2nd Review of the National Tuberculosis Programme in Thailand

July 1999

Department of Communicable Disease Control
Ministry of Public Health
Thailand
&
World Health Organization
2\textsuperscript{nd} Review of the National Tuberculosis Programme in Thailand

10-23 July 1999

Department of Communicable Disease Control
Ministry of Public Health
Thailand
&
World Health Organization
# Contents

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXECUTIVE SUMMARY</td>
<td>3</td>
</tr>
<tr>
<td>MAJOR RECOMMENDATIONS</td>
<td>5</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>6</td>
</tr>
<tr>
<td>Objectives</td>
<td>6</td>
</tr>
<tr>
<td>Methodology</td>
<td>7</td>
</tr>
<tr>
<td>GENERAL INFORMATION ON THAILAND</td>
<td>8</td>
</tr>
<tr>
<td>Geography</td>
<td>8</td>
</tr>
<tr>
<td>Population</td>
<td>8</td>
</tr>
<tr>
<td>Economy</td>
<td>9</td>
</tr>
<tr>
<td>Government and administration</td>
<td>9</td>
</tr>
<tr>
<td>EPIDEMIOLOGY OF TB</td>
<td>9</td>
</tr>
<tr>
<td>Long term epidemiological trends</td>
<td>9</td>
</tr>
<tr>
<td>Estimates of total disease burden</td>
<td>9</td>
</tr>
<tr>
<td>Case notifications</td>
<td>10</td>
</tr>
<tr>
<td>Regional differences</td>
<td>10</td>
</tr>
<tr>
<td>Impact of HIV</td>
<td>11</td>
</tr>
<tr>
<td>Drug resistance</td>
<td>11</td>
</tr>
<tr>
<td>Future trends</td>
<td>12</td>
</tr>
<tr>
<td>ORGANIZATION OF TB SERVICES</td>
<td>13</td>
</tr>
<tr>
<td>POLITICAL COMMITMENT</td>
<td>15</td>
</tr>
<tr>
<td>DOTS coverage and expansion</td>
<td>15</td>
</tr>
<tr>
<td>Adherence to Policy</td>
<td>16</td>
</tr>
<tr>
<td>Human Resources</td>
<td>16</td>
</tr>
<tr>
<td>Budget of the NTP</td>
<td>17</td>
</tr>
<tr>
<td>Recommendation</td>
<td>17</td>
</tr>
<tr>
<td>Training</td>
<td>18</td>
</tr>
<tr>
<td>Recommendations</td>
<td>18</td>
</tr>
<tr>
<td>Supervision</td>
<td>19</td>
</tr>
<tr>
<td>Recommendations</td>
<td>19</td>
</tr>
<tr>
<td>Advocacy</td>
<td>20</td>
</tr>
<tr>
<td>Coordination with other health sectors</td>
<td>20</td>
</tr>
<tr>
<td>Recommendation</td>
<td>20</td>
</tr>
<tr>
<td>DIAGNOSTIC AND MICROSCOPY SERVICES</td>
<td>21</td>
</tr>
<tr>
<td>Health Education</td>
<td>23</td>
</tr>
<tr>
<td>Recommendations</td>
<td>23</td>
</tr>
<tr>
<td>TREATMENT SERVICES AND CASE MANAGEMENT</td>
<td>26</td>
</tr>
<tr>
<td>Recommendations</td>
<td>28</td>
</tr>
<tr>
<td>DRUG SUPPLY AND LOGISTICS</td>
<td>29</td>
</tr>
<tr>
<td>Recommendations</td>
<td>29</td>
</tr>
<tr>
<td>MONITORING</td>
<td>30</td>
</tr>
<tr>
<td>Recording and reporting system</td>
<td>30</td>
</tr>
<tr>
<td>Recommendations</td>
<td>32</td>
</tr>
<tr>
<td>Operational Research</td>
<td>32</td>
</tr>
<tr>
<td>Recommendations</td>
<td>33</td>
</tr>
<tr>
<td>ANNEX</td>
<td>34</td>
</tr>
<tr>
<td>Annex 1: TB Control in the Bangkok Metropolitan Administration</td>
<td>35</td>
</tr>
<tr>
<td>Annex 2: Smear Microscopy Quality Assurance (QA)</td>
<td>44</td>
</tr>
<tr>
<td>Annex 4: Team members, list of places visited and people met</td>
<td>51</td>
</tr>
<tr>
<td>Team Members</td>
<td>51</td>
</tr>
<tr>
<td>Places Visited</td>
<td>52</td>
</tr>
<tr>
<td>People Met</td>
<td>53</td>
</tr>
<tr>
<td>Annex 5: Organization of the Ministry of Public Health</td>
<td>58</td>
</tr>
<tr>
<td>Annex 6: Abbreviations</td>
<td>58</td>
</tr>
</tbody>
</table>
EXECUTIVE SUMMARY

Introduction

In 1995, the Government of Thailand and the World Health Organization (WHO) conducted a review of tuberculosis (TB) control activities, which revealed that case detection rates and treatment outcomes were unsatisfactory, due to centralization of treatment services, and lack of directly observed treatment. Based on the recommendations of that review, DOTS (Directly Observed Treatment, Short Course) was introduced in Thailand in 1996, and has gradually expanded across the country. DOTS is a five point strategy for effective TB control consisting of political commitment, diagnosis based on sputum smear microscopy, standardised drug regimens, adequate supplies of drugs and other materials, and close monitoring. The objectives of the current review were to assess DOTS implementation, identify reasons for successful implementation and constraints, explore priority areas for further DOTS implementation, e.g. urban TB control, and propose recommendations for expansion of DOTS.

Five teams, comprising ten international experts in TB control from WHO and institutions in Europe and Asia, together with 25 national experts from the Ministry of Public Health (MoPH), the Bangkok Metropolitan Administration (BMA), the Anti TB Association of Thailand (ATAT), the Department of Corrections, major universities, and senior TB consultants, visited 20 provinces and districts including the Bangkok metropolitan area. The teams interviewed health personnel at all levels, TB patients and community members, and collected and analysed information on the structure, process and outcome of DOTS implementation.

Burden of TB

Approximately one third of the population of Thailand is infected with TB. Nearly 100,000 people suffer from active TB every year, including 37,000 who have infectious disease, and spread the bacteria to the community. Regional variations in incidence are considerable, due to migration of people from rural areas to cities, and the HIV epidemic. Nearly 20% of people with TB live in Bangkok. HIV and multi-drug resistant (MDR) TB both contribute to a high mortality from TB. Approximately 15% of TB patients in the country have HIV, which results in a high death rate in some regions, particularly in the north of Thailand where 40% of TB patients are co-infected with HIV. Due to improper use of anti TB drugs in the past, one in 50 new TB patients already has MDR TB. Treatment of MDR TB is expensive, toxic, and few patients are cured. Failure to effectively implement DOTS will increase the epidemic of MDR TB.

Status of DOTS Implementation in Thailand

Thailand can rapidly reduce the high burden of TB by achieving the global targets for TB control. The number of people developing TB will be halved within 15 years through countrywide and effective expansion of DOTS, and will protect the current generation of children from the growing threat of MDRTB.
DOTS is internationally recognised as the only effective strategy for controlling TB. The
government of Thailand has expanded this strategy to cover 74 provinces and 364 districts by
mid 1999, equivalent to 40% of the country. This was possible as the budget for TB control
activities was maintained despite the economic crisis. This demonstrates considerable
national commitment to improving TB control in Thailand.

In general, all of the key components of the DOTS strategy are in place. Sputum smear
eexamination is the main tool for diagnosis of infectious TB, and requires a comprehensive
quality assurance system. This is being developed, based on models tested in the country. A
key component of the DOTS strategy is supervision of treatment, and several alternative and
innovative methods of direct observation of treatment have been developed, involving health
personnel, community volunteers and family members. There is a high level of patient
satisfaction with DOTS, and health personnel are enthusiastic and motivated to deliver high
quality care to their clients.

Successful implementation of DOTS has resulted from:

- Utilisation of the strong health care infrastructure
- Coordination between the district hospital and the district health office
- Extensive training of health personnel at all levels
- Decentralization of treatment to health centres
- Frequent contact between health personnel and patients
- Development of a strong system of supervision
- Regular monitoring of programme performance through analysis of treatment outcome
  at regional and provincial DOTS meetings.

The coverage and quality of DOTS implementation varies from province to province,
depending on the political commitment of provincial health authorities. Although 75% of
people are now treated successfully, there is considerable variation between regions with
treatment success rates ranging from 60-81%. A relatively low level of commitment to DOTS
in some provinces has resulted in low coverage, inadequate supervision, and poor programme
performance.

TB in Bangkok

TB control in urban areas of Thailand presents a major challenge due to problems such as
migration, diversity of health care providers and a high burden of HIV and MDRTB. One
sixth of the population of Thailand live within the Bangkok metropolitan area, where an
estimated 15,000 new TB cases occur each year. The BMA system currently reports on only
about 1,500 cases annually. The remaining 90% are managed outside the BMA, mostly by
large hospitals. Treatment outcomes at these hospitals are unsatisfactory with high default
rates (30-50% at the institutions visited), as they do not have the infrastructure to provide
supervised treatment for patients. DOTS has been successfully implemented at a small
number of BMA health centres, with a smear conversion rate in excess of 90%. The BMA
health infrastructure could potentially supervise treatment through a comprehensive system of
health centres and community health volunteers. The BMA has developed a plan for
expansion across the metropolitan area and city-wide coverage will be achieved by the year
2000. Future success of TB control in Bangkok will depend on collaboration between all
major institutions managing patients with TB, with referral of the majority of cases from large
hospitals to the BMA health centres. In order to facilitate this coordination, the BMA will
lead a partnership of health care providers, academic institutions, NGOs and community organisations.

Significant progress has also been made in establishing DOTS in Bangkok prisons, with high treatment success rates. The prison DOTS programme will soon expand to provincial prisons.

Conclusions

Thailand has demonstrated that the DOTS strategy can be implemented and expanded rapidly within a short period. The challenge is to achieve countrywide coverage and reach the national target of 85% treatment success rate. National coverage can be achieved by the year 2001, given the country’s infrastructure and sustained support to TB control efforts. The recent developments in Bangkok give Thailand the opportunity to develop an international model for urban TB control.

MAJOR RECOMMENDATIONS

Based on the results of this evaluation, the review team recommends that:

1. **Thailand achieves countrywide coverage of DOTS by the year 2001. To facilitate this, each province must prepare a plan for phased expansion of DOTS, including their urban areas. Expansion should be based on the capacity of the province to ensure adherence to NTP policies, provide adequate quantity and quality of supervision, maintain quality assurance of sputum smear microscopy, and achieve high cure rates;**

2. **The Office of the Permanent Secretary of the Ministry of Public Health includes monitoring of DOTS in the responsibilities of health inspectors, thereby demonstrating the high priority for TB control and ensuring the quality of DOTS;**

3. **The Bangkok Metropolitan Administration develops and leads the partnership for effective and comprehensive TB control activities in Bangkok.**
INTRODUCTION

The National Tuberculosis Programme (NTP) in Thailand was established in 1966. Tuberculosis (TB) control was implemented as an integral part of the existing general health services as a permanent programme, aiming to provide countrywide services accessible to the population. Control measures focused on BCG vaccination, case finding and treatment of patients. These measures, combined with socio-economic development in the country, contributed to the steady decline in the annual risk of TB infection and reduction in deaths due to TB until the 1980s. The emergence of the HIV epidemic and its close association with TB led to an increase in the notification of TB cases and deaths in the early 1990s. Recognizing the seriousness of the situation, the Government of Thailand and the World Health Organization (WHO) conducted a review of the TB situation and an assessment of the TB control activities in the country in June 1995. The review found that less than 50% of the estimated number of TB patients were notified, and cure rates in these patients were less than 40%, with a high proportion of patients defaulting and being transferred out. To improve this situation and to prevent the further emergence of drug resistance, the review recommended that an effective strategy for TB control be implemented in Thailand.

The Government of Thailand adopted the WHO recommended strategy known as Directly Observed Treatment, Short-course (DOTS) in 1996, with the aim of achieving the global targets for TB control. These are to cure 85% of new infectious cases and detect 70% of infectious cases estimated to occur each year. A policy for TB control was formulated and the strategy was implemented in 8 pilot districts of the North East region. Based on these experiences, DOTS was gradually expanded during 1998 and 1999, covering 364 districts in 74 provinces of the country by mid 1999. The quality of DOTS performance, judged by reports on case finding and treatment outcomes varies widely between regions and provinces. This second review of the National TB programme in the country was conducted in July 1999 to assess the status of DOTS implementation, and to analyse the reasons for success and the constraints to expansion. The purpose was to identify areas for further DOTS implementation and propose recommendations to the Ministry of Public Health on DOTS expansion in the country.

Objectives

The second review of the NTP focused on DOTS districts and in crucial areas where DOTS has yet to be widely implemented, such as the Bangkok metropolitan area. Particular emphasis was given to analysis of discrepancies in the performance of the DOTS districts. The specific objectives of the review were to:

- Assess the status of DOTS implementation and review the adequacy of existing policies
- Analyse the reasons for successful implementation of DOTS
- Identify the key constraints for further expansion
- Explore priority areas and develop plans for TB control in special areas, such as urban populations, and in the Bangkok metropolis
- Propose a system for quality assurance of sputum smear microscopy
- Recommend strategies for further expansion of DOTS in the country.
Methodology

Preparations for the review began in January 1999. The need for the review, justification and areas to be covered were discussed by staff of the TB Division, Zonal TB Directors and WHO. The main objectives of the review were agreed with the Ministry of Public Health (MoPH) in February 1999. A task force chaired by the Permanent Secretary of Health, and consisting of senior officials of MoPH, Department of Corrections, Bangkok Metropolitan Administration (BMA), Anti TB Association of Thailand (ATAT), major universities and senior TB consultants, was convened and met in April to assess the preparations for the review.

Prior to the review, national experts and WHO reviewed the information available on the epidemiology of TB in the country, particularly concerning regional variations. The preliminary findings were presented to all members participating in the review on the first day. The preparations also included work on specific areas such as plans for TB control in Bangkok (Annex 1) and quality assurance of smear microscopy (Annex 2). The following documents were made available for the members of the review team:

- "Battle against Tuberculosis" Tuberculosis Division, Ministry of Public Health
- Draft policy guidelines for the tuberculosis control programme in the Bangkok Metropolis
- Draft guidelines for a laboratory QA system

The review team consisted of 10 international experts from WHO and leading TB control institutions in Europe and Asia and 25 national experts from the MoPH, BMA, the Department of Corrections, major universities, ATAT and senior tuberculosis consultants (see list in annex 4). A briefing meeting was held on 11th July 1999 to review the developments of the NTP, TB situation in Bangkok, organization of health services, TB epidemiology and to discuss the review process and schedule for the field visits. The members were divided into 5 teams, which visited the Bangkok metropolitan area, Central, North, North East and South regions. The teams assessed TB control services in a sample of provincial and district hospitals, health centres, three large hospitals and two prison services in Bangkok. Interviews were conducted with the personnel at these institutions and with Regional CDC centres (4), Zonal TB centres (2), provincial health offices (15), private pharmacies (2), patients (25) and the community. A total of 42 health facilities were visited, 1 provincial hospital, 20 district hospitals and 21 health centres (see annex 4). Structured interviews and questionnaires prepared by the TB Division were utilized. Quantitative data on the case finding, sputum smear conversion and final treatment outcomes were obtained by a careful review of the laboratory and TB registers.

Each team prepared a written report of their field visits, summarizing the findings and recommendations. A detailed oral report was presented by each team in Bangkok during the plenary session. Following discussions a summary of the main findings, conclusion and recommendations was prepared. These were presented to the task force on 21st July 1999, when Mr Kamron Na Lamphun (Deputy Minister MoPH) and Dr Kachit (Deputy Governor BMA) accepted the recommendations. This was followed by a press conference attended by Dr Pichit Rattakul (Governor of Bangkok), Dr EB Doberstyn (WHO Representative in Thailand), Dr A Kochi (Director, Prevention and Control of Communicable Diseases, WHO/HQ), and chaired by the Deputy Minister, Mr Kamron Na Lamphun. The conclusions of the review were disseminated to the press and a statement was released announcing that MoPH and the BMA would join hands in fighting TB (see annex 3). The final report
consolidating the findings and recommendations of all the teams was prepared and approved by the MoPH and WHO.

