Report on National TB Prevalence Survey 2009-2010, Myanmar

Ministry of Health, Department of Health
Government of Myanmar

Report on National TB Prevalence Survey

2009-2010, Myanmar

Acknowledgements

The National Tuberculosis Prevalence Survey 2009-2010 for Myanmar was conducted by the National Tuberculosis Programme (NTP), Department of Health (DOH), Ministry of Health (MOH), the Union of Myanmar with the technical support from the World Health Organization (WHO) and the Research Institute of Tuberculosis/Japan Anti-Tuberculosis Association (RIT/JATA).

Financial, human resources and technical support for the survey were provided by the MOH, WHO, Three Diseases Fund, Japan International Cooperation Agency, RIT/JATA, Population Services International and the United States Agency for International Development (see Annex 1).

For data collection, NTP coordinated with state, regional, district and township health authorities. Local laboratory technicians and Basic Health Staff worked closely with the survey teams. The contribution of the Myanmar Health Assistant Association was also of great value in completing data collection, data cleaning and data entry. In addition, volunteers, local authorities and local communities participated and made great contributions to the survey.

The NTP is most grateful to MOH for its guidance and approval of this survey and for the continual encouragement which enabled NTP to complete the survey during a challenging period.

We express our deep thanks and appreciation to all organizations and individuals for their contribution in making this survey successful. We record our special thanks to Dr Hans H. Kluge from WHO for his strong support for this survey, and to Dr Ikushi Onozaki of WHO and Dr Norio Yamada of RIT/JATA for their tremendous contributions.

It is our hope both that the survey's findings reflect our country's actual disease burden, and also that it will lead to constructive changes in future plans to control tuberculosis in Myanmar.

Table of contents

List of Tables and Figures

Unless otherwise stated, data for all Tables and Figures are derived from the National TB Prevalence Survey, Myanmar, 2009-2010

List of Abbreviations

AFB	Acid-fast bacillus
ASEAN	Association of Southeast Asian Nations
BHS	Basic Health Staff
BMI	Body mass index
CCU	Central Coordinating Unit
CXR	Chest X-ray
DOH	Department of Health
DOTS	the basic package that underpins the Stop TB Strategy
GDF	Global Drug Facility
GP	General practitioner
IPW	Inverse probability weighting
JICA	Japan International Cooperation Agency
MDR-TB	Multidrug-resistant TB
MIDCP	Major Infectious Disease Control Project
MMA	Myanmar Medical Association
MOH	Ministry of Health
MOTT	Mycobacterium other than TB
NGO	Non-governmental organization
N/P	Notification/Prevalence
NTP	National Tuberculosis Programme
NTRL	National TB Reference Laboratory
OR	Odds ratio
PAL	Practical Approach to Lung Health
PNB	Para-nitrobenzoic acid
PPM	Public-private mix
PPS	Probability proportionate to size
PSI	Population Services International
PSU	Primary sampling unit
RHC	Rural Health Centre
RIT/JATA	Research Institute of Tuberculosis/Japan Anti-Tuberculosis Association
SOP	Standard operating procedures
TB	Tuberculosis
3DF	Three Diseases Fund
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
UTI	Union Tuberculosis Institute
WHO	World Health Organization
ZN	Ziehl-Neelsen

Executive summary

The National TB Prevalence Survey for Myanmar was concluded by the National Tuberculosis Programme in April 2010. In this survey, 57 607 eligible adults aged 15 or older were recruited, of whom 51 367 (89.2%) participated, in 70 clusters. The average number of participants per cluster was 728 (ranging from 621 to 850). Females showed higher a participation rate (91.8%) than males (86%), and rural clusters had a slightly higher participation rate (90%) than urban clusters (86.3%). Among the 70 clusters, only four had a participation rate of less than 80%. There was no significant difference in participation rate among age groups.

The methodology was to first conduct symptom screening by face-to-face interview, followed by chest X-ray screening for all participants except pregnant women and those who refused. For participants with any TB-suspect symptom or any lesion showing in the chest X-ray, sputum microscopy for acid-fast bacillus (AFB) and culture were performed at TB reference laboratories in Yangon and Mandalay.

The survey identified 123 smear-positive cases and 188 culture-positive cases, totalling 311 bacteriologically confirmed pulmonary TB cases. Smear-positive TB prevalence was calculated as 242.3 (186.1-315.3)/100 000 population aged 15 years and above, whereas bacteriologically confirmed TB prevalence was 612.8 (502.2-747.6)/100 000 population 15 years and above. With the assumption that 0.7% of bacteriologically positive TB prevalent cases are children, smear-positive and bacteriologically confirmed TB prevalence became 172 (132-225)/100 000 population and 437 (358-533)/100 000 population, respectively. The smear-positive TB prevalence was higher in states than in regions (369 vs 191.6/100 000 population 15 years and above), higher in urban than in rural areas (330.7 vs 216.1/100 000 population 15 years and above), and higher in males than in females (397.8 vs 122.2/100 000 population 15 years and above).

Participants with TB-suspect symptoms were 3.3% of the survey sample (1691/51 367), and those with any TB symptom were 37.2% of participants. Only 34.1% (42/123) of survey-detected smear-positive TB patients had a cough for more than three weeks, and 78.9% (97/123) had any TB symptom. Among 762 active TB cases detected by chest X-ray, only 164 were bacteriologically positive. On the other hand, among 298 bacteriologically confirmed TB patients, 80 did not have active TB and were diagnosed as having healed TB or other diseases.

The survey found 79 patients currently on treatment and 1 463 previously treated. Of the previously treated patients, 66% had sought treatment in the public sector and 32% in the private sector, while among patients currently in treatment, 80% were being treated in the public sector and 18% in the private. Among patients with chronic cough, 10% and 29% first visited public centres and medical facilities, respectively, while 26% went to pharmacies as their first action. Assessing risk factors, smoking and drinking seemed to be associated with bacteriologically positive TB by crude analysis; however when adjusted by other factors such as age and sex, there was no significant relationship.

It may be concluded from the survey that the vast majority of TB cases remain undetected. The gap between the TB prevalence found in the survey and the notification rate of 2009 may be due to a slow decline of TB incidence or to the limitations of the current case-finding strategy. Regarding health-seeking behaviour, visits to public and medical facilities as a first action was not common. There is a need to accelerate case-finding activities in Myanmar though improved access to diagnostic services, improved TB screening tools and algorithms, and to expand partnerships for TB control.

1. INTRODUCTION

Despite the efforts of the government and its partners, tuberculosis (TB) is still a major health problem in Myanmar, which is one of 22 TB high-burden countries. To fight the disease, it is essential that the National Tuberculosis Programme (NTP) know the epidemiology of TB in the country, especially its scale and trends. Although Myanmar has achieved the global TB targets, case notification rates vary significantly between regions and states, and the HIV/AIDS epidemic of the past decade has confused TB epidemiology assumptions.

Properly understanding the TB situation is essential in order to review and revise current strategies and develop a future plan to fight TB, not only to save people's lives but also to save them from poverty. Myanmar's last national TB survey was conducted in 1994, and there are plans to expand TB and TB/HIV services in collaboration with partners such as the Three Diseases Fund (3DF), the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund), the World Health Organization (WHO), the Union, and the Japan International Cooperation Agency (JICA). It is therefore high time to assess current TB epidemiology in Myanmar.

A proposal for a national TB prevalence survey and Yangon survey was submitted to the Ministry of Health (MOH) by NTP in 2005 and was approved. However, due to time and financial constraints (such as the termination of the first Global Fund grant in 2006), only the Yangon survey could be carried out in 2006, with some training sessions in Mandalay region. The survey was conducted with great success by the NTP and local authorities in collaboration with partner agencies such as the Global Fund, the United Nations Development Programme, JICA, the Research Institute of Tuberculosis (RIT) and WHO. A participation rate of more than 90% was achieved.

Despite the extensive expansion of TB services based on the DOTS strategy, the 2006 survey showed a high prevalence of smear- and bacteriologically positive TB both in urban and rural areas of Yangon. Prevalence of smear-positive TB was 279/100 000 eligible subjects aged 10 or above, and 229/100 000 population. Of cases detected by the survey, 75% were previously unknown new cases. These results demonstrated the necessity of a national survey.

The Yangon survey suggested the serious limitation of TB symptom screening by interview to identify TB cases in the community. X-ray examination is an essential tool to screen subjects in a prevalence survey. The 1994 national survey based on symptom screening might therefore have underestimated TB prevalence. NTP had already achieved 100% case detection under the current estimation of TB burden based on the 1994 study. It was considered essential to know the nationwide epidemiological situation of TB more accurately. An evidence-based approach would be crucial in order for NTP to develop a plan to provide quality care to TB patients across the country. The results from a high-quality prevalence survey would lead appropriate national and international investment for TB control. As TB prevalence is one of the indicators of the Millennium Development Goals and the Global Plan to Stop TB, a TB prevalence survey would also be one of the most effective tools to monitor the impact of the TB control programme.

NTP and WHO jointly carried out the National TB Prevalence Survey in 2009-2010, calling for support from national and international partners.

1.1 History of the National TB Programme

NTP started with a five-year plan in 1964-1965. WHO and the United Nations Children's Fund (UNICEF) supported the programme. NTP implementation began in 1966 and gradually expanded to cover six zonal TB centres in 1972. The programme was eventually expanded to states and regions, reaching 13 centres in 2004 and 14 in 2007. NTP has implemented five-year strategic plans which were systematically developed together with implementing partners. The impact of the TB control activities was assessed by conducting several periodic surveys.

From the start, NTP's standard treatment regimen was injection streptomycin and isoniazid. This regimen, used for 28 years, was replaced with short-course chemotherapy in 1994. In 1997, WHO recommended DOTS, and this strategy was introduced in 153 townships and gradually expanded. Support from the Global Drug Facility (GDF)

began in 2001-2002. With the availability of anti-TB drugs, total township coverage was accomplished in November 2003. A daily anti-TB treatment regimen with a four fixed dose combination was introduced in 2004. Patient kits were used in 2007 in 38 townships as a pilot and expanded to the whole country in 2010.

HIV prevalence among TB patients was assessed in the mid-1990s and found to be 4.5% on average. From 2006, HIV sentinel surveillance by the National AIDS Programme included new TB patients as a subgroup, and this now functions in 20 sites. However, TB/HIV collaborative activities are functioning in only 11 townships.

The first nationwide survey of drug-resistant TB was conducted in 2002-2003, and the second in 2007-2008. Drug sensitivity testing for a Category II failure study was done in 2006-2007. Based on the patterns of drug resistance, a standardized treatment regimen was formulated to treat multidrug-resistant TB (MDR-TB) patients who failed the Category II regimen. An MDR-TB management pilot project began in early July 2009 in Yangon and Mandalay. The goal was to treat 275 MDR-TB patients, and by August 2011, 291 patients had been enrolled in treatment. It is estimated that about 9000 MDR-TB patients emerge in the country each year. Myanmar has two hospitals to treat MDR-TB, one in Yangon and one in Mandalay.

A laboratory quality control system was started in Yangon region in 1998. In 2001, the National TB Reference Laboratory was established, and the laboratory quality control system covered all states and regions by 2010. The National TB Reference Laboratory (NTRL) in Thailand acts as a supranational TB reference laboratory for Myanmar. Biosafety level-three laboratories for TB diagnosis were established at NTRL, Yangon and the Upper Myanmar TB Laboratory in Patheingyi in July 2010. Liquid culture and drug sensitivity testing and line probe assay tests were introduced to facilitate the diagnosis of MDR-TB.

After the extraordinarily support of first-line anti-TB drugs by GDF for seven years (2002-2009), continuation of these drugs was assured with the support of 3DF and the Government of Japan for 2010 and 2011, respectively. Paediatric formulation of anti-TB drugs is being provided by UNITAID for four years (2008-2011). The supply chain management for drugs and diagnostic supplies and equipment related to TB control was established, and standard operating procedures (SOP) were developed with the technical assistance of WHO.

Eleven international organizations and five local non-governmental organizations (NGOs) are involved in TB control as implementing partners of NTP. The Major Infectious Disease Control Project (MIDCP) has been implemented in Yangon and Mandalay Regions since 2004 with the support of JICA.

Aiming to improve case finding, Population Services International (PSI) Myanmar has implemented public–private mix DOTS (PPM–DOTS) using Sun Quality Clinics since 2004. Myanmar Medical Association (MMA) has being implemented PPM–DOTS activities since 2005. MMA is a professional organization that provides a link between private practitioners and their counterparts in the public sector so that they can participate in public health-care activities. Non-NTP laboratories have also been accredited under the PPM scheme. In 2010, PPM activities were carried out in 168 townships with PSI and 70 townships with MMA. Altogether 1500 private practitioners out of about 20 000 nationally are involved in TB control, a level of coverage which needs to be improved.

Some ministries are also providing health care, mainly curative, for their employees and their families. The Ministry of Labour has set up a TB hospital in Htantapin to give services to those entitled under the social security scheme.

In line with the National Health Policy, NGOs such as the Myanmar Maternal and Child Welfare Association, Myanmar Red Cross Society, Myanmar Health Assistant Association and Myanmar Nurses Association are also taking some share of service provision.

Funding for NTP comes mainly from the government. International funding sources are WHO, JICA, 3DF, the United States Agency for International Development (USAID), UNION and JATA. The Global Fund Round 2 supported NTP for only one year (2005-2006) and unilaterally terminated at the end of 2006. Global Fund Round 9 was approved for five years and activities started in May 2011. Support also came from FIDELIS in 2007-2008 for activities implemented in Sagaing Region.

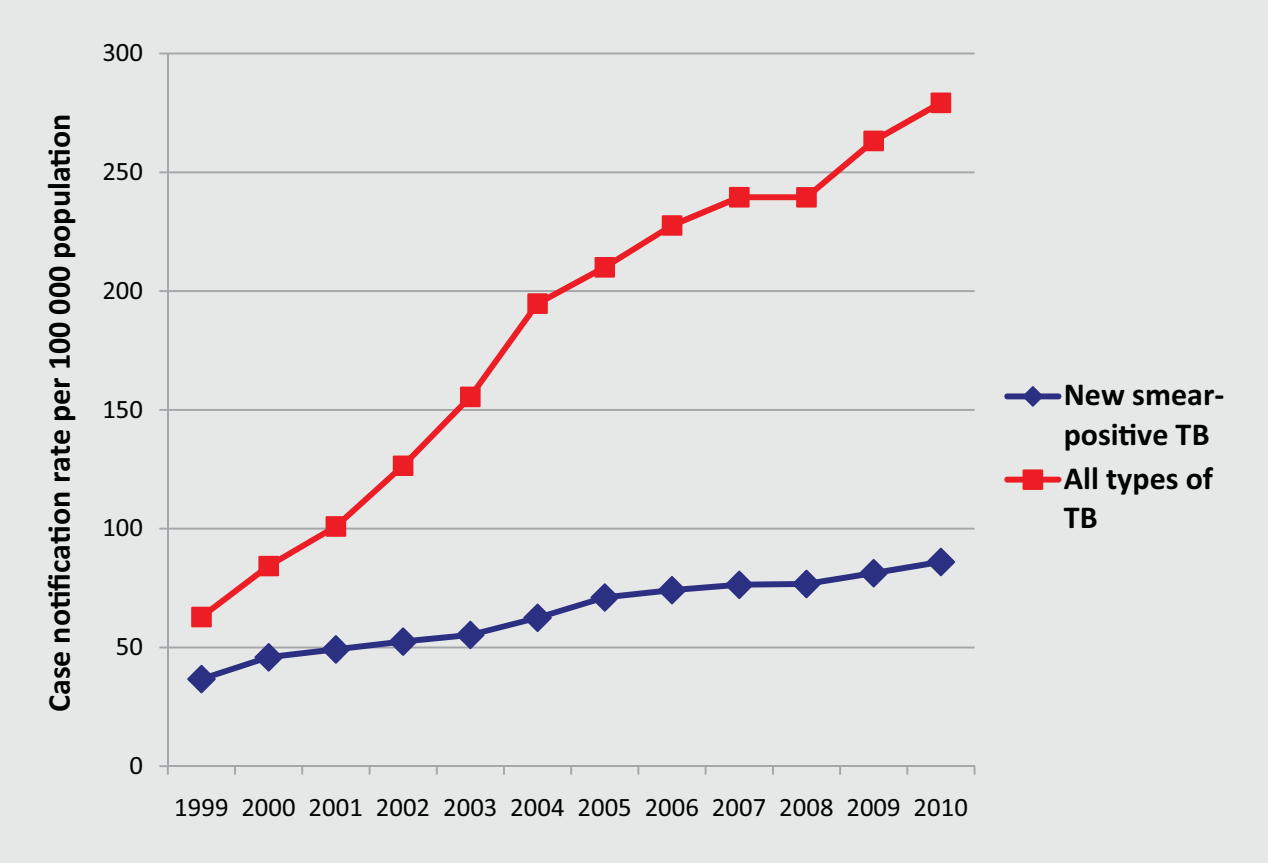
1.2 Historical and current status of TB control in Myanmar

In 1972, a baseline survey of the TB situation in Myanmar was conducted. The survey showed the annual risk of TB infection to be 1.66%. Of the population surveyed (35 206), 2339 (6.6%) had chest symptoms (86% cough); 51 were smear-positive for TB (2.2% of the chest symptomatic and 145/100 000 of the study population). All 51 smear-positive patients reported a cough; 41(80%) of these had a cough with a duration of four weeks or longer, 9 (18%) had a cough with a duration of at least two weeks, and 1 had a cough of only one week's duration. In urban clusters, 3.6% of the population was found to have a chest X-ray (CXR) suggestive of TB; of these patients, 0.25% were sputum smear-positive and 0.18% were smear-positive in urban clusters.

The second national sputum smear-positive TB survey was conducted in 1994, and 37 424 people were screened. Reported overall prevalence of sputum acid-fast bacillus (AFB) positive smears was 104/100 000 population. Prevalence was higher in rural than urban populations (117/100 000 population and 73/100 000 population, respectively). The prevalence was also higher in states than regions (198/100 000 population and 65/100 000 population, respectively).

Today, TB mainly affects the most productive age group of 15-54 years. HIV prevalence among new TB patients was 10.4% in 20 selected sentinel sites in 2010. Two nationwide surveys (in 2002-2003 and 2007-2008) reported MDR-TB prevalence among new TB patients at 4% and 4.2%, respectively, and among previously treated TB patients at 15.5% and 10%, respectively.

Figure 1. Case notification rate of TB patients (1999-2010)



Source: National Tuberculosis Programme, Myanmar

According to WHO estimates (Global Tuberculosis Control Report 2010), TB prevalence in Myanmar decreased from 922/100 000 population in 1990 to 595/100 000 population in 2009, and TB mortality also declined from 133/100 000 population in 1990 to 59/100 000 population in 2009.

The case notification rate of all types of TB increased from 63/100 000 population in 1999 to 279/100 000 population in 2010. The case notification rate for new smear-positive TB patients increased from 37/100 000 population in 1999 to 86/100 000 population in 2010.

1.3 Goals of the National TB Programmee

The goal of the NTP is to reduce morbidity, mortality and transmission of TB until it is no longer a public health problem. Programme activities aim to reach interim targets of halving TB deaths and prevalence by 2015 from the 1990 situation (Millennium Development Goals, Goal 6, Target 6.c, Indicator 6.9), and to reach and thereafter sustain the target of achieving at least 70% case detection and successfully treating at least 85% of detected TB cases under DOTS (Millennium Development Goals, Goal 6, Target 6.c, Indicator 6.10). NTP is implementing the Stop TB Strategy with the following six components:

1. **Pursue high-quality DOTS expansion and enhancement**

   i. Secure political commitment, with adequate and sustained financing
   ii. Ensure early case detection and diagnosis through quality assured bacteriology
   iii. Provide standardized treatment with supervision and patient support
   iv. Ensure effective drug supply and management
   v. Monitor and evaluate performance and impact

2. **Address TB/HIV, MDR-TB and the needs of poor and vulnerable populations**

   i. Implement collaborative TB/HIV activities
   ii. Implement prevention and management of MDR-TB
   iii. Address the needs of TB contacts, and poor and vulnerable populations

3. **Contribute to health system strengthening based on primary health care**

   i. Improve health policies, human resource development, financing, supplies, service delivery and information
   ii. Strengthen infection control in health service locations, other communal settings and households

4. **Engage all health care providers**

   i. Involve all public, voluntary, corporate and private providers through PPM approaches
   ii. Promote use of International Standards for Tuberculosis Care

5. **Empower people with TB and communities through partnership**

   i. Pursue advocacy, communication and social mobilization
   ii. Foster community participation in TB care, prevention and health promotion
   iii. Promote use of Patients' Charter for Tuberculosis Care

6. **Enable and promote research**

   i. Conduct programme-based operational research
   ii. Participate in research to develop new diagnostics, drugs and vaccines

2. OBJECTIVES AND METHODOLOGY OF THE SURVEY

2.1 Primary objectives

1. Determine the national prevalence of pulmonary TB in Myanmar at a defined point in time (2009):

   - Smear-positive pulmonary TB
   - Culture-positive pulmonary TB
   - Symptoms suggestive of TB
   - Radiological abnormalities suggestive of pulmonary TB

2. Set a baseline for assessing trends in TB prevalence through a series of surveys at five- to ten-year intervals.

2.2 Secondary objectives

1. Identify health-seeking behaviour of TB patients and individuals reporting chest symptoms
2. Identify utility of the private sector, such as proportion of TB patients under treatment in private sector
3. Identify TB risk factors such as nutrition, smoking, gender, housing conditions, other socioeconomic factors, etc.

2.3 Methodology

In order to oversee the National TB Prevalence Survey, NTP organized a Steering Committee and a Technical Committee. Several working units were organized under the Central Coordination Unit (CCU), which actually conducted the survey.

2.4 Survey organization

2.4.1 Steering Committee

The Steering Committee was given primary responsibility for designing, preparing, supporting and monitoring the survey. The 15 members included representatives from the Department of Health (DOH), NTP, the Upper and Lower Myanmar TB centres, and NTRL, as well as 3DF, PSI, WHO and JICA, among other stakeholders (see Annex 2).

2.4.2 Technical Committee

The Technical Committee included 21 national and international experts in surveys, laboratories, radiology and epidemiology, whose role was to provide timely technical advice to the Central Coordinating Unit (CCU) (see Section 2.4.4 below). The Technical Committee included experts from JICA, the Japan Anti-Tuberculosis Association (JATA), RIT, WHO and also consultant TB specialists from the DOH at the MOH (see Annex 3).

2.4.3 Central Panel for Diagnosis

In addition to the above committee, a Central Panel was formed to determine final diagnosis and case management for the benefit of participants. This panel consisted of survey team leaders, a radiologist, a chest physician, microbiologist and WHO technical experts. The Central Panel checked the survey records and radiological and bacteriological results (see Annex 4).

2.4.4 Central Coordinating Unit

The CCU was led by the National Survey Coordinator, guided by the Programme Manager. The Survey Coordinator was responsible for the smooth conduct of the survey and reported monthly to WHO. The CCU had five sub-units: a Data Management Unit, Census Unit, Radiology (X-ray) Unit, Bacteriology Unit and Administrative Unit for finance and logistical management (see Annex 5).

2.4.5 Survey field teams

NTP formed five survey teams, two for Upper Myanmar and three for Lower Myanmar. Those survey teams conducted field surveys in 70 clusters over a period of nine months. The survey was designed to operate with three teams concurrently; however, due to the inadequate capacity of the laboratory and a delay in procurement of two sets of portable X-ray machines, only two teams could operate at the same time using two existing portable X-ray units and 2 X-ray vans. While those two teams (one from Upper Myanmar and another from Lower Myanmar) were conducting the field operation, the remaining teams were kept on standby preparing for the next cluster.

Each team consisted of three units: a Census Unit, Radiology (X-ray) Unit and Bacteriology Unit. The survey team was equipped with one X-ray van or one portable X-ray machine and two rented vehicles (light pickup trucks). Each survey team consisted of 23 members (24 if the X-ray van was being used). The NTP teams were combined with five local Basic Health Staff (BHS) and five local volunteers working together as a team for each cluster. There were two medical doctors in each team: one served as a team leader of the survey team, while the other acted as X-ray unit team leader and read chest X-rays in the field.

Composition of a survey team:

Team leader :	1 medical doctor
Census Unit :	4 health assistants from MHAA and NTP staff
X-ray Unit :	1 medical doctor as X-ray Unit leader
	3 radiographer, technician and darkroom assistant
Bacteriology Unit :	1 local laboratory technician
	1 clerk
Drivers :	2 (rented cars) and 1 (X-ray van)
Others :	5 local BHS
	5 local volunteers

2.4.6 Training with field survey manual

All of the members participating in the survey were trained on the following components in Yangon:

1. Understanding of the rationale for survey and study protocol
2. Data collection techniques: theory and practice
3. Reporting and recording forms and simulation exercise
4. Field pilot testing to integrate all the above components

The training was held over two days and was followed by field testing for two days. A special CXR reading training (half-day) was arranged for medical officers for standardization of CXR spot reading in the field. With the assistant of JATA and JICA, X-ray technicians were trained on utilization of the X-ray van, portable X-ray machine, portable auto film processor, and fixing and developing of CXR films. The laboratory training was provided for three days, with a focus on standardizing laboratory procedures and strictly following the SOP. These trainings were held in February and March, 2009.

After completion of all trainings, NTP revised the survey manual as a field guide. The survey forms were also revised based on the experiences of the field testing.

2.4.7 Staff mobilization

NTP was closely guided by DOH and the Steering Committee. Therefore, the necessary human resources were successfully mobilized from the other states and regions apart from Yangon and Mandalay where the Upper and Lower Myanmar centres are located.

2.4.8 Procurement of equipment and consumables

NTP prepared ahead to be able to procure all necessary machines and X-ray films (see Annex 7). Two organizations were used for procurement: WHO and JICA. WHO procurement was delayed, and four out of 16 items delivered differed from NTP's specifications. This limited the ability to complete the survey according to plan.

2.5 Survey design

The National TB Prevalence Survey was a nationwide, community-based cross-sectional survey of the adult population aged 15 years or above. The survey population was screened with interviews followed by CXR examination. Those subjects suspected for TB identified by symptom screening and radiological screening also underwent sputum smear examination and culture in order to determine the prevalence of smear-positive TB, culture-positive TB, symptomatic TB and radiologically proven TB.

2.5.1 Survey period

The survey took two years from training (first quarter of 2009) to dissemination of the results (December 2010). Field data collection began on 4 June 2009 and ended on 9 April 2010.

2.5.2 Sample size

The required sample size was calculated as 49 690 aged 15 or above,[1] taking into account several determinants. The expected prevalence of smear-positive pulmonary TB among the population aged 15 or above was 278.4/100 000 (0.002784%), based on the prevalence in the Yangon Regional TB Prevalence Survey conducted in 2006. In the Yangon survey, the prevalence of smear-positive TB among the eligible survey population aged 10 or above was 279/100 000, and rural villages showed as high a prevalence as urban wards. When the number of survey participants aged 15 or above was applied to the denominator, the smear-positive prevalence among those aged 15 or above was estimated as 348/100 000 with a population structure adjustment. Taking a safer side, 80% of this figure, 278.4, was applied to calculate the required sample size.

- Relative precision was taken as 20% of true value
- Confidence level was 95%
- Design effect was 1.3 (from Yangon survey experience)
- Expected minimum participation rate was taken as 90%
- Therefore, $n = Z^2 p(1-p)/d^2 = 34\ 401$
- Taking the design effect into account, n = 44 721
- Taking the attendance rate into account, n = 49 690

2.5.3 Sampling procedure

The study population was selected using a multi-staged cluster sampling method. The survey was conducted with two strata—regions and states—in order to arrive at a better estimation. However, the survey was not designed to estimate states' and regions' prevalence independently.

1 Children aged below 15 years were excluded from the survey on several technical and ethical grounds: 1) even a large number of children from this age group would yield few bacteriologically positive TB cases; 2) it is difficult to take sputum specimens from children; and 3) CXR is not recommended for healthy children.

Based upon the findings and experiences from the pilot testing in the field, the capacity of the survey team to conduct interviews and X-ray screening was calculated at 150-200 per day, and the size of a cluster unit was determined as 710 in order to complete cluster work within six days, including census and sputum collection. It was therefore necessary to have 70 clusters to obtain the required sample size of 49 690.

Because 28% of the population lived in the state area, 20 clusters were allocated to states, while 50 clusters were selected systematically from the regions by applying probability proportionate to size (PPS) methodology.

2.5.4 Sampling unit selection

There are 325 townships, 2987 wards and 55 034 villages in Myanmar. Thirty-two townships, representing ~2.5% of the total population, were excluded from the sampling frame, mostly due to logistical and transportation problems for field operations. The sampling frame thus included 293 townships with a total population of 54 435 619. The selection of the sample units proceeded as follows:

1. 20 townships from states and 50 townships from regions were chosen by the PPS sampling method. The cluster selection was done by the CCU. The sampling interval was calculated separately for the states (sampling interval of 698 572) and the regions (sampling interval of 809 316).

2. Ward- and village-wise population data of the selected 70 townships were collected to construct a sampling frame.

    - From the sampling frame of the selected townships, a ward or a village was selected as an eligible cluster applying PPS methodology. Military facilities, diplomatic compounds, hospital or other institutional facilities such as jails were excluded. If a selected block contained one of these areas, it was replaced by another block in the same ward/village.

The selected clusters are shown by state/region and urban/rural categorization in Annex 8.

Within a selected cluster, the survey site was randomly selected as follows:

- Once a cluster ward/village (group) was selected, precise population data were obtained during a pre-visit by the survey team leader.

- According to the above criteria, when the population of a selected cluster ward/village was markedly larger than 1000, it was divided into appropriate blocks according to paths, natural boundaries such as creeks and/or existing household groups. The survey team then randomly selected a block/household group by lottery. Within the selected group, households were chosen until the number of people including children reached 800, which would give the required sample size of people eligible for the survey.

- Any individual aged 15 years or above who had been in a selected area for at least two weeks at the time of the survey was eligible. Therefore, people staying in survey-designated cluster areas without registered residential status, such as seasonal visitors, seasonal workers and students were considered potentially eligible subjects.

- Villages with a population significantly lower than 1000, where it was not expected that there would be 750 people aged 15 or above, were grouped together with one or more villages in the same sub-rural health centre as a village group.

- In every step of selection, Excel 2003 was used to create random numbers.

In practice it proved difficult to cut off the sample in the middle of the group, and all people in the last household group/block chosen were often included in the survey, which led to over-sampling. Only two clusters had to increase the cluster size, although the ward/village group first selected in Mindat and Kunlon clusters could not reach the required sample size. Three clusters had to reselect due to hard-to-reach villages (Kyarinseikkyi, Nattalin and Bokepyin clusters).

2.6 Survey preparations

2.6.1 Field survey preparations

Representatives from the CCU and survey team leaders visited the 70 selected clusters to assess their feasibility and accessibility for the survey, considering factors such as seasonal conditions and transportation to each survey site. During the visit, the team decided upon the eligible area for the survey within the selected ward/village. The team also informed the local authorities about the enumeration areas for the survey and communicated with the respective State/Regional Health Director and local authorities to obtain their cooperation in the survey.

At the same time, logistical preparations were made in Yangon. Ordering of supplies and equipment, procurement of stationery, printing of survey forms and registers were carried out and trainings were provided, followed by team organization.

Preparation for two culture laboratories was also carried out in order to have sufficient laboratory supplies and reagents and especially adequate staffing resources.

2.6.2 Pre-visit to selected survey sites

During the preparatory phase, the survey team leader visited the survey sites at least twice, two to three weeks before the field operation was started. During these visits, the team leader enumerated the population of the survey site and identified the eligible population within the area. During the pre-visit, the team leader reported to the CCU any serious concerns such as difficulty in transportation, poor road conditions and poor security for the field survey operation. If the concerns were insurmountable, the CCU replaced the survey sites in the same township by reapplying the selection process using PPS for that cluster. The clusters where this applied are shown in Table 1.

Table 1. Survey clusters re-assigned for logistical or other reasons

Cluster Code	Township	Previously selected site	Replaced survey site	Reason
61	Bokepyin	Ahlaeman village	Ayechanthar ward	Security problem
21	Kyarinnseikkyi	Taungson village	Ahnankwyin village	
12	Nattalin	Kwaygyi, Nyaunglaypin villages	Laemainn, Bantbwegone villages	Transportation difficulty
17	Mindat	Dauk Dwe ward and 6 villages	From the selected ward, four nearby villages replaced the preselected villages which were far away.	Insufficient population aged 15 years and above
54	Kunlon	3 villages	From Lwair Kann village, two adjacent villages replaced the preselected villages which were far away.	

The team leader had full responsibility for arranging the travel and arrival of the whole survey team and for the smooth management of the process step by step. During the pre-visit, the team leader:

1. Conducted advocacy meeting with local authorities, Township Medical Officer, community leaders and religious leaders to explained the purposes, methods and procedures of the survey, the selected ward/ village, date and time of operation, need for volunteers from local area, etc.
2. Discussed lodgings for the survey team and arranging the setting for the survey site with responsible persons from the local area.
3. Trained assigned local volunteers and local BHS on how to complete the Household Register for the census.
4. Arranged food, water, fuel and electricity required for the survey process.
5. Made special arrangements for collected sputum to be transported to respective laboratories within 24 hours with cold chain.
6. Evaluated the accessibility of the community to the survey site depending on road and weather conditions.

