starting treatment.
3. The NSP 2017-2021 is ready to be implemented, and includes using the rapid molecular diagnostic tests routinely to diagnose both TB and MDR-TB.
4. Treatment success in 2016 was well below the 85% target in many districts owing to weak follow up.
5. Clear understanding of the national TB burden is limited by multiple data collection systems each requiring its own data entry.
6. Thailand needs to plan now for the end of Global Fund support.

Recommendations
1. The DDC, MOPH should
   - support BTB with additional staff and finances;
   - establish the National TB Prevention and Control Committee to support BTB to strengthen health sector and inter-sectoral links, and to monitor the progress of the NSP;
   - BTB should revise the NTP manual by mid-2017 and carry out a major training initiative for front-line clinical workers to create awareness of the NSP 2017-2021, and disseminate the concept that - “Failing to cure the patient is a failure of the system — not of the patient”
2. The DDC, MOPH should also
   - introduce new rapid diagnostic tests (e.g. Cartridge based Nucleic Acid Amplification tests, CBNAAT) as the first line test for TB detection (which will also increase MDR-TB detection);
   - expand the number of diagnostic machines to about 150 and introduce specimen transport.
• enlist the help of FIND and other partners to negotiate the discount rate for cartridge-based tests to which high burden countries are entitled.
  1. ODPCs should
• reduce TB case fatality and default by strengthening patient centred care in low success rate districts,
• establish collaboration with the private hospitals that do not report cases, and
• strengthening collaboration with CSOs, to enhance both case finding and treatment success.
  4. BTB should agree on a unified surveillance system for TB cases with single data entry and have it working nationwide by 2018 producing high quality data.
  5. MOPH needs to increase budget allocations for items currently covered by the Global Fund.

Annex 2.
Main Messages from the International Mini-Review of the Thailand National Tuberculosis Programme, December 6-16, 2016, for His Excellency, the Governor of Bangkok

Objectives of the Mini-Review
1. To review progress in TB control at the national level, and in Bangkok, since the previous review (2013) and assess the status of the current program and of monitoring & surveillance (M&S).
2. To provide practical recommendations to the Thai National TB Program and the Bangkok Metropolitan Administration (BMA) to ensure sustainability of achievements, and to strengthen future control measures.

Organization
Three teams of international and Thai experts visited sites in Bangkok, December 13, to address the TB control programme and M&S system.

Recent achievements in TB Control in BMA facilities
• About ten thousand TB cases notified per year since 2010.
• Amongst smear positive TB patients, treatment success rate in BMA is 90% but in non-BMA hospitals it is <80%.
• Hiring 22 health assistants to collect data, thus increasing notification of TB cases up to three-fold, yet only 1 / 4 academic hospitals are reporting data to BTB.
• Awareness of airborne infection control has increased among BMA facilities
• Establishing a TB Referral Centre is a step in the right direction to improve treatment care.

Major findings of the Mini-Review nationally
• BTB is not receiving the support needed to address TB control
• Insufficient notification of MDR TB cases
• The new NSP 2017-2021 needs to be implemented and the use of new rapid molecular diagnostics increased
• Provision of TB care needs to be patient-centred

Major program issues identified by the Mini-Review in Bangkok
1. While progress has been made to improve TB control in Bangkok insufficient coordination with BTB persists. TB care and treatment in private hospitals needs further improvement.
2. To maximise treatment adherence, care needs to be more convenient for patients (patient centred care) which requires greater financial and human resources for TB control.
3. New rapid molecular tests are available to detect TB and drug resistant TB. Well equipped hospitals should share their laboratory facilities with less equipped hospitals.
4. The inability of private hospitals to deliver patient centred care results in unacceptably low success rates and high default rates. We observed 20% default rates in smear negative and 11% in smear positive patients in one hospital visited.
5. TB case rates were up to three times higher that of the general population in health care workers in the hospitals visited in Bangkok despite some improved infection control measures.
Recommendations

1. The Mini-Review supports city-wide coordination of TB control for the city of Bangkok through closer collaboration with BTB. Further coordination is required between BMA’s Department of AIDS, TB and STIs Control Division and the Institute for Urban Health, BTB and ODPC13.

2. To improve patient centred care, the BMA should enable the patient to receive care at a time and place that is convenient to the patient; 1) Enable co-management of common comorbidities at a single health facility (e.g. TB, HIV and DM); 2) significantly increase referrals to the TB Referral Centre; and 3) improve specimen transport. BMA should join with MOPH, NGOs and CBOs to develop specific patient centred strategies for improving care. Test and pilot innovative ideas such as Video DOT and SMS reminders.

3. To improve detection of TB and drug resistant TB the BMA should extend the use of molecular methods for diagnosing TB and drug resistant TB as directed by the NSP. Collaborate with BTB to train health care staff on the appropriate use of molecular methods for diagnosis of TB and MDR TB.

4. To improve quality of care for TB at academic and private hospitals the BMA should ensure improvement of TB services at private and academic services through regulation, particularly patient centred care and recording and reporting.

5. To reduce TB among Health Care workers the BMA should commission infection control assessment of health care facilities by airborne infection control specialists and act on the recommendations.