GENERAL INFORMATION ON THAILAND

Geography

The Kingdom of Thailand, situated in the centre of South East Asia, shares borders with Myanmar to the west and north, the Democratic People's Republic of Lao to the west, north and east, Cambodia to the east, and Malaysia in the south. The country occupies 513,115 square kilometers and is divided into four geographical regions: North, North East, Central and South.

Map of Thailand

Population

According to the most recent data from the National Statistic Office (1993-1997), the total population is 60,816,227 inhabitants equally distributed between males and females, corresponding to a population density of 118 per km². About 17.5% of people live in urban areas. Major ethnic groups are Thai (75%) and Chinese (14%). Distribution of the population by age groups is 16.4% under 5 and 45.1% under 15 years old. The North East region is the most populated region with more than 21 million inhabitants (one third of the country). Bangkok metropolis has an official population of 5,604,772, but many more people are migrants to the city, and the true figure is probably around 10 million. The crude birth rate and crude death rate per 1000 were 16.7 and 5.9 respectively in 1996, giving a natural growth rate of 1.08% per year (excluding in/out migration). Infant mortality rate was 5.2 per 1000 livebirths in 1996. Life expectancy at birth is now estimated around 65 and 70 years for males and females respectively.
Economy

Until 1997, Thailand showed a positive annual growth rate varying from 5.5 to 11.2% but has been seriously affected by the profound economic crisis in 1997-98 and growth fell to -8.0%. The Gross National Product (GNP) per capita has been continuously increasing from 1990 to date reaching more than US$ 2,000 in 1998. The national budget amounted to US$ 20,063 million in 1998 (US$ 30,092 million in 1997), and the proportion allocated to the health sector was 7.5%.

Government and administration

The government of Thailand is a constitutional monarchy. There are 385 representatives elected to the parliament and 255 senators. Bangkok metropolis has its own administrative system (the BMA) and budget which allows development and implementation of its own projects (including health) under the approval of the metropolitan council, as well as from the Ministry of Interior in specific circumstances.

Thailand is divided into 75 provinces (each with an appointed Governor), 876 districts, 7,255 sub-districts and 67,777 villages, directly governed by the Ministry of the Interior. Bangkok metropolis is divided into 46 districts and 152 sub-districts headed by one governor and two councils (Metropolitan and zonal councils).

EPIDEMIOLOGY OF TB

Long term epidemiological trends

Thailand has experienced a continuous decline of the tuberculosis epidemic in the decades following the second world war. The reported mortality from the disease declined tenfold from a rate of 65/100,000 in 1945 to 6.2/100,000 in 1997. The overall socio-economic development of the country in combination with various successful activities of the NTP is responsible for this trend. Continuous reports of notified cases are available since 1980. The highest reported incidence rate of 150/100,000 (total cases) was observed in 1985, whereafter the rate declined to 76/100,000 in 1991. At the beginning of the 1990s, an increase of countrywide notifications was observed to a peak of 85/100,000 in 1993. This was largely attributed to the impact of the HIV epidemic. With the introduction of DOTS, the previous monthly cross-sectional reporting system is gradually being replaced by trimesterly cohort reporting. This means that reliable case notification figures are only available from DOTS areas since 1996, which do not yet cover the whole country.

Estimates of total disease burden

Estimates of the total disease burden can be made from a series of surveys of the prevalence of infection and disease, of which five were performed from 1962 through 1991. The 1991 survey was not useful for estimates of the prevalence of infection due to the very high BCG coverage. The estimated annual risk of infection (ARI) was 2.3% in 1983 and 2.0% in 1987. Continuation of the downward trend of 3.5% annually would lead to an estimate of the ARI of approximately 1.4% in 1998.
WHO has recently calculated new global estimates of the burden of tuberculosis, which include country-specific estimates (C. Dye et al., JAMA, 1999). These estimates were based on a variety of methods, including incidence estimates based on ARI, assessments of the impact of HIV and critical evaluations of reported data. In this survey, the estimated incidence for smear-positive cases is reported as 63/100,000 and the estimated total incidence as 142/100,000. The estimated rate of death from the disease is 29/100,000. Based on a population size of 59.2 million, the corresponding annual numbers of cases and death are 37,000 (smear-positive), 85,000 (total incidence) and 17,000 (deaths).

**Case notifications**

To estimate case notification ratios, reported figures after 1995 are not useful because of the incompleteness of data. In 1995, the reported rate of smear-positive cases was 33.4, which would indicate an overall case notification ratio of 47.7% (assuming an incidence of 70/100,000). Case notification appears to be higher in DOTS areas, where the countrywide average was 72% in 1998. To analyze the gap in case finding further, the age distribution of cases should be considered.

![Figure 1: Expected and reported age distribution of cases](image1)

![Figure 2: Population age distribution in various regions](image2)

Epidemiological modelling indicates that at the current state of the epidemic in Thailand (indicated by the current ARI and recent trends of ARI decline), case notifications should be substantially higher in the younger age groups (age 15 – 44). This age group is most prominently represented in large cities (for example, see Bangkok in the graph below), where tuberculosis programmes are currently facing great difficulties. One can therefore conclude that case finding ratios in Thailand could be substantially improved by focusing on TB control in urban areas, and that this should particularly lead to higher case finding in the younger age groups.

**Regional differences**

Case notification rates differ in the various regions of the country. This can be either due to differences in case-finding proportions, or differences in the overall incidence of the disease. An indication of regional differences in disease incidence can be derived from the 1987 prevalence survey, which was conducted in all of the country’s 12 regions. The data from the survey has been re-evaluated prior to this review to derive region-specific estimates of the ARI. It should be noted that these estimates can only provide broad indications of the actual
current situation, since the survey was performed twelve years ago, and sample sizes in the survey were not designed to provide regional estimates, but a national average figure. A table with region-specific estimates of the ARI in 1987 is provided below.

Table 1: Regional variations of the ARI

<table>
<thead>
<tr>
<th>Region</th>
<th>CDC</th>
<th>0-4</th>
<th>5-9</th>
<th>10-14</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central (East)</td>
<td>2</td>
<td>4.5</td>
<td>2.9</td>
<td>3.8</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>3.8</td>
<td>2.9</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>6.2</td>
<td>3.1</td>
<td>4.5</td>
</tr>
<tr>
<td>NE</td>
<td>5</td>
<td>2.5</td>
<td>2.2</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>2.6</td>
<td>2.1</td>
<td>2.9</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>2.1</td>
<td>2.1</td>
<td>2.8</td>
</tr>
<tr>
<td>N</td>
<td>8</td>
<td>1.3</td>
<td>1.2</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>2.5</td>
<td>2.1</td>
<td>2.7</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>2.4</td>
<td>2.7</td>
<td>2.9</td>
</tr>
<tr>
<td>S</td>
<td>11</td>
<td>2.3</td>
<td>1.5</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>4.2</td>
<td>3.9</td>
<td>4.6</td>
</tr>
<tr>
<td>U</td>
<td></td>
<td>3.7</td>
<td>2.5</td>
<td>3.1</td>
</tr>
<tr>
<td>R</td>
<td></td>
<td>2.4</td>
<td>2.1</td>
<td>2.9</td>
</tr>
<tr>
<td>Totals</td>
<td>all</td>
<td>2.9</td>
<td>2.3</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Impact of HIV

The impact of the HIV epidemic has differed markedly between the country’s regions. Highest HIV-prevalence figures in TB cases have been reported from the North (CDC region 10) where the prevalence of HIV co-infection was 45.7% in 1995 and has since declined to 41.2% in 1998. The countrywide average was highest in 1996 (22.3%) and has since declined to 15% in 1998. In general, there appears to be a countrywide decline of HIV co-infection levels since 1995/1996, except for CDC region 6 in the North-East, where co-infection levels have risen continuously to 14.6% in 1998. The impact of HIV on case incidence has been most marked in CDC region 10. In Chiang Mai, the reported number of cases has increased from 1,300 in 1992 to 2,100 in 1997, whereas in Chiang Rai case numbers rose from 700 in 1993 to 1,400 in 1997, a 100% increase over a period of four years.

Drug resistance

National figures on drug resistance are available from a survey conducted in collaboration with WHO in 1996/98. The national average of MDR prevalence in previously untreated patients was 2.07%. However, regional differences exist, with areas afflicted by HIV reporting particularly high MDR levels (e.g. Chiang Rai 6.6%). The drug-resistance situation also appears to be worse in Bangkok, where the Central Chest Hospital (CCH) reported initial MDR levels of 4.4% in 1996. Total MDR levels (including acquired resistance) were in excess of 20% at CCH during recent years. Similar levels are also reported from Bamras
Hospital, which specializes in the care of HIV-infected patients. This highlights the role of HIV for the spread of MDR strains in Thailand.

**Future trends**

An assessment of future trends of tuberculosis in Thailand with and without the implementation of DOTS has been performed in 1995 (Sawert et al, Soc Sci Med.). At that time, it was estimated that the implementation of the DOTS strategy could reduce case incidence levels to less than half over a period of 20 years, resulting in direct cost savings of up to 100 Million USD and an overall economic benefit for the country (including income savings due to reduced morbidity and mortality) of 2.3 Billion USD.

In preparation for this review, a renewed epidemiological assessment indicated that approximately 350,000 new cases could be averted of the next two decades if WHO target levels were reached within five years, a goal that appears to be practically achievable given the current speed of DOTS implementation.
Organization of TB Services

The TB Division of the Department of Communicable Disease Control (CDC) is responsible for development of technical policies, planning and monitoring of TB control in the country. Four national co-ordinators are responsible for monitoring each of the four geographical regions. The TB Division also has a large TB clinic providing diagnostic and treatment services.

The 13 Zonal TB Centres have been integrated into the Regional CDC, and are now responsible for monitoring, training and supervision. They also provide clinical services, but now refer most patients to provincial and district hospitals. Regional TB Coordinators (RTC)s have been appointed to provide technical support to the provinces.

The provincial health office (PHO) comes directly under the Office of the Permanent Secretary of the MoPH, and is monitored by health inspectors from the office of the permanent secretary. Health inspectors have a checklist for monitoring 11 priority programmes within the MoPH; these currently include dengue, HIV/AIDS, and polio. It would be important to include TB in this checklist, to increase political commitment to TB at the provincial level. Each PHO is headed by a Provincial Chief Medical Officer (PCMO), who is responsible for public health in the province. Provincial TB Coordinators (PTCs) have been appointed in each PHO. There is considerable variation between provinces in the level of staffing for TB control, in terms of the number of PTCs, and their time allocation for TB control activities. Further reforms to the health sector are planned which may result in increased decentralisation of management responsibilities to the provincial and district levels.

Curative services are provided by regional (in large provinces), general (provinces and large districts), and community (district) hospitals, which are under the Office of the Permanent Secretary, MoPH (Department of Medical Services, Health Care Services and provincial administration – see Annex 5: Organization of the Ministry of Public Health). Regional hospitals have 500-1000 beds, and include medical and surgical specialties. General hospitals have 150-500 beds, with some specialized services. Community hospitals have 10-120 beds, with 2-4 doctors, and little or no specialisation. The Department of Medical Services also administers four large general hospitals in Bangkok.

DOTS implementation is decentralized to the district, which is the unit of management for TB control. Diagnosis of TB is largely done by doctors in district and provincial hospitals, which have laboratory and X-ray facilities. TB clinics (usually within the sanitation and Social Medicine sections of these hospitals), register people with TB, and maintain the treatment cards. Directly observed treatment services are provided in district and provincial hospitals, health centres, and by utilizing trained community health volunteers and family members. Training and supervision of district and health centre staff is done by regional and provincial staff, particularly Regional and Provincial TB Coordinators.

A District TB Coordinator (DTC) working out of the District Health Office (DHO) is responsible for coordinating TB control activities in the district, and works in close collaboration with the TB clinic in the hospital. The DTC is responsible for ensuring that patients are notified to health centres, for supervising health centres, and for preparing the trimesterly reports in collaboration with staff of the TB clinic. District health coordinating committees have facilitated DOTS implementation. Good coordination has been established between the TB clinic staff, the DTC and the health centre staff, ensuring that patients are provided the most convenient method of directly observed treatment.
An organizational chart of the NTP is shown in the following figure.

NTP STRUCTURE

Private Sector

Ministry of Public Health

BMA
- Dept. of Health
- Dept. Med. Service

ATAT

Department of CDC

Health Inspector

Office of Permanent Secretary

Province of CDC

Office of Regional CDC

Central Chest Hospital

TB Division

Provincial Health Office

District Hospital

District Health Office

Zonal TB Centre

Provincial Hospital

Health Centre

___ Line of command

___ Line of coordination
POLITICAL COMMITMENT

The first element of the DOTS strategy is political commitment, which is usually expressed in three ways:

- The Ministry of Health makes TB control a high priority
- The National TB Programme (NTP) develops national policies based on the DOTS strategy
- The government allocates adequate resources to TB control

Evidence of increased commitment to DOTS at all levels in Thailand comes from several sources:

- Approval of a national policy for organization of TB control services based on DOTS, and preparation of a national manual describing the technical policies of the NTP
- Expansion of DOTS to cover 74 provinces and 364 districts by mid 1999, equivalent to 40% of the country
- Maintenance of the TB Division budget despite the recent economic crisis
- Increased involvement of the provincial and district health offices in planning and monitoring TB control activities
- Appointment of coordinators for TB control at the regional, provincial and district level
- Organisation of regular regional and provincial DOTS meetings
- Involvement of the Health Centres in supervision of patients on treatment

DOTS coverage and expansion

DOTS has expanded to cover 364 districts in 74 provinces, equivalent to 40% population coverage. Some regions have expanded more rapidly than others, and most have planned to achieve full coverage by the end of the year 2001. The following graph shows current coverage and planned expansion.

![Plan for DOTS Expansion and Achievements](image)

* Up to mid-1999
The national policy indicates that provinces should expand DOTS at the rate of two districts per year. Those provinces that have achieved satisfactory results will be able to expand at a faster rate, and should be encouraged to do so. Provinces that have not yet demonstrated successful results in their pilot districts should take urgent steps to improve the quality of DOTS, and achieve satisfactory smear conversion rates before planning further expansion.

Adherence to Policy

The Ministry of Public Health prepared national policy guidelines for the NTP in 1998, describing roles and responsibilities of agencies and personnel at different levels of the health service. These have been widely disseminated and form the basis of organization of the NTP. The TB Division has also prepared technical guidelines for diagnosis, treatment and monitoring of patients, which have also been widely distributed. These are generally followed by staff that have received DOTS training, but compliance with technical policies is less amongst those medical officers who have yet to be trained.

All technical and operational polices conform to those recommended by WHO. The recording and reporting system is similar to the WHO recommended format. Case definitions, registration and treatment outcome categories are compatible with WHO recommendations, allowing for standardized cohort analysis.

Human Resources

Adequate human resources are available for implementing DOTS. Zonal TB Centers have been integrated with Regional CDCs since 1996. The reorganization of services, by developing a unified strategy for communicable disease control, has resulted in a matrix management, providing integrated delivery of common requirements such as logistics, laboratory facilities, etc. This has increased the working relationships between various programmes and broadened the experience of those dealing with specific issues such as DOTS implementation. The introduction of RTCs, PTCs, and DTCs has enhanced the level of supervision and improved the capacity to rapidly train personnel at the TB Clinics of provincial and district hospitals and health centre staff, including Health Workers (HWs) and Village Health Volunteers (VHVs). The lack of adequate numbers of trained staff at present owing to the infrequency of training courses, now held only once a year, and frequent transfers among staff at the provincial and district levels are issues that need to be addressed.