During the second visit, the team leader collected the Household Registers from the local BHS and confirmed the census with the local authorities. The forms were then transferred to the Census Unit of the survey team who were to conduct the census. After the pre-visit, the team leader reported to the CCU with the pre-visit report form.

2.6.3 Briefing session

Before the survey began in the field, representatives from the CCU gave a briefing in order to give support, recall the duty and responsibilities of each team member and distribute stationery, cold boxes and other necessary supplies.

2.7 Field survey procedures

In most clusters, each survey team took one week per cluster for field operations. The whole survey team usually left the base on Saturday and arrived at the survey site on Sunday morning (see Figure 2), but there were some variations between clusters depending on distance and road conditions as well as weather conditions, since the survey started in the rainy season.

Figure 2. Basic schedule for field survey

Saturday	Travelling day
Day (0) Sunday	➢ Arrival at cluster ➢ Taking census and inviting the household and the participants
Day (1) Monday	Survey Field Operation (Interview, Spot CXR, Sputum collection) carried out with an average of 200 persons/day
Day (2) Tuesday	➢ Survey Field Operation - 200 persons/day ➢ Absentees from the previous day called ➢ Forms and CXR reviewed and rechecked by team leader
Day (3) Wednesday	➢ Survey Field Operation - 200 persons/day ➢ If necessary, operation time extended up to night (10:00 pm) ➢ Collected sputum specimens sent to respective laboratories with cold chain ➢ Absentees from the previous days called
Day (4) Thursday	➢ Survey Field Operation - 200 persons/day ➢ Absentees from the previous days called ➢ Forms and CXR reviewed and rechecked by team leader
Day (5) Friday	➢ Final collection of sputum specimens ➢ Departure from survey site to base (Yangon or Mandalay)

2.7.1 Census taking

On the first survey day in the village, usually a Sunday, the Census Unit checked the household registry completed by the local BHS and volunteers. The Census Unit then assigned ID numbers and divided the team into four groups, each consisting of one Census Unit member, one BHS and one local volunteer. Each group went into the ward/village as assigned by the survey team leader, who took up position at the centre of the ward/village to communicate with all groups.

Every household was given an explanation of the aims of the survey and an invitation letter for each eligible person. A household identification sheet with a serial number of the household was pasted on the door or the gate of households selected.

The Census Unit members paid one or more home visits to every household to confirm the eligible subjects on the name list of the Household Register to complete the Survey Census form. During these visits, local volunteers, community leaders, religious leaders and local BHS helped to motivate the eligible subjects to participate in the survey. During the census, the team also found out whether there were any missing households that needed to be added.

While taking the census, newcomers who had stayed more than two weeks or any missing households were added to the household registry and absentees (not available for survey) who had been gone for more than two weeks were omitted. The Census Unit also reviewed the household population register and excluded those who had died, moved to other places, worked in other cities/countries or had been travelling for more than two weeks. They also inquired about any newborns to add to the census. Once the Census Unit had obtained the total population numbers, those under 15 years of age were defined as ineligible for the survey, according to the inclusion criteria.

Interview and examination days and times were allocated for each subject. Generally the invitation days and times were assigned to each census group before they were sent out into the community.

A registration number was given to each subject regardless of their availability on the survey day, using the format XX - # # # - OO (cluster code - household number - individual number).

During the census, the Census Unit also examined and recorded housing conditions relating to causes of respiratory symptoms and TB, as part of the survey.

2.7.2 Detailed screening procedure

Individual interviews and on-the-spot CXR examinations were used to screen survey participants for bacteriological examinations.

2.7.3 Screening with interview

Each eligible subject was interviewed separately with a structured Individual Survey Card (see Annex 9) relating to their background characteristics, general health (especially TB symptoms), past history of TB, and health-seeking behaviour. Informed written consent was taken from all respondents after explaining the survey procedures to them. The interviewer recorded the respondents' answers on the Individual Survey Cards with household number and registration number. Body weight and height were also measured and recorded. All interviewees except excused subjects (those with a first-trimester pregnancy, and subjects who refused) were screened with X-ray examinations. Those whose symptoms identified them as TB-suspects were sent for sputum examination after CXR, regardless of the CXR result. Pregnant women who had been excluded from CXR examination underwent a compulsory sputum examination. Those who did not appear at the survey site due to sickness, old age, disability or mental incapacity were visited by the team, and transportation was arranged if necessary. Where possible, the team took sputum specimens from those who could not be screened by X-ray.

2.7.4 Screening with on-the-spot chest X-ray examination

- The X-ray van or portable X-ray machine was used in each cluster. Which equipment was used was decided by the team leader after the pre-visit, depending on the distance and geographical situation of each cluster. Full-size films of 14"x14" (green type) were used.
- All eligible subjects, except those exempted, were asked to undergo a CXR examination. Examinations were conducted by trained X-ray technicians.
- After the exam, the X-ray technician fixed and developed the chest X-ray films with an automatic film processor.
- Once the CXR films were developed, the field X-ray reader interpreted them while participants waited for a decision on whether sputum collection was needed or not.
- The X-ray reader intentionally "over-read" the films to minimize the number of overlooked abnormalities. The result was recorded on the Individual Survey Card and also in the CXR examination register book. When the quality of the CXR film was too poor to interpret the screening purpose, the Medical Officer of the X-ray Unit consulted with the team leader and asked the participant to have a second CXR.
- All subjects with an abnormal chest radiograph in the lung field or mediastinum greater than a single small calcification nodule or pleural adhesion at the costophrenic angle were asked to proceed to the Bacteriology Unit immediately for sputum collection.
- The X-ray reader coded the CXR result according to the following codes: 1) Normal, 2) active TB, 3) TB suspect, 4) Healed TB, 5) Other lung diseases, 6) Heart disease, 7) Other findings in lung, 8) others _____ and 9) Not interpretable.
- Those with serious disease were advised to take appropriate medical intervention by the survey team in collaboration with the local health authority. If emergency management was needed in the case of pneumothorax and massive pleural effusion, those patients were immediately referred to the hospital.
- Finally, all the radiographs taken in each cluster were packed and sent to the CCU for central reading. The field reader was required to make a summary report on CXR screening to the team leader, copied to CCU.

2.7.5 Bacteriological examination

- TB-suspected persons, whether screened by CXR and found to have abnormal radiological findings and/or detected by the field interviewer through symptoms screening, were invited to undergo a bacteriological examination.
- In the field, two sputum specimens were collected (one spot specimen on the same day, and one early-morning home specimen collected in a screw-capped container on the following day).
- In each cluster, the trained laboratory technician collected systematic sputum specimens and completed the forms with information including the number of specimens and survey code number, name, age and sex.
- Laboratory technicians from the respective cluster townships were mobilized to be responsible for sputum sample collection and recording. The team leader gave on-the-job training to these technicians for collection of sputum and storage of specimens.
- The uniform instruction for sputum collection was: "Take a deep breath in and out for two times, and then breathe in for the third time, hold the breath for a while, then make a forceful cough out and spit sputum into the given container. Close the container tightly and submit it to the technician."
- Once the subject submitted the specimen, the seven-digit survey registration number and "S" (for "spot")

were labelled with permanent pen on the side of the container. In addition, the serial survey lab number from the Sputum Collection List was written and circled on the container. This made it easy to find the sputum containers collected serially. Another new container was labelled with the identical survey registration number and "H" (for "home") and given to the subject to collect sputum at home on the next morning, with the same instructions as before.

- If the subject failed to bring in the second specimen by noon the next day, the voluntary worker was sent to collect the specimen from the home.

- Laboratory technicians kept the specimens in the ice-cooled boxes/containers and checked multiple times to keep the cold chain.

2.7.6 Storage of specimen containers

- Each specimen collected was put into a plastic bag tied with a rubber ring and put in an ice box containing ice packs. Home specimens were stored close to the corresponding spot specimen, and all specimens were then transferred to big ice boxes. The specimens were kept continuously at a temperature below 10 °C until they reached the NTRL, Yangon or Mandalay TB Laboratory for examination.

- The sputum specimens collected on Monday, Tuesday and early Wednesday morning were transported on Wednesday (Day 3) and arrived at the respective laboratory within 24 hours, together with Sputum Smear Examination Request Forms and Sputum Collection Lists, for smear and culture examinations and identification tests.

- Sputum specimens collected on Wednesday, Thursday and Friday were transported by the survey team and sent to the laboratory immediately upon arrival (regardless of the time). All the specimens arrived at their respective laboratories within seven days, even from hard-to-reach clusters like Maungdaw, Kunlon, etc.

2.7.7 Before leaving the cluster

Under the guidance of the team leader, the whole survey team summarized the facts on the previous days' work: name of village; dates of field work; number of households listed; number of people listed; number of people who had an X-ray taken; number of abnormal X-rays; number of people interviewed with abnormal X-ray; number of people with symptoms; number of smears taken; and name of the survey team leader who completed the cluster summary report.

This report was useful for checking, and all data (X-ray, sputum specimens, questionnaire) were collected in order to give feedback to the township/ward/village authorities, and also for recovering any missing data later during data processing.

2.8 Laboratory procedures (for more details see Annex 10)

2.8.1 Specimen receiving at laboratory sites

The survey team leader informed the laboratory-in-charge of the number of specimens to be sent from field and the approximate date and time of their arrival. This gave the laboratory time to be well prepared to receive the specimens. On arrival, the specimens were checked for temperature, breakage, leakage, whether labels were attached, and correspondence between the number of specimen containers received and the number stated on the Sputum Collection List. If discrepancies were seen, a report was made to laboratory-in-charge, who then informed the survey team leader.

Specimens reaching the laboratory after office hours were checked to see whether they were cool, and ice packs were changed when necessary. The responsible technician registered them in the Laboratory Register from the Sputum Collection List, and a Laboratory Culture Number for each person was written in the remarks column of

the Sputum Collection List. Laboratory Culture numbers were assigned consecutively from the first specimen at the start of survey until the last specimen received at the end of survey.

The specimen containers were removed from the ice boxes/chests and arranged serially according to the laboratory number in the first column of the Sputum Collection List. The containers were then pasted with the Laboratory Culture Number.

2.8.2 Smear making and staining

In principle, the assigned laboratory technicians received sputum specimens from the field twice a week, within three days after they were taken from the participants, and treated the specimens immediately or within two days of reception. Direct smear preparation was performed in the reference laboratories.

The technician wrote the Laboratory Culture Number from the remarks column of the Sputum Collection List serially on the frosted end of the clean slide using pencil. For each culture number there were two specimens (S and H). The specimen was taken with a clean wooden stick and smeared on the glass slide which had same label. The slides were air dried and stained with Fluorescent Staining (auramine stain) using auramine O solution, decolourized with hydrochloric acid and counterstained with potassium permanganate solution.

2.8.3 Microscopic examination

The stained slides were examined serially with a fluorescent microscope. The technician examined a minimum of 100 fields (two horizontal lines) before the smear was reported as negative. However, slides showing positive (yellow rods on black background) were re-stained with Ziehl-Neelsen (ZN) staining and examined with an ordinary light microscope.

The positive slides were graded according to WHO standards. As a first step, only those slides showing positive with ZN staining were taken as positive and a primary report sent to the CCU. All the stained slides were stored serially in slide boxes. For smear-negative, culture-positive cases, the negative slide was re-stained with ZN stain and examined again. If positive, it was taken as a smear-positive, culture-positive case.

2.8.4 Quality checking of slides

For quality control, six slides from each cluster were selected, in accordance with the National Guidelines on External Quality Assessment-LQAS for AFB Microscopy (NTP, DOH, Myanmar 2007). The selected slides were checked by either the Medical Officer (Laboratory) or a skilled technician from NTRL.

2.8.5 Culture

For cultivation of sputum specimens, reference laboratories used Ogawa media.

The Ogawa media was prepared one week ahead and checked for purity. Each specimen to be cultivated was decontaminated with 4% sodium hydroxide solution, vortexed, kept at room temperature for 10-15 minutes and then inoculated on the media, after which it was incubated at 37 °C in an incubation room for a maximum of eight weeks. Culture reading was done every Tuesday by the microbiologist or the assigned Medical Officer. Those bottles where colonies appeared were marked as positive quantitatively. Growth rate, appearance, edge of colonies and pigmentation were also recorded. Contaminated bottles were noted and discarded. The negative bottles were discarded only at the end of the eighth week. Positive cultures were confirmed by smear for cord formation.

2.8.6 Identification tests for *Mycobacterium tuberculosis*

The identification of *M. tuberculosis* was confirmed by characteristics of the suspected colonies, microscopic examination with ZN stain, para-nitrobenzoic acid (PNB), Niacin test and Capilia test. The Capilia test was used as second confirmation test.

- **PNB test:** Culture-positive bottles were confirmed for *M. tuberculosis* by inoculating one loopful of two-

week-old culture onto PNB-containing media. No growth on media even after 30 days was taken as PNB-sensitive, i.e., as *M. tuberculosis*. If there was growth it was marked as PNB-resistant.

- **Niacin test:** A commercially available Niacin strip (Japan) was used. First, 2 ml of boiling water was poured over the surface having sufficient mycobacterial growth (100 or more colonies). After 15 minutes, 1 ml of culture extract was transferred into another sterile bottle and tested with the Niacin strip. If after 15 minutes pink/orange stripes were seen on the strip above the immersed portion, it was taken as Niacin-positive, i.e. *M. tuberculosis*. Finally, 1 ml of 4% sodium hydroxide solution was added to the bottle for detoxification, and the bottle was autoclaved.

- **Capilia test:** Growths showing as Niacin-resistant or weakly sensitive were given a Capilia test with Capilia device (TAUNS). Appearance of red or purple lines at both C and T places was taken as Capilia test-positive, i.e. *M. tuberculosis*.

2.8.7 Identification of TB cases

Bacteriologically positive TB was diagnosed according to survey case definitions recommended by WHO:

- **Sputum smear-positive case:** two sputum smear-positive results, or one positive smear result with X-ray result consistent with active TB, or one positive smear result with a culture confirmation. Even scanty positive (<10/100HPF) was considered as smear-positive.

- **Sputum smear-negative and culture-positive case:** two sputum smear-negative results with at least one culture confirmation of *M. tuberculosis*.

- **Bacteriologically positive TB case:** "Sputum smear-positive" or "Sputum smear-negative and culture-positive" as defined above.

- **Bacteriologically negative but X-ray active TB case:** No evidence of bacteriologically positive TB but with strongly suggested active TB disease in the X-ray examination, as assessed by the Central Panel consisting of at least two chest physicians.

2.9 Management

2.9.1 Reporting and recording

- Collected data forms, CXR films, cluster summary reports, CXR registers, CXR reports and survey registers were sent to the CCU.

- All the documented forms and CXR films taken in the field survey were stored systematically and serially with the cluster number.

- Smear and culture results were recorded in the Laboratory Register.

- Laboratory staff entered all results on the Sputum Smear Positive Examination Report and submitted this to the survey coordinator. Positive results were reported immediately upon confirmation to the CCU.

- Monthly Cluster Summary reports were combined by the CCU and submitted to the Steering Committee, NTP central and also to WHO, PSI and 3DF.

- A report was made to respective township medical officers by the survey coordinator for provision of treatment to TB patients detected by the survey (with smear-positive, smear-negative but culture-positive, or X-ray-active cases).

2.9.2 Central reading for CXR

A minimum of three X-ray readers formed a central CXR committee (one for Yangon and one for Mandalay) and read all CXR films, using the same codes as the field readers, to re-evaluate the CXR taken in the field for quality assurance purposes.

In 10 clusters where the field readings had missed a considerable number of suspected active TB cases, the CCU arranged to recollect sputum specimens with the help of local BHS and respective township TB coordinators.

2.9.3 Central panel for joint CXR reading

All active CXR (code 2 in the CXR register), all suspect CXR (code 3 in CXR register) and approximately 10% of normal CXR were picked up to re-read for counterchecking and re-evaluation by the Central Panel for Diagnosis.

Members of the Central Panel re-read the CXR to arrive at a final consensus and submitted results to the CCU Data Management Unit.

2.9.4 Quality assurance, monitoring and supervision, technical assistance

A quality assurance system was established for the X-ray assessment, laboratory, training, pilot testing and questionnaire administration. Quality control involved specific tasks and procedures to ensure the highest quality, including standardization of procedures and definitions, training and supervision. Supervisory visits to survey sites were made by the Steering Committee and technical committees, together with partner associations and agencies, for quality assurance in the field.

An initial assessment of the technical capacity for doing smears, cultures and radiography was made by RIT/JATA in collaboration with WHO and JICA. Based on this assessment, additional training was then provided. RIT collaborated fully with NTP in data analysis and external quality assurance of the activities of the central TB laboratories.

Quality assurance was also secured after standardization of X-ray taking and reading in the field. The system was developed to describe and record the appearance of films in the field, screen them again centrally, and finally review them again with the expert panel after compiling all the X-ray reports and smear and culture results at the CCU. The X-ray reading was standardized in pre-survey training.

The laboratories involved in the survey came under the quality control systems of internal quality assessment and under NTRL.

2.9.5 Statistical analysis

The central data management unit paid attention to the confidentiality of survey participants. RIT and WHO provided technical assistance on data management.

Quality controllers and team leaders followed data safeguarding procedures during data collection. These included the transfer of data from completed questionnaires into computers, maintaining a data collection monitoring sheet, and back-up of data so as to have a copy of each record.

Data (from the Household Register and Individual Survey Form) were entered into a computer by the NTP statistical staff and additional specially hired staff, using Epi-Info version 6.04d. Blinded double entry was done, and data were verified with original documents when there were any discrepancies in double entry. Key variables of the Individual Survey Card were used to verify double-entry data files. The laboratory and X-ray registers were also entered with Excel 2003 as a database.

Data consistency was evaluated by team leader of central data management. Coding and filter errors, incorrect non-responses, range checks and any other irregularities were checked.

The central Data Management Team was responsible for data importing and for initial data cleaning and validation. After validation, data were transformed into Stata version 10.0 (Stata Corp, Texas) for statistical analysis. Statistical analysis was done with Stata version 11.1 in collaboration with RIT. Analysis consisted of the estimation of prevalence and situation analysis of health-seeking behaviour of TB suspects.

A detailed explanation of the methods used to obtain prevalence is provided in Annex 11.

3. RESULTS

Field data collection for the National TB Prevalence Survey 2009-2010 was carried out from June 2009 to April 2010. A total of 93 806 individuals in 70 clusters were enumerated in the survey census (Figure 3). Of the enumerated individuals, 27 399 (29.2%) were excluded from the survey since they were children under 15 years of age. In addition, 8800 (9.4%) individuals aged 15 years or above were not eligible because of the residential duration criteria. Among the 57 607 eligible individuals, 51 367 (89.2%) participated in the survey and completed at least the screening interview. CXR screening was performed in 50 241 (97.8%) of these individuals. Those with TB-suspected symptoms and/or any abnormality in the lung or mediastinum by CXR were eligible for sputum bacteriological examinations. Those exempted from CXR were also requested to submit sputum specimens. In total, 12 235 (23.8%) participants were eligible for sputum examinations, out of which 12 144 (99.3%) submitted at least one sputum specimen. Two smear and culture results were available for 11 587 (94.7%) of the requested individuals. The bacteriological investigations showed that:

- 132 individuals had at least one positive sputum smear microscopy result. Among these:
    - 116 had culture-confirmed TB
    - Six had culture-negative results but TB was suggested by CXR findings
    - One pregnant woman was exempted from CXR but had two smear-positive specimens
    - Seven individuals who did not show any other evidence supportive of TB disease were excluded from the survey case
    - Two had mycobacterium other than TB (MOTT) isolated without any isolate of *M. tuberculosis*.
- Among smear-negative participants, mycobacterium could be isolated by culture in 223 participants. Among these:
    - 201 had *M. tuberculosis* and 22 MOTT
    - 13 subjects with *M. tuberculosis* isolates were excluded from the survey due to strong suspicion of cross-contamination in the laboratory.

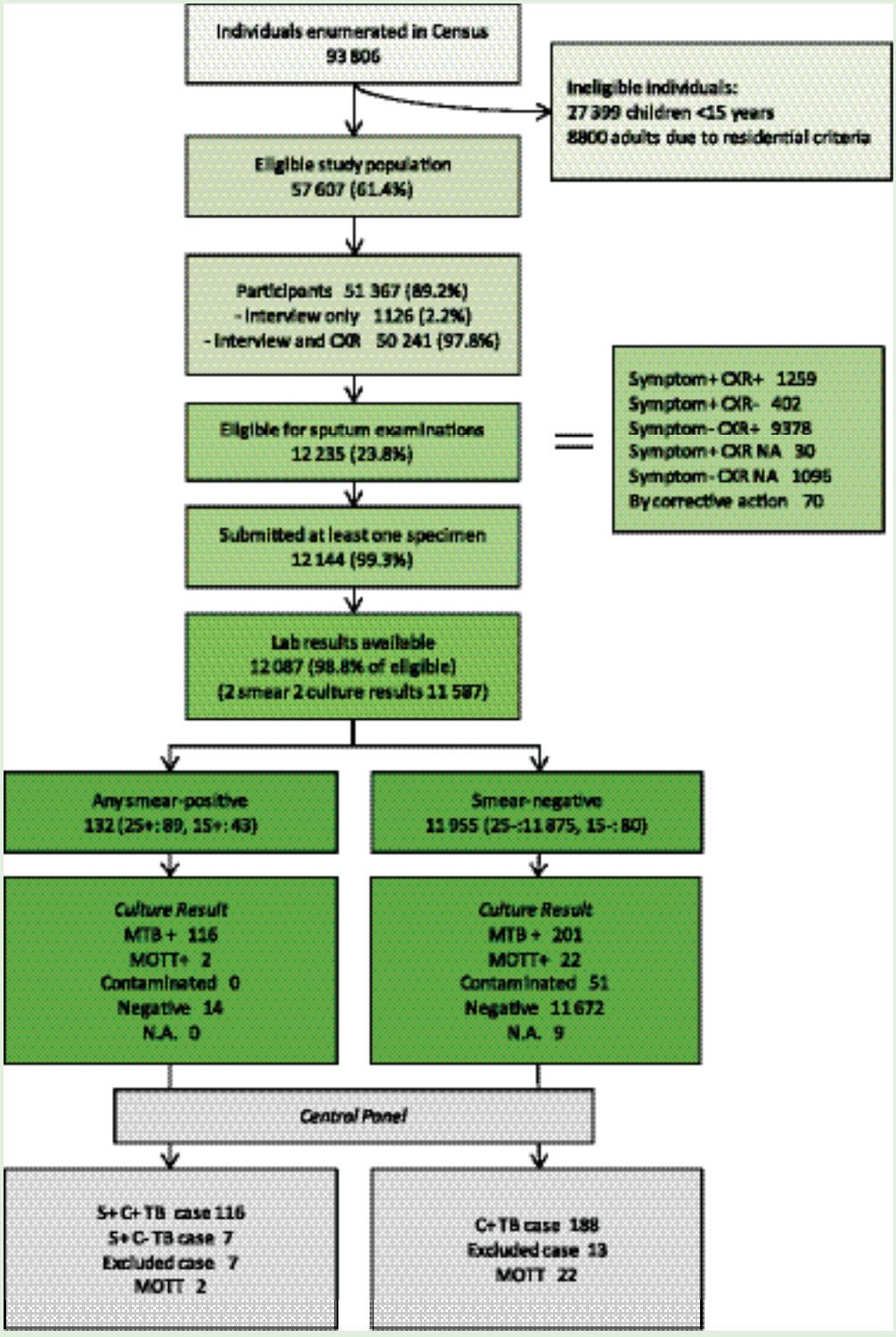
Based on the above, the Central Panel for Diagnosis classified 123 participants as smear-positive TB cases and 188 participants as smear-negative, culture-positive TB cases. Thus there were 311 survey cases of bacteriologically positive pulmonary TB. Among these cases, 280 were undetected by the health system (neither identified as TB nor treated).

By a design-based analysis, the prevalence of smear-positive TB and bacteriologically positive TB among people aged 15 and above was 242.3/100 000 survey population (95% C.I. 186.1-315.3, design effect=2.18) and 612.8/100 000 survey population (95% C.I. 502.2-747.6, design effect=3.15), respectively. With a conservative assumption that there was no bacteriologically positive TB among children, who accounted for 29.2% of the population according to the survey census, the observed prevalence of smear-positive TB was 171 (131-223)/100 000 population and that of bacteriologically positive TB was 434 (355-529)/100 000 population, respectively.

3.1 Census: Survey-eligible population

The census team screened 93 806 individuals, including 27 399 children under the age of 15 (29.2% of the population)

Figure 3. Summary of National TB Prevalence Survey, 2009-2010



in 70 clusters, by home visit one day before the cluster data collection (see Table 29, before Annex 1). The survey census in each cluster was held based on a household list prepared by local health workers after a second pre-visit to the cluster site, carried out a few weeks before the survey census.

Among 66 407 individuals aged 15 years and above, 57 607 (86.7%) were registered as eligible survey subjects (Table 2). While 90.1% of female adults screened were eligible for the survey, only 83.1% of male adults were eligible. Young adults were less available to participate in the survey than elders. Only 74.0% of males aged 15-24 years were eligible for the survey. Most of those who were ineligible had been away from their registered address for a long time.

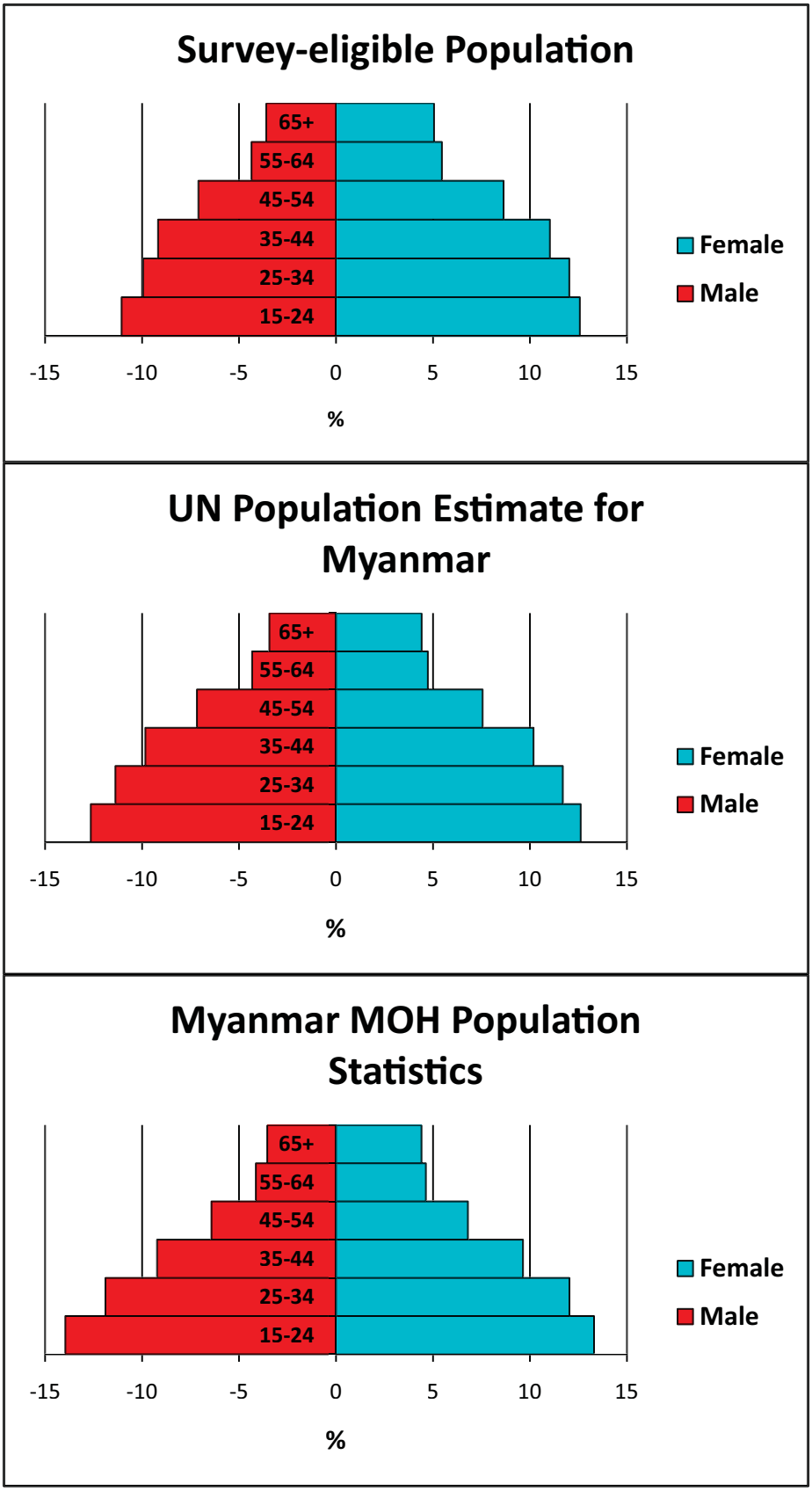
The proportion of children among the population excluding non-eligible adults was 32.2%. The survey census identified a smaller number of children under five than those aged five to nine years. Nevertheless, the observed proportion of children (29.2% of the total census population, or 32.2% of the total eligible population) was slightly higher than had been expected from national population census data when the survey was designed (27%), in part because there is lower mobility among children than among adult men.

Population pyramids for adults in the survey-eligible age groups are shown in Figure 4. There was no significant difference in age and sex distributions between the survey-eligible subjects, the UN's population estimate for Myanmar, and the population statistics routinely used by the NTP based on TB reports from townships.

Table 2. Survey census results: Eligible and ineligible subjects

	Eligible	%	Ineligible aged >= 15	%	Ineligible aged < 15	%	Total
Total	57 607	61.4%	8 800	9.4%	27 399	29.2%	93 806
Sex							
Male	26 052	57.6%	5 314	11.8%	13 858	30.6%	45 224
Female	31 555	65.0%	3 486	7.2%	13 541	27.9%	48 582
Age							
Unknown (<15)	0	0.0%			10	100.0%	10
0-4	0	0.0%			7 554	100.0%	7 554
5-9	0	0.0%			9 523	100.0%	9 523
10-14	0	0.0%			10 312	100.0%	10 312
15-24	13 608	77.9%	3 867	22.1%			17 475
25-34	12 656	82.5%	2 679	17.5%			15 335
35-44	11 640	89.8%	1 315	10.2%			12 955
45-54	9 066	94.4%	541	5.6%			9 607
55-64	5 651	95.8%	247	4.2%			5 898
65+	4 986	97.2%	142	2.8%			5 128
Unknown (>=15)	0	0.0%	9	100.0%			9
Strata							
Region	41 127	65.1%	4 574	7.2%	17 495	27.7%	63 196
State	16 480	53.8%	4 226	13.8%	9 904	32.4%	30 610
Urban/Rural							
Urban	13 040	63.3%	1 945	9.4%	5 622	27.3%	20 607
Rural	44 567	60.9%	6 855	9.4%	21 777	29.8%	73 199

Figure 4. **Population pyramids: Survey-eligible population, UN estimation and NTP/MOH statistics**



3.2 Participants

3.2.1 Survey participation

Among 57 607 eligible adults, 51 367 (89.2%) participated in the survey and received the symptom screening interview (Table 3). The participation rate was close to the 90% anticipated by the survey design. The average number of survey participants per cluster was 728, range 621-850 (Table 29, before Annex 1). The participation rate was higher among females (91.8%) than among males (86.0%). Rural clusters showed a slightly higher participation rate (90.0%) than urban clusters (86.3%). Only 4 out of 70 clusters recorded a participation rate lower than 80%. There was no significant difference in participation rate between age groups.

Table 3. Survey participation rates

	Eligible	Partici-pants	%	Non-Partici-pants	%	Inter-viewed	%	Chest X-ray	%
Total	**57 607**	**51 367**	**89.2%**	**6 240**	**10.8%**	**51 367**	**100%**	**50 241**	**97.8%**
Age									
Male	26 052	22 394	86.0%	3 658	14.0%	22 394	100%	22 347	99.8%
15-24	6 367	5 404	84.9%	963	15.1%	5 404	100%	5 401	99.9%
25-34	5 728	4 808	83.9%	920	16.1%	4 808	100%	4 806	100.0%
35-44	5 287	4 526	85.6%	761	14.4%	4 526	100%	4 522	99.9%
45-54	4 088	3 606	88.2%	482	11.8%	3 606	100%	3 598	99.8%
55-64	2 508	2 231	89.0%	277	11.0%	2 231	100%	2 226	99.8%
65+	2 074	1 819	87.7%	255	12.3%	1 819	100%	1 794	98.6%
Female	31 555	28 973	91.8%	2 582	8.2%	28 973	100%	27 894	96.3%
15-24	7 241	6 495	89.7%	746	10.3%	6 495	100%	6 219	95.8%
25-34	6 928	6 416	92.6%	512	7.4%	6 416	100%	5 914	92.2%
35-44	6 353	5 936	93.4%	417	6.6%	5 936	100%	5 719	96.3%
45-54	4 978	4 674	93.9%	304	6.1%	4 674	100%	4 659	99.7%
55-64	3 143	2 936	93.4%	207	6.6%	2 936	100%	2 928	99.7%
65+	2 912	2 516	86.4%	396	13.6%	2 516	100%	2 455	97.6%
Strata									
State/ Urban	4 096	3 514	85.8%	582	14.2%	3 514	100%	3 421	97.4%
State/ Rural	12 384	10 690	86.3%	1 694	13.7%	10 690	100%	10 436	97.6%
Region/ Urban	8 944	7 740	86.5%	1 204	13.5%	7 740	100%	7 551	97.6%
Region/ Rural	32 183	29 423	91.4%	2 760	8.6%	29 423	100%	28 833	98.0%

3.2.2 Further demographic factors of participants

All participants received a structured interview by a trained interviewer and a member of the central survey team, covering basic demographic factors, health risks and TB-related symptoms, behaviour and history. Body weight and height were measured to obtain BMI.