Table 2: Staff involved in the NTP

<table>
<thead>
<tr>
<th>Level of service</th>
<th>Staff involved in TB control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Region</td>
<td>Regional CDC Director, Director Zonal TB centre, TB Programme manager, Regional TB Coordinator</td>
</tr>
<tr>
<td>Province</td>
<td>Provincial Chief Medical Officer, Head CDC, Provincial TB Coordinator</td>
</tr>
<tr>
<td>District</td>
<td>Director of district hospital, Chief of DHO, TB clinic staff, District TB Coordinator</td>
</tr>
<tr>
<td>Health centre</td>
<td>Health Workers (one assigned for DOTS)</td>
</tr>
<tr>
<td>Community</td>
<td>Village health volunteers, family members</td>
</tr>
</tbody>
</table>
The potential for coordination with private clinics who treat TB patients, and with NGO's currently largely involved with AIDS and other community concerns, needs to be explored and could be significant if appropriate mechanisms to involve them are identified.

Budget of the NTP

The priority given to TB control through DOTS by the Department of CDC and the MoPH has been demonstrated by the policy of maintaining the NTP budget during the past three years despite the financial setbacks suffered by Thailand during this period. The budget for the NTP is provided entirely by the MoPH. Although the allocation to the NTP as a proportion of the total health budget has decreased from 0.9% in 1991 to 0.5% in 1998, the per capita expenditure on TB remained roughly the same over this period (USD 0.12 in 1991, USD 0.13 in 1998). The total allocation to the NTP was USD 8.1 million in 1998 compared to USD 7.1 million in 1991.

This commitment has resulted in 40% coverage of the country with DOTS since it was first implemented in 1996. Incremental costs incurred have mainly been in the areas of training of personnel and for supervisory visits to maintain the performance of trained staff. The proposed expansion of DOTS to the entire country by the year 2001 could be achieved with marginal changes in budget allocation to cover costs in these two areas, as costs for medicines and other equipment are already included in the regular budget. However, it is important to maintain budget and secure incremental funds for training and supervision as DOTS coverage expands.

In terms of direct costs, improving DOTS coverage will result in substantial decreases in costs/patient cured. The indirect economic costs resulting from the TB epidemic (i.e. loss of worker productivity due to morbidity and premature mortality from the disease) are calculated based on the marginal product of labour, indicated by the average GDP. Projections based on modelling have shown that the effective implementation of DOTS would ultimately result in a reduction of indirect costs of about US$ 2.3 billion over 20 years.

Recommendations

1. Thailand should achieve countrywide coverage of DOTS by the year 2001. To facilitate this, each province must prepare a plan for phased expansion of DOTS, including urban areas. Expansion should be based on the capacity of the province to ensure adherence to NTP policies, provide adequate quantity and quality of supervision, maintain quality assurance of sputum smear microscopy, and achieve high cure rates;

2. The Office of the Permanent Secretary of the Ministry of Public Health should include monitoring of DOTS in the responsibilities of health inspectors, thereby demonstrating the high priority for TB control and ensuring the quality of DOTS;

3. The MoPH should maintain the budget for TB control in order to ensure the sustainability of the NTP
Training

The NTP has developed a schedule for training of staff in preparation for the implementation of DOTS at district level as shown in the following table:

Table 3: NTP training courses

<table>
<thead>
<tr>
<th>Staff:</th>
<th>Place and duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>• At least one doctor per hospital</td>
<td>• One day at zonal level</td>
</tr>
<tr>
<td>• At least one TB clinic staff per hospital</td>
<td>• Two days at zonal level</td>
</tr>
<tr>
<td>• At least one laboratory technician per hospital</td>
<td>• Three days at zonal level</td>
</tr>
<tr>
<td>• At least one DTC per district</td>
<td>• Four days at zonal level</td>
</tr>
<tr>
<td>• At least one health worker per health centre</td>
<td>• One day at district or provincial level</td>
</tr>
<tr>
<td>• At least one PTC per 500,000 population</td>
<td>• Four days at zonal level</td>
</tr>
</tbody>
</table>

The modified WHO module for TB control at district level and the National Guidelines of the NTP are used as training materials. The zonal level in collaboration with the provincial level prepared a budget for training to be approved and funded by the TB division.

Extensive training of health personnel on DOTS has been conducted at all levels. Technical policies were well understood and practiced. In some places a high turnover of staff poses a problem. The number of medical doctors trained is less than expected as the course duration is long and the location inconvenient. Consequently, many doctors do not follow NTP diagnostic and treatment polices, as they have been trained in different technical policies in medical school. Though the technical skills of PTC’s and RTC’s are adequate, their capacity for planning and management is not yet sufficient. So far no special orientation sessions have been held with the chief of the DHO. An innovative development in the area of training is the collaboration between Regional CDC 10 and the faculty of pharmacy in Chiang Mai University. The aim is to include DOTS on the curriculum for pharmacy students by training the lecturers and professors on the national TB control policy and guidelines.

Recommendations

1. The TB division should promote the inclusion of the national TB policies and the DOTS strategy in the curricula of the medical and paramedical students.

2. The TB division should shorten the training for doctors to half a day; zonal staff should organize such training at provincial level, to facilitate the participation of medical officers.

3. The TB Division should develop a module for planning and management training of PTC’s and RTC’s.

4. The TB division should develop and implement a module for orientation of the chief of the DHOs.
Supervision

For supervision of DOTS districts the NTP has formulated the following policy:

Table 4: NTP supervision plan

<table>
<thead>
<tr>
<th>Supervising staff</th>
<th>Level</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>• TB Division</td>
<td>• Zonal level</td>
<td>• Once yearly</td>
</tr>
<tr>
<td>• RTC</td>
<td>• Provincial and district</td>
<td>• Every two months during the implementation phase, thereafter each trimester</td>
</tr>
<tr>
<td>• PTC</td>
<td>• District</td>
<td>• As above</td>
</tr>
<tr>
<td>• DTC</td>
<td>• Health centres</td>
<td>• Monthly</td>
</tr>
<tr>
<td>• Health workers</td>
<td>• Patients home (when supervised by family member)</td>
<td>• Weekly during intensive phase, monthly during continuation phase</td>
</tr>
</tbody>
</table>

For program coordination the following meetings are held:
- At regional level for RTC’s and PTC’s each trimester
- At provincial level for PTC and DTC’s each trimester
- At district level for TB clinic staff, DTC and Health Centre staff each month

Supervision from PTC’s and DTC’s has increased considerably, but varies in quantity and quality from province to province. The quality of TB control services appears to relate directly to the level of supervision from the province. Provinces achieving good cure rates usually have a full-time PTC, or a team of part-time PTC’s. Provinces with only 1 or 2 part time PTC’s achieved lower cure rates. Some provinces, which expanded DOTS in all districts simultaneously, had difficulties maintaining adequate supervision and did not achieve acceptable sputum conversion and cure rates. Though a checklist for RTC’s and PTC’s has been developed it is unclear to what extent this list is adequate and used widely. When the population to be covered by one PTC exceeds 500,000 the quality of supervision cannot be assured. In some places it was reported that RTC and PTC were not actually checking the treatment cards and registers in any detail, but only paid attention to the final figures. No formal feedback mechanism from the RTC through the PTC to the DTC has been developed. Therefore many DTC’s receive insufficient feedback from higher levels. Sufficient transport and funds are available for conducting supervisory visits. All staff were aware of the importance of supervisory support to ensure the quality of program performance.

Recommendations

1. The TB division should introduce a feedback mechanism for supervision visits

2. The TB division should ensure that the supervision checklist is used as an integral part of all field visits.

3. During visits, supervisors should perform on the spot training of staff in data analysis as a planing and management tool.
Advocacy

Sustained advocacy efforts by the TB division in the past four years has resulted in increased political commitment for TB, and maintained adequate resources for TB control. The TB division produces an attractive newsletter highlighting developments with DOTS and has included comparative treatment results from the provinces in the latest issue.

Other advocacy initiatives have included translation of WHO materials, radio messages, and TV slots. These efforts must be maintained in order to ensure continued interest and support for TB control.

Coordination with other health sectors

The University and military hospitals diagnose and treat TB patients outside of the NTP – as do the private clinics. Criteria for diagnosis and regimens followed vary widely. University hospitals and military hospitals are expected to participate once the DOTS infrastructure is uniformly implemented, by referral of non complicated cases.

Some regional CDCs have held meetings with private practitioners. None of them volunteered to participate in DOTS. Outside of the major urban areas it appears that private practitioners treat relatively few TB patients, and refer most to the public sector.

Traditional medicine also holds a significant place in some communities. The proportion of TB patients who try herbal medicines first, and the contribution to delayed diagnosis is not known. It appears that traditional forms of treatment are quite popular amongst people with HIV.

The Anti TB Association of Thailand (ATAT) is based in Bangkok, and runs a TB clinic and hospital. An independent branch provides services in Chiang Mai. A few local NGOs function at the local level. Most are involved in working with AIDS. No real partnerships have been formed; most simply refer TB suspects to the local hospital.

Recommendation

1. The TB division should explore the potential for involvement of NGOs and the private sector in DOTS.
DIAGNOSTIC AND MICROSCOPY SERVICES

There has been increased use of smear microscopy for the diagnosis and follow-up of infectious cases, resulting in an increasing proportion of smear-positive cases. In almost all centres visited this is now over 50%. There is still some over-reliance on X-ray for diagnosis in some districts and provinces, particularly among people with HIV and people with old inactive TB. Many respiratory symptoms and smear negative cases do not have 3 smear examinations (around 40% on average, but up to 84% observed). There is a tendency to diagnose smear positive TB on the basis of one positive smear plus an abnormal X-ray, rather than a second positive smear. On average 50%, but up to 83% of smear-positive cases had only one positive result. This is less satisfactory means for confirmation of smear positive cases, in view of the low specificity of chest X-ray for diagnosis of TB.

Table 5: Case finding in patients registered from Feb-May 1999

<table>
<thead>
<tr>
<th>District</th>
<th>New Smear-POSITIES</th>
<th>Relapses</th>
<th>New Smear-NEGATIVE</th>
<th>New Extra- PULMONARY</th>
<th>Total</th>
<th>Smear-Pos. RATE</th>
<th>Relapse RATE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Khaosaming</td>
<td>6</td>
<td>0</td>
<td>11</td>
<td>1</td>
<td>18</td>
<td>33%</td>
<td>0%</td>
</tr>
<tr>
<td>Kang Hang Maew</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td>71%</td>
<td>0%</td>
</tr>
<tr>
<td>Bang Pli</td>
<td>16</td>
<td>1</td>
<td>17</td>
<td>2</td>
<td>36</td>
<td>46%</td>
<td>6%</td>
</tr>
<tr>
<td>Kaengkrachan</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>63%</td>
<td>0%</td>
</tr>
<tr>
<td>Nangsuay</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>3</td>
<td>11</td>
<td>10%</td>
<td>100%</td>
</tr>
<tr>
<td>Northen Region</td>
<td>23</td>
<td>0</td>
<td>22</td>
<td>6</td>
<td>30</td>
<td>52%</td>
<td>7%</td>
</tr>
<tr>
<td>Phan</td>
<td>30</td>
<td>2</td>
<td>22</td>
<td>6</td>
<td>60</td>
<td>52%</td>
<td>7%</td>
</tr>
<tr>
<td>Sarapee</td>
<td>14</td>
<td>1</td>
<td>6</td>
<td>0</td>
<td>21</td>
<td>70%</td>
<td>7%</td>
</tr>
<tr>
<td>Banti</td>
<td>6</td>
<td>2</td>
<td>9</td>
<td>1</td>
<td>18</td>
<td>38%</td>
<td>33%</td>
</tr>
<tr>
<td>Song</td>
<td>17</td>
<td>2</td>
<td>9</td>
<td>0</td>
<td>28</td>
<td>65%</td>
<td>12%</td>
</tr>
<tr>
<td>Payuhakiri</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>83%</td>
<td>0%</td>
</tr>
<tr>
<td>Southern Region</td>
<td>33</td>
<td>1</td>
<td>30</td>
<td>3</td>
<td>36</td>
<td>65%</td>
<td>9%</td>
</tr>
<tr>
<td>Praseang</td>
<td>10</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>12</td>
<td>83%</td>
<td>0%</td>
</tr>
<tr>
<td>Promkeeree</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Nayong</td>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td>9</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Bangkaew</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>9</td>
<td>63%</td>
<td>20%</td>
</tr>
<tr>
<td>Rattapum</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>8</td>
<td>63%</td>
<td>0%</td>
</tr>
<tr>
<td>Mahchananachi</td>
<td>22</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>36</td>
<td>65%</td>
<td>9%</td>
</tr>
<tr>
<td>As Samad</td>
<td>7</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>25</td>
<td>29%</td>
<td>14%</td>
</tr>
<tr>
<td>Kamalsai</td>
<td>19</td>
<td>2</td>
<td>11</td>
<td>1</td>
<td>33</td>
<td>61%</td>
<td>11%</td>
</tr>
<tr>
<td>Gudbak</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>14</td>
<td>57%</td>
<td>0%</td>
</tr>
<tr>
<td>Ranue Nakorn</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>75%</td>
<td>0%</td>
</tr>
</tbody>
</table>

Follow up smear are done at 2, 5 and 6 months. The national policy is to examine 2 smears at these intervals, but most hospitals only perform one examination. In some centres monthly smears are done, which increases the workload of the laboratory staff unnecessarily.

Laboratory facilities, equipment (including good quality binocular microscopes), personnel and supplies are adequate. Maintenance, care and cleanliness/tidiness was good in all laboratories visited (Table 7). Technicians have received a good basic education, and the majority have been trained by the NTP. However the quality of this training has improved in
recent years, and those trained earlier did not learn how to use the NTP laboratory forms and registers.

Collection of sputum specimens has started in a few Health Centres, with patients or health personnel bringing those to the hospital laboratories. In exceptional cases smears were prepared at the Health Centres. Quality of AFB-microscopy appears to be satisfactory, based on the positive smears checked during the review.

Some factors may have a negative effect on the reliability of AFB-microscopy:

- all laboratories visited have a low workload, examining only 100 to 150 smears per trimester. This will automatically lead to lesser proficiency, possibly increasing the number of false positives
- in areas where HIV is prevalent, more cases will have low bacillary excretion, thus affecting the reliability of microscopy
- stocks of reagents were undated in many districts. Quality control of new batches of stains is sometimes incomplete (only positives tested, therefore contamination of stain was not excluded)
- smearing and staining was inadequate in many centres (thick smears, insufficient decolorisation)

The quality of smear microscopy could not be fully assessed during the review, because of time constraints and a non standardised quantification system which was in use until recently. Recent results of quality control (QC) by cross-checking were available at very few centres. Some cross-checking is carried out, mainly by zonal TB centres, and one provincial hospital laboratory (Chantaburi). QC methods are non-standardised, inadequate in some respects, and there has been insufficient feed-back. Proficiency testing (test smears prepared centrally) organised by Regional Medical Sciences Laboratories (RMSL) is carried out in some regions, with good results, indicating that capacity of the technicians.

Deficiencies observed in the quality control system were:

- positive smears usually had the result written on the slide, preventing blinded unbiased control. Identification of slides was not always unequivocal.
- in some districts, sampling was not unbiased, and the peripheral technician selected slides for QC
- the provincial laboratory doing cross-checking submitted all slides to multiple examinations by different technicians. Too much time was spent per examination in an attempt to detect all the errors

Supervision of laboratories has been left completely to Zonal TB Centre laboratory technicians, and PTCs and DTCs have not been involved. For this reason, supervision has been infrequent. Administrative weaknesses in the laboratories were encountered that could easily have been solved during supervision by PTCs and DTCs. A proposed system for quality assurance (QA), including quality control by rechecking, training and supervision is described in the annex 2.
Health Education

Following diagnosis of TB, health education is provided to patients and their family members by staff of the TB clinic. Excellent material for educating patients on symptoms, sputum collection, treatment, side effect of drugs and need for follow up and completing treatment have been developed in some districts. During these sessions, the treatment supervisor is identified and trained on observing the swallowing of drugs and filling the DOTS cards. Excellent health education is provided by health workers to those patients attending health centres for supervised treatment. This has resulted in increased trust and bonding between health personnel, patients, and families.

Health workers during field visits provide information regarding TB along with information about other diseases. On World TB Day and during the National TB Week Campaign they give extra emphasis to TB through exhibition of posters, pamphlets and talks based on materials prepared by the TB Division. Despite these efforts, there is little awareness in the community about DOTS or TB. This may contribute to unnecessary delay of 2 months or more between falling ill and seeking diagnosis and treatment.