The most common occupation among the participants (44.6%) was agriculture/farming (52.3% of males and 38.6% of females). The vast majority of participants (91.7%) was Buddhist. Among all participants, 79.2% had a primary-level education or above, while 6.7% of male and 8.0% of female participants (10.9% of the total) were illiterate (this could be assessed in the process of obtaining written informed consent) (See Table 4).

3.2.3 Health risk factors of participants

Among the participants, 48.6% of males and 13.3% of females were current smokers (Table 5). However, most of them were not heavy smokers: only 3.0% of male smokers smoked 20 or more cigarettes a day and 2.2% had a Brickman Index[1] of 400 or more. Daily passive smoking was reported from 6.3% of male non-smokers and 7.8% of female non-smokers. Alcohol drinking habits were recorded in 35.2% of males and 0.7% of females.

The survey provided probably the largest population-based data on BMI in the adult population of Myanmar (Table 6). BMI less than 18.5 was reported among 23.8% of male and 22.5% of female participants.

Hypertension was reported by 5448 participants (10.5%), and 385 (0.7%) participants reported having diabetes. However, this reporting is probably not reliable since many of the chronic conditions were likely not diagnosed.

Among all participants, only nine reported HIV infection.

A close contact history to a TB patient was reported in 6.7% of the participants. There was no difference between males and females (Table 7).

Table 4. Backgrounds of survey participants

Occupation	Male	%	Female	%	Total	%
Professional	52	0.2%	83	0.3%	135	0.3%
Private business	134	0.6%	99	0.3%	233	0.5%
Trader	1 075	4.8%	2 529	8.7%	3 604	7.0%
Support staff	2 401	10.7%	1 285	4.4%	3 686	7.2%
Sale worker	92	0.4%	152	0.5%	244	0.5%
Agriculture/farm	11 724	52.4%	11 173	38.6%	22 897	44.6%
Production worker	434	1.9%	875	3.0%	1309	2.5%
Manual worker	3 008	13.4%	3 006	10.4%	6 014	11.7%
House worker	1	0.0%	114	0.4%	115	0.2%
Student	898	4.0%	961	3.3%	1 859	3.6%
Dependent	2 064	9.2%	8 624	29.8%	10 688	20.8%
Religious leader	414	1.8%	37	0.1%	451	0.9%
Other	97	0.4%	35	0.1%	132	0.3%
Total	**22 394**	**100%**	**28 973**	**100%**	**51 367**	**100.0%**

1 *Brickman Index quantifies lifelong smoking exposure: "average daily consumption "x" years of smoking".*

Religion						
Buddhist	20 516	91.6%	26 586	91.8%	47 102	91.7%
Christian	957	4.3%	1 239	4.3%	2 196	4.3%
Hindu	9	0.0%	18	0.1%	27	0.1%
Muslim	686	3.1%	901	3.1%	1 587	3.1%
Other	226	1.0%	229	0.8%	455	0.9%
Unknown	0		0		0	0.0%
Total	**22 394**	**100%**	**28 973**	**100%**	**51 367**	**100.0%**
Marital status						
Single	6 708	30.0%	8 245	28.5%	14 953	29.1%
Married	14 693	65.6%	17 202	59.4%	31 895	62.1%
Separated	220	1.0%	500	1.7%	720	1.4%
Widow	773	3.5%	3 026	10.4%	3 799	7.4%
Unknown	0	0.0%	0	0.0%	0	0.0%
Total	**22 394**	**100%**	**28 973**	**100%**	**51 367**	**100.0%**
Education level						
Illiterate	1 493	6.7%	4 131	14.3%	5 624	10.9%
Read/write	2 806	12.5%	2 258	7.8%	5 064	9.9%
Primary	7 662	34.2%	11 910	41.1%	19 572	38.1%
Middle	5 775	25.8%	5 475	18.9%	11 250	21.9%
Higher	3 377	15.1%	3 216	11.1%	6 593	12.8%
University	565	2.5%	595	2.1%	1 160	2.3%
Graduate	716	3.2%	1 388	4.8%	2 104	4.1%
Unknown	0	0.0%	0	0.0%	0	0.0%
Total	**22 394**	**100%**	**28 973**	**100%**	**51 367**	**100.0%**

3.2.4 TB history

A total of 79 participants (0.15%) reported that they were receiving TB treatment at the time of the survey, 46 males (0.21%) and 33 females (0.11%). Of these, 36 (45.6%) were receiving treatment at a public hospital, 27 (34.2%) at a community health centre or health post and 12 (15.2%) from a general practitioner (GP) (Table 8).

A previous TB treatment history was reported by 1463 participants (2.8%). Among them, 433 (29.6%) received treatment from GPs, while those receiving treatment by health centre/post numbered 250 (17.1%).

Table 5. **Smoking and drinking habits of survey participants**

Sex	Male							Female						
Age to	<24	<34	<44	<54	<64	65+	all	<24	<34	<44	<54	<64	65+	all
Smoking (number)														
Non-smoker	3 442	1 967	1 754	1 088	675	478	9 404	6 393	6 011	5 111	3 477	1 824	1 327	24 143
Ex-smoker	110	280	385	447	371	503	2 096	13	35	62	194	246	419	969
Smoker	1 852	2 561	2 387	2 071	1 185	838	10 894	89	370	763	1 003	866	770	3 861
Total	**5 404**	**4 808**	**4 526**	**3 606**	**2 231**	**1 819**	**22 394**	**6 495**	**6 416**	**5 936**	**4 674**	**2 936**	**2 516**	**28 973**
Smoking (%)														
Non-smoker	63.7%	40.9%	38.8%	30.2%	30.3%	26.3%	42.0%	98.4%	93.7%	86.1%	74.4%	62.1%	52.7%	83.3%
Ex-smoker	2.0%	5.8%	8.5%	12.4%	16.6%	27.7%	9.4%	0.2%	0.5%	1.0%	4.2%	8.4%	16.7%	3.3%
Smoker	34.3%	53.3%	52.7%	57.4%	53.1%	46.1%	48.6%	1.4%	5.8%	12.9%	21.5%	29.5%	30.6%	13.3%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Passive smoking (number)														
No passive smoking	1 368	787	817	510	335	277	4 094	3 147	2 897	2 509	1 763	994	853	12 163
Not daily	1 791	1 073	841	528	305	180	4 718	2 770	2 590	2 170	1 450	712	415	10 107
Daily passive smoking	283	107	96	50	35	21	592	476	524	432	264	118	59	1 873
Total	**3 442**	**1 967**	**1 754**	**1 088**	**675**	**478**	**9 404**	**6 393**	**6 011**	**5 111**	**3 477**	**1 824**	**1 327**	**24 143**
Passive smoking (%)														
No passive smoking	39.7%	40.0%	46.6%	46.9%	49.6%	57.9%	43.5%	49.2%	48.2%	49.1%	50.7%	54.5%	64.3%	50.4%
not daily	52.0%	54.6%	47.9%	48.5%	45.2%	37.7%	50.2%	43.3%	43.1%	42.5%	41.7%	39.0%	31.3%	41.9%
daily	8.2%	5.4%	5.5%	4.6%	5.2%	4.4%	6.3%	7.4%	8.7%	8.5%	7.6%	6.5%	4.4%	7.8%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**
Drinking (Number)														
Non-drinker	4 116	2 131	1 815	1 570	972	946	11 550	6 477	6 375	5 867	4 625	2 887	2 487	28 718
Ex-drinker	108	333	573	662	632	648	2 956	5	8	12	11	10	4	50
Drinker	1 180	2 344	2 138	1 374	627	225	7 888	13	33	57	38	39	25	205
Total	**5 404**	**4 808**	**4 526**	**3 606**	**2 231**	**1 819**	**22 394**	**6 495**	**6 416**	**5 936**	**4 674**	**2 936**	**2 516**	**28 973**
Drinking (%)														
Non-drinker	76.2%	44.3%	40.1%	43.5%	43.6%	52.0%	51.6%	99.7%	99.4%	98.8%	99.0%	98.3%	98.8%	99.1%
Ex-drinker	2.0%	6.9%	12.7%	18.4%	28.3%	35.6%	13.2%	0.1%	0.1%	0.2%	0.2%	0.3%	0.2%	0.2%
Drinker	21.8%	48.8%	47.2%	38.1%	28.1%	12.4%	35.2%	0.2%	0.5%	1.0%	0.8%	1.3%	1.0%	0.7%
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 6. **Body Mass Index (BMI) of survey participants**

Sex	Male							Female						
Age	**<24**	**<34**	**<44**	**<54**	**<64**	**65+**	**All**	**<24**	**<34**	**<44**	**<54**	**<64**	**65+**	**All**
BMI (number)														
Unknown	2	1	5	1	1	2	12	3	1	4	6	1	8	23
<15	80	21	22	32	25	67	247	55	41	53	104	127	267	647
15.0-18.4	1 608	917	800	687	496	565	5 073	1 469	1 074	877	854	736	859	5 869
18.5-24.9	3 595	3 588	3 235	2 470	1 424	1 038	15 350	4 602	4 340	3 576	2 529	1 469	1 104	17 620
25.0-29.9	103	256	403	362	252	130	1 506	331	797	1 093	886	442	214	3 763
30.0+	16	25	61	54	33	17	206	35	163	333	295	161	64	1 051
Total	**5 404**	**4 808**	**4 526**	**3 606**	**2 231**	**1 819**	**22 394**	**6 495**	**6 416**	**5 936**	**4 674**	**2 936**	**2 516**	**28 973**
BMI (%)														
Unknown	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.3%	0.1%
<15	1.5%	0.4%	0.5%	0.9%	1.1%	3.7%	1.1%	0.8%	0.6%	0.9%	2.2%	4.3%	10.6%	2.2%
15.0-18.4	29.8%	19.1%	17.7%	19.1%	22.2%	31.1%	22.7%	22.6%	16.7%	14.8%	18.3%	25.1%	34.1%	20.3%
18.5-24.9	66.5%	74.6%	71.5%	68.5%	63.8%	57.1%	68.5%	70.9%	67.6%	60.2%	54.1%	50.0%	43.9%	60.8%
25.0-29.9	1.9%	5.3%	8.9%	10.0%	11.3%	7.1%	6.7%	5.1%	12.4%	18.4%	19.0%	15.1%	8.5%	13.0%
30.0+	0.3%	0.5%	1.3%	1.5%	1.5%	0.9%	0.9%	0.5%	2.5%	5.6%	6.3%	5.5%	2.5%	3.6%
Total	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Table 7. **TB contact history of survey participants**

	All	%	Male	%	Female	%
Yes	3 433	6.7%	1 424	6.4%	2 009	6.9%
No	47 690	92.8%	20 860	93.1%	26 830	92.6%
Not sure	244	0.5%	112	0.5%	132	0.5%
Total	**51 367**	**100.0%**	**22 396**	**100.0%**	**28 971**	**100.0%**

Table 8. **Current and previous TB treatment and providers of survey participants**

	All	%	Male	%	Female	%	Urban	%	Rural	%	State	%	Region	%
Current TB Treatment														
On treatment	79	0.154%	46	0.205%	33	0.114%	33	0.293%	46	0.115%	25	0.176%	54	0.145%
Not on treatment	51 288	99.8%	22 348	99.8%	28 940	99.9%	11 221	99.7%	40 067	99.9%	14 179	99.8%	37 109	99.9%
Total	**51 367**	**100.0%**	**22 394**	**100.0%**	**28 973**	**100.0%**	**11 254**	**100.0%**	**40 113**	**100.0%**	**14 204**	**100.0%**	**37 163**	**100.0%**
Place of Current Treatment														
HP/HC	27	34.2%	15	32.6%	12	36.4%	16	48.5%	11	23.9%	10	40.0%	17	31.5%
Public hospital	36	45.6%	20	43.5%	16	48.5%	10	30.3%	26	56.5%	7	28.0%	29	53.7%
GP	12	15.2%	7	15.2%	5	15.2%	4	12.1%	8	17.4%	5	20.0%	7	13.0%
Private hospital	2	2.5%	2	4.3%	0	0.0%	2	6.1%	0	0.0%	2	8.0%	0	0.0%
Pharmacy	1	1.3%	1	2.2%	0	0.0%	1	3.0%	0	0.0%	1	4.0%	0	0.0%
Other	1	1.3%	1	2.2%	0	0.0%	0	0.0%	1	2.2%	0	0.0%	1	1.9%
Total	**79**	**100.0%**	**46**	**100.0%**	**33**	**100.0%**	**33**	**100.0%**	**46**	**100.0%**	**25**	**100.0%**	**54**	**100.0%**
Previous Treatment History														
Yes	1 463	2.85%	803	3.59%	660	2.28%	586	5.21%	877	2.19%	419	2.95%	1 044	2.81%
No	49 901	97.1%	21 591	96.4%	28 310	97.7%	10 666	94.8%	39 235	97.8%	13 784	97.0%	36 117	97.2%
Not sure	3	0.0%	2	0.0%	1	0.0%	2	0.0%	1	0.0%	1	0.0%	2	0.0%
Total	**51 367**	**100.0%**	**22 396**	**100.0%**	**28 971**	**100.0%**	**11 254**	**100.0%**	**40 113**	**100.0%**	**14 204**	**100.0%**	**37 163**	**100.0%**
Place of Previous Treatment														
HP/HC	250	17.1%	146	18.2%	104	15.8%	122	20.8%	128	14.6%	72	17.2%	178	17.0%
Public hospital	716	48.9%	394	49.1%	322	48.8%	203	34.6%	513	58.5%	215	51.3%	501	48.0%
GP	433	29.6%	226	28.1%	207	31.4%	224	38.2%	209	23.8%	115	27.4%	318	30.5%
Private hospital	29	2.0%	18	2.2%	11	1.7%	17	2.9%	12	1.4%	6	1.4%	23	2.2%
Pharmacy	11	0.8%	7	0.9%	4	0.6%	5	0.9%	6	0.7%	0	0.0%	11	1.1%
Other	21	1.4%	10	1.2%	11	1.7%	14	2.4%	7	0.8%	9	2.1%	12	1.1%
Unknown	3	0.2%	2	0.2%	1	0.2%	1	0.2%	2	0.2%	2	0.5%	1	0.1%
Total	**1 463**	**100.0%**	**803**	**100.0%**	**660**	**100.0%**	**586**	**100.0%**	**877**	**100.0%**	**419**	**100.0%**	**1 044**	**100.0%**

3.3 Screening

3.3.1 TB-related symptoms

All 51 367 participants, including those aided by family members or guardians, were interviewed for symptom screening.

The primary interview identified 1433 (2.8%) TB suspects with "cough 3 weeks or more" according to the NTP definition of a TB suspect. After re-assessment by a physician, 1691 (3.3%) of participants, including those with "blood in sputum" (302 or 1.4%) were categorized as eligible for sputum examinations, i.e. TB-suspect from symptoms. Prevalence of chronic cough increased significantly with age, and those living in states reported chronic cough more often than those in regions (Tables 9 and 10). A total of 19 110 (37.2%) of participants reported at least one symptom.

Table 9. Results of screening interview: TB-related symptoms

Symptom	Number	%
1. Illness	9 015	17.6%
2. Cough	12 268	23.9%
1-13 days	10 106	19.7%
14-20 days	622	1.2%
21 days+	1 433	2.8%
3. Sputum	9 953	19.4%
4. Haemoptysis	285	0.6%
5. Weight loss	1 512	2.9%
6. Fever	3 122	6.1%
7. Chest pain	6 827	13.3%
8. Other	2 490	4.8%
Eligible for sputum exam by interview	1 691	3.3%
Any of symptoms 2-8	19 110	37.2%
No symptom	32 257	62.8%
Total	**51 367**	**100.0%**

3.3.2 Chest X-ray

A total of 50 241 participants (97.8%) received CXR (Table 3). However, 49 males (0.2%) and 1077 females (3.7%) were exempted from CXR examinations. Declaring pregnancy (635) was a major reason for exemption from CXR. However, as it was not necessary to declare a reason to decline CXR, most women who declined CXR without any specified reason might be pregnant. Participants unable to stand received interviews at home and were also exempted from CXR. Those who were exempted from CXR were advised to submit sputum specimens regardless of the presence of symptoms. Among the participants who were exempted from CXR, 30 conformed to the symptom criteria of suspected TB.

CXR over-reading was encouraged in spot screening readings so as not to miss any abnormality. This led to 10 637 (21.1%) participants being categorized as eligible for sputum examination with any abnormality in the lungs from the spot screening reading (Table 11). Male participants (24.6%) showed more CXR abnormality than female participants (18.5%). The proportion of abnormal CXR increased significantly with age.

Table 10. Detailed results of screening interview

	Interviewed	Any cough	%	Cough 14-20 days	%	Cough 21+ days	%	Sputum	%	Blood sputum	%	Weight loss	%	Fever	%	Chest pain	%	Other	%	Any 2-8	%	Eligible for sputum by symptom	%
Total	**51 367**	**12 268**	**23.9%**	**622**	**1.2%**	**1 540**	**3.0%**	**9 954**	**19.4%**	**285**	**0.6%**	**1 512**	**2.9%**	**3 122**	**6.1%**	**6 827**	**13.3%**	**2 490**	**4.8%**	**19 111**	**37.2%**	**1 691**	**3.3%**
Sex																							
Male	22 394	5 766	25.7%	306	1.4%	789	3.5%	4 830	21.6%	149	0.7%	670	3.0%	1 267	5.7%	2 790	12.5%	899	4.0%	8 545	38.2%	867	3.9%
15-24	5 404	1 194	22.1%	58	1.1%	81	1.5%	945	17.5%	19	0.4%	135	2.5%	316	5.8%	447	8.3%	174	3.2%	1 753	32.4%	91	1.7%
25-34	4 808	1 206	25.1%	48	1.0%	107	2.2%	1 022	21.3%	25	0.5%	143	3.0%	290	6.0%	600	12.5%	169	3.5%	1 846	38.4%	123	2.6%
35-44	4 526	1 093	24.1%	68	1.5%	140	3.1%	916	20.2%	29	0.6%	131	2.9%	220	4.9%	614	13.6%	177	3.9%	1 703	37.6%	154	3.4%
45-54	3 606	975	27.0%	48	1.3%	168	4.7%	851	23.6%	37	1.0%	112	3.1%	195	5.4%	542	15.0%	149	4.1%	1 447	40.1%	187	5.2%
55-64	2 231	669	30.0%	48	2.2%	145	6.5%	545	24.4%	21	0.9%	79	3.5%	142	6.4%	327	14.7%	108	4.8%	951	42.6%	156	7.0%
65+	1 819	629	34.6%	36	2.0%	148	8.1%	551	30.3%	18	1.0%	70	3.8%	104	5.7%	260	14.3%	122	6.7%	845	46.5%	156	8.6%
Female	28 973	6 502	22.4%	316	1.1%	751	2.6%	5 124	17.7%	136	0.5%	842	2.9%	1 855	6.4%	4 037	13.9%	1 591	5.5%	10 566	36.5%	824	2.8%
15-24	6 495	1 232	19.0%	61	0.9%	72	1.1%	952	14.7%	21	0.3%	168	2.6%	409	6.3%	676	10.4%	239	3.7%	2 044	31.5%	87	1.3%
25-34	6 416	1 281	20.0%	65	1.0%	95	1.5%	1 051	16.4%	29	0.5%	165	2.6%	368	5.7%	828	12.9%	283	4.4%	2 156	33.6%	114	1.8%
35-44	5 936	1 260	21.2%	56	0.9%	139	2.3%	1 007	17.0%	25	0.4%	161	2.7%	335	5.6%	885	14.9%	332	5.6%	2 122	35.7%	152	2.6%
45-54	4 674	1 113	23.8%	60	1.3%	151	3.2%	870	18.6%	26	0.6%	162	3.5%	333	7.1%	746	16.0%	298	6.4%	1 832	39.2%	161	3.4%
55-64	2 936	796	27.1%	41	1.4%	136	4.6%	623	21.2%	19	0.6%	87	3.0%	209	7.1%	468	15.9%	212	7.2%	1 212	41.3%	145	4.9%
65+	2 516	820	32.6%	33	1.3%	158	6.3%	621	24.7%	16	0.6%	99	3.9%	201	8.0%	434	17.2%	227	9.0%	1 200	47.7%	165	6.6%
Geography																							
State/ Urban	3 514	1 074	30.6%	76	2.2%	185	5.3%	885	25.2%	51	1.5%	94	2.7%	399	11.4%	594	16.9%	239	6.8%	1 573	44.8%	216	6.1%
State/ Rural	10 690	3 202	30.0%	184	1.7%	547	5.1%	2 666	24.9%	86	0.8%	427	4.0%	643	6.0%	1 817	17.0%	286	2.7%	4 608	43.1%	585	5.5%
Region/ Urban	7 740	1 449	18.7%	63	0.8%	187	2.4%	1 165	15.1%	25	0.3%	158	2.0%	501	6.5%	641	8.3%	337	4.4%	2 351	30.4%	202	2.6%
Region/ Rural	29 423	6 543	22.2%	299	1.0%	621	2.1%	5 238	17.8%	123	0.4%	833	2.8%	1 579	5.4%	3 775	12.8%	1 628	5.5%	10 579	36.0%	688	2.3%
Smoking																							
Current or ex-Smoker	17 820	6 152	34.5%	328	1.8%	999	5.6%	5 254	29.5%	154	0.9%	693	3.9%	1 251	7.0%	3 039	17.1%	880	4.9%	8 450	47.4%	1 073	6.0%
Non-Smoker	33 547	6 116	18.2%	294	0.9%	541	1.6%	4 700	14.0%	131	0.4%	819	2.4%	1 871	5.6%	3 788	11.3%	1 610	4.8%	10 661	31.8%	618	1.8%

Central CXR reading by NTP specialists was carried out soon after the field data collection without awaiting the laboratory results. The central reading reported that there were 781 (1.55%) images suggesting the presence of active TB disease. While the central reading suggested that 2449 (4.9%) of CXR showed abnormal findings consistent with TB including 781 TB-suggestive, 1772 (3.5%) with healed TB and 5934 (11.8%) with other abnormal findings in the lungs, the field reading categorized 10 637 (21.2%) with any abnormality in the lungs as eligible for sputum examinations. A total of 5742 CXRs categorized as abnormal by field reading were normal in the central reading (Table 12). Although over-reading was practised in the field reading, the central expert reading detected 22 TB-suggestive CXRs and 347 CXRs with TB-suspected findings that had been judged as non-eligible for sputum examinations by a screening reader.

Table 11. Chest X-ray field screening results

	CXR not taken	CXR taken	Non-eligible for sputum (Normal)		Eligible for sputum (Abnormal)		N.A. film	
	Number	Number	Number	%	Number	%	Number	%
Total	**1 126**	**50 241**	**39 604**	**78.8%**	**10 637**	**21.2%**	**0**	**0**
Sex								
Male	47	22 347	16 860	75.4%	5 487	24.6%	0	0
15-24	3	5 401	4 700	87.0%	701	13.0%	0	0
25-34	2	4 806	3 921	81.6%	885	18.4%	0	0
35-44	4	4 522	3 466	76.6%	1 056	23.4%	0	0
45-54	8	3 598	2 484	69.0%	1 114	31.0%	0	0
55-64	5	2 226	1 374	61.7%	852	38.3%	0	0
65+	25	1 794	915	51.0%	879	49.0%	0	0
Female	1 079	27 894	22 744	81.5%	5 150	18.5%	0	0
15-24	276	6 219	5 669	91.2%	550	8.8%	0	0
25-34	502	5 914	5 215	88.2%	699	11.8%	0	0
35-44	217	5 719	4 798	83.9%	921	16.1%	0	0
45-54	15	4 659	3 619	77.7%	1 040	22.3%	0	0
55-64	8	2 928	2 024	69.1%	904	30.9%	0	0
65+	61	2 455	1 419	57.8%	1 036	42.2%	0	0
Strata								
State/Urban	93	3 421	2 617	76.5%	804	23.5%	0	0
State/Rural	254	10 436	7 724	74.0%	2 712	26.0%	0	0
Region/Urban	189	7 551	6 066	80.3%	1 485	19.7%	0	0
Region/Rural	590	28 833	23 197	80.5%	5 636	19.5%	0	0

Table 12. Relationship between field screening readings and central expert readings

	Central Reading		Field Screening Reading			
	Number	% of total	Eligible for exam	%	Ineligible	%
Normal	42 030	83.7%	5 742	13.7%	36 288	86.3%
Active TB-suggestive	781	1.6%	759	97.2%	22	2.8%
TB-suspect	1 668	3.3%	1 321	79.2%	347	20.8%
Healed TB	1 772	3.5%	1 365	77.0%	407	23.0%
Other lung disease	1 713	3.4%	869	50.7%	844	49.3%
Cardiovascular abnormality	1 374	2.7%	309	22.5%	1 065	77.5%
Other findings in lung	260	0.5%	117	45.0%	143	55.0%
Findings other than in lung	448	0.9%	120	26.8%	328	73.2%
Not interpretable	195	0.4%	35	17.9%	160	82.1%
Not available for reading	0	0.0%	0	0%	0	0%
Total	**50 241**	**100.0%**	**10 637**	**21.2%**	**39 604**	**78.8%**

3.3.3 Screening results

Randomly selected participants were re-assessed on the spot for quality assurance purposes. In addition, after the daily work, documents and CXR images were re-checked by survey team members. Corrective actions were taken when a false negative error was suspected to ensure the high quality of the survey. As a result, 70 participants who were originally recorded as "non-eligible for sputum examinations" were asked to submit sputum specimens.

Through the screening process, including these internal quality-control activities, 12 235 participants were categorized as "eligible for sputum examinations". Among them, 1259 were eligible both by symptoms and CXR abnormality and 9 378 were eligible only by CXR abnormality (Table 13).

Table 13. Summary screening results: reasons for eligibility for sputum examinations

CXR	Interview (Symptom screening)		
	Eligible	Ineligible	Total
Eligible by screening	1 259	9 378	10 637
Ineligible	402	39 202	39 604
Eligible without CXR	30	1096	1 126
Total	**1 691**	**49 676**	**51 367**
Eligible for sputum examination by first screening TOTAL	12 165		
Sputum examination request by corrective action	70		
Total number of sputum examination requests	**12 235**		

3.4 Laboratory examinations

3.4.1 Sputum collection

A total of 12 235 survey participants were considered eligible for sputum examinations and were asked to submit two sputum specimens. Out of these individuals, 12 144 (99.3%) submitted at least one specimen according to the

field report. The sputum of 82 participants in 10 clusters was collected through follow-up activities (see Section 2.9.2) when the CCU found that a significant number of TB had suspects missed the sputum examinations. Around 340 specimens were collected per cluster. Due to logistical challenges, the specimens from three clusters out of the 70 could not be processed within five days after the collection (six or seven days: two clusters; more than seven days: one cluster). Specimens were re-collected in one cluster due to a high contamination rate (initial results were cancelled). Laboratory results were available for 12 087 participants (Table 14). Examinations with two specimens were conducted for 98.9% (1672/1691) of those eligible by symptoms and 99.0% (758/766) of those with TB-suggestive CXR findings. Among the total of 11 979 participants (97.9% of those requested) who were examined with two smears and two cultures, interpretable results of both specimens were available for 11 587. (The drying-up of specimens during transportation, contamination and coding errors were responsible for the discrepancy between the collection and examination results.)

Table 14. Screening and CXR results and sputum examinations

	Eligible	2 smear 2 culture	%	2 S 1 C	%	2 S 0 C	1S 1C	No Exam
Eligible by symptom only	402	395	98.3%	1	0.2%	0	1	5
Eligible by chest X-ray abnormality only	9 378	9 250	98.6%	13	0.1%	6	61	48
Eligible by both symptom and CXR	1 259	1 242	98.6%	3	0.2%	1	10	3
CXR exempted with symptom	30	30	100.0%	0	0.0%	0	0	0
CXR exempted without symptom	1 096	992	90.5%	2	0.2%	2	8	92
Corrective actions	70	70	100.0%	0	0.0%	0	0	0
Total	**12 235**	**11 979**	**97.9%**	**19**	**0.2%**	**9**	**80**	**148**
CXR central reading								
Normal	6 119	6 032	98.6%	11	0.2%	6	36	34
Active TB-suggestive	766	758	99.0%	0	0.0%	0	6	2
TB-suspect	1 354	1 337	98.7%	3	0.2%	1	7	6
Healed TB	1 382	1 366	98.8%	0	0.0%	0	9	7
Other lung disease	886	879	99.2%	2	0.2%	0	3	2
Cardiovascular abnormality	323	314	97.2%	1	0.3%	0	5	3
Other findings in lung	119	116	97.5%	0	0.0%	0	3	0
Findings other than lung	123	119	96.7%	0	0.0%	0	3	1
Not interpretable	37	36	97.3%	0	0.0%	0	0	1
Not available for reading	1 126	1 022	90.8%	2	0.2%	2	8	92
Total	**12 235**	**11 979**	**97.9%**	**19**	**0.2%**	**9**	**80**	**148**

3.4.2 Smear examination results

In total, 132 participants showed at least one positive slide by fluorescent microscope which was confirmed by ZN staining. The spot specimens showed 107 positive slides and the morning specimens showed 114 positive slides (Table 15). The relationship between the spot and the morning results is shown in Table 16. Scanty positive slides occupied 23.3% of positives in spot (25/107) and 28.9% of positives in morning specimens (33/114), and 1+ was most frequently observed in both specimens.

Both spot and morning specimens were cultured (two tubes per specimen). Culture results were not available due to contamination in 1.7% of spot specimens and 1.9% of morning specimens. Mycobacterium was isolated in 341

subjects. Among 132 AFB smear-positive subjects, 118 (89.4%) had at least one culture-positive result (Tables 17 and 18). Among 163 specimens with smear grade 1+ or more, 153 (93.9%) were culture-positive. According to the protocol, the identification tests were carried out at NTRL in Yangon, requiring transportation of cultured strains from Mandalay to Yangon. Some cultured strains were lost during subculture, store or transportation. The identification of 11 strains was based only on morphological judgment by senior laboratory technologists. *M. tuberculosis* was identified from 317 participants, 116 from smear-positive and 201 from smear-negative. MOTT was isolated from 24 participants, 2 from smear-positive and 22 from smear-negative, without co-isolate of *M. tuberculosis*. While there were 215 *M. tuberculosis* isolates in spot specimens, there were 266 in morning specimens (Table 19). Clustering of culture-positive results was observed in a few survey clusters. The expert panel was convened to review the laboratory process, records and survey data including CXR. The panel decided to remove 13 participants with positive results from the survey case list because of suspicions of cross-contamination.

3.5 Central Medical Panel

The central medical panel reviewed all available information for the individuals with positive results from the laboratory. The panel provided medical advice to survey participants with positive results and certified individual survey results according to the case definition of the survey protocol. Whenever clustering of the bacteriologically positive subjects without CXR abnormality was observed, the possibility of cross-contamination in laboratory was considered to decide whether a subject with bacteriologically positive result should be a survey case.

Among 132 subjects with AFB smear-positive result, 116 with *M. tuberculosis* isolates were categorized as definite smear-positive TB cases. Seven subjects were categorized as probable smear-positive TB cases without culture confirmation. Of these, six subjects had TB-consistent findings with CXR by a panel decision and one subject had two smear-positive results. However, seven subjects with one smear-positive result without any CXR findings consistent with TB disease, nor any follow-up information to support the presence of disease, were excluded from the survey case list as a possible TB cases. Two subjects with isolates of MOTT were also excluded from the case list as non-TB. Among 201 smear-negative, culture-positive subjects with *M. tuberculosis* isolates, 188 were categorized as definite culture-positive TB cases that filled at least one of following conditions:

- CXR finding consistent with tuberculosis disease by panel reading
- Culture-positive in two different specimens
- Culture-positive at least with five colonies when *M. tuberculosis* was isolated from only one specimen.

The panel review excluded 11 subjects based on probable cross-contamination and with only a single tube culture-positive among four tubes with one or two colonies without CXR supportive evidence. Moreover, two subjects with 5 and 10 colonies in the same cluster were removed due to a strong suspicion of laboratory error.

Table 15. **Smear examination results**

	Spot Sputum						Morning Sputum					Combined Results							
	Requested	Examined	Positive	%	Negative	N.A.*	Examined	Positive	%	Negative	N.A.*	Examined	2 Ps	%	1 P 1 N	%	1 P 1 NA	2 N	1 N only	2 NA
Eligibility																				
Eligible by symptom only	402	397	0	0.0%	397	5	396	0	0.0%	396	6	397	0	0.0%	0	0.0%	0	396	1	5
Eligible by CXR abnormality only	9 378	9 324	66	0.7%	9 258	54	9 275	73	0.8%	9 202	103	9 330	52	0.6%	35	0.4%	0	9 182	61	48
Eligible by both symptom and CXR	1 259	1 253	39	3.1%	1 214	6	1 249	40	3.2%	1 209	10	1 256	36	2.9%	7	0.6%	0	1 203	10	3
CXR exempted with symptom	30	30	0	0.0%	30	0	30	0	0.0%	30	0	30	0	0.0%	0	0.0%	0	30	0	0
CXR exempted without symptom	1 096	1 004	2	0.2%	1 002	92	996	1	0.1%	995	100	1 004	1	0.1%	1	0.1%	0	994	8	92
Corrective actions	70	70	0	0.0%	70	0	70	0	0.0%	70	0	70	0	0.0%	0	0.0%	0	70	0	0
Total	**12 235**	**12 078**	**107**	**0.9%**	**11 971**	**157**	**12 016**	**114**	**0.9%**	**11 902**	**219**	**12 087**	**89**	**0.7%**	**43**	**0.4%**	**0**	**11 875**	**80**	**148**
Geography																				
State Rural Clusters	3 135	3 116	38	1.2%	3 078	19	3 113	35	1.1%	3 078	22	3 117	29	0.9%	15	0.5%	0	3 068	5	18
State Urban Clusters	922	913	11	1.2%	902	9	896	12	1.3%	884	26	916	8	0.9%	7	0.8%	0	878	23	6
Region Rural Clusters	6 396	6 356	39	0.6%	6 317	40	6 319	45	0.7%	6 274	77	6 361	34	0.5%	16	0.3%	0	6 264	47	35
Region Urban Clusters	1 782	1 693	19	1.1%	1 674	89	1 688	22	1.3%	1 666	94	1 693	18	1.1%	5	0.3%	0	1 665	5	89
Sex and age																				
Male	5 776	5 713	76	1.3%	5 637	63	5 688	86	1.5%	5 602	88	5 720	67	1.2%	28	0.5%	0	5 586	39	56
15-24	745	741	4	0.5%	737	4	737	3	0.4%	734	8	742	3	0.4%	1	0.1%	0	732	6	3
25-34	933	921	13	1.4%	908	12	918	12	1.3%	906	15	923	9	1.0%	7	0.8%	0	900	7	10

	Spot Sputum						Morning Sputum					Combined Results							
	Requested	Examined	Positive	%	Negative	N.A.*	Examined	Positive	%	Negative	N.A.*	Examined	2 Ps	%	1 P 1 N	%	1 P 1 NA	2 N	1 N only	2 NA
35-44	1 107	1 096	20	1.8%	1 076	11	1 086	25	2.3%	1 061	21	1 096	20	1.8%	5	0.5%	0	1 061	10	11
45-54	1 168	1 158	15	1.3%	1 143	10	1 156	17	1.5%	1 139	12	1 159	13	1.1%	6	0.5%	0	1 136	4	9
55-64	885	879	13	1.5%	866	6	874	15	1.7%	859	11	881	11	1.2%	6	0.7%	0	855	9	4
65+	938	918	11	1.2%	907	20	917	14	1.5%	903	21	919	11	1.2%	3	0.3%	0	902	3	19
Female	6 459	6 365	31	0.5%	6 334	94	6 328	28	0.4%	6 300	131	6 367	22	0.3%	15	0.2%	0	6 289	41	92
15-24	861	847	1	0.1%	846	14	844	2	0.2%	842	17	848	1	0.1%	1	0.1%	0	841	5	13
25-34	1 241	1 227	6	0.5%	1 221	14	1 218	4	0.3%	1 214	23	1 227	4	0.3%	2	0.2%	0	1 212	9	14
35-44	1 187	1 172	12	1.0%	1 160	15	1 165	9	0.8%	1 156	22	1 173	9	0.8%	3	0.3%	0	1 152	9	14
45-54	1 103	1 095	5	0.5%	1 090	8	1 089	6	0.6%	1 083	14	1 095	4	0.4%	3	0.3%	0	1 082	6	8
55-64	948	933	6	0.6%	927	15	930	3	0.3%	927	18	933	3	0.3%	3	0.3%	0	924	3	15
65+	1 119	1 091	1	0.1%	1 090	28	1 082	4	0.4%	1 078	37	1 091	1	0.1%	3	0.3%	0	1 078	9	28

Table 16. Relationship between spot and morning specimen results by smear examination (grading by ZN staining)

		Morning							
		Negative	Scanty	1+	2+	3+	NA	Total	(%)
Spot	Negative	11 875	19	4	2	0	71	11 971	99.04%
	Scanty	12	7	6	0	0	0	25	0.21%
	1+	4	7	33	3	1	0	48	0.40%
	2+	0	0	2	16	3	0	21	0.17%
	3+	2	0	1	1	9	0	13	0.11%
	NA	9	0	0	0	0	0	9	0.07%
	Total	**11 902**	**33**	**46**	**22**	**13**	**71**	**12 087**	
	(%)	98.5%	0.26%	0.36%	0.17%	0.10%	0.55%		

Table 17. Culture examination results

	Spot Sputum									Morning Sputum								Combined Results					
	Requested	Not tested	Examined	MTB (+)	%	MOTT	Negative*	Contami-nated	N.A.	Not tested	Examined	Positive	%	MOTT	Negative**	Contami-nated	N.A.	MTB (+)	%	MOTT	%	2 N	%	1 N only
Eligibility																								
Eligible by symptom only	402	5	397	1	0.2%	0	389	7	0	6	396	1	0.2%	3	384	7	1	2	0.5%	3	0.7%	379	94.3%	10
Eligible by CXR abnor-mality only	9 378	64	9 314	151	1.6%	3	8 997	157	6	109	9 269	196	2.1%	13	8 873	184	3	236	2.5%	15	0.2%	8 704	92.8%	328
Eligible by both symp-tom & CXR	1 259	7	1 252	55	4.4%	4	1 166	26	1	12	1 247	59	4.7%	4	1 157	26	1	64	5.1%	5	0.4%	1 128	89.6%	53
CXR exemp-ted with symptom	30	0	30	1	3.3%	0	29	0	0	0	30	1	3.3%	0	29	0	0	1	3.3%	0	0.0%	29	96.7%	0
CXR exemp- ted\ w/out symptom	1 096	94	1 002	7	0.6%	1	973	19	2	102	994	7	0.6%	0	971	16	0	12	1.1%	1	0.1%	946	86.3%	41
Corrective actions	70	0	70	0	0.0%	0	70	0	0	0	70	2	2.9%	0	67	1	0	2	2.9%	0	0.0%	67	95.7%	1
Total	**12 235**	**170**	**12 065**	**215**	**1.8%**	**8**	**11 624**	**209**	**9**	**229**	**12 006**	**266**	**2.2%**	**20**	**11 481**	**234**	**5**	**317**	**2.6%**	**24**	**0.2%**	**11 253**	**92.0%**	**433**
Geography																								
State Rural	3 135	20	3 115	61	1.9%	4	2 981	69	0	22	3 113	82	2.6%	6	2 966	59	0	90	2.9%	7	0.2%	2 910	92.8%	89
State Urban	922	9	913	23	2.5%	1	858	31	0	27	895	26	2.8%	0	835	34	0	34	3.7%	1	0.1%	799	86.7%	77
Region Rural	6 396	52	6 344	85	1.3%	3	6 159	89	8	86	6 310	99	1.5%	10	6 085	111	5	122	1.9%	12	0.2%	5 978	93.5%	218
Region Urban	1 782	89	1 693	46	2.6%	0	1 626	20	1	94	1 688	59	3.3%	4	1 595	30	0	71	4.0%	4	0.2%	1 566	87.9%	49
Sex and Age																								
Male	5 776	68	5 708	150	2.6%	6	5 432	116	4	92	5 684	171	3.0%	14	5 377	120	2	208	3.6%	16	0.3%	5 243	90.8%	222
15-24	745	4	741	6	0.8%	0	720	15	0	8	737	9	1.2%	1	721	6	0	10	1.3%	1	0.1%	709	95.2%	18
25-34	933	13	920	24	2.6%	0	878	18	0	15	918	26	2.8%	1	858	32	1	33	3.5%	1	0.1%	838	89.8%	44
35-44	1 107	13	1 094	36	3.3%	1	1 040	16	1	23	1 084	41	3.7%	3	1 019	21	0	49	4.4%	4	0.4%	997	90.1%	40
45-54	1 168	11	1 157	31	2.7%	1	1 103	19	3	14	1 154	42	3.6%	1	1 090	21	0	49	4.2%	2	0.2%	1 068	91.4%	34
55-64	885	6	879	25	2.8%	2	832	20	0	11	874	24	2.7%	3	822	24	1	28	3.2%	3	0.3%	802	90.6%	42
65+	938	21	917	28	3.0%	2	859	28	0	21	917	29	3.1%	5	867	16	0	39	4.2%	5	0.5%	829	88.4%	44
Female	6 459	102	6 357	65	1.0%	2	6 192	93	5	137	6 322	95	1.5%	6	6 104	114	3	109	1.7%	8	0.1%	6 010	93.0%	211
15-24	861	17	844	2	0.2%	1	831	9	1	19	842	2	0.2%	0	831	9	0	3	0.3%	1	0.1%	819	95.1%	21
25-34	1 241	18	1 223	13	1.0%	0	1 192	17	1	27	1 214	15	1.2%	3	1 173	23	0	19	1.5%	3	0.2%	1 156	93.2%	40
35-44	1 187	15	1 172	18	1.5%	0	1 134	19	1	22	1 165	26	2.2%	0	1 116	22	1	27	2.3%	0	0.0%	1 098	92.5%	44
45-54	1 103	9	1 094	14	1.3%	0	1 064	15	1	14	1 089	15	1.4%	0	1 049	24	1	20	1.8%	0	0.0%	1 032	93.6%	38
55-64	948	15	933	8	0.8%	1	907	16	1	18	930	14	1.5%	1	902	13	0	16	1.7%	2	0.2%	888	93.7%	22
65+	1 119	28	1 091	10	0.9%	0	1 064	17	0	37	1 082	23	2.1%	2	1 033	23	1	24	2.1%	2	0.2%	1 017	90.9%	46

% Denominator is number of requested sputum examinations

* (CXR eligible for sp exam/TB symp-)+(CXR uninterpretable/TB symp-) on "tab fcxrsympcat culid1b_l ,m"

**(CXR eligible for sp exam/TB symp-)+(CXR uninterpretable/TB symp-) on "tab fcxrsympcat culid2b_l ,m"

* (CXR eligile for sp exam/TB symp+)+(CXR uninterpretable/TB symp+) on "tab fcxrsympcat culid1b_l ,m"

**(CXR eligile for sp exam/TB symp+)+(CXR uninterpretable/TB symp+) on "tab fcxrsympcat culid2b_l ,m"

Table 18. Relationship between smear and culture results

Spot		Culture					
		Negative	MTB	MOTT	Contaminated	N.A.	Total
Smear	Negative	11 613	123	6	207	22	**11 971**
	Scanty	6	19	0	0	0	**25**
	1+	2	45	1	0	0	**48**
	2+	1	17	1	2	0	**21**
	3+	2	11	0	0	0	**13**
	Total	**11 624**	**215**	**8**	**209**	**22**	**12 078**
Morning		**Culture**					
		Negative	MTB	MOTT	Contaminated	N.A.	Total
Smear	Negative	11 467	168	18	234	15	**11 902**
	Scanty	9	24	0	0	0	**33**
	1+	1	43	2	0	0	**46**
	2+	2	20	0	0	0	**22**
	3+	2	11	0	0	0	**13**
	Total	**11 481**	**266**	**20**	**234**	**15**	**12 016**
Culture+/smear positive = 194/221 (87.8%)							
Culture+/smear 1+ or higher = 153/163 (93.9%)							

Table 19. Relationship between spot and morning specimen results by culture examination

		Morning					
		Negative	Positive MTB	MOTT	Contaminated	N.A.	Total
Spot	Negative	11 253	97	16	184	74	**11 624**
	Positive MTB	50	164	0	1	0	**215**
	Positive MOTT	3	0	4	0	1	**8**
	Contaminated	154	5	0	48	2	**209**
	NA	21	0	0	1	9	**31**
	Total	**11 481**	**266**	**20**	**234**	**86**	**12 087**

Table 20. TB cases (survey cases) by interview and CXR results

	S+ C+ TB case	S+ C- TB case	S- C+ TB case	Smear-positive study case	%	Bacterio-logically positive study case	%
Total	**116**	**7**	**188**	**123**	**100%**	**311**	**100.0%**
Symptom							
Eligible	40	2	24	42	34.1%	66	21.2%
Ineligible	76	5	164	81	65.9%	245	78.8%
Field CXR							
Eligible	115	6	175	121	98.4%	296	95.2%
Ineligible	0	0	2	0	0.0%	2	0.6%
No CXR	1	1	11	2	1.6%	13	4.2%
Central Reading							
Normal	6	0	12	6	4.9%	18	5.8%
Active TB-suggestive	77	5	82	82	66.7%	164	52.7%
TB-suspect	12	0	41	12	9.8%	53	17.0%
Healed TB	19	0	29	19	15.4%	48	15.4%
Other lung disease	1	0	7	1	0.8%	8	2.6%
Cardiovascular abnormality	0	0	3	0	0.0%	3	1.0%
Other findings in lung	0	1	2	1	0.8%	3	1.0%
Findings other than lung	0	0	1	0	0.0%	1	0.3%
Not interpretable	0	0	0	0	0.0%	0	0.0%
Not available for reading	1	1	11	2	1.6%	13	4.2%
Sex and Age							
Male	83	5	118	88	71.5%	206	66.2%
15-24	3	0	5	3	2.4%	8	2.6%
25-34	14	1	17	15	12.2%	32	10.3%
35-44	23	1	26	24	19.5%	50	16.1%
45-54	16	2	30	18	14.6%	48	15.4%
55-64	14	1	14	15	12.2%	29	9.3%
65+	13	0	26	13	10.6%	39	12.5%
Female	33	2	70	35	28.5%	105	33.8%
15-24	1	1	1	2	1.6%	3	1.0%
25-34	5	1	14	6	4.9%	20	6.4%
35-44	12	0	14	12	9.8%	26	8.4%
45-54	7	0	11	7	5.7%	18	5.8%
55-64	4	0	11	4	3.3%	15	4.8%
65+	4	0	19	4	3.3%	23	7.4%

Geography							
State Rural Clusters	37	1	48	38	30.9%	86	27.7%
State Urban Clusters	13	2	18	15	12.2%	33	10.6%
Region Rural Clusters	43	4	75	47	38.2%	122	39.2%
Region Urban Clusters	23	0	47	23	18.7%	70	22.5%
Treatment							
On TB treatment	8	0	3	8	6.5%	11	3.5%
Previously treated (not on Tx)	22	1	19	23	18.7%	42	13.5%

3.6 Prevalence

3.6.1 Smear-positive TB

123 subjects met the survey definition of smear-positive TB cases, out of which 88 (71.5%) were male and 35 (28.5%) were female. Eight culture-positive and two culture-negative cases were already on treatment, while 113 cases (91.9%: 91 new and 22 previously treated) were unknown (undetected). Only 42 smear-positive TB cases (34.1%) reported symptoms suggesting TB. Though the number of cases was highest in the age group 35-44 years (Figure 5a), prevalence increased by age group. The prevalence of smear-positive TB was estimated at 242.3/100 000 population aged 15 or older (95% C.I., 186.1-315.3). The design effect was 2.18, much greater than anticipated by a pilot survey in Yangon, 1.3 (as per the survey protocol). The male/female ratio in the prevalence of smear-positive TB was 3.1, 392/100 000 in males and 128/100 000 in females.

3.6.2 Smear-negative/culture-positive TB

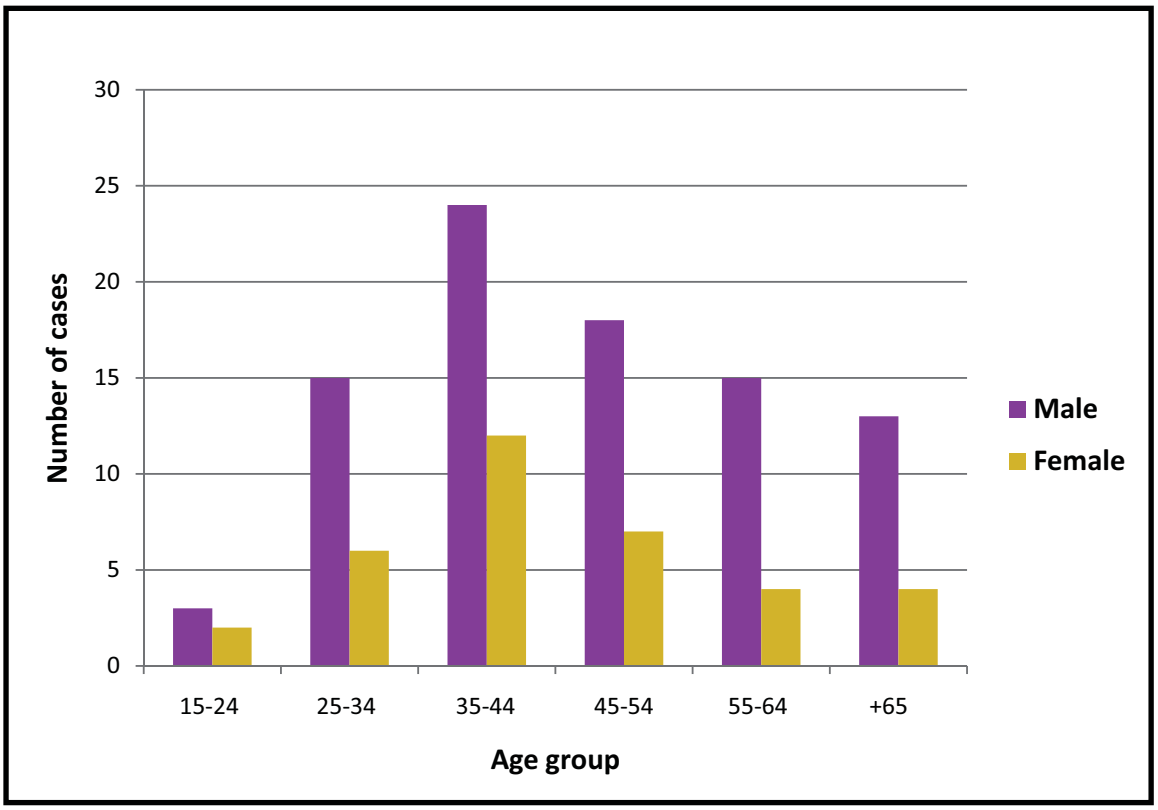
The survey detected 188 smear-negative, culture-positive TB cases, 370 (293-468)/100 000 among the population aged 15 or above. Of these cases, 167 (88.8%) were undetected new cases. The male/female ratio in the prevalence rate of smear-negative, culture-positive TB was 1.7, much smaller than that among smear-positive cases.

3.6.3 Bacteriologically positive TB (smear- positive and/or culture-positive)

A total of 311 bacteriologically positive TB patients were detected by the survey, corresponding to a prevalence of 612.8 (502.2-747.6)/100 000 population with a design effect of 3.15.

Figure 5. **Number of cases detected by sex and age group**

a) Smear-positive cases



b) Bacteriologically positive cases

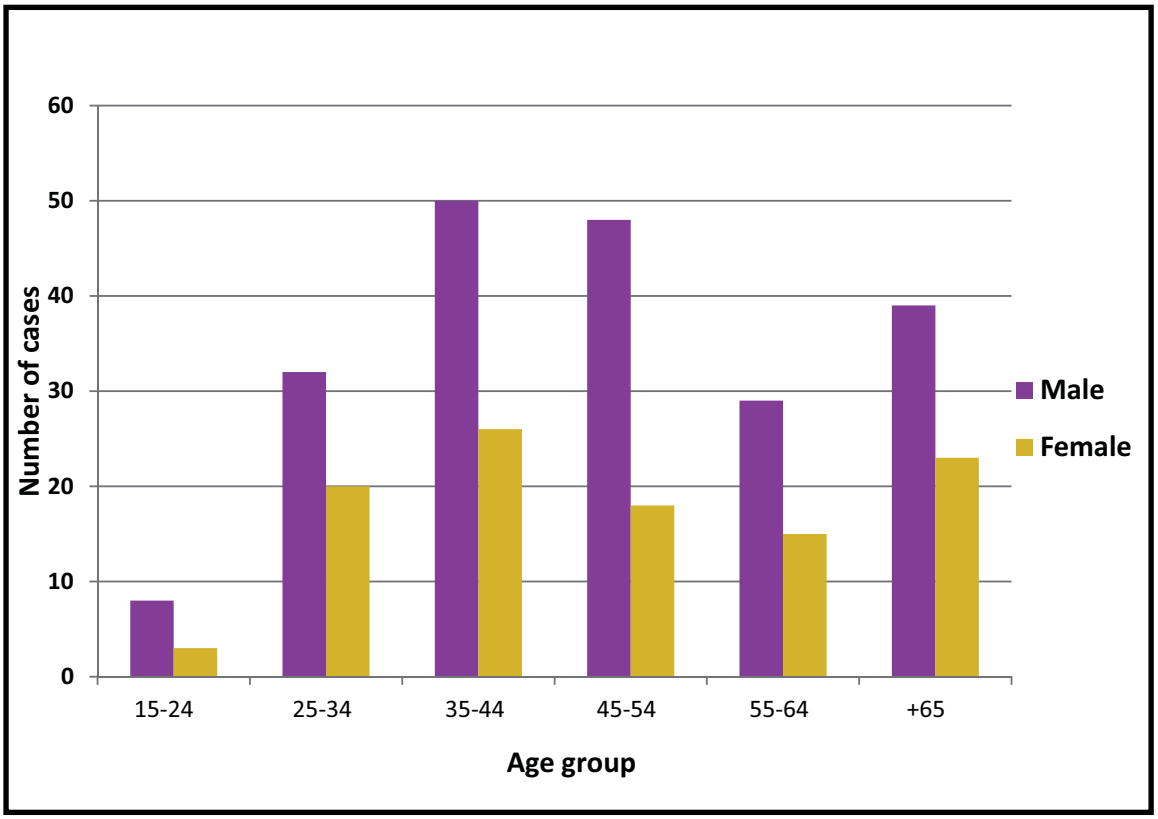


Table 21. TB prevalence among survey participants aged 15 years or above

			Smear-positive cases				Smear-negative, culture-positive cases				Bacteriologically positive cases		
	n	%	n	/100 000	95% CI		n	/100 000	95% CI		n	/100 000	95% CI	
Total	**51 367**	**100%**	**123**	**242.3**	**186.1**	**315.3**	**188**	**370.5**	**293.3**	**468.0**	**311**	**612.8**	**502.2**	**747.6**
Strata														
Region	37 163	72%	70	191.6	137.4	267.3	122	331.1	256.1	428.1	192	522.8	420.9	649.1
State	14 204	28%	53	369.0	235.6	577.5	66	469.0	288.4	761.8	119	838.0	560.3	1 251.5
Urban/Rural														
Urban	11 254	22%	38	330.7	216.2	505.7	65	572.4	415.0	789.2	103	903.2	661.8	1 231.5
Rural	40 113	78%	85	216.1	153.6	304.0	123	310.7	228.7	422.0	208	526.8	410.1	676.5
Strata Urban/Rural														
Rural Region	29 423	57%	47	163.9	105.2	255.1	75	255.0	186.3	349.0	122	418.8	326.5	537.2
Rural State	10 690	21%	38	351.9	198.4	623.5	48	455.6	239.6	864.6	86	807.5	480.7	1 353.4
Urban Region	7 740	15%	23	290.0	179.5	468.3	47	601.1	418.6	862.5	70	891.2	639.5	1 240.6
Urban State	3 514	7%	15	420.2	147.2	1 193.5	18	509.4	199.8	1 292.3	33	929.6	378.1	2 267.3
Region														
L. Myanmar	26 908	52%	74	273.0	193.2	385.5	87	326.2	237.9	447.2	161	599.2	480.6	746.9
U. Myanmar	24 459	48%	49	207.9	135.2	319.5	101	420.2	296.6	595.0	150	628.1	443.0	889.8
Sex and Age														
Male	22 394	44%	88	397.8	301.3	524.9	118	532.8	407.2	696.9	206	930.6	742.6	1 165.5
15-24	5 404	11%	3	57.7	19.4	171.6	5	94.5	33.1	269.3	8	152.2	65.3	354.5
25-34	4 808	9%	15	317.3	200.9	500.9	17	361.6	205.7	634.7	32	678.9	464.8	990.5
35-44	4 526	9%	24	537.4	345.5	834.9	26	583.0	385.7	880.4	50	1 120.4	832.0	1 507.2
45-54	3 606	7%	18	504.3	290.4	874.4	30	845.8	534.1	1 337.0	48	1 350.1	917.0	1 983.8
55-64	2 231	4%	15	683.8	421.6	1 107.3	14	634.2	369.7	1 086.1	29	1 318.1	905.8	1 914.2
65+	1 819	4%	13	716.8	403.9	1 268.8	26	1425.8	917.2	2 210.2	39	2 142.6	1 539.5	2 974.8
Female	28 973	56%	35	122.2	76.9	194.2	70	245.2	181.7	330.8	105	367.4	287.7	469.1
15-24	6 495	13%	2	31.0	7.6	126.0	1	15.7	2.1	115.6	3	46.7	15.0	145.1
25-34	6 416	12%	6	94.0	42.2	209.1	14	218.2	119.8	397.2	20	312.2	196.7	495.1
35-44	5 936	12%	12	206.9	108.2	395.2	14	242.6	143.3	410.3	26	449.5	301.0	670.8
45-54	4 674	9%	7	149.9	75.1	299.1	11	244.7	145.3	411.9	18	394.6	260.8	596.7
55-64	2 936	6%	4	136.3	52.5	353.6	11	372.4	200.1	692.0	15	508.7	299.6	862.3
65+	2 516	5%	4	162.2	60.4	434.8	19	767.3	479.4	1 226.2	23	929.6	606.2	1423.0

Model-1 design-based analysis restricted to survey participants using svy command in stata svy: logit

4. DISCUSSION

The survey confirmed a TB prevalence in Myanmar nearly 2.5 times higher than what had been estimated when the survey was designed.

A further analysis of the survey data suggested the following key features:

- a successful reduction in the prevalence of smear-positive cases with chronic cough in the community;
- a greater than expected variation in the TB epidemiological situation;
- the frequent utilization of pharmacies and traditional healers as the first contact with health care;
- the limitations of the current TB screening and diagnostic strategies.

4.1 Eligibility criteria

The eligibility criteria of survey subjects were decided in order to include the mobile population as much as possible, especially those who migrated to urban areas to work, even if only seasonally. Those who stayed in a survey area for 14 days or more were included in the survey regardless of their residential status. However, it was difficult to catch the populations temporarily away from home for work or study. For example, those who were registered as residents but basically stayed in another place during the week to work or study were categorized as non-eligible, while residents who went out for field work such as fisheries and forest work were categorized as eligible regardless of their actual availability on the survey day. The exclusion from the survey census of military camps, large monasteries, school campuses/dormitories and corrective facilities may have contributed to the low involvement of males in the survey. International emigration may also have contributed to the observed gender imbalance in the community.

According to the survey design a cluster size of 700-750 eligible adult subjects was expected. However, 823 subjects per cluster were recruited on average as eligible subjects. The principal possible reasons for oversampling were:

- Field teams were competent enough to examine more than 200 participants a day.
- Field teams recruited more eligible subjects to be sure of securing enough participants in clusters where they anticipated a lower participation rate, such as in urban or remote areas where there were many absentees.
- It was difficult for the survey team to stop the recruitment in the middle of a household group/block, so once the team began the census, it tended to recruit all households in the same block.
- There were uncertainties about the proportion of children, which resulted in a higher overall recruitment of individuals.

4.2 Survey participation

The pre-visits to the clusters as well as the involvement of the community, including religious leaders, contributed to the high participation rate in the survey. On one of the four survey days, evening shifts (until 22:00) were held to allow for the participation of workers occupied during the daytime. Transportation by a survey team car also facilitated the participation of disabled and elderly people. Despite the mop-up operation, including home visits, a slightly lower participation rate was observed among those aged 65 or above.

The recruitment of participants in urban areas was challenging. There was limited access to apartment compounds with guards, neighbours did not know each other and there were no influential community leaders to facilitate the participation. Although a participation rate of 86% was recorded in urban clusters, recruitment of participants in communities with a more urbanized lifestyle will be a significant challenge for future surveys.

4.3 Participants

4.3.1 Religion and literacy

The survey interview indicated that 91.7% of participants were Buddhist, a figure close to government statistics stating that 89.2% of Myanmar's population are Buddhists (Ministry of Foreign Affairs at www.mofa.gov.mm/aboutmyanmar/religion.html). Similarly, the illiteracy rate of 10.9% among all participants was consistent with previous reports on the literacy rate (91.8% according to UNESCO, 2008).

4.3.2 Health risk factors

The survey found a BMI of less than 18.5 among 23.8% of male and 22.5% of female participants. These findings are consistent with a previous survey which showed that in 16.8% of urban males, 10.8% of urban females, 26.0% of rural males and 22.0% of rural females aged 25 to 74 were underweight (BMI < 18.5). (WHO stepwise approach to NCD surveillance: Myanmar disaggregation of urban and rural data 2003).

4.3.3 TB history

The NTP's notification rate of all TB cases was 257/100 000 in 2009 (WHO Global Report 2010). According to national TB notification data from 2009, 8259 (17.3%) out of 47 877 smear-positive patients were notified by "other than NTP facilities" such as GPs (NTP report 2009). Given that the average duration of treatment is six months, 308/100 000 adults in this survey population received TB treatment in a year. The observations of the survey were consistent with notification data in the NTP report.

The difference in the proportion of TB patients currently receiving treatment at a health centre/post (34.2%) and those previously treated who went to a health centre/post (17.1%) may suggest a successful expansion of DOTS to peripheral facilities in recent years.

4.4 Smear examination results

While there were 215 *M. tuberculosis* isolates in spot specimens, there were 266 *M. tuberculosis* isolates in morning specimens (Table 18). The yield from the second specimen cannot be neglected and it seems that the morning specimens have superiority over the spot specimens in isolating *M. tuberculosis* by culture with solid media.

4.5 Prevalence of TB

Point estimates of the prevalence of bacteriologically positive TB of different groups/strata are shown in Table 21. Though various analytical methods were conducted (see Tables 30 and 31 in Annex 10), the results of design-based analysis restricted to survey participants without imputation was adopted as the official survey result, as shown in Table 21. When the difference in participation between sex and age groups was adjusted, the estimated prevalence increased by 1%-2% depending on the population data source. When considering missing values (those who did not participate in each step might have a certain chance of showing positive in screening and/or laboratory examinations), some scenarios show an increase of nearly 10% in prevalence (see Tables 30 and 31). However, since the survey was carried out in a high-quality manner and with high participation rates at each step of the process, and since the individuals who did not participate in each step of the survey were probably less likely to have TB than

those who participated, it was decided to show the results by the design-based analysis without imputation as the official results of the survey. A conservative estimation was also chosen because the estimated prevalence available by this survey was significantly higher than that previously estimated without imputation.

4.5.1 Prevalence in population (all ages)

With the conservative assumption that there was no bacteriologically positive TB among children, who occupied 29.2% of the population according to the survey census, the observed prevalence of smear-positive TB becomes 171 (131-223)/100 000 population and that of bacteriologically positive TB becomes 434 (355-529)/100 000 population. To follow practices in past surveys for international comparison, these figures represent the official results of the survey. However, in 2009, the survey year, 41 389 new smear-positive cases, including 282 children under 15 years of age (0.7%), were notified by NTP and partners (NTP Myanmar Annual Report 2009. Table 26, p.62). With the assumption that 0.7% of prevalent cases are children, the prevalence of smear-positive TB therefore becomes 172 (132-225)/100 000 and that of bacteriologically positive TB becomes 437 (358-533)/100 000 population.

In 2008, when the survey was designed, the WHO Global TB Report estimated that the TB prevalence of all TB cases in Myanmar was 169/100 000 population (WHO Global TB Report 2008). However, even with the assumption that there were no bacteriologically positive cases in children under 15 years old, the survey's observed prevalence of bacteriologically positive TB, 434 (355-529)/100 000 population was 2.5 times higher than the WHO estimate of all TB cases at that time. When TB in children, extra-pulmonary TB, and bacteriologically negative TB are taken into consideration, the TB prevalence in Myanmar could be 600/100 000 population or more. Based on the preliminary finding of the survey, the 2009 point estimate of all TB cases in Myanmar was revised to 598/100 000. (WHO Global Report 2010). This means that Myanmar, with a total population of more than 50 million, has 300 000 or more TB cases.

A detailed explanation of the analytical methods including imputations is provided in Annex 11.

4.5.2 Cluster variation and geographical differences

Although the National TB Prevalence survey aimed to estimate the TB prevalence at country level, the high participation rate and high TB prevalence made comparison between strata feasible. However, the observed variation between clusters (design effect of smear-positive TB: 2.18) was much greater than assumed by the survey design according to the pilot survey in Yangon (design effect of smear-positive TB: 1.3).

While 5 clusters did not have any bacteriologically positive cases, 13 clusters had eight or more cases, equivalent to a prevalence of bacteriologically positive cases of more than 1000/100 000 population (Figure 6). States showed a higher prevalence than regions, which may be related to access to TB services. The TB burden in urban areas is high, and prevalence was higher in urban areas than in rural areas, although more patients are treated in urban areas.