Recommendations

1. The TB division should prepare an operational policy on quality assurance of sputum smear microscopy, for approval by the permanent secretary of the MoPH

2. The TB division should develop technical procedures for implementation of a comprehensive system of quality assurance of sputum smear microscopy, and prepare a plan to field test this system in two regions.

3. The TB division should prepare IEC materials to raise community awareness about TB, and reduce the delay in seeking diagnosis and treatment
### Table 6: Laboratory performance

<table>
<thead>
<tr>
<th>PROVINCE</th>
<th>DISTRICT</th>
<th>% POS.</th>
<th>% POS.</th>
<th>SLIDES</th>
<th>% CASES</th>
<th>% SMEAR-POS.</th>
<th>AVERAGE Case Series</th>
<th>CONSIST ENT DELAY</th>
<th>SUSPECTS</th>
<th>SM. NEG. CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CENTRAL REGION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trad</td>
<td>Khaosaming</td>
<td>9%</td>
<td>9%</td>
<td>2.8</td>
<td>60%</td>
<td>0%</td>
<td>33%</td>
<td>4</td>
<td>33%</td>
<td>54%</td>
</tr>
<tr>
<td>Chantaburi</td>
<td>Kang Hang Maew</td>
<td>18%</td>
<td>16%</td>
<td>1.4</td>
<td>43%</td>
<td>0%</td>
<td>2</td>
<td>2</td>
<td>33%</td>
<td>4%</td>
</tr>
<tr>
<td>Samut Prakan</td>
<td>Bang Pri</td>
<td>8%</td>
<td>9%</td>
<td>6.9</td>
<td>75%</td>
<td>4%</td>
<td>2</td>
<td>13%</td>
<td>84%</td>
<td>31%</td>
</tr>
<tr>
<td>Petchburi</td>
<td>Kaenkrachan</td>
<td>20%</td>
<td>0%</td>
<td>1.2</td>
<td>0%</td>
<td>0%</td>
<td>3</td>
<td>80%</td>
<td>56%</td>
<td>0%</td>
</tr>
<tr>
<td>Phatthongthani</td>
<td>Nong Suay</td>
<td>6%</td>
<td>7%</td>
<td>2.7</td>
<td>40%</td>
<td>0%</td>
<td>67%</td>
<td>0%</td>
<td>38%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>NORTHERN REGION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chiang Rai</td>
<td>Phan</td>
<td>13%</td>
<td>10%</td>
<td>12.8</td>
<td>12%</td>
<td>3%</td>
<td>2</td>
<td>80%</td>
<td>0%</td>
<td>31%</td>
</tr>
<tr>
<td>Chiang Mai</td>
<td>Sarapee</td>
<td>16%</td>
<td>0%</td>
<td>3.2</td>
<td>18%</td>
<td>0%</td>
<td>2</td>
<td>38%</td>
<td>0%</td>
<td>38%</td>
</tr>
<tr>
<td>Lamphun</td>
<td>Banti</td>
<td>6%</td>
<td>0%</td>
<td>5.0</td>
<td>63%</td>
<td>0%</td>
<td>2</td>
<td>20%</td>
<td>0%</td>
<td>20%</td>
</tr>
<tr>
<td>Phrae</td>
<td>Song</td>
<td>23%</td>
<td>1%</td>
<td>3.9</td>
<td>32%</td>
<td>0%</td>
<td>3</td>
<td>21%</td>
<td>0%</td>
<td>21%</td>
</tr>
<tr>
<td>Nakorn Sawan</td>
<td>Payuhaki</td>
<td>11%</td>
<td>20%</td>
<td>1.3</td>
<td>100%</td>
<td>0%</td>
<td>2</td>
<td>43%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>SOUTHERN REGION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Swathani</td>
<td>Prasaeang</td>
<td>13%</td>
<td>4%</td>
<td>3.3</td>
<td>42%</td>
<td>0%</td>
<td>2</td>
<td>64%</td>
<td>33%</td>
<td>13%</td>
</tr>
<tr>
<td>Nakhon Sri Thammarat</td>
<td>Promkeeree</td>
<td>7%</td>
<td>4%</td>
<td>3.5</td>
<td>71%</td>
<td>0%</td>
<td>3</td>
<td>56%</td>
<td>64%</td>
<td>0%</td>
</tr>
<tr>
<td>Songkhla</td>
<td>Rattapum</td>
<td>12%</td>
<td>15%</td>
<td>4.3</td>
<td>42%</td>
<td>0%</td>
<td>2</td>
<td>43%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td><strong>NORTH EASTERN REGION</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yasothon</td>
<td>Mahachanachai</td>
<td>8%</td>
<td>0%</td>
<td>8.4</td>
<td>32%</td>
<td>0%</td>
<td>2</td>
<td>33%</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>Roi-et</td>
<td>As Samad</td>
<td>7%</td>
<td>0%</td>
<td>3.5</td>
<td>71%</td>
<td>0%</td>
<td>3</td>
<td>56%</td>
<td>64%</td>
<td>0%</td>
</tr>
<tr>
<td>Kalasin</td>
<td>Kamalasai</td>
<td>6%</td>
<td>0%</td>
<td>5.5</td>
<td>63%</td>
<td>0%</td>
<td>3</td>
<td>43%</td>
<td>75%</td>
<td>0%</td>
</tr>
<tr>
<td>Sakol Nakorn</td>
<td>Gudbak</td>
<td>10%</td>
<td>0%</td>
<td>3.1</td>
<td>25%</td>
<td>0%</td>
<td>3</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
</tr>
<tr>
<td>Nakorn Panom</td>
<td>Runue Nakorn</td>
<td>5%</td>
<td>0%</td>
<td>0.9</td>
<td>0%</td>
<td>0%</td>
<td>2</td>
<td>77%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Note:** The table details the laboratory performance metrics for different regions, including the percentage of positive samples, cases, smear positivity, case series, and sputum examination results.
### Table 7: Laboratory Quality

<table>
<thead>
<tr>
<th>PROVINCE</th>
<th>DISTRICT</th>
<th>Space &amp; Utilities</th>
<th>Waste Disposal</th>
<th>Microscopes</th>
<th>Supplies</th>
<th>Manpower</th>
<th>Register Accuracy</th>
<th>SMEARS AND STAINING</th>
<th>QA LAST 12 MONTHS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Central Region</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trad</td>
<td>Khaosamung</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>adequate</td>
<td>not good variable</td>
<td>weak</td>
<td>sent</td>
</tr>
<tr>
<td>Chantaburi</td>
<td>Kang Hang Maew</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>adequate</td>
<td>good</td>
<td>not good</td>
<td>sent</td>
</tr>
<tr>
<td>Samut Prakan</td>
<td>Bang Pri</td>
<td>good</td>
<td>good</td>
<td>good</td>
<td>not good</td>
<td>adequate</td>
<td>not good variable</td>
<td>weak</td>
<td>on spot</td>
</tr>
<tr>
<td>Petchburi</td>
<td>Kaenkrachan</td>
<td>moderate</td>
<td>good</td>
<td>good</td>
<td>low</td>
<td>low</td>
<td>good</td>
<td>weak</td>
<td>0x</td>
</tr>
<tr>
<td>Pratham Thani</td>
<td>Nang Suae</td>
<td>good</td>
<td>good</td>
<td>1 ok/1 not</td>
<td>good</td>
<td>adequate</td>
<td>good</td>
<td>not seen</td>
<td>weak</td>
</tr>
</tbody>
</table>

| **Northeast Region** |                  |                   |                |             |          |          |                   |                     |                   |
| Chiang Rai     | Phan             | good              | good           | adequate    | good     | sent     | yes               |                     |                   |
| Chiang Mai     | Sarapee          | good              | good           | adequate    | good     | sent     | yes               |                     |                   |
| Lumphun        | Banti            | good              | good           | adequate    | good     | 0x       | no                |                     |                   |
| Phial          | Song             | good              | good           | adequate    | good     | 0x       | no                |                     |                   |
| Nakhonsawan    | Payuhakiri       | good              | not good       | adequate    | good     | 0x       | no                |                     |                   |
TREATMENT SERVICES AND CASE MANAGEMENT

Treatment services are provided in the government sector (regional hospital, general hospital, community hospital, zonal TB centre), special hospitals (university hospitals, military hospitals and prison hospitals), and private sector.

Following diagnosis, patients are referred to the TB clinic in the sanitation section of the hospital. The TB treatment category and regimen is usually decided by the doctor. In general, patients are categorized correctly; however, most smear negative cases are treated with the Category 1 regimen. The TB clinic staff register the patient and provide counselling to patients and their family members. In the areas without DOTS, patients are asked to attend TB clinic regularly but without close supervision by TB clinic staff or health workers in the health centres. In the area with DOTS, the case management is done as follows.

The TB clinic gives a few days of medicines to the patients and informs the DTC at the district health office (DHO), usually on the same day. The DTC then informs the appropriate health centre.

There are several methods for directly observing treatment of patients:

- Health Workers or TB Clinic staff gives the medicines to the patient who visits the health facility every day
- Village health volunteers (VHV) observe the patient daily, and health centre staff supervises VHV regularly.
- Family members observe the patient daily and health centre staff visit the patient's home once a week

In many districts, most of the patients follow the last system ("family DOTS") but in some districts, patients are strongly urged to choose one of the health personnel as their DOTS observer. The factors contributing to the success of family DOTS are thought to be as follows:

- Strong culture of compliance and family support
- Good counselling of patients
- Frequent contact between patients and health centre staff
- Weekly distribution of medicines by health centre
- Use of the DOTS card to record treatment

Some districts, particularly in the central region, have a high proportion of migrant workers who do not live with their families. Alternative methods to ensure observation of treatment need to be developed in such areas and could include factory health services, and community organisations.

The proportion of patients supervised by different methods varies considerably between districts, as can be seen from the following table, which highlights the commonest method used in some of the districts visited:
Table 8: Methods of treatment supervision in districts

<table>
<thead>
<tr>
<th>District</th>
<th>Hospital staff</th>
<th>health center staff</th>
<th>VHV</th>
<th>Family members</th>
<th>Others</th>
<th>non DOTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northeast 1</td>
<td>0%</td>
<td>50%</td>
<td>0%</td>
<td>50%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Northeast 2</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Northeast 3</td>
<td>6%</td>
<td>0%</td>
<td>0%</td>
<td>94%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Northeast 4</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Northeast 5</td>
<td>0%</td>
<td>11%</td>
<td>36%</td>
<td>53%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>South 1</td>
<td>0%</td>
<td>15%</td>
<td>70%</td>
<td>7%</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>South 2</td>
<td>0%</td>
<td>75%</td>
<td>0%</td>
<td>25%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>South 3</td>
<td>0%</td>
<td>18%</td>
<td>0%</td>
<td>79%</td>
<td>4%</td>
<td>0%</td>
</tr>
<tr>
<td>South 4</td>
<td>0%</td>
<td>32%</td>
<td>3%</td>
<td>65%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>South 5</td>
<td>0%</td>
<td>5%</td>
<td>0%</td>
<td>95%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>North 1</td>
<td>15%</td>
<td>60%</td>
<td>15%</td>
<td>10%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

The duration of direct observation is usually 6 months (in the case of family DOTS, weekly supervision by health centre staff during intensive phase and monthly during continuation phase), but in some provinces, only the intensive phase is supervised. In DOTS area, overall treatment results are shown in the following tables, with an overall treatment success rate of nearly 80%.

In many of the districts visited, there was no link between the treatment outcome and the type of DOTS observation followed. However, in Phan district in Chiang Rai Province, the default rates in 1996 and 1997 were around 30%. During this period, patients were observed by family members without proper supervision from health centre staff. In 1998 the method of treatment supervision changed – 75% by health personnel, 15% by VHVs and only 10% by family members. Preliminary analysis indicates that there have been no defaulters during the intensive phase of treatment in these cohorts of patients.

Table 9: Two month smear conversion results in new smear positive patients registered from Oct 98-Jan 99

<table>
<thead>
<tr>
<th>Region</th>
<th>total in register</th>
<th>not evaluated</th>
<th>negative</th>
<th>Positive</th>
<th>Not done</th>
<th>Died</th>
<th>default</th>
<th>Transfer out</th>
<th>Smear conversion rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>38</td>
<td>2</td>
<td>26</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>82%</td>
</tr>
<tr>
<td>North</td>
<td>53</td>
<td>2</td>
<td>43</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>81%</td>
</tr>
<tr>
<td>Northeast</td>
<td>59</td>
<td>1</td>
<td>51</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>88%</td>
</tr>
<tr>
<td>South</td>
<td>34</td>
<td>0</td>
<td>33</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>97%</td>
</tr>
</tbody>
</table>
Table 10: Treatment outcome of new smear positive patients registered from Feb-May 1998 (data collected during field visits)

<table>
<thead>
<tr>
<th>Region</th>
<th>Total in register</th>
<th>Not evaluated</th>
<th>Cured</th>
<th>Complete</th>
<th>Fail</th>
<th>Died</th>
<th>Default</th>
<th>Transfer out</th>
<th>Success rate</th>
<th>Cure rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>47</td>
<td>0</td>
<td>30</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>74%</td>
<td>64%</td>
</tr>
<tr>
<td>North</td>
<td>54</td>
<td>0</td>
<td>41</td>
<td>2</td>
<td>0</td>
<td>9</td>
<td>2</td>
<td>11</td>
<td>80%</td>
<td>76%</td>
</tr>
<tr>
<td>Northeast</td>
<td>41</td>
<td>0</td>
<td>29</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>80%</td>
<td>71%</td>
</tr>
<tr>
<td>South</td>
<td>8</td>
<td>0</td>
<td>6</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>75%</td>
<td>75%</td>
</tr>
</tbody>
</table>

In some districts in the central region, the treatment results were not favorable. Some characteristics were common in those districts and provinces:
- Infrequent contact between patient and health centre staff
- High proportion of migrant workers
- Inadequate frequency and quality of supervision from the PTC to the district.

Other factors related to poor treatment outcomes are HIV infection and migration. Migrant workers find it difficult to identify a treatment supervisor since they live alone; when they move, these transfer out cases are lost to follow-up. There is an urgent need to establish a system to track patients who are referred before starting treatment, and those transferred out while on treatment. The PTCs have an important role in coordinating the referral and transfer of patients within the province and between the provinces.

Table 11: Treatment outcome of new smear positive patients registered in DOTS districts from Feb-May 1998 (data from routine reports)

<table>
<thead>
<tr>
<th>Total registered</th>
<th>Not evaluated</th>
<th>Cured</th>
<th>Complete</th>
<th>Fail</th>
<th>Died</th>
<th>Default</th>
<th>Transfer out</th>
</tr>
</thead>
<tbody>
<tr>
<td>2342</td>
<td>53</td>
<td>1615</td>
<td>144</td>
<td>31</td>
<td>198</td>
<td>217</td>
<td>84</td>
</tr>
<tr>
<td>(100%)</td>
<td>(2.3%)</td>
<td>(69.0%)</td>
<td>(6.1%)</td>
<td>(1.3%)</td>
<td>(8.5%)</td>
<td>(9.3%)</td>
<td>(3.6%)</td>
</tr>
</tbody>
</table>

The districts visited are not representative of the country as a whole; the most recent national cohort shows a treatment success rate of 75% in over 2,300 new smear positive patients.

Recommendations

1. **Different methods for observation of treatment should be provided, based on patient convenience, but ensuring adequate supervision and high treatment success rates.**

2. **DHOs should mobilize community level alternatives to family DOTS in urban/semi-urban areas, which could include, factory and company health facilities and community organizations.**

28
3. Transfers and referral within a province should be coordinated by the PTC. Transfers and referrals between provinces will be more difficult to manage, and should be coordinated by the regional CDC and TB division.