4.6 Comparison of screening tools

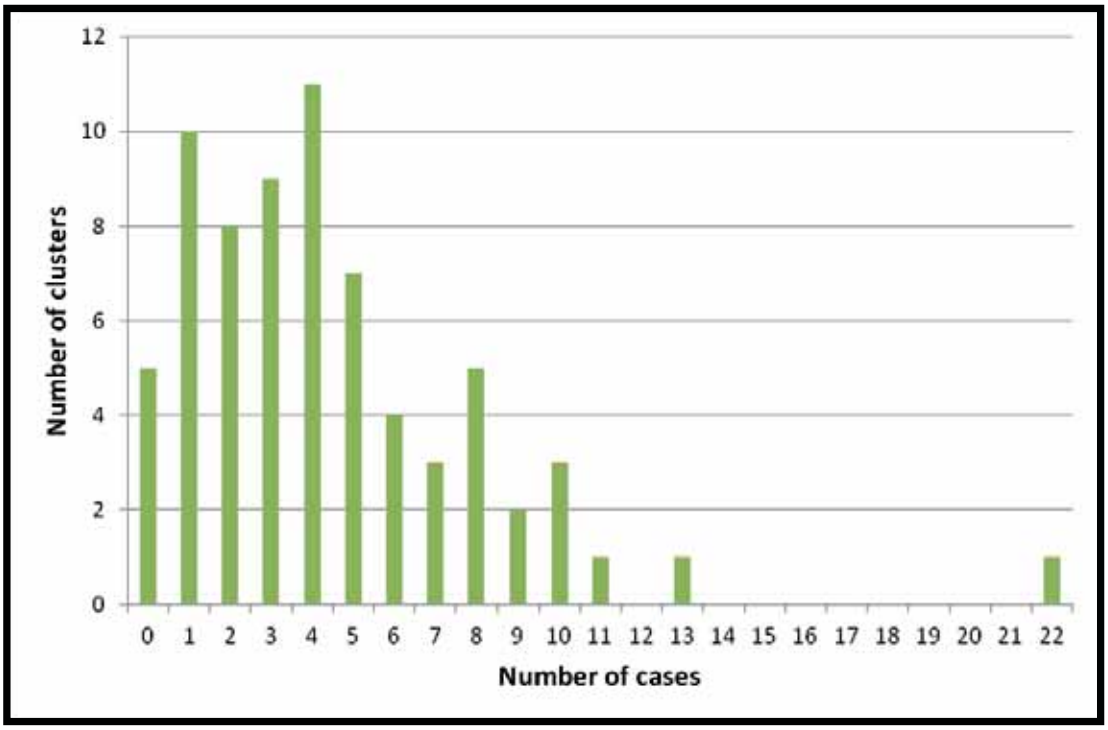
Among 116 smear-positive, culture-positive TB cases, only 48 (41.4%) reported a chronic cough for two weeks or more (Table 22). The corresponding figure for bacteriologically positive cases was even lower, 25.6% (78/311). Thus, the current NTP definition of a TB suspect by a cough for three weeks can detect only one-third of smear-positive and one-fifth of culture-positive TB cases. Most prevalent TB cases in the community do not present with the classical TB screening criteria by symptoms or do not report any symptoms (20% of smear-positive and 38% of culture-positive cases).

CXR was a more sensitive screening tool to detect both smear- and culture-positive TB cases. Among culture-positive TB cases who received both interview and CXR screening, the field screening reading of abnormality (21.1% or 10 622 out of 50 195) detected 99% (115/116) of smear-positive, culture-positive TB, and 93% (175/188) of smear-negative, culture-positive TB. There was almost no yield by the classic TB screening criteria of chronic cough. However, when limiting the CXR screening criteria "TB consistent (TB-suggestive or -suspect)" (4.9% or 2449) by expert (central) reading without knowing the laboratory results, the sensitivity of CXR screening dropped to

77% (89/115) of smear-positive and 74% (130/175) of smear-negative, culture-positive cases, respectively. When expanding the screening criteria to any abnormal findings in the lung and/or hilar mediastinum (16.0%: 8016/50 241) the sensitivity increased to 95% (107/115) and 91% (160/175) respectively. A significant proportion (16.6%) of bacteriologically positive cases was classified as "healed TB" by the central reading. When the CXR panel knew the bacteriological information it identified TB consistent findings in 96% of bacteriologically positive cases. The panel identified that a poor-quality image caused under-diagnosis by the central team.

If "any symptom" was applied as a screening criteria, around 80% of smear-positive cases could be detected, almost the same as "TB suggestive or suspect by CXR". However, while 5% of the participants showed CXR abnormality that suggested suspect TB, 37% of the participants reported at least one of the symptoms listed. There was a significant difference in the workload required of the laboratory to detect the same number of cases by different screening strategies.

Figure 6. Cluster variation: Number of bacteriologically positive TB cases



4.7 Prevalence of smear-positive TB with chronic cough

The prevalence of "smear-positive cases with TB suspected symptom" (cough for more than two weeks) was 98/100 000 population aged 15 or above (69-141), almost the same as the 2009 notification rate of new smear positive TB cases (102/100 000 aged 15 or above) (Table 23). Most smear-positive cases (73/123) did not report chronic cough. Of the 70 clusters, 45 did not have any smear-positive cases that reported TB-suspected symptoms according to the NTP definition. A comparison of the prevalence of smear-positive TB and that with chronic cough is shown in Figure 7. Although the NTP definition of suspect TB is "cough for three weeks or more", Figure 7 uses a cut-off criterion of cough for two weeks or more to permit comparison with 1994 survey results that used only interview as a screening tool without CXR (see Box following Section 4.11). The 2009-2010 survey results show that the NTP has successfully removed smear-positive TB cases with chronic cough from the community. However the prevalence of smear-positive TB with chronic cough was still very high in states, at 194/100 000 population aged 15 or above (112-339), compared with regions, at 61/100 000 population aged 15 or above (38-96). This shows that case detection with basic DOTS has not penetrated into the community in the states.

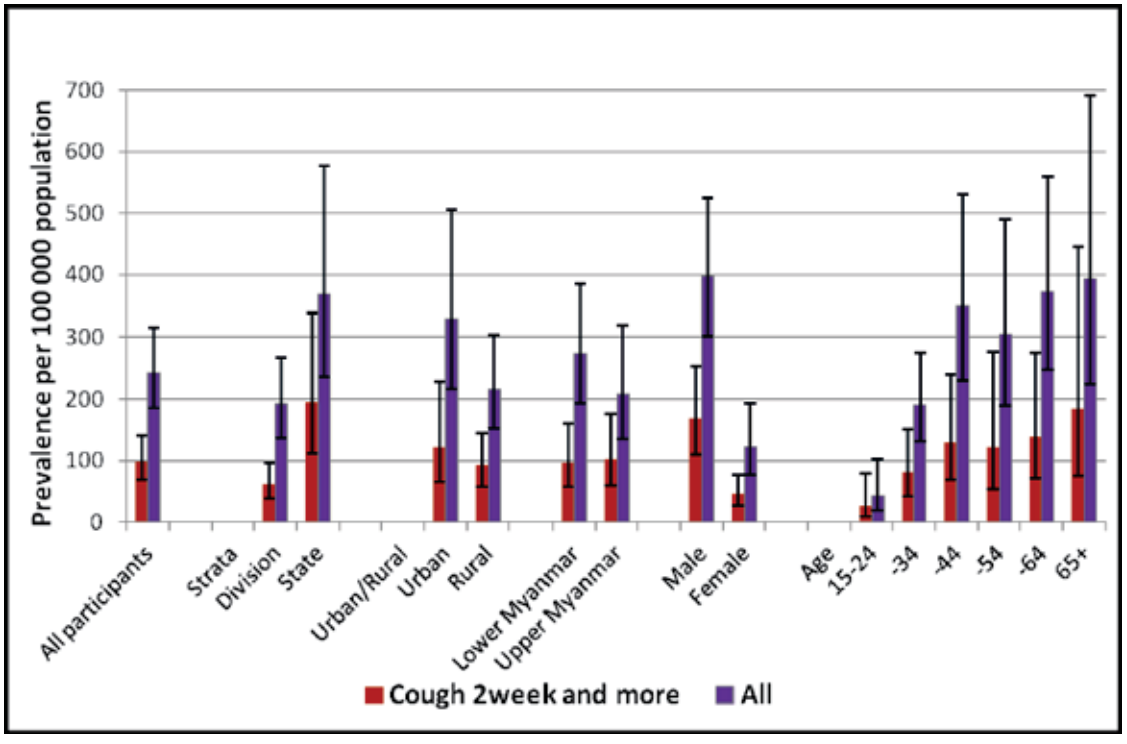
Table 22. Screening results of definite TB cases

Symptom	Number (a)	%	S+ C+ definite (b)	%	S- C+ definite (c)	%	BACT(+) (d) (b)+(c) =(d)	%
Illness	9 015	17.6%	52	44.8%	40	21.3%	92	30.3%
Cough	12 268	23.9%	84	72.4%	71	37.8%	155	51.0%
1-13 days	10 106	19.7%	36	31.0%	41	21.8%	77	25.3%
14-20 days	622	1.2%	8	6.9%	10	5.3%	18	5.9%
21+ days	1 433	2.8%	40	34.5%	20	10.6%	60	19.7%
Sputum	9 953	19.4%	78	67.2%	50	26.6%	128	42.1%
Haemoptysis	285	0.6%	4	3.4%	4	2.1%	8	2.6%
Weight loss	1 512	2.9%	23	19.8%	16	8.5%	39	12.8%
Fever	3 122	6.1%	25	21.6%	21	11.2%	46	15.1%
Chest pain	6 827	13.3%	37	31.9%	29	15.4%	66	21.7%
Other	2 490	4.8%	7	6.0%	11	5.9%	18	5.9%
TB-suspect by interview	1 691	3.3%	40	34.5%	24	12.8%	64	21.1%
Any of symptoms 2-8 [see Table 9]	19 110	37.2%	92	79.3%	96	51.1%	188	61.8%
No symptom	32 257	62.8%	24	20.7%	92	48.9%	116	38.2%
Total	**51 367**	**100.0%**	**116**	**100.0%**	**188**	**100.0%**	**304**	**100.0%**
Field reading								
Eligible for exam (abnormal)	10 637	21.2%	115	100.0%	175	98.9%	290	99.3%
Total	**50 241**	**100.0%**	**115**	**100.0%**	**177**	**100.0%**	**292**	**100.0%**
Central reading								
1. Normal	42 030	83.7%	6	5.2%	12	6.9%	18	6.2%
2. Active TB/opacity	781	1.6%	77	67.0%	89	50.9%	166	57.2%
3. TB-suspect	1 668	3.3%	12	10.4%	41	23.4%	53	18.3%
4. Healed TB	1 772	3.5%	19	16.5%	29	16.6%	48	16.6%
5. Other lung disease	1 713	3.4%	1	0.9%	7	4.0%	8	2.8%
6. Cardiomegaly	1 374	2.7%	0	0.0%	3	1.7%	3	1.0%
7. Other findings in lungs	260	0.5%	0	0.0%	2	1.1%	2	0.7%
8. Other	448	0.9%	0	0.0%	1	0.6%	1	0.3%
9. Not interpretable	195	0.4%	0	0.0%	0	0.0%	0	0.0%
Total	**50 241**	**100.0%**	**115**	**100.0%**	**175**	**100.0%**	**290**	**100.0%**

Table 23. Prevalence of smear-positive symptomatic cases

			Cough 2 weeks or more Prevalence of smear-positive cases			
	n	%	n	/100 000	95% CI	
Total	**51 367**	**100%**	**50**	**98.9**	**69.1**	**141.6**
Strata						
Region	37 163	72%	22	60.8	38.5	95.9
State	14 204	28%	28	194.3	111.2	339.4
Urban/Rural						
Urban	11 254	22%	14	122.6	66.0	227.6
Rural	40 113	78%	36	91.9	58.2	145.2
Region						
Lower Myanmar	26 908	52%	26	95.7	57.0	160.5
Upper Myanmar	24 459	48%	24	102.6	59.7	176.1
Sex						
Male	22 394	44%	37	167.6	110.8	253.4
Female	28 973	56%	13	45.9	27.1	77.6
Age						
15-24	11 899	23%	3	26.2	8.8	78.6
25-34	11 224	22%	9	80.6	42.9	151.4
35-44	10 462	20%	13	128.5	68.9	239.4
45-54	8 280	16%	10	122.1	54.0	276.0
55-64	5 167	10%	7	139.1	70.4	274.3
65+	4 335	8%	8	183.4	75.3	445.9

Figure 7. Comparison of prevalence of smear-positive TB and TB with chronic cough



4.8 Health-seeking behaviour towards chronic cough

All survey participants were asked about their responses and experiences towards chronic cough. There was no significant difference in behaviour between TB cases and others. The majority (59% of smear-positive cases and 64% of TB-suspected symptomatic) had not visited any medical service facility when they experienced chronic cough. They ignored the symptoms, self-medicated or visited traditional healers or pharmacies. Only 27% of smear-positive participants and 22% of TB-symptomatic participants visited medical facilities beyond pharmacies. The results show that the utilization of the public sector is different between urban and rural areas. While 62-77% of TB-symptomatic participants chose the public sector in rural areas, only 15-36% of those in urban areas visited the public sector.

Figure 8 shows the behaviour pattern of prevalent TB cases detected by the survey. There are limitations to interpreting the results. First, it should be noted that it may not represent the behaviour of TB patients in general since most of the cases detected in the survey were undetected cases by the programme. A comparison study with TB cases detected by routine programme activities was planned independently. Secondly, due to the chronic and self-curing nature of TB disease, being asymptomatic at the time of the survey does not mean that the patient did not have symptoms in the past. There may be a recall bias, and one cannot distinguish rapidly progressive cases and chronic cases by one-time observation.

4.9 Risk analysis

TB prevalence surveys are not an ideal tool to assess risk factors for developing TB. Most TB cases already detected by the health system cannot be involved in the survey. Rapidly progressing TB patients who are more likely to die are also less likely to be involved. However, a TB prevalence survey is a good opportunity to understand the predictive (risk) factors of TB patients in the community. In this survey risks and factors associated with having bacteriologically positive TB were examined from two aspects. In one analysis (Table 24) factors that are considered results of disease, such as BMI, symptoms, CXR abnormality and current TB treatment, were excluded, while the other (Table 25) includes these factors in order to understand the predictive factors to detect bacteriologically positive TB in the community.

4.9.1 Factors regarded as a risk for TB

Crude analysis was made for administrative area (state or region), type of areas (urban/rural), religion (Buddhist or not), sex and age groups, education status (illiterate or not), occupation (agriculture or not), smoking status, alcohol consumption, previous TB history and history of contact with TB, as listed in Table 24. They were associated with bacteriologically positive TB, as shown in Table 24. To incorporate the structure of data due to cluster sampling, a random-effects logit regression model was used to see the association of these factors by adjusting each other. In the random-effects model, a response of "not sure" in previous TB and contact history was regarded as "no". The results are shown in Table 24 as adjusted odds ratio (OR). The ex-smokers were associated, while current smoking was not. This might at least partially reflect those who stopped smoking due to respiratory symptoms due to TB and the situation in which the majority of current smokers consumes a small number of cigarettes per day.

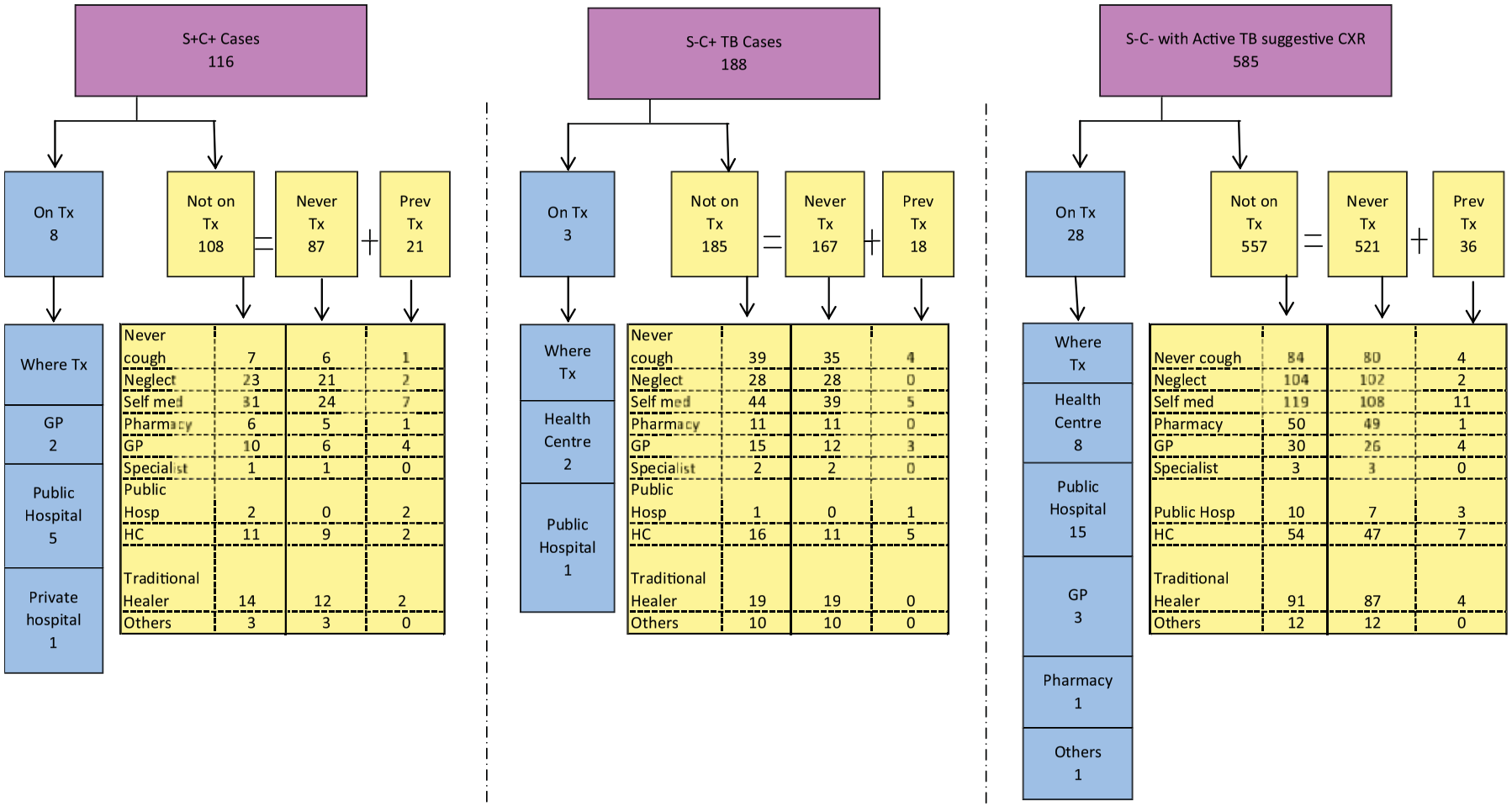
4.9.2 Factors regarded as surrogate/ consequence of TB

To see what factors are regarded as predictive factors for prevalent TB, the association of central CXR results, symptoms, current history of TB and BMI with bacteriologically positive TB was investigated. In a crude analysis, they are associated with TB. Adjusted ORs for these factors were then estimated by random-effects modelling including them and the other factors mentioned in the 1) above. The results are shown in Table 25. Association of current TB history was statistically marginal (p-value is not less than 0.05) while the association of symptom, CXR findings and BMI are still statistically significant in the random-effects model.

4.9.3 Discussion

From crude odds, current smoking and drinking seemed to be risks associated with bacteriologically positive TB. However, the significance disappeared when it was adjusted with other factors such as age and sex (Table 24).

Figure 8. Behaviour patterns of TB cases towards symptoms



Smoking did not predict a significant increase of TB in this survey (p=0.15). As shown in previous sections, very few cases had heavy smoking exposure as most of them were light smokers. Among the socioeconomic factors, non-farmers, illiterate and urban residents had an increased risk of having TB (OR>1, p<0.05). This supports the high notification rate in urban congestive setting such as Yangon city centre. The survey confirmed a higher risk of TB among TB contacts (OR 2.04) and among people with a previous history of TB (OR 3.28).

Having CXR abnormality was a very strong predictive factor for bacteriologically positive TB (Table 25). Bacteriological examinations for those with a CXR abnormal shadow are justified. Lower BMI was associated with having TB. However, the survey could not show if low BMI is a cause or result of the disease.

Among those who declined or were exempted from CXR (1126 participants), 2 smear-positive and 11 culture-positive cases were identified. Since pregnancy was a major reason for CXR exemption, a risk analysis was done only with females aged 15-44 (Table 26). It seems that CXR exemption in this age group (known pregnancy) was associated with TB. However since the results of HIV testing were not available among survey participants, it was not possible to estimate the impact of HIV on TB among the pregnant. Further study is necessary to clarify whether pregnant women in Myanmar are at greater risk of TB.

4.10 High prevalence of smear-negative, culture-positive TB and limitation of CXR diagnosis

The prevalence of smear-negative but culture-positive TB, 370 (293-468)/100 000 population, was higher than smear-positive TB, 242 (186-315)/100 000 population. The survey showed that smear microscopy could only detect one-third of prevalent bacteriologically positive TB cases in the community. Although this may justify a high proportion of smear-negative TB cases among pulmonary TB cases by routine case detection, the survey data revealed the limitation of CXR as a diagnostic tool. Only 76% of bacteriologically definite cases were diagnosed as TB-suggestive or suspect by a group of TB specialists and/or radiologists, while only 21.2% (166/781) of those radiologically diagnosed as having active TB disease were bacteriologically positive (Table 22). TB diagnosis dependent on a

Figure 9. Gap between smear-positive and bacteriologically positive TB cases

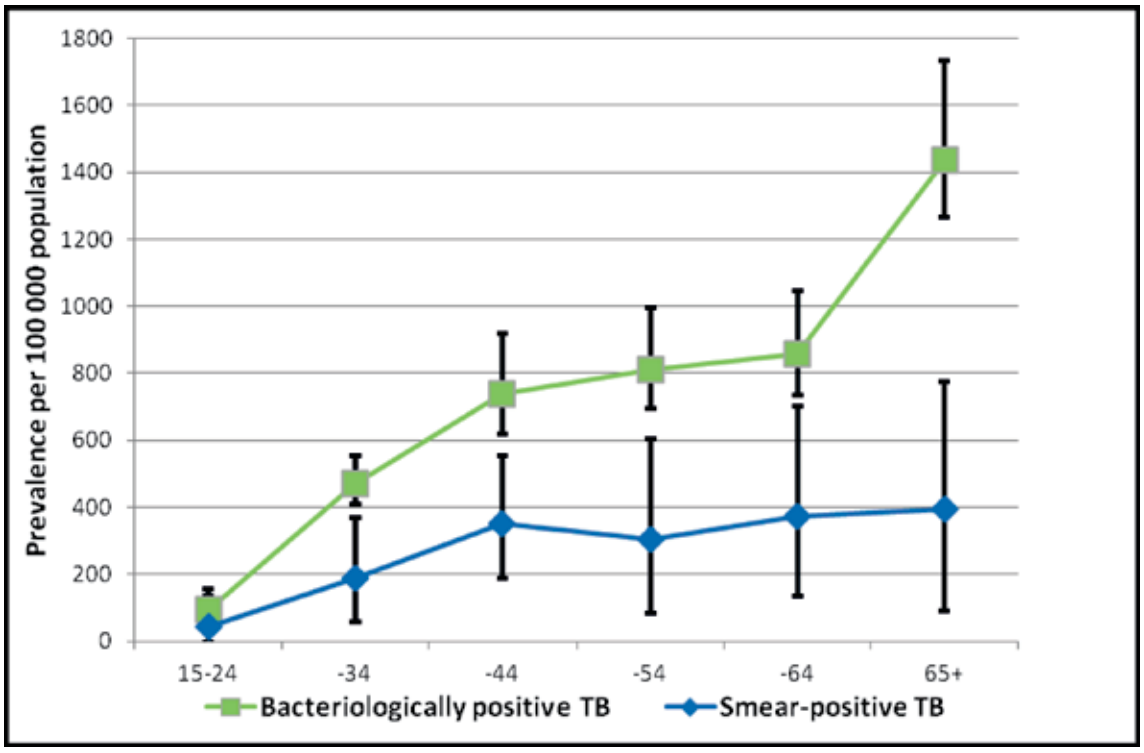


Table 24. **Risk Analysis: Prevalence, crude odds ratio and adjusted odds ratio (random effect model)**

	Bacteriologically positive TB		/100 000	Crude OR				Adjusted OR (random effect model)*			
	Cases	Partici-pants		OR	95% CI		P>z	OR	95% CI		P>z
State/Region											
Region	192	37 163	516.6	Reference				Reference			
State	119	14 204	837.8	1.63	1.29	2.05	0.00	1.43	0.98	2.09	0.065
Urban/Rural											
Rural	208	40 113	518.5	Reference				Reference			
Urban	103	11 254	915.2	1.77	1.40	2.25	0.00	1.50	1.02	2.22	0.041
Sex											
Male	206	22 394	919.9	Reference				Reference			
Female	105	28 973	362.4	0.39	0.31	0.50	0.00	0.41	0.30	0.56	0.000
Age group											
15-24	11	11 899	92.4	0.20	0.10	0.38	0.00	0.36	0.18	0.72	0.004
25-34	52	11 224	463.3	Reference							
35-44	76	10 462	726.4	1.57	1.10	2.24	0.01	1.47	0.97	2.22	0.067
45-54	66	8 280	797.1	1.73	1.20	2.49	0.00	1.08	0.70	1.65	0.736
55-64	44	5 167	851.6	1.85	1.23	2.76	0.00	0.84	0.53	1.34	0.463
65+	62	4 335	1 430.2	3.12	2.15	4.51	0.00	0.83	0.52	1.32	0.434
Religion											
Non-Buddhist	48	4 265	1 125.4	Reference				Reference			
Buddhist	263	47 102	558.4	0.49	0.36	0.67	0.00	0.71	0.46	1.10	0.127
Education											
Literate	256	45 743	559.6	Reference				Reference			
Illiterate	55	5 624	978.0	1.75	1.31	2.35	0.00	1.36	0.95	1.95	0.091

	Bacteriologically positive TB		/100 000	Crude OR				Adjusted OR (random effect model)*			
	Cases	Partici-pants		OR	95% CI		P>z	OR	95% CI		P>z
Occupation											
Non-farmer	198	28 470	695.5	Reference				Reference			
Farmer	113	22 897	493.5	0.71	0.56	0.89	0.00	0.70	0.53	0.93	0.012
Previous Tx											
Not answered Yes	269	49 904	539.0	Reference				Reference			
Answered Yes	42	1 463	2 870.8	5.45	3.92	7.58	0.00	3.28	2.31	4.64	0.000
Contact											
Not answered Yes	267	47 934	557.0	Reference				Reference			
Answered Yes	44	3 433	1 281.7	2.32	3.92	7.58	0.00	2.04	1.46	2.85	0.000
Smoking											
Never smoked	135	33 547	402.4	Reference				Reference			
Ex-smoker	49	3 065	1 598.7	4.02	2.89	5.59		1.55	1.06	2.25	0.023
Current smoker	127	14 755	860.7	2.15	1.69	2.74	0.00	1.16	0.88	1.55	0.295
Alcohol											
Never	191	40 268	474.3	Reference				Reference			
Ex-drinker	49	3 006	1 630.1	3.48	2.53	4.77		1.27	0.87	1.84	0.211
Current drinker	71	8 093	877.3	1.86	1.41	2.44	0.00	0.96	0.69	1.34	0.798

*Adjusted OR: All variables with $p < 0.05$ in crude analysis except variables regarded as consequence or surrogate of TB which are listed in Table 25.

Table 25. Analysis of predictive factors of being a bacteriologically positive prevalent case: Prevalence, crude odds ratio and adjusted odds ratio (random effect model)

Variables regarded as consequence or surrogate of TB	Cases	Partici-pants	/100 000	Crude OR	95% CI		P>z	Adjusted OR*	95% CI		P>z
Current Tx											
Not answered Yes	298	51 288	581.0	Reference				Reference			
Answered Yes	13	79	16 455.7	33.70	18.39	61.75	0.00	2.02	0.99	4.12	0.053
Symptom											
No symptom	118	32 257	365.8	Reference				Reference			
Any other than TB symptom	127	17 419	729.1	2.00	1.56	2.57	0.00	1.46	1.10	1.93	0.009
TB symptom	66	1 691	3 903.0	11.06	8.15	15.01	0.00	2.92	2.02	4.22	0.000
Central CXR											
No abnormal lung shadow**	22	43 852	50.2	Reference				Reference			
Abnormal lung shadow other than TB active/suspect	59	3 745	1 575.4	31.89	19.52	52.09	0.00	19.89	11.80	33.54	0.000
TB-active/suspect shadow	217	2 449	8 860.8	193.69	124.67	300.93	0.00	122.72	77.55	194.19	0.000
Uninterpretable	0	195	0.0	(Omitted due to no positive case)							
Exempted	13	1 126	1 154.5	23.27	11.69	46.31	0.00				
BMI											
<15	16	894	1 789.7	Reference							
15.0-18.4	131	10 942	1 197.2	0.66	0.39	1.12	0.13				
18.5-24.9	149	32 970	451.9	0.25	0.15	0.42	0.00				
25.0-29.9	12	5 269	227.7	0.13	0.06	0.27	0.00				
30.0+	3	1 257	238.7	0.13	0.04	0.44	0.00				
Not available	0	12	0.0	(Omitted)							
BMI											
Continuous variable (excluding unknown)				0.82	0.79	0.86	0.00	0.91	0.87	0.95	0.000

*Adjusted OR: Analysis was done with all variables with $p < 0.05$ in crude analysis (the variables are listed in Table 24). 50 024 participants.
**No abnormal lung shadow: This includes Normal, Cardiovascular abnormality and Other abnormality such as goiter and injury that were considered "ineligible for sputum examinations".

Table 26. Association of not taking CXR with bacteriologically positive TB among females aged 15-44 yrs

Variable	OR	95% CI		P>z
CXR				
Examined	Reference			
Exempted	6.29	3.18	12.43	0.000
Age Group				
15-24	Reference			
25-34	5.69	1.68	19.28	0.005
35-44	8.24	2.45	27.67	0.001
Contact				
Not answered Yes				
Answered Yes	2.45	1.13	5.33	0.023
Previous Tx				
Not answered Yes				
Answered Yes	4.82	1.79	13.00	0.002
Smoking				
Never				
Ex-smokers	3.14	0.41	23.90	0.270
Current-smokers	2.34	1.03	5.30	0.042
State/Region				
Region				
State	1.52	0.71	3.26	0.282
Urban/Rural				
Rural				
Urban	1.42	0.63	3.22	0.403

Analysis strategy:

Selecting variables by forward stepwise with p <0.05 Additional variables regardless of the results from stepwise: demographic variables (state/region, urban/rural).
Assessing the associations by random-effects model

single image causes both under- and over-diagnosis. Development of a new screening and diagnostic algorithm or introduction of new technologies is essential to detect the majority of TB cases in the community.

Having a high-quality CXR image is essential. External quality assessment by a technical assistance and funding agency, JICA, suggested that in the survey was of a high quality. Only 0.4% of the images were not interpretable due to poor quality. However, even when it was interpretable, poor quality led to over-reading at field level and under-diagnosis at central level. When an image was poor, the field reader tended to judge it as abnormal and the expert tended to judge it as normal. Discrepancies between field reading and central reading or between central reading "normal" and laboratory "positive" results happened often among those with poor-quality images.

4.11 Comparison with the 1994 national TB prevalence survey

The prevalence of smear-positive TB was estimated as 104 (71-137)/100 000 population in the 1994 national survey (see the Box following this section). The 1994 survey result was used for the baseline estimation of the TB burden in Myanmar with an estimated annual risk of TB infection around 1.5%.

However, despite the efforts of DOTS expansion across the country since the late 1990s, the 2009-2010 survey showed a higher prevalence of smear-positive TB, 171 (131-223)/100 000 population. It would be possible to infer from this that the TB situation in Myanmar has deteriorated. However, while the survey in 2009-2010 used both CXR and symptoms as screening tools, the 1994 survey used only TB suspected symptoms, cough for two weeks or more as a screening tool. In the resource-limited setting in 1994, at the beginning of the DOTS era, it was reasonable to conduct a survey without CXR screening as well as culture diagnosis. However, there were clear limitations to the methodology used in the 1994 survey, since it was unable to detect any smear-positive cases in Yangon clusters, whereas a pilot survey in Yangon prior to the 2009-2010 national survey with CXR screening identified a high prevalence of smear-positive TB, 229 (161-297)/100 000 population (NTP report).