**DRUG SUPPLY AND LOGISTICS**

The TB division is responsible for planning and procurement, based on requests from zonal TB centres and provincial/district hospitals throughout the country. Most anti-TB drugs used by the NTP are manufactured in Thailand; these are more costly than drugs procured internationally (approximately $100 for Category I regimen and $175 for a Category II regimen). The NTP spends 80% of the total drug budget for purchases through the Government Pharmaceutical Organization (GPO) located in Bangkok. No more than 20% of the drug budget may be used to purchase drugs which are not on the essential drugs list, such as fixed dose combination tablets. The GPO’s essential list includes combination of anti-TB drugs such as isoniazid and rifampicin, and recently isoniazid+rifampicine+pyrazinamide was approved. Quality control of drugs in Thailand is the responsibility of the Drug Analysis Division of the Department of Medical Sciences in collaboration with the Food and Drug Administration (FDA). To date no adverse reports have been received for anti-TB drugs from public and private sectors.

The GPO is responsible for delivery of essential drugs to all locations in Thailand. Zonal TB centres supply provincial and district hospitals. Currently, distribution systems are not uniform. The policy of the TB Division is to provide anti-TB drugs to TB patients, free of charge. During the last years, there has been no shortage of anti TB drugs at any level. Stock management of anti-TB drugs at peripheral level is not uniform at TB clinics or in hospital pharmacy stores. Poor stock controls has resulted in overstocking and expiry of some medicines. TB clinics package medicines according to patient weight, treatment category, and phase of treatment. Many centres distribute medicines in individual daily packs in a plastic box containing a months supply of medicines.

**Recommendations**

1. **The TB division should explore the feasibility of a uniform ordering and stock control system at the hospital pharmacies**

2. **The TB division should switch to fixed dose combination tablets of proven quality and bioavailability**
MONITORING

Recording and reporting system

The NTP recording and reporting system has the following components:

- Laboratory register
- Laboratory request form
- District TB register
- TB treatment card
- DOTS card kept by the observer
- 4-monthly reports on: case-finding, sputum conversion at the end of the intensive phase and treatment outcome.

The WHO recommended recording and reporting system is used in all DOTS districts. The quality and completeness of all components of the system was adequate. Delays in reporting are few now. The new system has yet to be applied in non-DOTS districts, most of which still use the old register. However, as the old reporting system has collapsed, national case finding reports are incomplete, and there is an urgent need for all districts to introduce the revised recording and reporting system.

Mistakes in registration and reporting as well as incomplete registration are few. A duplicate TB register is kept by the DTC in many districts. Filling in treatment cards and TB registers is usually done by the TB clinic staff. In some districts there are different formats of treatment cards. Health workers generally keep excellent records in the areas visited. Trimesterly reports are usually prepared by the DTCs, in collaboration with the TB clinic staff. In some districts the data and reports are reviewed every trimester during the DTC meetings. This enables discussion on the analysis and interpretation of data for decision making.

Provinces of the central region have unacceptably high rates of default and transfer out, related to the large number of migrant workers who move back to their homes during treatment. At present, there is little attempt to determine the outcome of patients referred or transferred between districts. PTCs should have an important role in monitoring the outcomes of patients moving between districts in the same province. Regional CDCs should be responsible for implementing similar systems for patients moving between provinces in the same region. Monitoring patients who move between regions will be extremely difficult without a national registry.

There are multiple parallel systems for collecting data on cases and deaths from hospitals, namely:

(a) Monthly activity reports to Health Statistics Division of the Bureau of Health and Planning Division.
(b) Notifiable disease reports to the division of Epidemiology.
(c) Central tuberculosis registration to the TB Division.

These are in addition to the trimesterly reports from the DOTS districts utilizing the recording and reporting system. The accuracy and reliability of the various numbers from these reporting systems are questionable. It would be useful to rationalize the
reporting system in the future, with a view to avoiding duplication and assure reliability.
Recommendations

1. The revised national recording and reporting system should be introduced in all districts as soon as possible.

2. The TB division should develop a system for monitoring referral and transfer of patients between districts, between provinces, and between regions, to ensure completeness of reporting.

3. The TB division, in collaboration with the Division of Epidemiology and Health Statistics Division, should study the feasibility of rationalizing the current parallel systems for reporting tuberculosis cases and deaths.

Operational Research

The Chulalongkorn University is involved in several important operational research projects together with the TB division:
1. Randomized controlled trial of DOTS versus non-DOTS
2. Economic impact of TB at household level
3. Cost effectiveness of TB control strategy
4. Factors associated with adherence to TB treatment

The Prince of Songkla University (PSU) works closely with the zonal TB centres in Southern Thailand to conduct studies regarding:
1. Evaluation of DOTS implementation in southern Thailand
2. Validation of directly observed treatment practice in lower part of southern Thailand

Another good example of operational research is “Model Development of DOTS in Prison in Thailand”. Thailand has a population of over 150,000 prisoners in 130 prisons. TB division has collaborated with Medical Service Division, Department of Corrections, Ministry of Interior to implement DOTS in 11 prisons in Bangkok since January 1997. Despite the high prevalence of TB/HIV (65%), smear conversion rates are high (>85%). The Prince of Songkla University is conducting a study on TB transmission in prisons using traditional epidemiology and also molecular epidemiological method, i.e., DNA fingerprinting. Together with the DOTS implementation in prison, these operational researches may give us important finding for prevention of transmission of TB.

These are excellent examples for the collaboration between University and Ministry of Public Health for development and improvement of TB control strategies, especially DOTS.

In the future, the analysis and interpretation of routine data collected through the trimesterly reports should be strengthened by identifying areas for operational research to improve DOTS implementation. Such research should improve management and possibly result in policy changes and new interventions for TB control. Topics for operational research in the future are:
(a) Transfers and referrals
(b) Urban TB control
(c) Standardized treatment for chronic patients (MDR-TB)
(d) DOTS by academic institutions

Recommendation

1. The TB division should collaborate with universities and medical schools to develop the capacity of PTCs and DTCs to conduct operational research.
ANNEX

Annex 1: TB control in the Bangkok Metropolitan Administration
Annex 2: Smear microscopy quality assurance (QA)
Annex 3: Press release for review briefing
Annex 4: Team members, list of places visited and people met
Annex 5: Organization of the Ministry of Public Health
Annex 6: Abbreviations
Annex 1: TB Control in the Bangkok Metropolitan Administration

Summary of Findings

1) Approximately one sixth of the total population of Thailand live in the Bangkok metropolitan area (estimated around 10 million). The expected annual number of smear-positive cases is 7,000, the total number of cases is approximately 15,000.

2) The control of TB in Bangkok is complicated by important differences to the situation in rural areas:
   • The proportion of drug-resistant cases is higher at some treatment facilities and has been increasing during recent years
   • The proportion of HIV-positive cases is higher
   • The migration of population from rural areas

3) 90% of TB cases in Bangkok are currently diagnosed and treated outside the BMA system. The majority of those present to large hospitals. Staff at these institutions acknowledge that treatment outcomes are generally poor, since the hospitals do not have the facilities to ensure direct patient observation during treatment.

4) The Bangkok Metropolitan Administration (BMA) has the necessary infrastructure to provide supervised treatment for every patient. The DOTS policy has been successfully introduced at a number of BMA health centres. Nevertheless, the proportion of all cases managed by the BMA to whom DOTS is offered is currently very small.

5) The BMA has developed TB control policy guidelines aiming at a comprehensive DOTS coverage of the Bangkok metropolitan area with DOTS treatment facilities. With the political commitment at highest levels, a rapid translation of the new policy into practical success appears possible.

6) There appears to be willingness on the part of large hospitals to refer TB cases to the BMA system after diagnosis. Registration, treatment management and outcome evaluation would then be the responsibility of the BMA.

7) The acceptance of the referral system depends on proven treatment success at BMA facilities and clear operational guidelines from the BMA regarding the administrative details of the referral system.

8) The DOTS policy has been successfully introduced in a number of prisons in Bangkok and expansion of the policy to provincial prisons is underway.

9) Currently, BMA has strong collaboration and links to the Anti-TB Association of Thailand (ATAT), who have dedicated staff/advisors. This provides good opportunities for their involvement in DOTS expansion.
Main recommendations

1) The BMA should rapidly expand DOTS coverage throughout Bangkok metropolitan area

To achieve this goal, the following steps are suggested:

- The BMA should urgently finalize the draft DOTS policy guidelines and issue them as an official BMA policy document for distribution to all BMA health care facilities.
- The BMA should introduce the DOTS strategy in a limited number of BMA zones in October 1999. Expansion to cover all zones should be implemented by February 2000, if the model DOTS centres achieve acceptable smear conversion results.
- All staff should be re-trained before introduction of DOTS in each zone. Specific emphasis should be given to the organization of DOTS within the BMA system and the responsibilities of staff at the various levels of health care facilities. The training courses should be organized in collaboration with the TB Division.
- Specific training courses on supervision skills for staff at all levels should be organized in collaboration with the TB Division. A schedule specifying the frequency of supervision at all levels should be urgently completed.
- Regular DOTS monitoring meetings for staff from all central network health centres should be started.
- The BMA should urgently clarify any requirements for additional funding for training, supervision and monitoring activities.
- There is a need for staff to learn from experiences with other successful urban DOTS projects. A joint team of experts from the BMA and the TB Division should visit a number of DOTS implementation sites in other countries.

2) The BMA should establish a comprehensive referral system for TB patients including all government hospitals in Bangkok

To establish such a system, the following activities are recommended:

- Design a map of Bangkok that can be used to identify DOTS treatment centres close to patients' homes. The map should include contact details (address, tel., fax) for each centre and clear guidelines about where referral forms should be sent (e.g., one copy to treatment centre, one copy to central network health centre).
- Develop standard referral forms for distribution to all hospitals.
- The initial introduction of DOTS in a small number of zones should include collaboration with staff from the large hospitals, who should be involved in the evaluation of treatment outcomes. This step is likely to increase confidence in the referral system, if outcomes are satisfactory. GIS mapping could be employed to visualize the functioning of the new system and the results achieved.

3) A strong advocacy program should accompany the process of DOTS implementation in Bangkok

The following activities are suggested:

- Strong links should be established between all institutions involved in TB control in Bangkok. Specific activities could be in the form of regular meetings of a newly established national TB committee.
• A variety of patient information materials (posters, brochures, videos) should increase public awareness of the DOTS referral system. The material should clarify why it is in the patients’ best interest to have their treatment monitored at BMA facilities, while supporting their freedom to choose a trusted institution for diagnosis.

• Potential roles of NGOs and other funding agencies in social mobilization should be explored. Specifically, the experience of agencies involved in advocacy for HIV/AIDS patients should be tapped.

4) Strong links between clinical facilities and academic and research institutions should be established

Specific recommendations are:

• Research fellowships should be established to enable staff from academic institutions to perform studies on TB control in Bangkok, with specific emphasis on evaluation of the new referral structure and the results of DOTS in the BMA system.

• Research findings could be presented at an international conference on urban TB control to be held in Bangkok. The conference could probably take place at the beginning of the year 2000. Planning should be initiated by the BMA in collaboration with the TB Division and WHO.
Overview of Current Situation

Population size

According to the data from the National Statistic Office (1993-1997), the population size of the Bangkok metropolitan area is officially reported as 5.6 million. However, it is currently estimated that actually around 10 million people live in the area, i.e., about one sixth of the total population of Thailand.

Organization of the health system within the Bangkok Metropolitan Administration (BMA)

Organization chart of the BMA shows 2 administrative departments dealing with health issues in the City: (1) the Department of Medical Services in charge of 8 public hospitals and (2) the Department of Health in charge of 60 health centres and 81 sub-health centres distributed in 6 zones to cover the total Bangkok. Both of them are under the Permanent Secretary for the BMA directly linked to the Governor’s Office. There are 4 deputy Governors, of whom one is responsible for Public Health. The BMA has various health committees which includes a Development Committee for TB Control for Bangkok Metropolis, currently chaired by Dr Kachit Choopanya. A comprehensive system of community health volunteers is managed at the health centre level.

The private health sector is playing a crucial role in Bangkok. About 200 private hospitals and around 4,000 private clinics are currently working in the capital city.

Epidemiology of TB in the BMA

On the basis of an average ARI for Thailand of 1.4% in 1998 (see Page 9, Estimates of total disease burden), approximately 7,000 smear-positive TB cases are expected to occur annually, and the total burden from all forms of TB is estimated to be 15,000.

The epidemiology of TB in Bangkok differs from the country average. Based on demographic characteristics of the Bangkok population, a greater case-load in the younger age-groups is expected. Since there is underreporting of cases in these age groups in rural areas, the actual case-load occurring in Bangkok may even exceed the figures noted above (see Page 10 Case notifications). Several institutions in Bangkok have reported drug resistance levels that considerably exceed the national average, with a rising trend during recent years. Initial MDR levels (including primary and unspecified previous TB treatment) at the Central Chest Hospital were 4.4% in 1996 (national average 2.5%). These findings may be exacerbated by the impact of the HIV epidemic, which is more pronounced in Bangkok. In 1998, the level of HIV positivity among TB cases was 19.9% at the Central Chest Hospital and 17.2% at the TB Division, while the national average for the same period was 15.8%.

Treatment and registration of TB patients in Bangkok

Treatment for TB patients is available at BMA health care facilities, government hospitals and university hospitals, as well as in private hospitals and clinics. Outside the BMA system, TB patients are regularly charged fees for both diagnosis and treatment. However, many hospitals charge fees depending on the patient’s socio-
economic status. The TB division currently supplies drugs to the BMA for free
distribution, but not to the large hospitals. A central register for all TB patients in
Bangkok does not exist and information has to be obtained from individual
institutions. The total number of TB cases registered at BMA facilities in 1998 was
1,500. During this review, three large hospitals were visited: Central Chest Hospital
(CCH), Siriraj and Bamras hospital. At CCH, the number of cases was 3,100 in 1998
(25% with residence outside Bangkok) and at each of the other two hospitals the
number exceeded 1,000. From this partial assessment, it appears that most of the 90% of
the estimated total cases that are not detected by the BMA, are currently treated at
hospitals outside the BMA system. At the hospitals (and currently in most of the
BMA system), the usual case management consists of drug supplies for one month
and monthly follow-up visits. With this system, CCH reported a default rate of 31% in
1998, Siriraj a treatment completion rate of less than 50% in 1998, and the BMA an
overall completion rate of 46% in 1998.

Recent efforts made to address previous issues

In response to the generally poor results of TB case management in Bangkok, there
have been various fragmented efforts at establishing a DOTS system during recent
years. Many of the large hospitals have tested the policy package at their OPD clinics
demonstrating better result in compliance and conversion rate with supervised
treatment of patients. However, the hospitals lack the infrastructure to offer
supervised treatment to patients living at further distances. Since confidence in the
BMA’s capacity to handle cases is generally low, referrals rarely occur. The BMA
has successfully tested the complete DOTS policy package in a small number of
health centres and has now developed draft policy guidelines that aim at achieving
coverage of the whole metropolitan area.

Organization of treatment under the new BMA policy

During this review, the team visited three BMA health centres that have implemented
the DOTS policy. At these centres, patients receive directly observed treatment either
daily at the health centre or through health volunteers, who report weekly to the
centres. Treatment outcomes at these centres are satisfactory with smear-conversion
rates exceeding 90%. The proposed method for expansion of the system is described
in a draft BMA policy document. Eighteen “Central network health centres” (CNHC)
are to be established across the city, each of which would be responsible for two to
four peripheral health centres (HC). The average population for the area covered by
each CNHC would be around 500,000. In the new system, the CNHC will be
exclusively responsible for the diagnosis and registration of new cases. TB suspects
presenting to peripheral HC will be sent to CNHC for diagnosis and management.
Each CNHC has facilities for sputum smear microscopy and chest x-ray. After
diagnosis, patients will be transferred to the HC (or sub-HC) closest to their homes for
further management. Follow-up sputum samples can be either collected by patients
presenting themselves at the CNHC or may be forwarded from peripheral HC.
Treatment evaluation will be performed at the CNHC, which is responsible for
forwarding the three trimesterly reports to the TB Section. Within each of Bangkok’s
six zones, one CNHC will also act as “coordination health centre”. In addition to the
CNHC functions described above, the coordination health centre will have the responsibility of supervising TB staff in all health centres within the zone. A graphical description of the new system is shown in Figure 1.