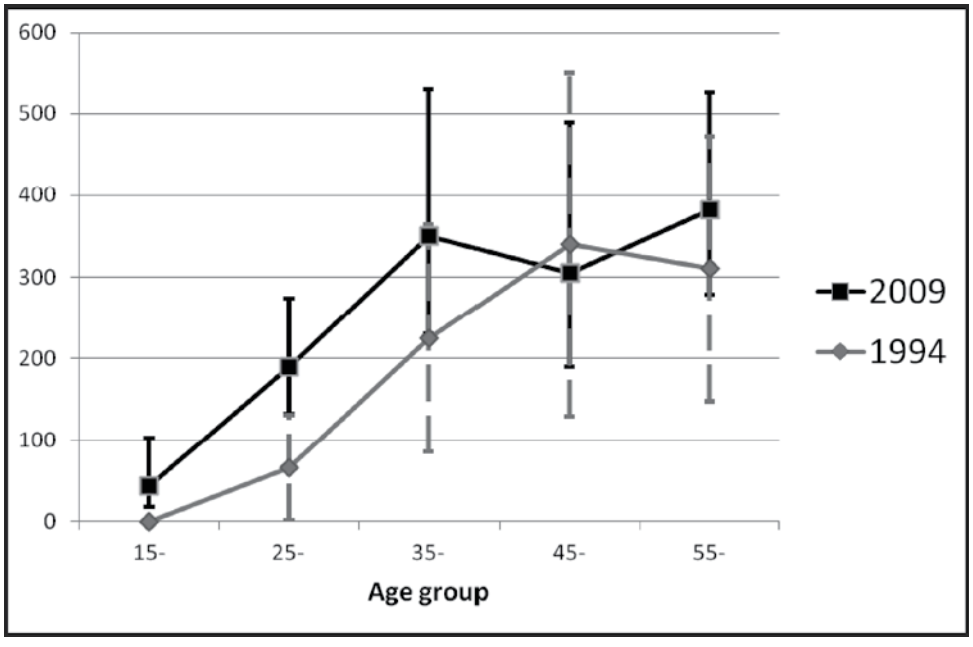
When comparing smear-positive TB prevalence in the 1994 and 2009-2010 surveys using the same screening criteria, it is clear that a significant reduction of smear-positive TB with chronic cough has been achieved in 15 years (Figure 10). Although TB/HIV may affect the TB epidemic more in 2009-2010 than in 1994, a 35% reduction in prevalence was observed over 15 years when the same screening and diagnostic algorism was applied to the two surveys. However, in the 1994 survey two smear-positive results out of three samples were considered smear-positive TB cases, while the 2009-2010 survey applied a new definition of one smear-positive result out of two.

NTP and its partners have been detecting smear-positive TB with chronic cough, according to the current screening criteria, effectively in most areas of the country; 40 out of 70 clusters did not have any smear-positive TB cases with chronic cough.

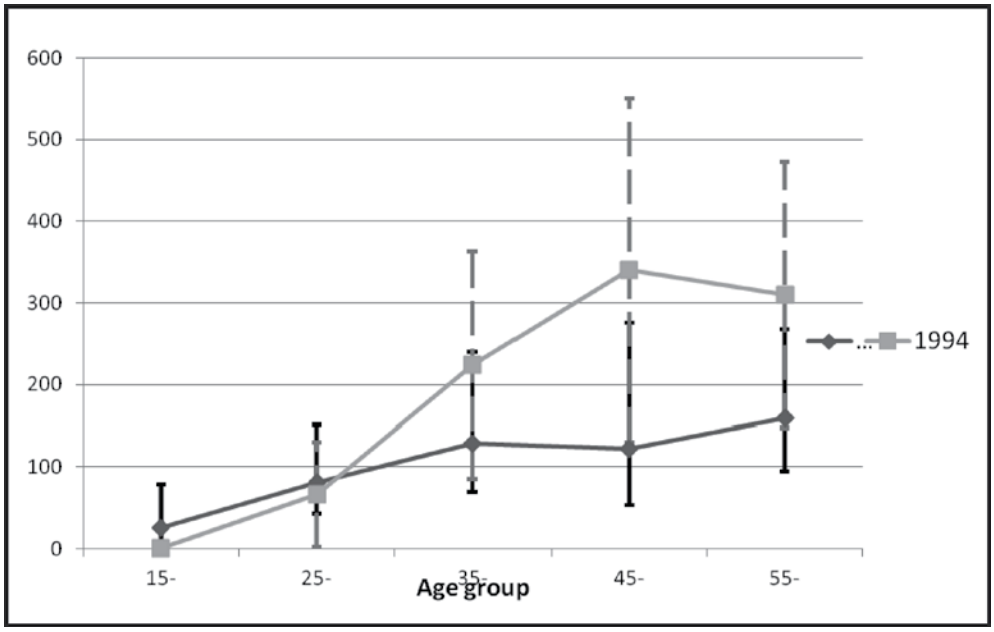
However, Myanmar has not observed a decline in case notification which may suggest that the limited ability of the current TB detection strategy does not have a significant impact on the incidence of TB. Smear-positive TB with classic TB-suspected symptoms made up only a small fraction of the bacteriologically positive prevalent TB cases in the survey (42/311). Most prevalent TB cases cannot be diagnosed in most rural areas where TB screening and diagnosis are totally dependent on symptoms and microscopy.

Figure 10. Comparison between National TB Prevalence Survey results, 1994 and 2000-2010

a) Direct comparison of survey findings



b) Survey findings adjusted with screening and diagnostic algorithm



Sputum Smear-Positive Point Prevalence Survey in Myanmar, 1994[1]

Objective

To study the point prevalence, magnitude and trend of the sputum smear-positive TB burden in Myanmar.

Sampling Methods

PPS of population was used to assure a good sample spread. There were three strata: *Stratum 1*: Yangon: From Inner Yangon, 1 district and 4 townships and from Outer Yangon, 2 districts and 9 townships were selected. *Strata 2 (Urban) and 3 (Rural)*: 28 districts and 28 townships were selected. The sample size for each rural portion of the township was equally shared by the selected Rural Health Centres (RHC) and each portion of RHC was subdivided by the villages selected. The shared sample of the population was surveyed by house-to-house visits in accordance with the cluster survey method used by the WHO Expanded Programme on Immunization survey.

Survey procedure

Screening Criteria: Persons age 10 years and above were questioned for the presence of cough with a minimum of two weeks' duration. From those with presence of symptoms, three sputum samples were collected: spot sputum, early morning sputum and second early morning sputum.

Diagnosis: Three smears were made from each symptomatic individual, from which two positive smears were taken as positive. All AFB-positive slides detected in the field and every sixth negative slide was counter-checked by the Reference Laboratories in Union Tuberculosis Institute (UTI) Yangon or Mandalay.

CXR and culture test: CXR and culture examination were conducted on a limited population. The sample population of Yangon inner area with sputum-negative results was subjected to CXR at UTI (Yangon). This symptomatic sample population of Yangon inner area was also sputum cultured. Children under 10 years were also interviewed in order to learn the magnitude of the problem of childhood TB.

1 *This summary was written by Mr K Izumi, WHO intern, based on an unpublished paper by the Myanmar Survey Team, 1994.*

Results

Sample areas and eligible subjects: The survey was carried out in all randomly selected 41 townships. The total number of patients examined was 37 424. *Sputum-positive cases*: Overall prevalence of sputum AFB-positive was found out to be 1.04/1000. The sputum AFB-positive rate in urban areas was 0.73/1000 and in rural area was 1.17/1000, but the difference was not significant (P=0.23). In comparison, the sputum AFB-positive rate for states was 1.98/1000 and for regions 0.65/1000, indicating a higher sputum AFB-positive rate in states than in regions. Out of 39 sputum-positive cases, 28 were new cases and 11 gave history of previous anti-TB chemotherapy. Thus, the ratio of new to retreatment cases was found to be 2.5:1.

Table: Overall prevalence of sputum AFB-positive Cases, Myanmar 1994 survey

Age group	Survey population						AFB(+) (/100 000)	Lower limit	Upper limit
	Male	Sputum AFB(+)	Female	Sputum AFB(+)	Total	Sputum AFB(+)			
15-24	3 233	0	3 971	0	7 204	0	0.0	0.0	0.0
25-34	2 689	3	3 370	1	6 059	4	66.0	1.3	130.7
35-44	1 933	8	2 523	2	4 456	10	224.4	85.5	363.4
45-54	1 416	8	1 526	2	2 942	10	339.9	129.6	550.2
55+	1 998	8	2 519	6	4 517	14	309.9	147.8	472.0
Subtotal	**11 269**	**27**	**13 909**	**11**	**25 178**	**38**	**150.9**	**103.0**	**198.9**
1-14	6 101	0	6 145	1	12 246	1	8.2	0.0	24.2
Total	**17 370**	**27**	**20 054**	**12**	**37 424**	**39**	**104.2**	**71.5**	**136.9**
			Urban		10 946	8	73.1	22.5	123.7
			Rural		26 478	31	117.1	75.9	158.3
			NTP-covered		19 311	24	124.3	74.6	174.0
			Non- NTP-covered		18 113	15	82.8	40.9	124.7

4.12 Comparison with surveillance data

The findings of the TB prevalence survey can be used to calibrate the surveillance data. For example, the results can be used to understand whether the magnitude of TB notifications reflects the TB burden. In the 2009-2010 survey, the high participation rate, few missing values and high prevalence make the comparison between prevalence and notification in some strata feasible. Among 79 survey participants who were identified TB cases on treatment, 63 (79.8%) were treated by NTP facilities and 12 (15.2%) by GPs. It seems that routine surveillance effectively captured the majority of TB cases that were diagnosed. However, the notification data does not reflect the TB burden in different places. Although states showed a lower notification rate than the national average, the prevalence is higher in states than in regions. This suggests a challenge in case detection in states and that the lower notification rate does not mean a lower TB burden.

Since there were no national disaggregated TB case notification statistics between urban and rural areas, a direct comparison of the survey results of urban/rural areas with the surveillance data is not feasible. However, the higher TB prevalence in urban area and higher TB notifications in Yangon and other cities suggest a high TB burden in urban areas. Notification/prevalence (N/P) ratios are shown in Table 27 and Figure 11. Although the NTP annual report did not show the geographical disaggregation of notified cases by partners (other units) that occupied 17% of notified cases, the original reports were studied to redistribute the cases to each stratum.

Lower N/P values indicate either lower case detection or longer duration of illness (smear-positive status), or both.

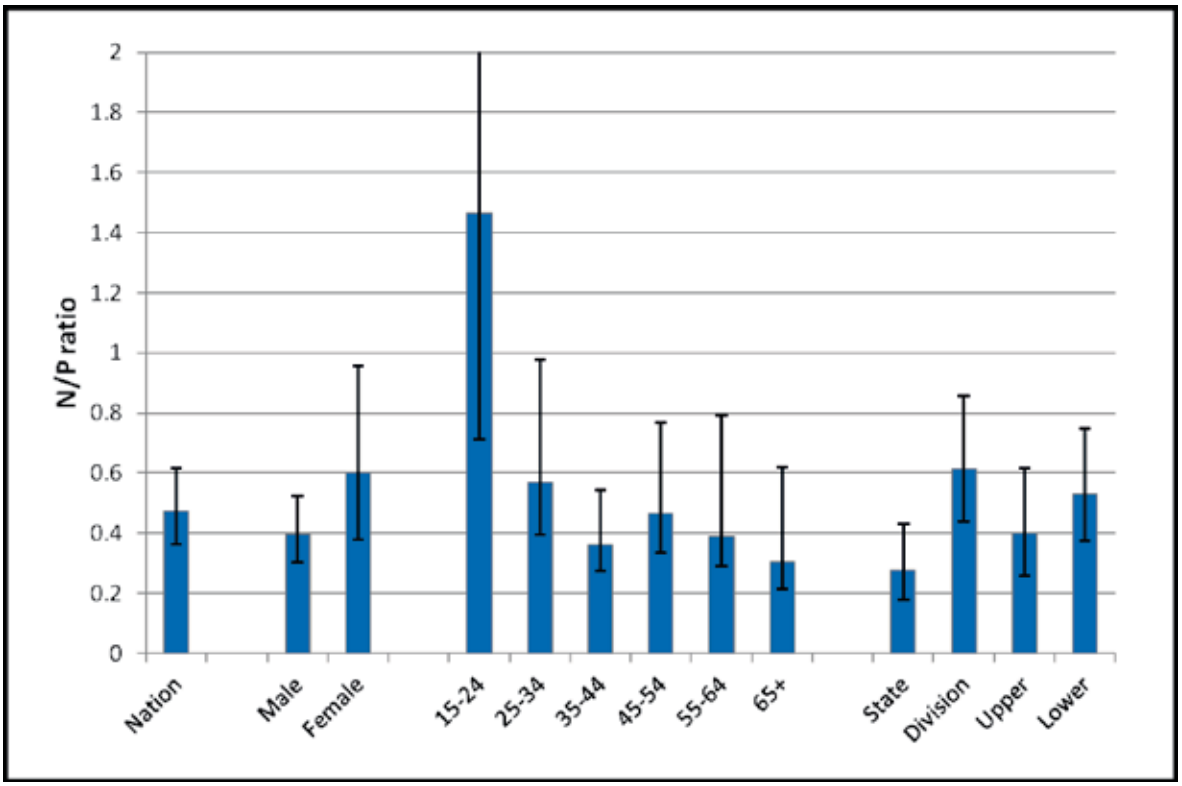
Young adults seem to have high a case detection rate and/or shorter duration of bacteriologically positive status than older adults. Due to their age, most of their TB might be from new infection and they may recognize the sickness and take action, while the chronic nature of the disease might prevent older people from seeking care. The high prevalence of respiratory symptoms in the older age group may also contribute to the lower recognition of illness.

Table 27. Notification/Prevalence ratios by different groups

	Prevalence*	95% CI		Notification 2009 /100 000	N/P	95% CI	
Total	**171.5**	**131.7**	**223.2**	**81**	**0.47**	**0.62**	**0.36**
Sex							
Male	275.9	209.0	364.1	110	0.40	0.52	0.30
Female	88.1	55.5	140.1	53	0.60	0.96	0.38
Age							
15-24	43.2	9.2	88.6	63	1.23	5.77	0.60
25-34	189.6	110.3	271.9	108	0.53	0.91	0.37
35-44	349.7	232.6	457.4	127	0.35	0.53	0.27
45-54	304.2	184.9	421.7	142	0.48	0.79	0.35
55-64	372.8	183.6	502.5	146	0.39	0.79	0.29
65+	394.5	193.4	557.6	120	0.26	0.54	0.19
Strata							
State	249.6	159.3	390.6	69	0.32	0.50	0.20
Region	138.6	99.3	193.3	85	0.71	0.99	0.51
Upper	147.5	95.9	226.6	59	0.46	0.71	0.30
Lower	192.9	136.6	272.4	102	0.61	0.86	0.43

*Prevalence assuming there were no smear-positive cases in children. Proportion of aged 15 or above among the survey census population was used. Notification data in 2009 are from NTP database. Urban/Rural disaggregation notification data are not available.

Figure 11. Notification/Prevalence ratios for smear-positive TB by different groups



4.13 Comparison with other surveys in ASEAN countries

The results of the survey were consistent with recent surveys in countries of the Association of Southeast Asian Nations (ASEAN) that had similar screening and diagnostic methodologies with CXR and culture (Table 28). Although the prevalence of smear-positive TB was higher than previously estimated in Myanmar, it was lower than the prevalence of smear-positive TB in the Philippines in 2007 and Cambodia in 2002. Both Viet Nam and the Philippines had achieved the previous international targets of TB control, 70% case detection rate and 85% treatment success by the survey year. However, in these two countries the N/P ratio of less than 0.5 indicated the limitations of case detection (although this ratio was slightly underestimated in the countries shown in Table 28 because notification of re-treatment cases was not included in N).

The higher prevalence of smear-negative, culture-positive cases than smear-positive was also observed in Cambodia and Philippines. A lower proportion of smear-negative TB in Viet Nam might be due to a single specimen for culture and strict CXR abnormality criteria by screening. While others took any abnormality in the lung as eligible for sputum examinations and two or more specimens for culture examinations, the Viet Nam survey took TB suggestive by CXR as a screening criteria and only one specimen was examined with culture. The prevalence of bacteriologically positive TB in Viet Nam might therefore be underestimated. The Myanmar survey of 2009-2010 confirms a high TB prevalence across the region.

Table 28. Results of recent TB prevalence surveys in Asia

Country	Year	Age	Smear-positive /100 000	Bacteriologically positive /100 000	S+/B+	Lab exam
Cambodia	2002	10+-	362 (284-461)	1 208 (997-1 483)	30.0%	2S 2C
Philippines	2007	10+	260 (170-360)	660 (510-810)	39.4%	3S 3C
Viet Nam	2007	15+	197 (149-254)	307 (248-367)	64.2%	3S 1C
Myanmar	2009	15+	242 (186-315)	613 (502-748)	39.5%	2S 2C

Country	Year	Age	Smear-positive /100 000	Notification (smear-positive NEW) /100 000	N/P
Cambodia	2002	all	269	125	0.46
Philippines	2007	all	200	98	0.49
Viet Nam	2007	all	145	62	0.43
Myanmar	2009	all	171	81	0.47

Sources for prevalence data
Cambodia: NTP Cambodia. National TB Prevalence Survey Report 2002. 2005.
Philippines: TE Tupasi et al. Significant decline in tuberculosis burden in the Philippines ten years after initiating DOTS. IJTLD 2009;13:1223-1230.
Viet Nam: Hoa NB et al. National survey of tuberculosis prevalence in Viet Nam. Bull WHO 2010; 88:273-280.
Sources for notification rates
Cambodia: Global Report 2004.
Philippines, Viet Nam and Myanmar: Global Report 2010.
Case notification of smear-positive new was used instead of that of all smear-positive.

4.14 Strengths and limitations of the survey and analysis

This survey was designed under the guidance of RIT and WHO and was based on the WHO survey handbook published in 2007. In addition to the Institutional Ethical Review Committee, DOH, Myanmar, and the NTP, the protocol was reviewed by the WHO Regional Office for South-East Asia, the WHO Global Task Force on TB Impact Measurement and RIT. RIT through JICA and WHO provided technical assistance throughout the survey process, and the Myanmar offices of PSI and 3DF took part in supervisory activities during the field operation. Despite the difficult field conditions, such as the monsoon and logistical challenges, NTP carried out the field operation very successfully. An international joint external review certified that the survey was of high quality. Quality indicators of the survey such as coverage and representativeness of the population, participation rate, quality of CXR, sputum submission rate, culture recovery and contamination rate showed satisfactory ranges. After the survey data collection, RIT/JICA and WHO fully supported the NTP for the data management and analysis.

The following limitations were recognized in the survey:

1. Survey design

- TB patients with no signs or symptoms of the disease could not be detected by this survey design, if such cases are defined as TB patients.
- The prevalence of TB in children and extrapulmonary TB could not be assessed.
- HIV examinations were not carried out within the survey. The relationship between a high TB prevalence in states and in urban areas and HIV infection could not be clarified.

2. Operational aspects

- Although the overall participation rate was high, a few urban clusters and remote clusters with ethnic minorities had a relatively low participation rate.
- Logistical challenges due to the delay in procurement (by WHO) caused quality problems for CXR and a delay in the operation as replacement of equipment became unfeasible. Poor quality of images caused over-reading at field level and under-reading at the central level. Radiography equipment with higher capacity such 110 kVp would have been ideal. However, due to the logistical challenges in the field, priority in the selection process was given to the portability of radiographic equipment and generators.
- Ideal sputum tubes for sputum collection and examination were not provided. The sputum cups used in the survey were inappropriate for processing culture, which may have resulted in cross-contamination.
- The two survey bases and laboratories in Mandalay and Yangon were far away from the capital city where the NTP is based. This caused a challenge in data entry and management.
- Coding problem of the laboratory results: the laboratory had their own survey numbers and specimen registration system. As a result of handwriting of code numbers, a few results were unavailable to match with the survey participants who submitted sputum specimens.
- Language barriers between English and Myanmar languages and between Myanmar language and ethnic groups' languages meant that some questions on behaviour might be misunderstood by the participants.
- There was a delay in the planned re-interviews to survey confirmed cases. This might have caused recall bias when the re-interview was carried out after treatment.

3. Analysis

- There was no clear guidance on how to overwrite a record of the primary screening results by the team leader or internal quality control activities. For example, CXR was re-assessed and when under-diagnosis

was found the participant was traced to collect sputum specimens. However, it was often unclear how the initial record was corrected.

- There was a gap between interview/screening result of each question by the interviewer and a final screening decision by the team leader in some individuals as well as those in CXR. For analysis, data of final judgments of sputum eligibility were used as an interview result and CXR screening result.

- Removing possible TB cases (such as subjects with one smear-positive slide or one culture-positive tube without any other evidence of disease) from the survey case list and official survey results without imputation of missing value may lead to an underestimation of the prevalence by around 10%-15%. However, we prefer a conservative estimation to a possible overestimation. Prevalence estimates with imputation of missing values are shown in Tables 30 and 31 (Annex 11).

- The absolute size of the country's population varies depending on the information source. Although the survey results were not affected by the total population of the country, an estimation of the TB burden and a comparison with the surveillance data may differ depending on a population data source.

5. PROGRAMME IMPLICATIONS

The 2009-2010 National TB Prevalence Survey revealed that the prevalence of TB in Myanmar is 2.5 times higher than previous estimates had suggested. The previous estimate was based on the 1994 prevalence survey results and an annual risk of infection estimate of around 1.5%. The TB burden in Myanmar is definitely much more serious than previously estimated. There are therefore several important questions to assess in the light of this survey.

5.1 TB prevalence

Whether the TB situation has worsened from the mid-1990s to today

Case notification rates of smear-positive TB jumped from 20/100 000 in the mid-1990s to 80+/100 000 in the late 2000s. Considering the surveillance data from Northern Thailand, which shares a border with Myanmar, there was a possibility that the TB burden and incidence in Myanmar deteriorated from the 1990s to the 2000s due to the HIV epidemic which had a peak prevalence in Myanmar of 2.7% in 1999 according to HIV prevalence data in antenatal care clinics (http://www.unaids.org/en/dataanalysis/monitoringcountryprogress/2010progressreportssubmittedbycountries/myanmar_2010_country_progress_report_en.pdf).

The unavailability of HIV information on survey participants and detected cases was a serious limitation of the survey. However, TB/HIV sero-sentinel surveillance data from 15 sites suggests that HIV prevalence has been consistently around 10% of new TB patients from 2005 to 2009 (NTP report for 2009, 2010 NTP). Although a declining trend of HIV among TB patients was observed in Yangon (11.3% in 2005 to 5.3% in 2009), an opposite trend in some other sentinel sites leads to a constant national average around 10%. The impact of HIV on the TB epidemic in Myanmar has been limited. Moreover, TB care and control under DOTS in Myanmar has significantly improved since the mid-1990s. It may be concluded that the increase in case notification in the last 15 years was mainly due to the expansion of DOTS, not to the deterioration of the TB situation. The negative impact of HIV was counteracted by programme efforts to improve TB care. The WHO Global Report 2010 estimated that the TB burden in Myanmar has been flat with no significant change since the 1990s. WHO estimates from the mid-1990s until recently have seriously underestimated the epidemiological situation of TB in Myanmar.

5.2 Programme impact

Whether the survey shows the impact of programme efforts upon TB epidemiology

The survey findings clearly showed the effective efforts of the NTP and its partners to remove smear-positive cases with chronic cough from the community through the DOTS strategy. There was a 35% reduction in the prevalence of such cases from 1994 to 2009.

Given the impact of HIV, smear-positive symptomatic cases (serious cases) are more likely to die if they are not treated. Since it was proven that NTP removed those cases rather efficiently from the community, NTP must have saved more lives of TB patients through service expansion since the mid-1990s, and TB mortality must have improved.

However, no reduction was observed in prevalence of TB in young adults. Although TB control services have removed smear-positive cases with chronic cough through the internationally recommended strategy with DOTS, no evidence was available to show a reduction in TB incidence, or a cutting of the chain of TB transmission, since TB among young adults must be from new infection mostly. The lack of reduction in case notification also supports this observation. The TB control efforts had a significant impact on prevalence and mortality but most probably not on incidence.

5.3 DOTS

Whether DOTS efforts have been adequate

Basic DOTS has not penetrated into most communities in the states. The survey clusters in the states showed a high prevalence of smear-positive TB with chronic cough. Lower notification rate in states do not mean a lower TB burden. Access to basic diagnosis and smear microscopy is still limited in remote areas in the states.

Higher prevalence of smear-positive cases with chronic cough in urban clusters than in rural clusters is very problematic. Although people living in urban areas have better access to TB service in terms of the distance, they tend to remain in the community without seeking care or without accessing formal TB services.

Efforts with DOTS have been insufficient. However, to the extent that this situation is due to targets set according to the underestimated TB burden, the international community should share the responsibility.

5.4 Case detection

Whether strengthening current efforts is enough

The gaps between all smear-positive cases and those with classic TB symptoms, chronic cough, and between bacteriologically positive and smear-positive cases suggest serious limitations in the current case detection strategies across the country. Myanmar has not observed a significant decline in case notification rates even in areas where higher notification rates of smear-positive TB cases have been achieved, most probably due to a large pool of those cases in the community. A larger gap between smear-positive and bacteriologically positive cases in older people suggests the chronic nature of TB in this age group and the longer duration of illness in the community. It is not acceptable that prevalence rate is around twice that of the annual notification rate. This means that in a district where 80 smear-positive cases are detected and treated in a year, there are in fact 170 smear-positive cases in the community, most of them unknown. It is necessary to review the case finding strategy comprehensively considering local contexts.

- Too much stress on chronic cough as a sign of TB and a single screening criterion for sputum examination may mislead both people and care providers. TB should be considered as a differential diagnosis for any undiagnosed chronic symptom, regardless of cough or any respiratory illness.

- The informal sector and pharmacies that are patients' first contacts should be involved in the TB control and care network. The survey identified that those staying in the community with TB are more likely to contact traditional healers, drug sellers and pharmacies. An aggressive approach should be taken to involve them in the network to detect cases earlier.

- Any undiagnosed CXR abnormality should be considered as "TB-suspect" for sputum examination. Before visiting TB service units, many patients take a CXR, which should be a good opportunity to detect TB. CXR is the most sensitive tool to detect suspected TB.

- Efforts to improve the quality of CXR should be made. The survey experience showed that poor-quality images cause both under- and over-diagnosis of TB. Since quality radiography will benefit other patients as well, NTP potentially can contribute to the health system in general through efforts to improve CXR quality.

- New technology to diagnose non-smear-positive TB should be introduced. Though culture examinations have been standard tools to diagnose TB in developed countries, the complexity of the technology and necessity for strict infection control measures limit their expansion in most TB high-burden countries. The survey also suggests that it is unrealistic to expand culture examinations to township or even region (region)/state level to diagnose smear-negative cases. NTP should take immediate action to introduce and expand simple molecular technologies. The survey results must justify the introduction.

- Specific measures should be taken for people in congested urban areas, where the TB burden is high. Although NTP and its partners detect and treat many in those areas, there are still many unknown cases, and TB must be circulating very efficiently there. Aggressive measures to detect cases should be taken, in collaboration with the private sector, which provides services at convenient hours for those living in urban areas. After case detection, collaboration with the private sector for appropriate treatment convenient for urban people is essential.

- Access to TB diagnostic services should be improved in the states. Given quality treatment, DOTS is available from primary health services in most villages. Introduction of a mobile diagnostic service should be piloted.

- Active case detection in high-risk populations should be piloted to use the human resource and technical capacity developed through TB prevalence survey. Since it is not necessary to carry out epidemiological sampling, and since NTP has developed the capacity to screen more than 300 people a day, active case detection may not cost a lot compared with the survey. The epidemiological impact of active case detection on TB transmission and incidence should be assessed. Introduction of new technologies in diagnosis (molecular diagnostics) and screening (digital radiography) should be piloted in the active case detection in a coordinated manner.

5.5 Stop TB Strategy

In the context of the Stop TB Strategy, the implications can be summarized as follows:

1. Pursue high-quality DOTS expansion and enhancement

a) Secure political commitment, with adequate and sustained financing

- The survey provides evidence to lead a stronger commitment of the government and donors

b) Ensure early case detection, and diagnosis through quality-assured bacteriology

- The survey clarified the limited diagnostic capacity of the states. Access to basic diagnostic services should be guaranteed promptly.

- The limitations of diagnosis with smear microscopy and the difficulty of expansion of culture were experienced. New molecular technologies should be introduced and piloted in each level of the health system to seek effective placement of new technologies.

- CXR was recognized as the most sensitive screening tool. Access to quality radiographic services should be improved.

- Active case detection should be piloted in different populations.

c) Provide standardized treatment with supervision, and patient support

- The survey suggested that quality treatment exists in most places. There are few chronic prevalent cases. Quality treatment through basic health services should be sustained.

d) Ensure effective drug supply and management

- A dramatic increase in TB cases is to be expected when the case detection target is revised. The drug supply should be adequately secured in advance.

e) Monitor and evaluate performance and impact

- Quality of surveillance should be reviewed. Individual patient-based electronic surveillance can be introduced using the experience of the TB prevalence survey, which gathered data from 50 000 individuals in nine months.

- A TB prevalence survey should be carried out around 2015 to measure the impact of strengthened TB services.

2. Address TB-HIV, MDR-TB, and the needs of poor and vulnerable populations

a) Scale up collaborative TB/HIV activities

b) Scale up prevention and management of MDR-TB

c) Address the needs of TB contacts and of poor and vulnerable populations

- Although HIV testing was not introduced in the survey, risk analysis could be performed. Based on the survey results, approaches to vulnerable populations should be improved. TB contacts and previously treated cases should be accessed.

- Efforts should be made to collect quality epidemiological information on TB/HIV continuously.

3. Contribute to health system strengthening based on primary health care

a) Help improve health policies, human resource development, financing, supplies, service delivery and information

b) Strengthen infection control in health services, other congregate settings and households

c) Upgrade laboratory networks, and implement the Practical Approach to Lung Health (PAL)

d) Adapt successful approaches from other fields and sectors and foster action on the social determinants of health

- The TB service in the periphery is already integrated with the general health service in Myanmar. NTP can strengthen its contribution to the health system through many aspects such as lab expansion, strengthening respiratory care (PAL), stop-smoking activities and quality radiography.

4. Engage all care providers

a) Involve all public, voluntary, corporate and private providers through PPM approaches

- Earlier contacts of TB patients are often with the informal sector or pharmacists. These should be involved in the TB care and control network. The private sector is the first choice of those living in urban areas. Collaboration with GPs and its associations should be strengthened.

5. Empower people with TB, and communities through partnership

- Knowledge, attitude and practice studies have been carried out. Their results should be analyzed and used to empower people.

- Patient-centred TB care should be planned, particularly in urban and remote settings.

6. Enable and promote research

a) Conduct programme-based operational research

- The survey identified areas for operational research discussed in this section. Budget and human resources should be allocated to carry out and analyze research.

5.6 Conclusion

The National TB Prevalence Survey of 2009-2010 offers numerous lessons. However, as it was planned and carried out to estimate the burden of bacteriologically positive TB among adult population, the survey could not show the TB situation among children, cases of extra-pulmonary TB, the relationship of the TB epidemic to HIV, and MDR-TB. Those challenges should be studied appropriately through research and in-depth analysis of strengthened surveillance data.

Understanding that the TB burden in Myanmar is twice or even three times as high as previously estimated, it is important that all stakeholders call more attention and investment to TB care and control services in Myanmar.

Table 29. Cluster summary

Cluster	Township	Strata	Area	Census Population	Non-Survey Population	Survey Population		Attendance			Treatment History		Symptom		CXR Screening			Sputum Examination			Survey Cases		
						<15yrs	Eligible	Attended	Absent	Participation rate (%)	Current	Previous	TB-symptomatic (TB-suspect)	Any symptom	CXR taken	Exempted	Shadow eligible for sputum exam	Eligible (sputum requested)	Result available	% (S/R)	Smear+	S-Culture+	Bac+
1	Dedaye	Region	Rural	1 392	91	483	818	720	98	88.0%	1	6	16	250	703	17	61	89	89	100.00%	1	0	1
2	Hinthada	Region	Rural	1 084	54	267	763	718	45	94.1%	2	8	19	368	706	12	243	255	253	99.22%	7	3	10
3	Ingapu	Region	Rural	1 195	57	287	851	722	129	84.8%	3	20	33	338	720	2	185	187	187	100.00%	4	0	4
4	Mawgyun	Region	Rural	1 329	117	385	827	734	93	88.8%	0	11	18	364	705	29	207	242	241	99.59%	0	0	0
5	Myaungmya	Region	Rural	1 340	50	532	758	709	49	93.5%	0	17	26	214	687	22	201	223	223	100.00%	1	0	1
6	Ngaputaw	Region	Rural	1 401	195	389	817	727	90	89.0%	0	20	28	285	713	14	185	201	200	99.50%	0	1	1
7	Nyaungdone	Region	Rural	1 412	92	400	920	841	79	91.4%	0	18	22	444	827	14	135	156	154	98.72%	0	1	1
8	Phyarpon	Region	Urban	1 150	71	207	872	715	157	82.0%	2	37	21	163	711	4	46	80	80	100.00%	2	8	10
9	Yekyi	Region	Rural	1 098	55	270	773	701	72	90.7%	2	30	32	267	687	14	142	165	165	100.00%	6	1	7
10	Bago	Region	Rural	1 405	142	447	816	706	110	86.5%	0	23	19	338	681	25	72	104	104	100.00%	0	6	6
11	Kawa	Region	Rural	1 438	150	478	810	773	37	95.4%	0	27	13	271	765	8	140	154	154	100.00%	3	1	4
12	Nattalin	Region	Rural	1 285	90	379	816	758	58	92.9%	0	15	36	364	743	15	77	110	110	100.00%	1	0	1
13	Paukkhaung	Region	Rural	1 184	28	286	870	753	117	86.6%	0	21	6	440	739	14	94	110	110	100.00%	0	1	1
14	Phyu	Region	Rural	1 221	109	344	768	718	50	93.5%	1	18	9	298	699	19	44	71	71	100.00%	3	3	6
15	Thanatpin	Region	Rural	1 377	137	433	807	748	59	92.7%	0	20	8	85	735	13	75	94	94	100.00%	2	1	3
16	Tharyarwaddy	Region	Rural	1 283	32	422	829	779	50	94.0%	2	19	20	241	754	25	146	172	172	100.00%	3	0	3
17	Mindat	State	Urban	1 932	315	788	829	675	154	81.4%	0	18	130	502	644	31	276	307	305	99.35%	1	2	3
18	Moemauk	State	Urban	1 327	89	475	763	701	62	91.9%	2	18	22	389	673	28	94	135	135	100.00%	5	8	13
19	Myitkyina	State	Rural	1 653	42	500	1 111	730	381	65.7%	1	38	16	223	709	21	93	122	122	100.00%	1	8	9
20	Hlaingbwe	State	Rural	1 856	539	523	794	745	49	93.8%	1	34	38	376	728	17	212	241	239	99.17%	7	1	8
21	Kyarinnseikkyi	State	Rural	1 521	117	598	806	653	153	81.0%	0	13	56	350	629	24	75	134	133	99.25%	2	1	3
22	Chaunk	Region	Rural	1 371	146	325	900	845	55	93.9%	2	16	11	201	829	16	48	67	67	100.00%	0	5	5
23	Natmauk	Region	Rural	1 409	123	371	915	849	66	92.8%	0	23	7	173	837	12	37	52	51	98.08%	1	3	4

						Survey Population		Attendance			Treatment History		Symptom		CXR Screening			Sputum Examination			Survey Cases		
Cluster	Township	Strata	Area	Census Population	Non-Survey Population	<15yrs	Eligible	Attended	Absent	Participation rate (%)	Current	Previous	TB-symptomatic (TB-suspect)	Any symptom	CXR taken	Exempted	Shadow eligible for sputum exam	Eligible (sputum requested)	Result available	% (S/R)	Smear+	S-Culture+	Bac+
24	Saw	Region	Rural	1 335	80	307	948	850	98	89.7%	1	8	29	359	835	15	199	214	212	99.07%	0	2	2
25	Thayet	Region	Rural	1 108	54	203	851	821	30	96.5%	0	3	48	332	814	7	275	297	297	100.00%	0	1	1
26	Yesagyo	Region	Rural	1 152	55	312	785	740	45	94.3%	0	6	11	120	726	14	172	186	185	99.46%	1	1	2
27	Amarapura	Region	Rural	1 382	71	401	910	739	171	81.2%	0	18	7	204	726	13	100	116	116	100.00%	1	4	5
28	Kyaukpadaung	Region	Rural	1 299	251	266	782	742	40	94.9%	0	17	19	136	731	11	101	115	112	97.39%	0	2	2
29	Kyaukse	Region	Rural	1 095	57	269	769	732	37	95.2%	0	24	10	148	718	14	162	176	175	99.43%	2	3	5
30	Maharaung-myay	Region	Urban	1 079	42	300	737	702	35	95.3%	0	28	10	119	691	11	93	110	110	100.00%	3	8	11
31	Meikhtila	Region	Urban	1 084	111	244	729	687	42	94.2%	2	27	21	177	671	16	97	114	105	92.11%	2	2	4
32	Pyawbwe	Region	Rural	1 308	47	376	885	818	67	92.4%	0	4	10	259	804	14	110	130	130	100.00%	1	4	5
33	Pyinoolwin	Region	Rural	1 131	52	322	757	728	29	96.2%	1	11	23	231	717	11	150	161	158	98.14%	0	3	3
34	Taungthar	Region	Rural	1 353	91	436	826	746	80	90.3%	0	7	12	400	734	12	132	147	146	99.32%	2	2	4
35	Wundwin	Region	Rural	1 318	35	360	923	752	171	81.5%	0	2	7	261	737	15	138	156	155	99.36%	0	2	2
36	Yamethin	Region	Rural	1 201	42	373	786	723	63	92.0%	1	1	3	371	709	14	49	63	62	98.41%	1	0	1
37	Mawlamyaine	State	Rural	1 907	654	417	836	723	113	86.5%	5	55	26	250	713	10	54	78	78	100.00%	1	4	5
38	Mudon	State	Rural	1 944	637	485	822	734	88	89.3%	4	31	24	275	722	12	56	78	78	100.00%	1	3	4
39	Paung	State	Rural	1 714	349	601	764	728	36	95.3%	0	27	46	351	707	21	150	186	186	100.00%	5	3	8
40	Thahton	State	Rural	1 428	65	548	815	740	75	90.8%	1	24	18	307	723	17	41	67	67	100.00%	0	3	3
41	Maungdaw	State	Rural	1 335	62	552	721	638	83	88.5%	0	10	46	278	625	13	208	233	227	97.42%	0	1	1
42	Minpya	State	Rural	1 465	62	560	843	766	77	90.9%	2	9	68	459	737	29	330	374	373	99.73%	4	1	5
43	Ponnagyun	State	Rural	1 092	82	337	673	641	32	95.2%	1	12	23	234	633	8	441	450	450	100.00%	1	5	6
44	Yethaetaung	State	Rural	1 434	176	483	775	754	21	97.3%	1	18	85	455	734	20	438	459	459	100.00%	5	1	6
45	Budalin	Region	Rural	1 117	23	339	755	722	33	95.6%	0	10	7	149	714	8	150	159	159	100.00%	1	3	4
46	Mawleik	Region	Rural	1 604	128	611	865	733	132	84.7%	0	5	21	293	703	30	257	288	286	99.31%	0	0	0
47	Monywa	Region	Urban	1 061	41	243	777	696	81	89.6%	0	16	21	157	686	10	181	191	190	99.48%	4	4	8

Cluster	Township	Strata	Area	Census Population	Non-Survey Population	Survey Population		Attendance			Treatment History		Symptom		CXR Screening			Sputum Examination			Survey Cases		
						<15yrs	Eligible	Attended	Absent	Participation rate (%)	Current	Previous	TB-symptomatic (TB-suspect)	Any symptom	CXR taken	Exempted	Shadow eligible for sputum exam	Eligible (sputum requested)	Result available	% (S/R)	Smear+	S-Culture+	Bac+
48	Pinlebu	Region	Rural	1 365	103	437	825	800	25	97.0%	1	8	26	310	783	17	295	314	313	99.68%	1	2	3
49	Sagaing	Region	Rural	1 135	70	290	775	703	72	90.7%	0	8	11	98	694	9	79	90	89	98.89%	1	3	4
50	Shwebo	Region	Rural	1 241	135	353	753	712	41	94.6%	0	19	26	274	694	18	142	169	169	100.00%	1	4	5
51	Tapeyin	Region	Rural	1 264	59	391	814	769	45	94.5%	1	6	26	341	754	15	164	189	188	99.47%	0	0	0
52	Yinmarpin	Region	Rural	1 198	46	320	832	768	64	92.3%	0	3	9	216	757	11	141	155	151	97.42%	0	0	0
53	Kuitkai	State	Rural	1 786	274	723	789	704	85	89.2%	0	8	60	333	679	25	201	226	222	98.23%	1	1	2
54	Kunlon	State	Rural	1 746	164	563	1 019	683	336	67.0%	3	22	62	390	666	17	154	201	200	99.50%	8	14	22
55	Mongmeik	State	Urban	1 240	144	263	833	728	105	87.4%	1	29	17	136	721	7	189	197	195	98.98%	3	4	7
56	Theinni	State	Urban	1 285	50	447	788	725	63	92.0%	3	14	29	233	713	12	173	186	184	98.92%	6	3	9
57	Kalaw	State	Rural	1 259	83	363	813	716	97	88.1%	0	11	3	143	701	15	156	173	172	99.42%	2	2	4
58	Namsum	State	Urban	1 531	238	410	883	685	198	77.6%	0	28	18	312	670	15	72	97	97	100.00%	0	1	1
59	Ywangan	State	Rural	1 155	84	268	803	735	68	91.5%	0	0	14	184	730	5	103	113	111	98.23%	0	0	0
60	Bokepyin	Region	Urban	1 589	155	571	863	734	129	85.1%	3	18	25	226	720	14	202	226	226	100.00%	1	2	3
61	Dawei	Region	Urban	1 267	102	367	798	621	177	77.8%	0	32	18	204	612	9	213	223	222	99.55%	0	2	2
62	Bahan	Region	Urban	1 105	131	183	791	654	137	82.7%	3	54	22	239	613	41	106	161	120	74.53%	1	2	3
63	Hlegu	Region	Rural	1 279	53	338	888	765	123	86.1%	1	24	10	299	741	24	89	118	118	100.00%	0	8	8
64	Kawhmu	Region	Rural	1 193	104	336	753	723	30	96.0%	3	19	18	189	699	24	111	143	140	97.90%	1	1	2
65	Shwepyithar	Region	Urban	1 167	149	239	779	671	108	86.1%	1	51	8	242	654	17	126	146	144	98.63%	0	4	4
66	South Dagon	Region	Urban	1 392	150	391	851	754	97	88.6%	0	59	27	200	736	18	122	171	169	98.83%	4	3	7
67	Southokkalapa	Region	Urban	1 144	95	224	825	750	75	90.9%	8	78	5	236	733	17	124	143	141	98.60%	4	6	10
68	Taikkyi	Region	Rural	1 361	120	371	870	800	70	92.0%	3	24	26	419	788	12	420	436	433	99.31%	1	1	2
69	Tarmwe	Region	Urban	1 253	62	269	922	756	166	82.0%	8	79	24	388	724	32	175	217	186	85.71%	2	6	8
70	Twantay	Region	Rural	1 242	121	348	773	736	37	95.2%	2	26	6	229	725	11	108	122	122	100.00%	1	3	4
	Total			**93 806**	**8 800**	**27 399**	**57 607**	**51 367**	**6 240**	**89.2%**	**79**	**1 463**	**1 691**	**19 110**	**50 241**	**1 126**	**10 637**	**12 235**	**12 087**	**98.79%**	**123**	**188**	**311**

Annex 1. Survey funding sources and cost breakdown

Funding sources

Funding source	Contribution (US$)	Description
Ministry of Health (MOH)		Human resources
World Health Organization (WHO)	15,000	Technical assistance, managerial assistance and coordination of partners (excluding human resources)
Three Diseases Fund (3DF)	270,000	Equipment, field operating costs, technical assistance, dissemination of survey findings
Japan International Cooperation Agency (JICA)	114,000	Technical assistance, training, equipment
Japan Anti-Tuberculosis Association/ Research Institute of Tuberculosis (JATA/ RIT)		Technical assistance
Population Services International (PSI)	358,000	Equipment, field operating costs, technical assistance, dissemination of findings and prevalence survey report
United States Agency for International Development (USAID)	120,000	Technical assistance
TOTAL	**877,000**	

Breakdown of costs

Item	Cost (US$)	Percentage of total
Technical assistance	8,000	0.9
Capital costs (procurement)	429,170	48.9
Field operation costs	261,657	29.8
Supervision	2,909	0.3
Pre-visits to the field	18,992	2.2
Training	9,174	1.0
Expenses for X-ray machine maintenance	6,000	0.7
Expenses for laboratory maintenance	5,000	0.6
Expenses for sputum microscopy and culture	20,451	2.3
Central data management	9,080	1.0
Stationery & printing forms	23,491	2.7
Contingency	2,036	0.2
WHO administrative costs (programme support costs)	81,040	9.2
TOTAL	**877,000**	**100.0**

Annex 2. Steering Committee

1.	Deputy Director General (Disease Control) DOH, MOH	Chairman
2.	Director (Disease Control), DOH, MOH	Vice-Chairman
3.	Director (International Health Region), MOH	Member
4.	Director (Planning), DOH, MOH	Member
5.	Regional TB Officer(Lower Myanmar),Yangon Region	Member
6.	Regional TB Officer (Upper Myanmar),Mandalay Region	Member
7.	Medical Superintendant, Aung San TB hospital	Member
8.	Jr Consultant Microbiologist, NTRL	Member
9.	National consultant, WHO	Member
10.	Dr Ikushi Onozaki, WHO HQ	Member
11.	Dr Attila Molnar, 3DF	Member
12.	Mr Marc Theuss, PSI	Member
13.	Project Management Team leader, JICA (MIDCP, TB)	Member
14.	Dr Ti Ti, (Foundation for Innovative New Diagnostics) National consultant	Member
15.	Project Manager, NTP, DOH, MOH	Secretary

Annex 3. Technical Committee

1.	Dr Win Maung	Director (Disease Control)
2.	Prof. Lin Tun Tun	Head, Department of Radiology, Yangon General Hospital
3.	Dr Thandar Lwin	Deptuy Director, NTP, DOH
4.	Dr Moe Zaw	Assistant Director, NTP, DOH
5.	Dr Si Thu Aung	Assistant Director, NTP, DOH
6.	Dr Hnin Wai Lwin Myo	Assistant Director, NTP, DOH
7.	Dr Tin Mi Mi Khine	Regional TB Officer, Yangon Region
8.	Dr Yin Yin	MS, TBH Aung San TB Hospital
9.	Dr Bo Myint	Regional TB Officer, Mandalay Region
10.	Dr Khin Pyone Naing	Sr Consultant Radiologist, University Medical Technology
11.	Dr Tin Tin Mar	Consultant Microbiologist, NTRL, Yangon
12.	Dr San San Shein	TB Specialist, Regional TB Centre, Yangon
13.	Dr Thandar Thwin	TB Specialist, Regional TB Centre, Mandalay
14.	U Maw Min Che	HA, NTP (Central)
15.	Technical Expert	PSI
16.	Technical Expert	JICA/JATA/RIT
17.	Dr Ikushi Onozaki	WHO HQ
18.	Representative from UNOPS	3DF
19.	Dr Ti Ti	Consultant Microbiologist (FIND)
20.	Dr Thida Aye	WHO for Mandalay
21.	Dr Myo Zaw	WHO for Yangon

Annex 4. Central Panel for Diagnosis

1.	Dr Win Maung	Director (Disease Control)
2.	Dr Thandar Lwin	Deputy Director NTP, DOH
3.	Dr Tin Mi Mi Khine	Regional TB Officer, Yangon Region
4.	Dr Tin Tin Mar	Consultant Microbiologist, NTRL, Yangon
5.	Dr Ikushi Onozaki	WHO, HQ
6.	Dr Norio Yamada	RIT/JATA
7.	Technical Expert	PSI
8.	Technical Expert	WHO

Annex 5. Central Coordinating Unit

Data Management Unit

1.	Dr Thandar Lwin	Deputy Director, NTP (Central)
2.	Dr Moe Zaw	Assistant Director, NTP, DOH
3.	Dr Si Thu Aung	Assistant Director, NTP, DOH
4.	Dr Hnin Wai Lwin Myo	Assistant Director, NTP, DOH
5.	U Maw Min Che	HA, NTP (Central)
6.	Daw Aye Mi Khin	UD, NTP (Central) responsible for laboratory
7.	Daw Khine Khine Swe	LD, Regional TB Centre, Mandalay
8.	Representative	PSI
9.	Daw Thida Nyein	WHO
10.	Daw May May Khin	WHO for laboratory
11.	Daw Mya Phone Htet	WHO

Survey Team Members
Survey Team Leaders

1.	Dr Si Thu Aung	Assistant Director, NTP,DOH,
2.	Dr Win Win Mar	Assistant Director, NTP,DOH
3.	Dr Htay Lwin	State TB Officer, Shan(East)
4.	Dr Htar Htar Oo	Assistant Director, NTP,DOH
5.	Dr Thandar Thwin	TB Specialist, Mandalay Region
6.	Dr Saw Thein	Regional TB Officer, Ayeyarwaddy Region (Reserved)
7.	Dr Tin Maung Swe	Regional TB Officer, Magway Region (Reserved)
8.	Dr Aye Thein	Regional TB Officer, Sagaing Region (Reserved)

Census Unit

1.	U Maw Min Che	Health Assistant, NTP, DOH
2.	U Aung Mon	Health Assistant, NTP, DOH
3.	U Nyunt Win	Statistical Staff, Yangon Region
4.	Daw Soe Soe	Health Assistant, NTP, DOH
5.	Daw Myat Myat Soe	LD, NTP, DOH
6.	Daw Htay Htay Win	LD, NTP, DOH
7.	Daw Yin Yin Win	LD, NTP, DOH
8.	Daw Khin Lai Win	LD, NTP, DOH
9.	Daw Zin Mar Wai	LD, NTP, DOH
10.	Daw Yin Yin Nu	UD, NTP, DOH
11.	U Thein Than Hteik	Health Assistant, MHAA
12.	U Than Kyaw Soe	Health Assistant, MHAA
13.	U Myo Aung Naing Win	Health Assistant, MHAA
14.	U Nyan Win Maung	Health Assistant, MHAA
15.	U Thu Rein Soe	Health Assistant, MHAA
16.	U Khun Chit San	Health Assistant, MHAA
17.	U Phyo Tayzar Min	Health Assistant, MHAA
18.	U Aung Min Swe	Health Assistant, MHAA
19.	U Aung Ko Ko Tun	Health Assistant, MHAA
20.	Daw Shwe Yi Win Lai Aung	Health Assistant, MHAA
21.	Daw Thi Thi Aung	Health Assistant, MHAA

Radiology (X-ray) Unit

1.	Dr San San Shein	TB Specialist, Yangon Region
2.	Dr Thin Thin Yee	Medical Officer, Mon State
3.	Dr Ohnmar Myint	Medical Officer, NTP
4.	Dr Myat Kyaw Thu	Medical Officer, Mandalay Region
5.	Dr Kyaw Htoo Myat	Medical Officer, Mandalay Region
6.	Dr Myat Myat Moe	Medical Officer, Yangon Region
7.	Dr Khing Sandar Aung	Medical Officer, Ayeyarwaddy Region
8.	Dr Thura Tun	Medical Officer, Mandalay Region
9.	Dr Nay Win Lin	Medical Officer, Kayin State
10.	Daw Aye Lwin	Radiographer
11.	Daw Sandar Lwin	Radiographer
12.	Daw Min Min Thin	Radiographer
13.	U Khin Aung Soe	Grade I
14.	U Saw Wai Htoo	Grade I
15.	Daw War War Win	Grade I
16.	Daw Win Win Htay	Grade I
17.	U Htay Min Soe	Grade II
18.	U Shwe Baw	Dark Room Assistant
19.	Daw Nwe Ni Maung	Radiographer
20.	Daw Thet Su Naing	Radiographer
21.	Daw Khin Htay Yi	Grade I
22.	Daw Su Su Myo	Grade I
23.	U Aye Thein	Dark Room Assistant
24.	U Hein Kyaw Thu	Dark Room Assistant

Laboratory Technicians

1.	Dr Wint Wint Nyunt	Microbiologist, NTRL
2.	Dr Thin Lei Swe	Microbiologist, Mandalay
3.	U Aung Min	Medical Technologist
4.	Kyi Kyi Soe	Medical Technologist
5.	Khin Khin Win	Medical Technologist
6.	Daw Aye Aye Thin	Grade I
7.	Daw Ohnmar Aung	Grade I
8.	Naw Saw Khu Sae	Grade I
9.	Daw New Ni	Grade I
10.	Daw Aye Myo Khing	Grade I
11.	Daw Tin Tin Moe	Grade I
12.	Daw Nan Cho Cho Tu	Grade I
13.	Daw Khin Hnin Swe	Grade II
14.	Daw Yin Mar Thet	Grade II
15.	Daw Hnin Wai Thazin Aung	Grade II

Other consultants supporting the survey

•	Dr Kosuke Okada	RIT/JATA, JICA Project focal point from 2008 to 2009
•	Mr Hiroaki Yamazaki	JICA: Bacteriology
•	Mr Yutaka Hoshino	RIT/JATA: Radiography
•	Dr Hidetoshi Igari	Chiba University: Respiratory Medicine/Radiology
•	Dr Hiroyuki Nishiyama	RIT/JATA, JICA Project focal point from 2010
•	Dr Satoshi Mitarai	RIT, Supra-National Laboratory

Annex 6. Prevalence survey report writing committee

1. Dr Saw Lwin, Deputy Director General (Disease Control), Department of Health
2. Dr Win Maung, Director (Disease Control), Department of Health
3. Dr Thandar Lwin, Deputy Director (TB), Department of Health
4. Dr Hnin Wai Lwin Myo, Assistant Director (TB), Department of Health
5. Dr Ikushi Onozaki, Medical Officer, WHO Headquarters, Geneva, Switzerland
6. Dr Norio Yamada, RIT/JATA, Tokyo, Japan
7. Mrs Eva Nathanson, Technical Officer, TB Unit, WHO Country Office Myanmar

Annex 7. Equipment and consumables

The equipment listed below was purchased specifically for the prevalence survey. Additional existing equipment was also used for the survey.

Equipment supported by JICA

No.	Item	Specifications	Qty
X-Ray machine, accessories, X-Ray films, etc.			
1	Portable X-ray unit with carrying case	Output: Current more than 20mA, Power: Single phase, 220V, 240V, Double insulation type (meets MDD directive). Size: Compulsory accessories, handy type, carrying case, long exposure switch cable (3 metres)	1
2	Stationary stand for portable X-ray system	Height adjustable, minute height adjustable by screw handle	1
3	Automatic X-ray film processor	Up to 14" x 17", AC single phase 220V, 240V, auto-feeder, stand, water filter kit, washing water saving kit, circulation pump system, customer parts kit	1
4	Compact dark room	Sectional type , double-layered curtain, lamp and lamp holders with carrying case, dimensions: 1200 (W) x 1200 (D) x 1800 (H) mm	1
5	X-ray protective accordion screen	Size: 1500 (W) x 1800 (H) mm, Pb contents:0.50 mm Pb	1
6	X-ray film viewer	Film viewing area: 14' x 17", front panel: acryl glass with film retention bar at top, aluminium housing, light source: 3 fluorescent tubes	1
7	X-ray film cassette (green)	Applicable to 14" x 14" film (carbon type), to be used for green type film	10
8	Microfine grid for X-ray	Focal range: 26", 32", 34", 44", 48", 72", Ratio: 8.1, type: focused	2
9	Film mark set	Lead markers in transparent plastic tablets, number: 0-9, letters: A-Z, symbols: (+ -) RL	1

10	X-ray film storage cabinet	Up to 14" x 17", 6 dozen, 1.0 mm Pb	1
11	Radiographic stand	Film size: up to 14" x 17", dimension: 450 (W) x 525 (D) x 1800 (H) mm	1
12	X-ray film (green)	14" x 14"	25 000 + 20 000
13	Generator	For portable X-ray unit, diesel engine, 22 HP/2200 rpm, 175 kg, single phase, 10 kW, 43.5A, 220/230V	2
14	Developer	Liquid for developer (2 bottles x 19 litres per box) for 10 000 films	67 + 133
15	Fixer	Liquid for fixer (2 bottles x 19 litres per box) for 10 000 films	67 + 133
Laboratory equipment			
16	Incubator	Capacity: 300 litres at least, Max. working temp: +550 °C, Min. working temp:+15 °C, door: inner safe glass door, power supply: 220V, 50/60Hz, shelves: adjustable 4 shelves	2
17	Shelf for incubator	Perforated stainless steel shelf, non-tipping (standard version)	12
18	Generator	Generator for incubator, brand new, prime KVA 45, recommended fuel: diesel	1

Equipment supported by 3DF (purchased by WHO)

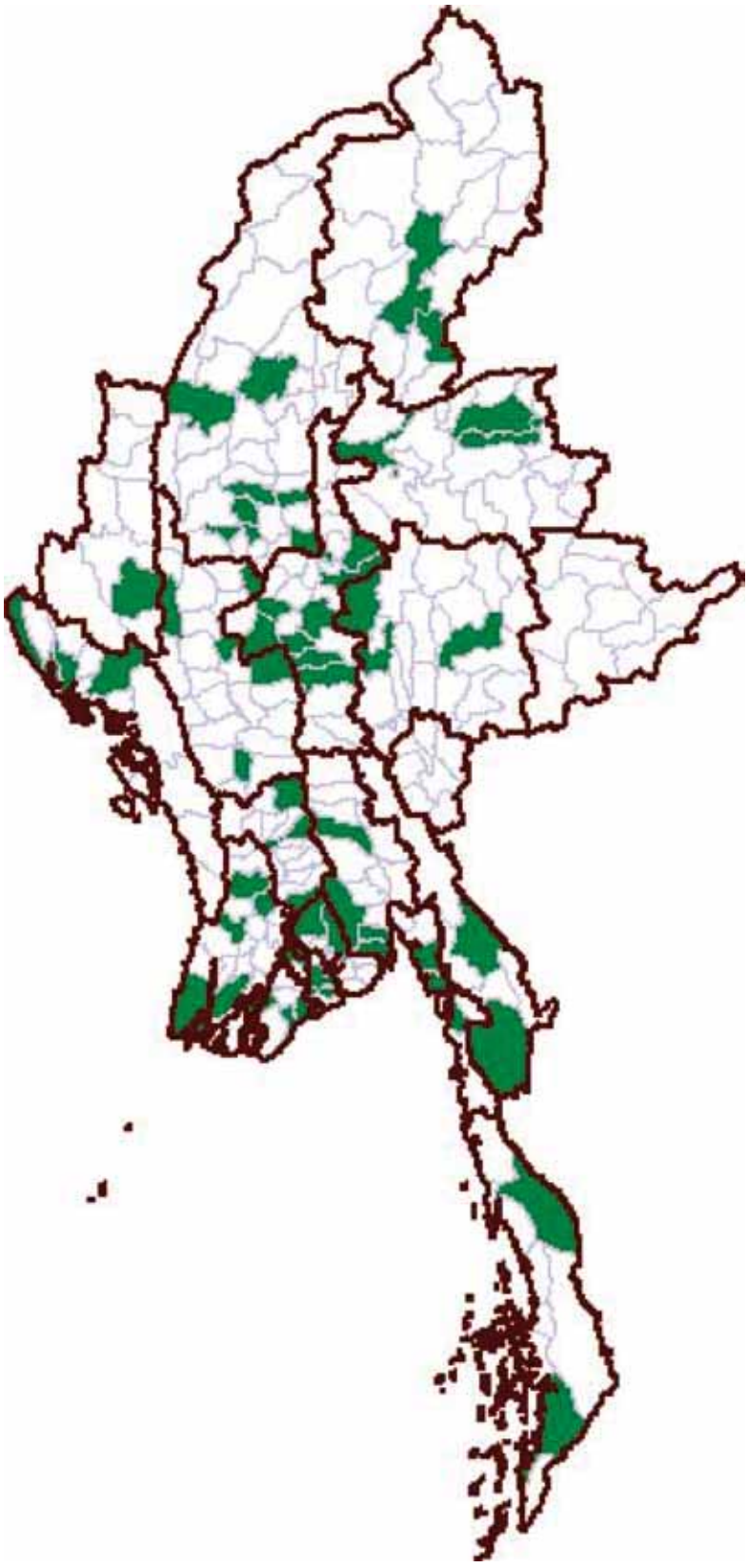
No.	Item	Specifications	Qty
1	Automatic X-ray film processor	Up to 14" x 17", AC single phase 220V, 240V, auto-feeder, stand, water filter kit, washing water saving kit, circulation pump system, customer parts kit	3
2	X-ray film viewer	Film viewing area: 14' x 17", front panel: acryl glass with film retention bar at top, aluminium housing, light source: 3 fluorescent tubes	3
3	Portable X-ray unit with carrying case	Output: Current more than 20mA, power: Single phase, 220V, 240V, double insulation type (meets MDD directive), size: compulsory accessories, handy type, carrying case long exposure switch cable (3 metres)	2
4	Stationary stand for portable X-ray system	Height adjustable, minute height adjustable by screw handle	2
5	Radiographic stand	Film size: up to 14" x 17", dimension :450 (W) x 525 (D) x 1800 (H) mm	2
6	X-ray film cassette	Applicable to 14" x 14" film (carbon type), to be used for green type film	10
7	Microfine grid for X-ray	Focal range:26", 32", 34", 44", 48", 72", ratio: 8.1, type: focused	2
8	X-ray protective accordion screen	Size: 1500 (W) x 1800 (H) mm, Pb Contents:0.50 mm Pb	6
9	Safe light		3
10	Densitometer	PDA 85, Konica	1

Annex 8. Survey clusters

Cluster Code	State/Region	Township	Urban/Rural	Participation rate (%)
01	Ayeyarwaddy Region	Dedaye	Rural	88.0
02		Hinthada	Rural	94.1
03		Ingapu	Rural	84.8
04		Mawgyun	Rural	88.8
05		Myaungmya	Rural	93.5
06		Ngaputaw	Rural	89.0
07		Nyaungdone	Rural	91.4
08		Phyarpon	Urban	82.0
09		Yekyi	Rural	90.7
10	Bago Region	Bago	Rural	86.5
11		Kawa	Rural	95.4
12		Nattalin	Rural	92.9
13		Paukkhaung	Rural	86.6
14		Phyu	Rural	93.5
15		Thanatpin	Rural	92.7
16		Tharyarwaddy	Rural	94.0
17	Chin State	Mindat	Urban	81.4
18	Kachin State	Moemauk	Urban	91.9
19		Myitkyina	Rural	65.7
20	Kayin State	Hlaingbwe	Rural	93.8
21		Kyarinnseikkyi	Rural	81.0
22	Magway Region	Chauk	Rural	93.9
23		Natmauk	Rural	92.8
24		Saw	Rural	89.7
25		Thayet	Rural	96.5
26		Yesagyo	Rural	94.3
27	Mandalay Region	Amarapura	Rural	81.2
28		Kyaukpadaung	Rural	94.9
29		Kyaukse	Rural	95.2
30		Mahaaungmyay	Urban	95.3
31		Myeikhtila	Urban	94.2
32		Pyawbwe	Rural	92.4
33		Pyinoolwin	Rural	96.2
34		Thaungthar	Rural	90.3
35		Wundwin	Rural	81.5
36		Yamethin	Rural	92.0

37	Mon State	Mawlamyine	Rural	86.5
38		Mudon	Rural	89.3
39		Paung	Rural	95.3
40		Thahton	Rural	90.8
41	Rakhine State	Maungtaw	Rural	88.5
42		Minpya	Rural	90.9
43		Ponnagyun	Rural	95.2
44		Yethaetaung	Rural	97.3
45	Sagaing Region	Budalin	Rural	95.6
46		Mawleik	Rural	84.7
47		Monywa	Urban	89.6
48		Pinlebu	Rural	97.0
49		Sagaing	Rural	90.7
50		Shwebo	Rural	94.6
51		Tapeyin	Rural	94.5
52		Yinmarpin	Rural	92.3
53	Shan(North) State	Kuitkai	Rural	89.2
54		Kulon	Rural	67.0
55		Mongmeik	Urban	87.4
56		Theinni	Urban	92.0
57	Shan(South) State	Kalaw	Rural	88.1
58		Namsum	Urban	77.6
59		Ywangan	Rural	91.5
60	Tanintharyi Region	Bokepyin	Urban	85.1
61		Dawei	Urban	77.8
62	Yangon Region	Bahan	Urban	82.7
63		Hlegu	Rural	86.1
64		Kawhmu	Rural	96.0
65		Shwepyithar	Urban	86.1
66		South Dagon	Urban	88.6
67		Southokkalapa	Urban	90.9
68		Taikkyi	Rural	92.0
69		Tarmwe	Urban	82.0
70		Twantay	Rural	95.2
	Average Participation Rate			89.2%

Map of Myanmar, with location of survey clusters marked in green



Annex 9. Individual survey card

National Tuberculosis Programme

National TB Prevalence Survey **Sr. No.** ☐

INDIVIDIAL SURVEY CARD (FORM-4)

Cluster No.		**Ward / Village**	
Township / Division		**Date**	
Filled by		**Code**	/ /
Participation:	**Agreed with consent**	**Refused**	**Absent, reason . . . . . .**

1. Name _____
2. Age (completed years) ☐☐
3. Sex (1.Male 2. Female) ☐
4. Body weight ☐☐ Kg
5. Height ☐☐ Cm
6. Occupation _____ (please specify) ☐

   (1.Professional, technical and worker 2.Own Business 3. Merchant 4. Service worker (including Government servant) 5. Sale worker 6. Agricultural, animal husbandry and forestry worker, fisherman and hunter 7.Production and related worker, transport, equipment operator and laborers 8.Workers not classified by occupation 9.House wife 10.student 11.Dependent 12. Religious person 13. Others _____)
7. Religion (1.Buddhist 2.Christian 3.Hindu 4.Islam 5.Others _____) ☐
8. Marital status (1.Single 2.Married 3.Separated/divorced 4.Widow/Widower) ☐
9. Education (1.Illiterate 2. can read/write 3.Primary school 4.Middle school 5.High school 6.College and University 7.Graduate) ☐
10. Smoking status (1.Never smoked 2.smoked in the past 3.Current smoker) ☐
11. Alcohol drinking (1. Never drink 2.drunk in the past 3. current drinker) ☐
12. Do you suffer any illness/symptom within one month? (1. Yes, 2. No) ☐
13. If Yes, What are the symptoms?

    If No, continue No. 14.