Figure 1: Organization of HCs in the BMA DOTS system (at zonal level)

The review team had the impression that the new system is principally adequate for achieving comprehensive DOTS coverage. However, the system is currently still in the planning phase and several shortcomings were noted. Not all health centres have been informed about the assignment of CNHC and there appeared to be some disagreement with the currently available plan. Responsibilities for recording and reporting were unclear, e.g., some staff at peripheral health centres would prefer to keep a patient register and were unclear about the policy of central registration at the CNHC. The DOTS system is currently limited to the level of health centres. The inclusion of additional resources, such as sub-health centres and health volunteers, is not yet fully explored.

Recommendations
1. To make the system of CNHC and peripheral HCs acceptable, discussions with all involved staff in each zone are strongly recommended. Once the assignments have been fixed, they need to be circulated as an official document to ensure compliance with the new system.
2. While the keeping of patient registers at peripheral HCs is acceptable, CNHCs should register TB patients and evaluate their outcomes.
3. The sub-HC should be included in the system, to ensure optimal management of a large number of cases.
4. The involvement of health volunteers should be strengthened, especially in providing supervised treatment to TB patients.

Diagnosis

All CNHC have good diagnostic facilities, including smear microscopy and chest x-ray facilities. However, laboratories were often under-staffed and there was no QA system. While all laboratory staff had been trained at the TB Division, the quality of smear preparation and staining appeared sub-optimal, especially in laboratories where smears were prepared by nurses (i.e., not qualified laboratory technicians). Although the use of nurses for smear examination is acceptable in a situation of general staff shortage, their performance should be systematically monitored through supervision and quality control.

Recommendations
1. The BMA should ensure that each CNHC has a qualified laboratory technician.
2. The policy of screening by chest x-ray should only be used for some high-risk populations.

Recording and reporting system

At BMA health centres where the DOTS policy has been implemented, recording and reporting follows the standards used within the NTP. The team observed that all records were adequately kept and there were no problems in the preparation of trimesterly reports. The reporting procedures within the BMA needs to be finalized. It was not clear whether CNHCs are to report to the co-ordination health centres or to the TB section. Also, it was unclear who would have authority to demand the submission of reports in cases of delay. The large hospitals follow individual methods of case registration. They usually did not follow standard NTP guidelines for case classification. Therefore it is impossible to perform cohort analyses with the systems in place. Due to the large case numbers, most registration systems are computerized. There is currently no central case register for all TB cases treated at the various institutions in Bangkok. It is therefore impossible to make precise statements about the total numbers who are currently registered.
**Recommendations**

1. The BMA and the TB Division should discuss the possibility of introducing the uniform recording/reporting system at the large hospitals.
2. A central TB register should be established for all treatment facilities in the Bangkok metropolitan area. The location of this database should be at the TB section of the BMA, which should regularly forward data to the TB Division.
3. The reporting procedures within the BMA should be established. It must be ensured that reports from all CNHC are received at the TB section. The TB section should establish a computerized database for all reports.
4. Training for laboratory personnel within the BMA system should specifically focus on the laboratory recording system.

**DRUG POLICY AND SUPPLY SYSTEM**

**Anti-TB Drug regimens**

All BMA health care facilities are using the standard regimens according to the national policy. TB drugs are given to patients on a daily basis or three times a week (intermittent treatment). TB drugs are packaged according to daily or intermittent treatment. Deviation from the national policy was noted in all hospitals visited during the review. For example, at Bamras hospital, most of the HIV+/TB patients receive the initial phase of treatment for more than 2 months, sometimes up to five months until sensitivity results are available. In general, there is no consensus on standardized regimens at hospitals.

**Drug Costs**

TB drugs are currently provided free of charge by the TB division to all BMA health care facilities. In all BMA health centres, TB drugs are provided free of charge to the patients. Government hospitals generally use their own budget. In hospitals, only patients who cannot afford to buy drugs can receive TB drugs free of charge.

The current reporting system from the BMA health centres to the TB division does not allow adequate annual planning to order and deliver TB drugs according to the needs. Although no drug shortages have occurred in the BMA health care facilities in recent years, there is considerable overstocking and large quantities of outdated TB drugs have been recently returned. In the future, when more patients are referred by the hospitals to the BMA health centres, a better drug monitoring and ordering system should be established.

**Recommendations**

1. Standard drug regimens should be used in all facilities implementing DOTS in Bangkok, and personnel (doctors, nurses, etc.) should be trained accordingly.
2. For planning purposes, and to provide TB drugs free of charge for all TB patients, the TB division should estimate, order and deliver TB drugs to BMA health centres and hospitals based on the number of cases registered in the recording and reporting system.
POLITICAL COMMITMENT

The new guidelines for TB control at the Department of Health of the BMA shows the strong commitment from the highest health authorities to ensure effective TB control through DOTS implementation.

A development committee for TB control has been established to facilitate DOTS implementation. However, translation of the policy into practice is still in the planning phase and political commitment needs to be sustained in the long term.

Recommendations

1. Advocacy materials should be developed and widely distributed to public and private hospitals, as well as to the general population. Advocacy messages should point out the positive achievements reached with DOTS in the already operational health centres.

2. Technical collaboration between the TB division and the BMA should be strengthened.

3. The newly established national TB committee should particularly focus on the problem of urban TB control.
Annex 2: Smear Microscopy Quality Assurance (QA)

Need and present situation

Smear microscopy for AFB in sputum is one of the pillars of the DOTS strategy. Diagnosis of the infectious cases and their follow-up during treatment are entirely based on this test. Quality assurance is thus always needed as a component of the NTP. The Thai NTP laboratories are mostly well staffed and well equipped, so basic conditions are fulfilled to assure a good quality of performance. However, some factors might have a negative influence:

- The number of sputum examined for AFB is low in most of the districts (often less than one positive is seen per week)
- Although training of technicians has been done systematically, it has not always included all aspects of AFB-microscopy (sometimes because of time constraints). Not much on-the-spot training has been possible because of the infrequent supervision. Finally, there is the unavoidable turn-over of staff.
- Quality of smearing and staining observed was regular sub-optimal. Occasionally a centre showed an unusually low positivity rate among suspects. More often there was excessive inconsistency of results in series of positive cases or/and rather low rates of positivity at 2 months follow-up.

For these reasons, a system for regular quality assurance is necessary.

At present, the situation regarding quality assurance is unsatisfactory. Various systems have been recommended in the past, but no clear guidelines have been developed by the NTP. Activities for QA seem highly variable between regions:

- QA of stains and reagents prepared by the zonal TB centres is done at least by some, but incompletely (only positive controls included). Batches of reagents were not numbered or dated.
- Proficiency testing by means of centrally prepared smears has been done on a limited scale by Regional Medical Science Laboratory (RMSL), and feed-back was given. The few results that could be seen were excellent.
- External quality control by cross-checking of routine smears at a higher level (QC) was said to be done in all provinces visited. However, evidence was most often only based on the statement of technicians that slides for QC had been sent regularly. No feed-back was present in the majority of the centres. As a rule, QC is the responsibility of the zonal TB centres. Controls in Chantaburi provincial laboratory were a local initiative. The techniques of sampling, sample size and system of controls used are not standardized since clear instructions are lacking.
- QA during laboratory supervision visits has been done only by people from the TB Division and Zonal TB Centres, without involvement of PTCs or DTCs. An extensive supervision checklist exists.

Components of a proposed QA system

A. Training

- Training of laboratory technicians / assistants:
  - at district level, it should cover techniques of smearing and Ziehl Neelsen staining, AFB microscopy, safety issues and administration, besides the storage of slides for QC
  - at provincial level, also QC technique including feed-back and supervision should be covered
  - at regional level, preparation and QA of reagents besides other logistic issues should be taught
- Training of DTCs, PTCs and RTCs should include some elements of QC, especially sampling and interpretation / feed-back.
B. Supervision
- Supervision by zonal TB centre laboratory technicians should continue at a once yearly rhythm or as per needs, and it would be desirable that also technicians from the provincial laboratory supervise their districts at this frequency. They will look mostly at technical and administrative issues, using a national format laboratory checklist.
- Since this supervision cannot be so frequent, DTCs and PTCs should visit the laboratory during their supervision visits to a centre. They can use a more general checklist, paying attention mainly to administrative issues, less to technical matters. At the same time, they can take a sample for QC and/or give feedback on earlier QC series.

C. Proficiency testing by sending smears with known results from central to periphery
- Although of lesser value for established centres and experienced microscopists, proficiency testing can continue to be organised by the RMSL if they wish to do so. A limited series of 4 to 6 slides sent out once a year is adequate.
- It is also an excellent tool to assess capacities at the end of a training course.
- It should be used to test zonal TB centre technicians in view of their high turn-over. TB Division is responsible for this part. For these two last indications, more extensive series (10 to 20 smears) should be used.

D. Cross-checking of smears (QC)
- This is the most efficient method to assess the level of performance of individual laboratories and to improve it at the same time. However, it is also the most demanding one. Well established QC should be considered as a priority requirement for DOTS expansion.
- A comprehensive QC system will require the incorporation of all levels of the health care structure, with the higher level controlling the one below: district is controlled by province, province by zone and zone by TB Division. At present QC is mainly the responsibility of the zonal TB centres, which are insufficiently staffed to provide QC to all districts, and are expected to suffer further personnel reductions in the future. Therefore, the incorporation of the provincial level is essential for a comprehensive QC system.
- The involvement of the provincial laboratories in the QC system will require a policy decision at the level of the Office of the Permanent Secretary of the MoPH.

E. Quality control of reagents
- Each batch of reagents prepared should be tested before distribution. It should be identified by a batch number, and records of the test results must be kept.
- Tests should include positive as well as negative control smears. Both should be checked for presence and colour of AFB as well as background after one staining cycle. To detect contaminating saprophytic mycobacteria possibly present in the acid or counterstain, the negative slides should then be cleaned of oil and subjected to one or more additional complete staining cycle, and re-examined for presence of AFB.
- Date of manufacturing should be shown on each bottle and peripheral laboratories should be instructed about the shelf-life of the reagents.
F. Internal quality control
- National guidelines for AFB smear microscopy should be present in each laboratory.
- They should include instructions on safety and protection of the laboratory staff. Safety cabinets should be used only if they are provided with an extract fan.

G. Quality assurance of culture and drug sensitivity testing (DST) of *Mycobacterium tuberculosis*
At present there are too many laboratories doing sensitivity testing, and only one of the TB Division participates in external proficiency testing by a supranational reference laboratory. Once QA of smear microscopy has been addressed satisfactorily, the NTP should scrutinise the needs for decentralised DST. If more than one laboratory is needed, they should all be subjected to QA of DST.

**Levels and facilities available for QC by cross-checking of smears**
- It is clear that the workload involved in cross-checking will be excessive for both TB Division and zonal TB laboratories. With full DOTS expansion, the TB Division would have to control over 800, the zonal TB laboratory on average 71 peripheral laboratories. With the present manpower, this is inconceivable on a regular basis.
- On the other hand, provincial laboratories would have to check on average only 11 laboratories (with a maximum of 30). At present they are busy with the routine work for the provincial hospitals, but staff and infrastructure seem adequate. However, some reorganisation of the routine AFB microscopy might be possible, i.e. saving time by examining the routine smears by fluorescent technique if this equipment is available. It is estimated that on average 25% of one full-time technician could be available for QC at the provincial laboratories. With a judicious choice of sample size, this can be sufficient for most provinces.
- Although it is desirable for the provincial laboratory technicians to supervise district laboratories in their own province, a brief survey in a number of provincial and regional hospitals in each region should be made to find out their present status (the number of personnel), whether they are involved in smear microscopy work only or multi-functional in their workload, for consideration to submit to the Office of the Permanent Secretary of the MoPH for policy decision. In the meantime, some of the provincial laboratories should be selected to do so on a trial basis (following the example in Chantaburi), particularly for provinces which proved to make good advance in their DOTS coverage expansion.
- As the zonal TB centres alone cannot cope with the workload in QA for all the districts in their zones at present, for the time being they should concentrate only on districts that have implemented DOTS, as an interim arrangement. For the non-DOTS districts, at least, they can choose to look into those which appear to have problems, such as those with smear results of very low positive rate, or with excessively high positive rate, etc.

**Proposed process for cross-checking of smears**
- Collection of smears: laboratories keep all slides, positives as well as negatives, in boxes according to their serial number. Separate boxes for positive slides can be used but this is not essential. Slides should be cleaned of most of the oil (toilet / tissue paper or xylene if this is preferred). All slides should be identified unequivocally, but no result should be written on them.
- Sampling: is done each trimester by the PTC during a supervision visit. 30 negative slides selected randomly are needed, as well as 6 positives. The positives do not have to be selected at random, but care should be taken to pick three low positives (scanty
or 1+ results). Suspect as well as follow-up smears can be included. Selection should start from the laboratory register to verify the completeness of the collection. A simple way of random selection is to count first the total number of negative results during the period, and divide this number by 30 to find the sampling interval to be applied. If for instance 90 negative results were recorded, every third negative should be selected starting with the first, second or third of the period. Laboratory numbers and local results are recorded accurately on a standard national QC form, and then the corresponding slides are taken from the boxes. A code for the centre is added on each slide if necessary. Slides that were not selected should be discarded immediately to allow for a fresh start of collection.

- Screening of selected smears: should be done by provincial laboratory technicians in a blinded way, for this reason they should only receive a form with slide identification numbers while the original list with peripheral results is kept by the PTC. First screening should start with a macroscopic assessment of smearing and staining. To cover all possible sources of error, all slides should then be cleaned in xylene and restained prior to microscopical reading. First reading should be done in the same way as instructed to the centres, so only 100 fields should be checked if this is the specification in the NTP manual.

- PTC will collect the screening results, add them to the original list and identify slides with discordant results. This should include mainly the difference positive-negative or scanty-negative, serious quantification differences (at least 2 log) can be included in a later stage. Identification numbers and both quantified results of discordant slides should then be listed on a new form, which should not show the origin of either result. It will be used for a second control of discordants only, which will allow to decide who made the error (peripheral centre or first controller), as well as to check the validity of the first controls.

- Second level of control: for operational simplicity and to allow early feed-back this should be done at the provincial laboratory as well, preferably by the head technician. The list with discordant results should be used for guidance, to stimulate for instance a more thorough search in case of a scanty - negative discordance or to show that accurate quantification is asked for. Bias can still be excluded since these controls will be blind to the origin of the results. This second controller should now spend sufficient time to confirm or exclude the presence of AFB with a high degree of certainty and this result will be considered as the gold standard. However, it should be realised that some errors will occur also at this level in case of smears containing only very few bacilli.

- Feed-back to centres: should be done as early and regular as possible. In general, the PTC should return the completed form showing all results and an appreciation / suggestions for improvement, or another standard format, together with the slides judged to be clearly false negative or false positive (so not the scanty). For those, records at the centre should be checked to exclude administrative errors i.e. a wrong result copied on the list, and then the peripheral technician should get the chance to check the slide again. This allows continuous education and constitutes a check on the performance of the second controller as well, i.e. in case the latter declares a false positive while the centre can show that AFB are present in sufficient numbers, the second controller should be encouraged to read more carefully.

- Interpretation and action to be taken: clearly false positive results are not acceptable, irrespective of statistical considerations. Their cause should always be investigated and corrective measures taken (i.e. more careful registration, or retraining...). False negative results cannot completely be avoided even by the best technician under optimal circumstances. Considering scanty and high false negatives together, a maximum of 5 % of all negatives could be taken for a start. At the proposed sample size (30 per centre per trimester or 90 per year) and applying a one-sided statistical test (Lot Quality Assurance Method, LQAS), this allowed maximum might be exceeded if among the 90 negatives more than 1 false negative was identified. An investigation as to the possible causes is then indicated. The latter may necessitate a
visit by provincial or zonal technicians, who will then review the whole process of smearing, staining and reading, check equipment.

- The LQAS test does not allow the calculation of error-levels within narrow confidence intervals for each centre. However, this is possible for the totals per province, zone or nationally.

- Workload for the provincial laboratories: on average 11 X 108 = 1200 slides have to be cross-checked per year per province, plus an additional 10% of discordants (to be counted double, more time-consuming readings). So estimated average annual number is about 1500. At 15 minutes per slide for the full process including administration, restaining and reading, this amounts to 375 working hours or less than 50 working days. This is 20% of one full-time technician.

If controls have to be done at the zonal laboratories, almost 2 full-time technicians would be needed.

For release on 21 July 1999

Thailand to lead in the fight against TB in cities

"Ministry of Public Health and the Bangkok Metropolitan Administration join hands in fighting TB"

Fighting TB in cities presents the next major challenge for health services in Thailand. The Bangkok Metropolitan Administration will lead a partnership of health care providers, academic institutions, NGOs and community organizations in implementing the TB control strategy known as DOTS in the city.

The Governor of Bangkok, Dr Pichit Rattakul, issued this statement today, following an international review of the TB situation in the country. The review was conducted by a group of 35 experts and consultants from the World Health Organization, the Ministry of Public Health, the BMA, major universities in the country and the Anti TB Association of Thailand.

DOTS is a system in which a trained health worker, volunteer or family member takes the responsibility to watch the patient swallow their medicines each day. This is the only method to ensure that patients complete their treatment and are cured, and prevents the development of drug resistant TB.

"The HIV epidemic, drug resistance, migration and inadequate treatment creates an environment in which TB spreads rapidly. These are all common features of the TB epidemic in large cities", said Dr Pichit Rattakul.

About 90% of TB patients in Bangkok are managed by large hospitals. Many of the patients fail to complete a full course of treatment, and continue to spread the disease. The new proposal is based on close collaboration between the many hospitals and health centres in the city, and will ensure that patients receive a full course of treatment. The BMA health infrastructure will provide supervised treatment to patients through the comprehensive system of health centres and community health volunteers.

"The BMA has developed a plan for DOTS expansion across the metropolitan area and citywide coverage will be achieved by the year 2000," said Dr Pichit Rattakul.

Success with DOTS in rural areas of Thailand has given the city authorities confidence that DOTS will work in Bangkok.

"Thailand introduced the WHO recommended strategy for effective TB control, known as DOTS in 1996" said Mr Kumron Na Lumphun, Deputy Minister of Public Health. "After achieving successful results in pilot districts, DOTS has gradually expanded to cover 40% of the country."

According to the review report, several innovative methods of direct observation of treatment have been developed at the community level, catering to the convenience of
the patient. The review team members noted a high level of patient satisfaction with
the DOTS. Health personnel are enthusiastic and motivated to deliver high quality
care to their clients.

Good results have been obtained with DOTS, and up to 9 out of 10 patients have been
treated successfully in many districts. This is a remarkable improvement since DOTS
was introduced in 1996.

"Thailand has demonstrated that DOTS can be successfully implemented in the
country," said Dr E.B. Doberstyn, the World Health Organization Representative in
Thailand. "This is due to the strong political commitment of the Ministry of Public
Health to DOTS. Financial support to the TB programme has been sustained during
the past years, enabling a continuous supply of drugs and other essential materials to
diagnose and treat patients".

"The Ministry of Public Health aims to expand DOTS rapidly to achieve countrywide
coverage by 2001. The experiences from the past three years will enable the provinces
to plan for training of personnel and monitoring of the programme performance," said
Dr Vallop Payanandana, Director of the TB Division.

Dr Arata Kochi, Director of the Prevention and Control of Communicable Disease
Control in the World Health Organization, Geneva welcomed these developments in
Thailand. "WHO is pleased with the priority given by Thailand to implement DOTS
and the plans to achieve countrywide coverage by the year 2001. With the continued
political commitment of the Ministry of Public Health and the BMA, Thailand is well
placed to reach its goals and be a leader in the fight against TB in Asia," he said.

For more information, contact:

Dr Vallop Panayandana
Director, TB Division
Department of CDC
Ministry of Public Health

Dr Pongpat Pongwatanakulsiri
Director, Disease Control Division
Bangkok Metropolitan Administration
## Annex 4: Team members, list of places visited and people met

### Team Members

<table>
<thead>
<tr>
<th>Team</th>
<th>Members</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bangkok Team</strong></td>
<td>Dr. Songkram Supcharoen, President, Anti-TB Association of Thailand</td>
</tr>
<tr>
<td></td>
<td>Dr. Teeravat Walaisatient, Director, TB Zonal Centre 5</td>
</tr>
<tr>
<td></td>
<td>Dr. Sripapra Nateniyom, Chief, Radiology Section, TB Division</td>
</tr>
<tr>
<td></td>
<td>Ms Pratin Jadton, TB Division</td>
</tr>
<tr>
<td></td>
<td>Dr. Charles Delacollette, Medical Officer, Division of Communicable Disease Prevention and Control, WHO, Geneva</td>
</tr>
<tr>
<td></td>
<td>Dr. Holger Sawert, Medical Officer, WHO, Thailand</td>
</tr>
<tr>
<td><strong>North Team</strong></td>
<td>Mr Sukson Jittimanee, Technical Officer TB Division</td>
</tr>
<tr>
<td></td>
<td>Ms Dhanida Rienthong, Medical Scientist, TB Division</td>
</tr>
<tr>
<td></td>
<td>Dr Dusita Chanachaiwiboonwat, Director Mahachanachai Hospital, Yasothon Province</td>
</tr>
<tr>
<td></td>
<td>Dr Somdej Pinitsoontorn, Associate Professor, Faculty of Medicine, Khon Kaen University</td>
</tr>
<tr>
<td></td>
<td>Dr Nadda Srisayaphaya, WHO Consultant, Thailand</td>
</tr>
<tr>
<td></td>
<td>Dr Chris Dye, Scientist, WHO Geneva (12-13 July)</td>
</tr>
<tr>
<td></td>
<td>Dr Jacob Kumaresan, Medical Officer, WHO Geneva</td>
</tr>
<tr>
<td><strong>North East Team</strong></td>
<td>Dr Manus Wongsagiam Central Chest Hospital, Bangkok</td>
</tr>
<tr>
<td></td>
<td>Dr Phanchai Rattanasuwan TB Centre Zone 11 Nakhon Sri Thammarat</td>
</tr>
<tr>
<td></td>
<td>Dr Prasit Palittapongampim National Centre of Genetic Engineering and Biotechnology and Faculty of Science, Mahidol University.</td>
</tr>
<tr>
<td></td>
<td>Dr Takashi Yoshiyama Research Institute of TB, Japan</td>
</tr>
<tr>
<td></td>
<td>Dr Ying Ru Lo, WHO Thailand</td>
</tr>
<tr>
<td></td>
<td>Dr Nani Nair, WHO SEARO</td>
</tr>
<tr>
<td></td>
<td>Mr Pornsak Kotwong Epidemiology unit, TB Division</td>
</tr>
<tr>
<td><strong>South Team</strong></td>
<td>Prof Dr Chaivet Nuchprayoon, Thai Anti-TB Association</td>
</tr>
<tr>
<td></td>
<td>Dr John Lerwitworapong, Central Hospital, Department of Corrections, Ministry of Interior</td>
</tr>
<tr>
<td></td>
<td>Dr Somsak Akksilp, TB Zonal Centre 7, Ministry of Public Health, Thailand</td>
</tr>
<tr>
<td></td>
<td>Dr Hideki Yanai, (observer) Research Institute of TB, Japan</td>
</tr>
<tr>
<td></td>
<td>Mrs Watharee Lawanyakul, TB division, Ministry of Public Health</td>
</tr>
<tr>
<td></td>
<td>Dr Maarten Bosman, STOP TB Initiative, Geneva</td>
</tr>
<tr>
<td></td>
<td>Mrs. Sunan Nasongkla, TB division, Ministry of Public Health</td>
</tr>
<tr>
<td><strong>Central Team</strong></td>
<td>Dr Pasakorn Akarasewi, WHO/TB Division</td>
</tr>
<tr>
<td></td>
<td>Mr Somsak Rienthong, TB Division</td>
</tr>
<tr>
<td></td>
<td>Dr Veerasak Chongsuwatwong Songkhla University</td>
</tr>
<tr>
<td></td>
<td>Dr Petchawan Puengrasami, Zonal TB Centre 12/Songkhla University</td>
</tr>
<tr>
<td></td>
<td>Dr Armand van Deun, Damien Foundation/Institute of Tropical Medicine, Antwerp, Belgium</td>
</tr>
<tr>
<td></td>
<td>Dr Ian Smith, WHO</td>
</tr>
<tr>
<td></td>
<td>Mr Booncherd Kladpaung, TB Division</td>
</tr>
</tbody>
</table>
## Places Visited

<table>
<thead>
<tr>
<th>Team</th>
<th>Mon 12 Jul</th>
<th>Tue 13 Jul</th>
<th>Wed 14 Jul</th>
<th>Thu 15 Jul</th>
<th>Fri 16 Jul</th>
</tr>
</thead>
</table>
| Bangkok  | • Bankgok Metropolitan Administration  
• BMA health centre 22                                                      | • BMA health centre 4  
• BMA health centre 52  
• Bang Kwang Prison                                                      | • Thonburi Remand Prison,  
• Central Chest Hospital Nonthaburi                                     | • Siriraj Hospital  
BMA Health Centre 29                                                      | • Bankgok Metropolitan Administration  
• Bamras Hospital                                                           |
| North    | • Chiang Rai PHO  
• Phan district hospital  
• Ban Samklang Health Centre                                              | • Regional CDC 10  
• Faculty of Pharmacy, Chiang Mai University  
• Chiang Mai PHO  
• Sarapo district hospital  
• Sansai health centre                                                     | • Lamphun PHO  
• Banthi district hospital  
• Hyeswai health centre                                                   | • Phrae PHO  
• Song district hospital  
• Huamnaai health centre                                                  | • Zonal TB  
Centre 10  
• Nakorn Sawan PHO  
• Payuakhiri district hospital  
• Srabao health centre                                                    |
| North East| • Yasothorn PHO  
• Mahachanachai District Hospital                                         | • Roi-et PHO  
• Ad Samad District Hospital                                              | • Kalasin PHO  
• Kamalasai district hospital                                              | • Sakol Nakorn PHO  
• Gudbak district hospital                                                 | • Nakorn Panom PHO  
• Ramee Nakorn district hospital                                           |
| South    | • Surathani province  
• Praseang District Hospital  
• Sai Sopa health centre                                                   | • Regional CDC centre  
11  
• Nakhon Sri Thammaraj PHO Promkeeree District Hospital  
• Ban Auakua Tambon (sub-district) health centre                           | • Trang PHO  
• Nayong District Hospital  
• Coke Saba Tambon Health centre                                           | • Bangkaew District Hospital  
• Ban Ron health centre                                                    | • Songkla PHO  
• Rattapum District Hospital  
• Tama Prang health centre                                                 |
| Central  | • Trad PHO  
• Khaosaming District Hospital                                             | • Chantaburi PHO  
• 2 pharmacies, Chantaburi  
• Phraopokklao Provincial Hospital (laboratory)  
• Kang Hang Maew District Hospital                                         | • Samutprakarn PHO  
• Bangplii District Hospital  
• Bangkeaw Health Centre                                                  | • Petchaburi PHO  
• Kaeng Krachan District hospital  
• Maekemery Health Centre                                                 | • Pathum Thani PHO  
• Nong Sua District Hospital                                               |
People Met

Bangkok Team

Bangkok Metropolitan Administration (BMA)
Dr Kachit Choopanya, Chairman, Advisor Committee to the Governor of Bangkok for the Medical Services
Dr Krit Hiranjisa, Deputy Dir General, Dep Of Health, BMA
Dr Pongsupong Rangwanankulakul, Director, CDC Division
Dr Suwanee Rakhtham, Dir General, Dep Of Health, BMA
Ms Chitravorn Chatboonkerd, Dep of Medical Services, BMA
Ms Udaiwan Kanavanapa, Nurse, TB Subdivision

BMA Health Centre No 22
Dr Prun Isarankura Na Ayuthaya, Director
Ms Mali Panunruji, Nurse (DTC)
Ms Kanokwan Ranart, Nurse (Lab)
Ms Arum Yamri, Head Nurse
Dr Kovit Yongvanitsit, Director, HC 21

BMA Health Centre No 4
Dr Chanchai Koompong, Director
Ms Chumpon Pratitun, Nurse
Ms Radhanee Sakabucha, Technical Nurse

BMA Health Centre No 52
Dr Thawatchai Leelawutthi, Director
Ms Duangpom Angk功rd, Nurse
Ms Wanpen Jongpipatchari

Bang Kwang Prison
Ms Bang-on Pooaram, Prof Nurse, Medical Services Division, Dep Of Corrections
Mr Taweekam Kasiropol, Prof Nurse, Medical Services Division, Dep Of Corrections
Mr Sura Phantasakorn, Commander, Bang Kwang Prison
Ms Yupha Jeowtree, Prof Nurse, Bang Kwang Prison
Mr Amnat, Nurse, Bang Kwang Prison

Thonburi Remand Prison
Mr Tanapat Chandraparn, Commander, Thonburi Remand Prison
Mr Pravat Donnum, Prof Nurse, Thonburi Remand Prison
Mr Panom Prabwij, Ass Pharmacist, Thonburi Remand Prison

Central Chest Hospital Nonthaburi
Dr Prasert Ratanawat, consultant chest physician
Dr Yui Poomrued, Chief, OPD Section
Ms Vichitra Rittichai, Microbiology section
Mr Channarong Sudsantmart, Microbiology section
Ms Ratana Chaiwattanuwat, Statistical Unit

Siriraj Hospital
Clin Prof Phisut Chirawong, Deputy Dean, Faculty of Medicine, Siriraj Hospital
Prof Khun Nama Manavero, Deputy Dean for Research and Academic Affairs, Chief, Div Of Resp Dis and TB
Assoc Prof Anitha Nana, Staff, Div Of Resp Dis and TB
Prof Suchai Charoenratankul, Staff, Div Of Resp Dis and TB
Assoc Prof Naruporn Chaiwong, Staff, Div Of Resp Dis and TB
Prof Surapop Suwanakul, Chief, Dep of Preventive and Social Medicine,
Saraburi District
Dr Chaimo T Charean, Director Saraburi Hospital
Ms Wipawan Udchavee, TB clinic Officer, Saraburi Hospital
Mr Narongkiet Ngamlue, DTC
Mr Panurut Varapreedeek, LT, Saraburi Hospital
Mr Amarin Norchaivong, TB clinic Officer, Saraburi Hospital
Mr Chaiwat Lertrakchareon, Community Health Officer Sansai Health Centre
Ms Haruthai Bunchaleem, Community Health Officer Sansai Health Centre
Mr Bujoon Sanyod, Community Health Officer Sansai Health Centre

Lamphun Province
Ms Mayuree Pompibool, Chief CDC section
Ms Rawiphan Mongkol, PTC
Ms Orapan Chaisorontorn, PTC
Ms Chaonpinit Sukharun, PTC

Banthi District
Dr Jaras Singhkraew, Director Banthi Hospital
Ms Ratree Maneekut, TB clinic Officer, Banthi Hospital
Mr Sant Manokim, DTC
Mr Suwin Saia-arad, Head Sanitary section, Banthi Hospital
Ms Pinoy Seasua, LT, Banthi Hospital
Mr Thavsan Maneekut, Head Hywesai Health Centre
Mr Tawatchai Puetree, Technical Officer, Hywesai Health Centre
Mr Damrongrado Mungaiwong, Community Health Officer, Hywesai Health Centre
Ms Darunee Munaivong, Community Health Officer, Hywesai Health Centre
Ms Sripli Junthasing, Community Health Officer, Hywesai Health Centre
Ms Parin Palaphin, Technical Officer, Hywesai Health Centre
Mr Luechai Chumsawat, Community Health Officer, Hywesai Health Centre

Regional CDC 9
Dr Sukoot Tipatee, TB Programme Manager
Dr Kowit Panchet, Director TB centre
Ms Niyana Siritaw, Reginal TB Coordinator

Phrae Province
Dr Bhudong Weerahalin, PTC
Ms Issaree Teepuporn, PTC
Ms Narumon Thongphrap, PTC
Dr Preeda Deesuwan, Deputy PCMNO
Mr Fienchart Turakit, Chief CDC section

Song District
Dr Wanchai Wantaneeyawong, Director Song Hospital
Mr Songkran Tatan, DTC
Mr Thanagit Chiangdee, TB clinic Officer, Song Hospital
Mr Montree Thresas, LT, Song Hospital
Mr Chaiwat Lokhumlu, Community Health Officer, Huamani Health Centre
Ms Pompana Sumpao, Community Health Officer, Huamani Health Centre

Regional CDC 8
Dr Niporn Udomrat, Director
Dr Fitchai Tosukhnowong, Director TB Centre and TB Programme Manager
Mr Awat Samart, RTC

Nakhon Sawan Province
Dr Winai Sawasdivorn, PCMNO
Mr Manas Wataniyawatch, Chief CDC section
Ms Nantasana Wongsawan, PTC
Ms Rerai Tipcharoenporn, PTC
Ms Chanitra Rujirathanaluk, PTC

Payyahkhi District
Dr Somdon Riankam, Director Payahkhi Hospital
Ms Chantana Songyiput, TB clinic Officer, Payahkhi Hospital
Ms Phanrat Buranongsri, DTC
Ms Kanayan Prawala, Community Health Officer, Srabao Health Centre
Ms Arunwaj Sirithra, Community Health Officer, Srabao Health Centre

North East Team

Regional CDC Zone 7 Ubolratthanani
Dr Narong Wongba, Director 7th Regional CDC Office
Mr Thawatt Lichaphool, Information Centre, Regional CDC Office Ubolratthanani
Miss Innthai Khungsupun, CDC Zone 7 Officer, RTC
Ms Uthai Ittanakke, CDC Zone 7 Officer, RTC
Miss Nitya Bursanakam, Pharmacist, CDC Zone 7 RTC
Mr Somdej Sriman, Social worker, CDC Zone 7 RTC

Yasothon Province
Dr Suwit Wiwitpan, PCMO Yasothon
Dr Prakay Wiwonwip, Deputy PCMO assistance
Ms Nittaya Porunsi, RTC
Ms Mukda Sawai, RTC
Ms Sunthee Rassamit, Chief of CDC

Mahachanaichai District Hospital
Dr Prachuachok Methanawin, Medical doctor
Mr Sa-ad Samerphub, Chief DHO
Mr Charan Chaebundit, DTC
Mr Amphorn Silarak, TB clinic
Ms Amporn Ukong, TB clinic
Mr Pravit Komdung, Head of laboratory
Mr Pracha Pinchum, Laboratory personnel
Miss Champ Commee, Laboratory personnel

Roi-et Province
Dr Tamanun Kamnoonratayakun, Deputy Chief of PHO
Dr Pongsawat Suwanna, Deputy Chief of PHO
Ms Sungva Charoenroj, Deputy Chief of PHO
Ms Jira Sirikanok, Head provincial CDC
Mr Damrong Ratanavej, Chief of subdivision of Environmental and Occupational Health
Ms Duangta Longjai, Chief of Planning and Education
Ms Supitaya Sungkapit, Chief of Health Promotion
Ms Jongsuk Sirichaichai, PTC
Ms Asim-On Areporratana, PTC

Ad Saran District Hospital
Dr Tiwa Bomrunkul, Physician
Mr Viroj Poangphoo, DHO
Ms Kade Chiyaphum, DTC
Ms Oranuch Assansri, previous DTC
Ms Sompol Promsiridech, TB clinic
Ms Lamul Wisepussana, TB clinic
Mr Polsak Hachaigul, LT
Mr Vito Srito, LT
Ms Songtan Khananun, AIDS counselor
Ms Paima Akunthapichat, Lecturer Faculty of Pharmaceutical Sciences, Sirnakhrinwit University at Prasammit
Ms Rabiab Pipatamanongkon, Head of health centre

54
Ms Patcharin Pempon, TB response health worker
Ms Suporn Kanakai, Assistant Suporn Kanakai

Kalasin province
Dr Suriya RatanaParinya, Deputy PCMO
Mr Supot Kunkwa, RTC
Ms Nongruag Nonrichai, PTC
Ms Pakwadi Supanjitwanna, PTC
Mr Prasit Nunsathit, PTC
Mr Nitchai Siributr, PTC

Kalasai district hospital
Dr Supat Thapet, Director district hospital
Mr Som Nasaam, DTC
Ms Noodang Chanta-Uil, TB clinic staff
Mr Sirisak Prompan, LT
Ms Benchaphorn Chumpachum, Health worker
Ms Kednapa Chumpachum, Health worker
Mr Apichat Tungpruchyakul, Health worker

Sakol Nakorn province
Dr Poranet Kingko, Deputy Chief PCMO
Dr Somchai Promchak, Director Wanorn Niwat District Hospital
Ms Anong Bangkratoke, Provincial CDC
Ms Chammien Srikulwong, RTC
Ms Kasit Ruechaisai, Head PTC
Ms Rattikorn Ponuk, PTC
Ms Ploenrit Tongpan, PTC

Gudbat district hospital
Dr Somkiat Choobunditkul, Director Gudbat district hospital
Mr Pratana Srisawad, Chief DHO
Mr Weerapong Ungsakul, DTC
Ms Thanaporn Chantawi, TB clinic staff
Mr Pichian Eabbi, TB clinic staff
Mr Prakan Suksoi, LT
Ms Boonlai Wanawong, Health worker
Mr Pongsak Pra-Udom, Health worker
Mr Sawang Tipsondang, Health worker
Mr Chokchai Pothini, Health worker
Mr Pornsak Ruekrai, Health worker
Mr Jamrat Prakummin, Health worker
Mr Chaleaw Jaisiri, Health worker
Mr Paitoon Gudsang, Health worker

Nakorn Panom province
Mr Pisit Nimmakorn, Chief PCMO
Mr Virat Patimeti, Deputy chief, PCMO
Ms Jongkon Tanmikannon, PTC
Ms Sawad Silpy, CDC staff
Ms Limhong Haewpet, CDC staff
Ms Mondee Subsomboon, CDC staff
Ms Nuttika Anuwun, CDC staff
Mr Wanchari Nutboon, Chief provincial CDC

Ranue Nakorn district hospital
Ms Sirinun Subcharoen, DHO officer
Mr Manu Chaiwongjoj, Director Ranu Nakorn district Hospital
Ms Saavakorn Mapuh, TB clinic staff
Ms Homsub Suthisarn, TB clinic staff
Mr Srisomnuk Chunchak, DTC
Mr Surachit Boachum, Health worker
Ms Supanee Sarnthong, Health worker
Mr Petchamarn Lasprom, Health worker

South Team

Surathani PHO
Dr Uthumporn Kamphu Na Ayuthaya, Deputy PCMO
Ms Supanee Jantawee, head of CDC section
Ms Jikarn Tannukit, PTC
Mr Sujin Kongtaweewee, PTC
Ms Navapan Satitumarm, Supervisor in CDC section

Praseang District Hospital
Dr Udom Pamnaphong, director
Mr Santhad Kongthep, Director, Praseang District Health Office
Ms Pattheart Kumputhak, DTC
Ms Chansri Ranuklin, staff, TB clinic, Praseang District Hospital
3 TB patients with 3 DOTs observers

Sai Sopa Health Centre
staff and 1 TB patient

Regional CDC centre 11
Mr Kiansak, Mr Amornthep, and other RTCs
Dr Panumad Yannavetsakul, Director of 11th zonal STD/AIDS centre

Nakhon Sri Thammaraj PHO
Dr Yuttana Sinlaprattam, PCMO
Ms Sunee Chaisawan, Head of CDC section
Ms Supaluk Sakkuna, PTC

Promkeeree District Hospital
Dr Sakkarin Somsak, director Promkeeree Hospital
Dr Jakkit Pompet, TB clinic doctor, Promkeeree Hospital
Ms Nannawan Somsak, Pharmacist, Promkeeree Hospital
Mr Narong Thongun, Director, Promkeeree District Health Office
1 TB patient
Dr Kritorn Thotuptiang, Director, Pigoon Hospital
Dr Peerasong Sitiyuno, Director, Nabon Hospital
6 RTCs from 11 regional CDC office
3 staff from Nakhon Sri Thammaraj PHO

Ban Auakua Tambon (sub-district) health centre
Staff and TB patients

Trang PHO
Dr Viraj Kiatmetha, PCMO
Dr Vitoon Luangdilok, Deputy PCMO
Ms Nongluck Tongcheep, PTC

Nayong District Hospital
Dr Boocha Naknan, Director of Nayong District Hospital
Mr Somheo Naknan, Director of Nayong District Health Office
Laboratory staff and 11 HC staff join the meeting

Coke Saba Tambon Health centre
Two patients

Bangkaew District Hospital
Dr Sawai Apiwajaneewong, Deputy PCMO
Ms Suleeporn Nakauroj, Head, CDC section, PHO
Ms Boonthip Sankham, PTC
Ms Suphadee Kantha, PTC
Dr Porphorn Suakork, Director, Bangkaew Hospital
Dr Voravut Kooninnon, Physician, Bangkaew Hospital
Mr Panadda Chaiwirak, TB clinic staff, Bangkaew Hospital

55
Ms Sayan Sungnoy, laboratory staff, Bangkaew Hospital
Mr Utai Srivayo, Director, Bangkaew District Health Office
Mr Nop Suwanwong, Mayor, Bangkaew Municipality
Mr Thanawut Kongchao, Mr Kajohn Suvunno, Ms Ubonraat Jansang, Mr Surapan Thongborn, Mr Chatchawan Roungdater, Mr Suparat Kongma Ms Naiwan Banyadet

Ban Ron Health centre
Staff and TB patient

Songkla PHO
Ms Thitima Nakkaew, Head, CDC Section
Ms Korathat Julanant, PTC
Ms Samatchaya Parachapanich, assistant PTC

Ratupum District Hospital
Dr Suwit Kongchuchai, Director, Ratupum Hospital
Mr Paros Siri, TB clinic staff, Ratupum Hospital
Ms Varanangima Prayadwong, laboratory staff, Ratupum Hospital
Mr Tianchai Ruangurai, Director, District Health Office
Ms Isara Boongunnnerd, DTC
5 TB patients

Tama Prang Health centre
Staff

Central Team

Trad PHO
Dr Sermsak Suthikaniwatana, PCMO
Ms Malee Hongnapha, Chief of CDC, PHO
Mr Thanee Khengnakruak, PTC

Khaosaming District Health Office
Mr Sengr Thingnai, Chief, DHO
Mr Vichan Phaithiranana, DTC

Khaosaming District Hospital
Dr Yuthana Wanaphoklang, Acting Director, Hospital
Mr Chumreun Thanprasop, Chief, Sanitation Unit
Mr Arkom Unbangluang, TB Clinic staff
Ms Twen Chaiyarakar, DTC

Klongphug Health Centre
Mr Sompong Thanajit, HW
Nopphorn Sukri, TB patient (12 years old - visited at home with parents)

Chantaburi PHO
Dr Sonchai Watana, PCMO
Ms Prane Nongklahe, PTC
Ms Varunee Prompuang, PTC
Mr Somdech Kiree, PTC
Mr Udha Srirom, PTC
Mr Prasert Sakulnityompon, Pharmacy chief
Ms Aranya Nakakorn, Pharmacist
Mr Surasak Kittisuphatwana, private pharmacist

Phrapokkla Provincial Hospital
Mr Somsak Sirinam, LT
Ms Kanya Pungratanamon, LT
Mr Huad Juthachan, laboratory staff

Kang Hang Maew District Health Office
Mr Likhit Tubtimkhan, Chief of DHO

Mr Somkid Tunprawati, DTC

Kang Hang Maew District Hospital
Dr Patpong U-dompattana, hospital director
Mr Sakchai Thaikul, Sanitary section chief
Ms Rusda Nurati, TB clinic staff
Mr Sasana Phasuk, TB clinic staff
Mr Surasak Armchantee, LT
Mr Somdech Pitisa, TB patient

Samutprakarn PHO
Dr Krietisak Jirasitkul, Deputy PCMO
Ms Waiapasri Sukusudech, PTC

Regional CDC 1, Bangkok
Dr Phapin Kamolwat, MO, Regional CDC 1
Ms Greenien Namtachai, RTC
Ms Suparb Ronseuk, RTC

Bangpli District Hospital
Dr Wanchai Phisansin, Hospital director
Dr Manchit Prathiphan, MO
Mr UN Chamrang, Chief of sanitary unit
Ms Yenta Promchat, TB clinic staff
Ms Ladda Kerdphol, TB clinic staff
Mr Npandun Tubpern, LT

Bangpli District Health Office
Mr Torsak Ketnark, DTC

Bangkaw Health Centre
Ms Naporn Paungkol, Head of HC
Mr Khomkorn Tangkittirunguang, HW
Mr Rongnachai Boon-un, HW
Ms Changpen Songsuwan, HW
Mr Sukum Tiengan, TB Patient (visited at home)
Ms Khemala Tiengan (patient's mother)

Regional CDC 4 Rachaburi
Ms Jintana Wacsawadi, RTC
Ms Kanya Aksadul, Technical Officer
Mr Krinuek Suthum, LT

Petchaburi Provincial Health Office
Dr Wichai Wecha-osothasada, PCMO
Dr Sawaeng Homman, Deputy PCMO
Ms Suntharee Chaimetham, Chief of CDC
Ms Thamolwan Um-klad, PTC
Mr Akarin Aoum-oom

Petchaburi Provincial Hospital
Ms Terat Apudthingh, TB Clinic

Muang District Health Office
Ms Punnee Mecaree, DTC

Kaeng Krachan District hospital
Dr Rachin Phipponporn, Acting hospital director
Mr Pornchai Phutinpanachai, TB clinic
Mr Sunet Klinkrun, TB clinic
Mr Prasit Ruenggook, TB clinic
Ms Pratoom Phawaphadung, LT

Kaeng Krachan District Health Office
Mr Sawaeng Decadaung, Chief of DHO
Mr Sommai Ruenghadee, DTC

Maeekemery Health Centre
Ms Weena Punyanatham, HW
Mr Chit, TB patient (visited at home)
Mr Duang, VHV (patient's relative)

Regional CDC 1, Bangkok
Dr Prateep Warnisorn, MO
Ms Rawiwan Siwapradit, RTC
Ms Ruerthaiwan Boonpemdech, RTC

Pathum Thani PHO
Dr Wiwatana Theerawibool, PCMO
DrKreangsak Mukdeepong, Deputy PCMO
Ms Chitra Kachatan, Chief of CDC
Ms Chaida Bunyabutra, PTC
Ms Praphaporn Prasertsom, Technical Officer

Nong Sua District Health Office
Mr Chisawatana Suntop, DTC
Mr Arthapol Sonthipet, technical officer
Mr Somchai Eim-erb, technical officer

Nong Sua District Hospital
Dr Somchai Lapcharean, Hospital director
Mr Prapha Champasri, Chief of sanitary unit
Mr Chawalit Poungmala, TB clinic
Ms Wongduan Siri, LT

Napparat Health Centre
Mr Sanya Beerthong, HW
Mr Serm Jammuan, TB patient (visited at home)
Ms Somsri Boontem, DOTS observer (patient's daughter)
Annex 5: Abbreviations

AFB  Acid fast bacilli
ARI  Annual risk of infection
ATAT  Anti TB Association of Thailand
BMA  Bangkok Metropolitan Administration
CCH  Central Chest Hospital
CDC  Communicable Disease Control
CNHC  Central Network Health Centres
DHO  District Health Office
DOTS  Directly Observed Treatment Short Course
DST  Drug Sensitivity Testing
DTC  District TB Coordinator
FDA  Food and Drug Administration
GDP  Gross Domestic Product
GNP  Gross National Product
GPO  Government Pharmaceutical Organization
HC  Health Centre
HIV  Human Immunodeficiency Virus
HW  Health Worker
LT  Laboratory technician
MDR TB  Multi Drug Resistant TB
MoPH  Ministry of Public Health
NTP  National Tuberculosis Programme
OPD  Out Patient Department
PCMO  Provincial Chief Medical Officer
PHO  Provincial Health Office
PTC  Provincial TB Coordinator
QA  Quality Assurance
QC  Quality Control
RMSL  Regional Medical Sciences Laboratory
RTC  Regional TB Coordinator
TB  Tuberculosis
VHV  Village Health Volunteer
WHO  World Health Organization
ZTC  Zonal TB Centre