			Duration of symptom
1) Cough	(1.Yes 2.No) ☐	if yes	_____ months_____ days
2) Expectoration	(1.Yes 2.No) ☐	if yes	_____ months_____ days
3) Haemoptysis	(1.Yes 2.No) ☐	if yes	_____ months_____ days
4) Weight loss	(1.Yes 2.No) ☐	if yes	_____ months_____ days

5) low grade fever (1.Yes 2.No) ☐ if yes _____ months_____ days

6) Chest pain (1.Yes 2.No) ☐ if yes _____ months_____ days

7) Others _____ (1.Yes 2.No) ☐ if yes _____ months_____ days

14. If No. 12 is NO., ask about any cough, expectoration, blood streak sputum and weight loss and fill up in above boxes. According to No. 12 & 14, please write your opinion that person is a TB suspect or not.

TB suspect means a person who has cough more than 3 weeks and or have haemoptysis.

Opinion: TB suspect (1.Yes 2.No) ☐

15. What do you usually do if you have any of above TB symptoms (1-8)? Only first action. (1 Nothing or neglect the symptom 2. .Self treatment 3. Pharmacy 4. Private GP 5. Specialist clinic 6. Public hospital 7.Traditional healer 8.Others _____) ☐

16. Any current TB treatment? (1.Yes 2.No) If no continue to No. 18. ☐

17. If yes, from where are you taking treatment? (1.Township health center 2. public hospital 3. Private clinic 4. private hospital 5. pharmacy 6.others _____) ☐

18 Any previous TB treatment was taken. (1.Yes 2. Not sure 3. No) (If No, go to (22) ☐

19. How many times treated for TB? (1.One time 2.Two times 3. More than two times) ☐

20. From where have you been treated? (1.Township health center 2. public hospital 3.Private clinic 4. private hospital 5. pharmacy 6.others _____) ☐

21. When was your last anti-TB treated? _____ year. (for eg. 1999) ☐

22. Any contact with TB patients either at home or working environment? (1.Yes 2.No) ☐

23. Any associated medical diseases (1.Nil 2.Diabetes 3.HIV 4.Others _____) ☐

24. Chest X-ray examination (1.yes 2.refused 3. Not taken X-ray. reason _____) ☐

25. Chest X-ray field reading result: ☐

1.Normal	5. Other Lung diseases
2. Active TB	6. Heart disease
3. Healed TB	7.Others findings in lung
4. TB suspect	8. Others _____

26. **Request for sputum collection (1.Yes 2.No)** ☐

27. Sputum Examination results:

Specimen	Collected date	Result of smear exam.			Result of culture			
		Positive	Neg.	Remarks	Positive	Neg.	Contaminated	PNB
1 (Spot)								
2 (Home)								

For smear examination result - to record either Not collected or Negative or Positive or Not applicable.

If smear positive, grading is to be provided.

For culture result - to record either Not applicable or Negative or Positive or Contaminated.

If culture positive, grading is to be provided.

For identification: to record either Non TB or TB or Not applicable or pending.

28. Result of central X-ray unit ☐

1. Normal
2. Active TB
3. Healed TB
4. TB suspect
5 .Other Lung diseases
6. Heart disease
7. Other findings in lung
8 . Others_____

29. Final Diagnosis: ☐

(1.No 2. Smear positive TB 3. Smear negative /culture positive TB 4. Bacteriologically negative, active TB suggested 5. TB suspect 6. Healed TB)

30. Other findings: ☐

(1. No abnormality 2. Other lung disease (active) 3. Other finding (inactive) 4. Heart disease 5. Other _____)

Annex 10. Laboratory procedures

a. Preparation of Auramine O Fluorescence staining reagents

Ingredients

Auramine O	3 g
Ethanol-95%	300 ml
Phenol crystals	90 g
Hydrochloric Acid, concentrated	5 ml
Ethanol-70%	1000 ml
Potassium permanganate	5 g
Distilled water	3610 ml

Preparation of staining solutions

1) Auramine O Stain (0.1%)

The above weighed auramine powder was dissolved in ethanol-95% for 1% stock solution (300 ml of solution A). The above weighed phenol crystals were dissolved in 2610 ml of distilled water for 3% stock solution (2700 ml of solution B). One part of solution A and nine parts of solution B were mixed for working solution of 0.1% auramine O stain and kept in amber bottle.

2) Acid alcohol decolorizer (0.5%)

To 1000 ml of 70% ethanol, 5ml of concentrated hydrochloric acid was carefully added.

3) Potassium permanganate counter-stain (0.5%)

The above weighed 5 g of potassium permanganate powder was dissolved in 1000ml of distiller water.

b. Method of Fluorescence staining and microscopy

- Smears were made carefully avoiding thick areas and placed on the staining rack keeping space between each other.
- After allowing to be dried in air, heat fixation was made by applying gentle heat under the slides.
- The smears were flooded with filtered 1% auramine O stain for 15 minutes.
- After that the smears were washed with clean running water and drained.
- Smears were then flooded with acid alcohol decolourizer and washed after 2 minutes.
- Then the smears were washed with clean running water and drained.
- Finally the smears were counterstained with potassium permanganate solution for 2 minutes and washed with clean water.
- The stained slides after air drying are stored serially in slide boxes and kept away from light.

- Reading of smears was made within 24hours with Fluorescent Microscope in dark room.
- Those smears showing positive were re-stained with Ziehl-Neelsen Staining.
- Grading was given according to Grading scales for bright field (Ziehl-Neelsen) and fluorescence microscopy.

c. Preparation of Ziehl-Neelsen staining reagents

Ziehl-Neelsen Stain

1) Carbol fuchsin solution { ZN (I) }

a) Stock alcoholic fuchsin

Fuchsin (basic) 25 g
Ethanol (95%) 800 ml

To the above weighed basic fuchsin powder, ethanol was added slowly while shaking the flask gently till all the powder dissolved.

b) 5% Phenol solution

Phenol melted 50 ml
Distilled water (Purified water) 950 ml

The cap of phenol reagent bottle was loosened and bottle placed in gentle warm water bath till the solid phenol melted. The phenol was added slowly into distilled water while stirring.

c) Ziehl's solution (1% Carbol fuchsin solution) { ZN (I) }

Stock alcoholic fuchsin 100 ml
5% Phenol solution 900 ml

The alcohol fuchsin solution was added slowly to phenol solution while stirring. This Ziehl's solution was filtered before use to remove the fuchsin crystals and particles. All the above solutions were stored in amber bottles.

2) 25% Sulphuric Acid { ZN (II) }

Concentrated sulphuric acid 250 ml
Distilled water (Purified water) 750 ml

Into the flask containing 750 ml of distilled water, concentrated sulphuric acid was added carefully and slowly along the inner side of the flask. The flask was placed in the middle of bowl containing cool water.

3) 01% Methylene Blue { ZN (III) }

Methylene blue 1 gm
Distilled water (Purified water) 1000 ml

Into the flask containing 500 ml of water methylene blue powder was added and shake slowly till all the powder dissolved. Then another 500 ml of water was added.

d. Method of Ziehl-Neelsen staining and microscopy

- The smears were flooded with filtered 1% Carbol fuchsin solution (ZN-I) and gentle heat was applied from below the slide until steam came out. After 5 minutes the stain was drained.
- Then the smears were washed with clean running water and drained.
- Smears were then flooded with 25% Sulphuric Acid (ZN-2) and left for 2-4 minutes. This step was repeated until the red/purple colour went off.
- Then the smears were washed again with clean running water and drained.
- After that the smears were counterstained with methylene blue ZN-3 solution for 30 seconds.
- Washed with clean water and drained.
- Air dried and examined under microscope with 100x immersion lens.
- Grading given according to grading scales for bright field (Ziehl-Neelsen) and fluorescence microscopy.

e. Reporting of smear microscopy results

Grading scales for bright field (Ziehl-Neelsen) and fluorescence microscopy # to adjust for altered magnification of fluorescent microscope divides the number of organisms seen by the factor provided and refer to column 1 for range and column 2 for what to report.

<table>
<tr><th rowspan="2">1
Carbol Fuchsin
1000X
(Ziehl-Neelsen)</th><th rowspan="2">2
Report</th><th colspan="2">3
Fluorescent microscopy magnification#</th></tr>
<tr><th>250 x</th><th>450 x</th></tr>
<tr><td>Zero</td><td>No acid-fast bacilli seen</td><td>zero</td><td>zero</td></tr>
<tr><td>1-9 AFB/ 100fields</td><td>Read exact count</td><td rowspan="4">Divide observed count by 10</td><td rowspan="4">Divide observed count by 4</td></tr>
<tr><td>10-99 AFB/ 100fields</td><td>1+</td></tr>
<tr><td>1-10 AFB/ field</td><td>2+</td></tr>
<tr><td>>10 AFB/ field</td><td>3+</td></tr>
</table>

Example : Suppose 20 acid-fast bacilli are observed per field using the 450x magnification. If this number is divided by the magnification factor of 4 according to the table, the comparable number of bacilli that would have been observed under 1000 x is 5 per field. The laboratory result should therefore read 2+,and not 3+, as originally indicated by 20 acid-fast bacilli per field.

Reference : WHO (1988) Pg .44

f. Preparation of Ogawa medium

Ingredients of Ogawa Medium

Salt Solution

Mono potassium phosphate (KH_2PO_4)	3 g
Sodium glutamate	1 g
Distilled water	100 ml
Glycerol	6 ml
2% malachite green	6 ml
Whole egg homogenate	200 ml

Preparation of salt solution (A)

Mono potassium phosphate and Sodium glutamate were dissolved in distilled water by shaking and autoclaved at 121° C for 15 minutes.

Preparation of whole egg homogenate (B)

The outer shell of the eggs was cleaned with brush in soap water and then in clean running tap water. Then dried up in the clean basket. The outer surface of the eggs were then wiped with spirit soaked cotton wool. The egg shell was cracked one by one and the contents poured into separate Petri dish. The freshness of egg was checked. Only the fresh ones were used and pooled into a clean sterile blender for homogenization. Then filter through 2 layers of sterile gauze into a 1000 ml size sterile cylinder.

Preparation of medium

The glycerol and malachite were added to the above solution (A) and cooled down to room temperature by gentle swirling. Then the whole egg homogenate (B) was gently poured along the side wall of the flask taking care not to form air bubbles. Gentle mixing was made and allowed to stand for 30 minutes. Five to six ml of complete raw medium was poured along the side wall of the sterile universal containers slowly to avoid air bubble formation. The media bottles were placed in the slant rack and inspissated for 60 minutes at 85° C.

Sterility Testing

The media bottles after cooling down were put in upright position into plastic bags with date of preparation labeled. The mouth of plastic bags was tightened with rubber band and incubated at 37° C for 48 hours. The media bottles with contamination, dryness of the surface and bubbles were discarded and the rest stored in refrigerator before use.

Annex 11. Methods of estimating overall prevalence of bacteriologically positive TB

Analysis was carried out following the methods recommended by the revised manual for the prevalence survey.

11.1 Categorization of survey population according to status of eligibility, participation and screening and identified TB disease to assess completeness of survey operation

The population included in the census activities of the prevalence survey was categorized by status of eligibility, participation, interview, CXR, eligibility for sputum examination and availability of sputum examination results. TB cases were determined by the Central Panel for Diagnosis as described in Sections 2.4.3 and 2.9.3 of this report.

11.2 Methods of estimating overall prevalence

11.2.1 Cluster-level analysis of prevalence

(Method 0 in Tables 30 and 31)

As a simple summary figure, the cluster-level average prevalence was calculated. The unit of analysis was the cluster. The average cluster-level prevalence was a point estimate of prevalence in the survey participants. Standard error was calculated by dividing the standard deviation of the cluster-level prevalence by the square root of the number of clusters.

Table 30. Prevalence of smear-positive TB by different analytical methods

No.	Analysis method	N	No. cases	Point estimates	LL	UL	DEFF
0	**Cluster-Level Analysis**	51 367	123	0.002423	0.001761	0.003085	
1	**No-imputation, adjusted for size of participants** (Classic survey analysis, logit model) (Stata command) svyset cluster [pweight = *inverse of no. participants in each cluster*], strata(stateregion) (Stata command) svy: logit allbpstudyc	51 367	123	0.002423	0.001861	0.003153	2.1764
1b	**No-imputation, adjusted for size of participants** (Classic survey analysis, without logit transformation) (Stata command) svyset cluster [pweight = *inverse of no. participants in each cluster*], strata(stateregion) (Stata command) svy: mean allbpstudyc	51 367	123	0.002423	0.001784	0.003062	
2	**Random-effects logit model** (Stata command) xtlogit allbpstudyc, re i(cluster)	51 367	123	0.001724	0.001247	0.002384	

No.	Analysis method	N	No. cases	Point estimates	LL	UL	DEFF
1-2	**No-imputation, adjusted for eligible population** (Classic Survey Analysis for estimating population figure, logit model)	57 607	123	0.002435	0.001869	0.003171	
1-3	**No-imputation, adjusted for population structure (national estimates)** (Classic Survey Analysis, logit model)			0.002441	0.001889	0.003154	
1-4	**No-imputation, adjusted for population structure (UN estimates)** (Classic Survey Analysis, logit model)			0.002467	0.001910	0.003185	
Primary method: Multiple imputation*							
3-1	**Imputation among participants** (classical analysis)	51 367		0.002534	0.001966	0.003264	
3-2	**Imputation among participants, adjusted for eligible population** (classic survey analysis, logit model)	57 607		0.002544	0.001974	0.003280	
3-3	**Imputation among participants, adjusted for population structure (national estimates) by IPW**** (classic survey analysis, logit model)	-		0.002550	0.001994	0.003262	
3-4	**Imputation among participants, adjusted for population structure (UN estimates) by IPW** (classic survey analysis, logit model)	-		0.002578	0.002016	0.003295	
Alternative methods							
3-1a	**Imputation among participants** (classic survey analysis)	51 367		0.002585	0.001998	0.003343	
3-2a	**Imputation among participants, adjusted for eligible population** (classic survey analysis, logit model)	57 607		0.002596	0.002006	0.003360	
3-3a	**Imputation among participants, adjusted for population structure (national estimates) by IPW** (classic survey analysis, logit model)	-		0.002600	0.002024	0.003339	
3-4a	**Imputation among participants, adjusted for population structure (UN estimates) by IPW** (classic survey analysis, logit model)	-		0.002626	0.002044	0.003373	

*Multiple imputation: details in Analysis Methods

**IPW: inverse probability weighting

Table 31. Prevalence of bacteriologically positive TB by different analytical methods

	Analysis Methods	N	No. Cases	Point estimates	LL	UL	DEFF
0	**Cluster-Level Analysis**	51 367	311	0.006128	0.004873	0.007384	
1	**No-imputation, adjusted for size of participants** (Classic survey analysis, logit model) (Stata command) svyset cluster [pweight = *inverse of no. participants in each cluster*], strata(stateregion) (Stata command) svy: logit allbpstudyc	51 367	311	0.006128	0.005022	0.007476	3.14851
1b	**No-imputation, adjusted for size of participants** (Classic survey analysis, without logit transformation) (Stata command) svyset cluster [pweight = *inverse of no. participants in each cluster*], strata(stateregion) (Stata command) svy: mean allbpstudyc	51 367	311	0.006128	0.004909	0.007348	
2	**Random-effects logit model** (Stata command) xtlogit allbpstudyc, re i(cluster)	51 367	311	0.004988	0.004067	0.006117	
1-2	**No-imputation, adjusted for eligible population** (Classic survey analysis for estimating population figure, logit model)	57 607	311	0.006172	0.005076	0.007502	
1-3	**No-imputation adjusted for population structure (national estimates)** (Classic survey analysis, logit model)			0.006123	0.005007	0.007486	
1-4	**No-imputation, adjusted for population structure (UN estimates)** (Classic survey analysis, logit model)			0.006139	0.005018	0.007509	
Primary method: Multiple imputation*							
3-1	**Imputation among participants** (Classic survey analysis)	51 367		0.006871	0.005640	0.008370	

	Analysis Methods	N	No. Cases	Point estimates	LL	UL	DEFF
3-2	**Imputation among participants, adjusted for eligible population** (Classic survey analysis, logit model)	57 607		0.006916	0.005700	0.008389	
3-3	**Imputation among participants, adjusted for population structure (national estimates) by IPW**** (Classical survey analysis, logit model)	-		0.006865	0.005628	0.008371	
3-4	**Imputation among participants, adjusted forpopulation structure (UN Estimates) by IPW** (Classic survey analysis, logit model)	-		0.006887	0.005643	0.008402	
Alternative methods							
3-1a	**Imputation among participants** (Classic Survey Analysis)	51 367		0.006972	0.005734	0.008476	
3-2a	**Imputation among participants, adjusted for eligible population** (Classic survey analysis, logit model)	57 607		0.007012	0.005782	0.008501	
3-3a	**Imputation among participants, adjusted for population structure (national estimates) by IPW** (Classic survey analysis, logit model)			0.006956	0.005715	0.008465	
3-4a	**Imputation among participants, adjusted for population structure (UN estimates) by IPW** (Classic survey analysis, logit model)			0.006975	0.005723	0.008498	

*Multiple imputation: details in Analysis Methods

**IPW: inverse probability weighting

11.2.2 Individual-level analysis of prevalence by different methods

Based on the status mentioned in the above, the prevalence of smear-positive and bacteriologically positive cases was estimated by the following methods. Instead of Model 1 and Model 2 in Table 32, these methods were based on survey data analysis, which could take into account sampling weights to adjust cluster size and stratification.

Table 32. Analysis methods described in the manual and applied in this report*

Model 1. Robust standard errors
This model does not account for variation in the number of individuals per cluster, or correlation among individuals in the same cluster when estimating the point prevalence of pulmonary TB. Equal weight is given to each individual in the sample. However, the model does correct for clustering (by using the observed between-cluster variation) when estimating the 95% confidence interval, and can control for the strata that were part of the survey design. This model exactly corresponds to the classical analysis of surveys (svy commands with Stata) when one does not need to adjust for sampling weights. This is indeed the case in the self-weighting survey design for nationwide TB prevalence surveys. This model is restricted to survey participants (=N2 in Table 34).
Model 2. Robust standard errors with missing value imputation
This model uses (multiple) missing value imputation for individuals: a) without a field CXR result and/or symptom screening, and b) for individuals with a positive CXR result or TB symptoms but without smear and/or culture results, in order to include all individuals who were eligible for the survey in the analysis (=N2 in Table 34). This model allows for both the clustering in the survey design and the uncertainty introduced by imputation of missing values when estimating the 95% confidence interval for the prevalence of pulmonary TB.
Model 3. Random-effects logistic regression
This model takes account of both clustering and variation in the number of individuals per cluster when estimating both the point prevalence of pulmonary TB and its 95% confidence interval. As with Model 1, this model is restricted to survey participants (=N2 in Table 34).
Model 4. Random-effects logistic regression with missing value imputation
This model takes account of both clustering and variation in the number of individuals per cluster when estimating both the point prevalence of pulmonary TB and its 95% confidence interval, and also incorporates imputation of the missing data. It includes all individuals who were eligible for the survey in the analysis (=N2 in Table 34).
Model 5. Robust standard errors with missing value imputation (for individuals eligible for sputum examination) and inverse probability weighting (IPW) (applied to all survey participants)
Missing value imputation is used for individuals eligible for sputum examination (defined as having a field CXR reading that was abnormal and/or TB symptoms) for whom data from one or more of the central CXR readings, some symptom questions, and smear and culture results were not available. Survey participants were defined for this analysis as individuals who had a CXR that was technically adequate and also participated in the symptom screening survey. IPW was then used to correct for differentials in participation in the survey by age, sex, and cluster. Through the combination of imputation of missing data and the use of weights, the analysis aims to represent the whole of the survey eligible population (=N1 in Table 34), but the weights are applied only to individuals who were screened by both CXR and symptoms (=N5 in Table 34).

*Text of this table is from the manual description

a) Non-imputation model (Logit model designed for survey data)

(Method 1 in Tables 30 and 31)

This model is a classic design-based analysis for survey data. It takes into account clustering, sampling weights and stratification in point estimates and standard errors. After specifying sampling weight (inverse of the number of participants in each cluster), primary sampling unit (PSU) (cluster number) and stratification (state/region) in svy set command in Stata, svy: logit command is used to compute a point estimate and its standard error. The denominators consist of participants and the numerators are detected TB cases.

b) Imputation model for participants (Survey Logit model with imputation among participants)

(Methods 3-1 and 3-1a in Tables 30 and 31)

Table 33. Imputation methods used in this report

A. Missing values to be imputed
A.1 Missing value in outcome variables (sputum-positive TB and bacteriologically positive TB) is set for the following: i. Participants categorized as eligible for sputum examination by symptom (including cough with unknown duration) but having no or only one decisive result of sputum examination ii. Participants eligible for sputum examination by field CXR reading (variable n59sputx) regardless of types of shadows, but having no or only one decisive result of sputum examination iii. Participants having abnormal shadow detected by central CXR reading but having no or only one decisive result of sputum examination
A.2 Missing value in exposure variables is set for the following: i. The results of field CXR reading if they are uninterpretable ii. The results of central CXR reading if they are uninterpretable iii. The results of filed and central CXR reading if CXR is not taken iv. Body mass index (BMI) if it is unknown Symptom with duration of cough unknown is regarded as TB symptom. Unknown history of previous treatment and contact with TB patients is regarded as "no history".
B. Imputation models
B.1. Primary model: Major variables which are associated with bacteriologically positive TB in clued analysis are included. These are state/region, urban/rural, age group, sex, religion (Buddhist or not), education level (illiterate or not), occupation (agriculture or not), smoking and drinking habits, histories of previous TB, current TB and contact with TB, BMI, field CXR results and central CXR results (no abnormal shadow in lung/lung shadow unrelated to TB/healed TB/suspect TB/active TB).
B.2. Alternative model Bacteriological status of those with only one decisive result (negative) is not taken into account in the primary model because it is regarded as a missing value. This may not be appropriate because one available result is not taken into account. An alternative model imputes specimen-wise smear and culture results. After imputation, status of TB is determined by a combination of them. Some positive results are not regarded by the Central Panel as "TB positive" due to cross-contamination and/or MOTT. They are re-coded as negative in the imputation model.
B.3. Implementation of multiple imputation The following commands are implemented on Stata/MP 11.2 for Windows (StataCorp, Texas): - ice for imputation. The number of imputations is 10 - mi estimate: svy: logit for estimation after setting strata, PSU, weights, poststrata and postweight

In this model, imputation of TB status among those eligible for sputum who did not have bacteriological results, which are regarded as negative in Method 1 (Tables 30 and 31), is made. The subjects included in the analysis are the participants. After multiple imputation and specifying sample weights, PSU and stratification in the same way as Method 1b (Tables 30 and 31), estimation is made for the imputed dataset by specifying the sample weight as the inverse of the number of participants. The imputation methods in Table 33 are applied.

c) **Imputation for participants with IPW for adjusting for the eligible population** *(Methods 3-2 and 3-2a in Tables 30 and 31)*

While participation rate is acceptable, this model takes into account non-participants under assumption of "missing at random" between sex/age group-wise participation and bacteriologically positive TB. This model combined the above ii) and the adjustment by IPW. After imputation mentioned above, weights are given reflecting size of the total eligible population and sex/age group-wise and inverse probability for sex/age group-wise participation at the cluster level.

d) **Adjustment for the population structure of the country (Imputation for participants with IPW for adjusting for age/sex structure of national and UN estimated population)**

(Methods 3-3, 3-3a, 3-4 and 3-4a in Tables 30 and 31)

Because the proportion of males is lower in the survey population than national and UN estimated population, post-stratification for age group and sex was made. For some reason, there may be a difference in the population distribution by sex and age group between the survey-eligible population and the population of the country. Post-stratification weights proportional to population size of sex/age group of the country population are given to participants after imputation mentioned in ii) above.

11.3. Estimated overall prevalence of bacteriologically positive TB from the survey

11.3.1 Categorization of survey population according to status of eligibility, participation and screening and identified TB disease to assess completeness of survey operation

Among 93 806 individuals captured in the census at the survey sites, 57 607 were eligible for the TB screening. Of these, 51 367 participated in the TB screening. All 51 367 participants responded to the interview. A CXR was not taken from 1126 individuals (the major known reason for this was pregnancy). Thus 50 241 persons underwent both an interview and CXR (see Table 34).

Some discrepancies were found between the variable of sputum request and judgment based on combination of TB symptoms and CXR shadows. Table 34 is based on the variable of sputum request based on TB symptoms and the variable of sputum request based on CXR findings. Some participants with CXR results recorded as active TB or TB suspects were not ask to submit to a sputum examination. Although this discrepancy may be caused by incorrect data recording or inadequate on-site quality control of CXR results, the conservative assumption should be that they were actually eligible for sputum examination. Table 35 is based on this assumption. Based on the variable of sputum request, 12 165 persons were regarded as the eligible for sputum examination (Table 34). Based on judgment including CXR results, 12 194 were eligible for sputum examination (Table 35).

Availability of sputum examination results is judged by matching with the laboratory register database. Although unmatched status may be due to incorrect data entry, it is regarded as "no laboratory results". All positive results of smear and culture examinations are listed by laboratory staff and reviewed by the Central Panel. By this definition, out of 12 165 individuals eligible for sputum examination in Table 34, 11 937 (98.1%) have two smear results and 11 957 (98.3%) have at least one culture result. Out of 12 194 individuals eligible for sputum examination in Table 35, 11 951 (98.0%) have two smear results and 11 971 (98.2%) have at least one culture result.

According to the database matching, there were 56 persons (N7b in Table 35) who were ineligible for sputum

Table 34. Categorization of survey population and TB screening implementation (based on variables of sputum request)

Survey Population and Status	Abbreviation	Number	Proportion	Identified TB cases		
				S+TB	S-C+TB	B+TB
Population under census	N	93 806				
Eligible population	N1	57 607	61.4% of population under census			
Participants	N2	51 367	89.2% of eligible population	123	188	311
Received symptom screening	N3	51 367				
Received CXR	N4	50 241				
Not received CXR		1 126				
Received both	N5	50 241				
Eligible for sputum exam based on symptoms and CXR[1]	N6	12 165		123	186	309
At least two smears examined	N7	11 937	98.1% of those eligible for sputum exam			
At least one culture done	N8	11 957	98.3% of those eligible for sputum exam			
Ineligible for sputum examination[2]	N6b	39 202		0	2	2
At least two smears examined	N7b	70				
At least one culture done	N8b	70				

(Footnotes)

1 Judged as TB symptomatic and/or as having CXR shadow eligible for sputum examination or having no CXR examination.

2 All participants except those meeting the criteria of note 3 above.

Table 35. Categorization of survey population and TB screening implementation (including persons with field reading recorded as active/suspect but who did not have sputum request recorded)

Survey Population and Status	Abbreviation	Number	Proportion	Identified TB cases		
				S+TB	S-C+TB	B+TB
Population under census	N	93 806				
Eligible population	N1	57 607	61.4% of population under census			
Participants	N2	51 367	89.2% of eligible population	123	188	311
Received symptom screening	N3	51 367				

Received CXR	N4	50 241				
Not received CXR		1 226				
Received both	N5	50 241				
Eligible for sputum examination based on symptoms and CXR*	N6	12 194		123	186	309
At least two smears examined	N7	11 951	98.0% of those eligible for sputum exam			
At least one culture done	N8	11 971	98.2% of those eligible for sputum exam			
Ineligible for sputum examination	N6b	39 173		0	2	2
At least two smears examined	N7b	56				
At least one culture done	N8b	56				

*This consists of those eligible in Table 2 and those who have field CXR reading results recorded as active/suspect TB but who are not categorized as eligible for the sputum examination.

examination according to the protocol but who had laboratory results. Among them, two smear-negative, culture-positive cases were detected. The identification was confirmed by checking name, age and sex between survey questionnaire form, CXR register and laboratory register. One of them had a TB-suggestive shadow according to Central and panel reading of the CXR film. Therefore actual field reading results may have been active TB after on-site quality control and the CXR may have been incorrectly recorded. However the other had no abnormality in the CXR. In this analysis, both individuals are included as smear-negative, culture-positive TB cases because the central panel regarded them as TB cases.

11.3.2 Prevalence

a) Cluster-level analysis of prevalence

Table 29 summarizes the eligible population, participants and detected TB cases at cluster level. The prevalence by cluster-level analysis is 242.3/100 000 population and 612.8/100 000 population for smear-positive TB and bacteriologically positive TB, respectively.

b) Individual-level analysis of prevalence by different methods

Including cluster-level analysis, TB prevalence estimated by different models is shown in Tables 30 and 31. The adopted imputation models, including the several variables associated with bacteriologically positive TB with/without the adjustment for eligible population structure (explained above), show an increase in estimated prevalence of up to about 10% from the figure derived from non-imputation analysis. The random-effects model without weights produces point estimates more than 10% lower than the survey data analysis. The primary objective of the prevalence survey is to estimate a population average rather than that of clusters. Therefore the design-based classic survey analysis is appropriate for this purpose.

c) Adjustment for population structure

The survey-eligible population of individuals aged 15 or over was compared with the estimated population from the Statistical Yearbook and the UN population estimate. The proportion of males in the survey population was lower than in these country population estimates. The difference between prevalence in the non-adjusted population and prevalence adjusted for population structure was not large, i.e., less than 5%.

Annex 12. Photographs from the survey

Examination with fluorescence microscope

Niacin testing in Bio-safety cabinet

Supervision by technical expert at NTRL for quality assurance

Central CXR

Reassessment of CXR by

Central supervision in the field

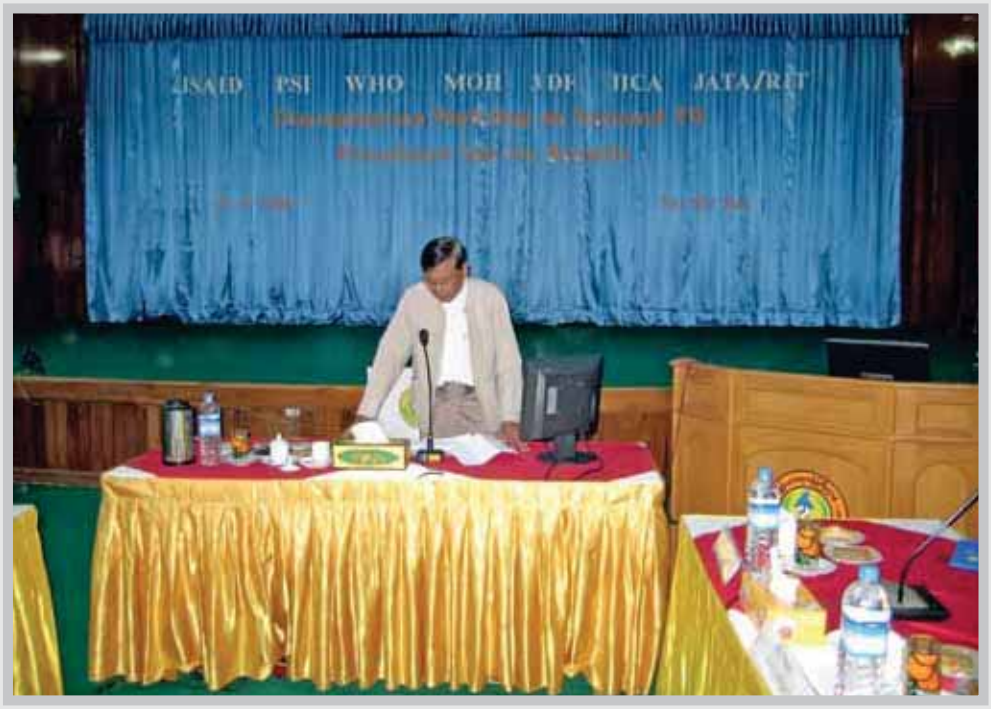
Joint supervision with partners (INGOs)

Feedback meeting with technical experts

Steering Committee Meeting

Experts Meeting for Preliminary Results

Annex 13. Photographs from the dissemination workshop in Nay Pyi Taw, 15 December 2010



H.E. Professor Dr Mya Oo, Deputy Minister for Health, delivering the opening speech on dissemination of results of National TB Prevalence Survey.

Annex 14.

Photographs from the dissemination workshop in Yangon, 16 December 2010

Annex 15. Forms used in the survey

Department of Health
National Tuberculosis Programme
National TB Prevalence Survey

Pre visit report (Form 1)

Date: _____ **Cluster No.** _____ **Ward/village** _____
District / township: _____ **State/Region:** _____

S.No.	Items	Remarks
1.	Total population	
2.	Census	
3.	Map	
4.	Name of local health authority and contact address	
5.	Name of local authority and contact address	
6.	Distance from TMO office to survey site	
7.	Route to travel to survey site (Please mention if more than one mean of traveling)	
8.	Estimated traveling time	
9.	Estimated traveling cost	
10.	Estimated fuel needs for traveling	
11.	Weather condition	
12.	Open season	
13.	Availability of electricity	
14.	Availability of fuel	
15.	Survey location: possibility of hiring a place for screening center (including tables/chairs)	
16.	Accommodation for team members	
17.	Food / water arrangement	
18.	Availability of local volunteers	
19.	Availability of lab. technician and 5 BHS	
20.	Frequency of sputum transportation and cold chain and how	
21.	Needs of translator	
22.	Clear explanation on difference between TB prevalence survey and specialist tour / mobile team to local authorities	
23.	Others	

Team leader _____
Team ( )

Ministry of Health, Myanmar
Department of Health
National Tuberculosis Programme
National TB Prevalence Survey

Cluster List

Cluster No.	State/Region	Township	Population in 2008	Survey site	Remarks
01	Ayeyarwaddy	Dedaye	262104		Portable
02	Region	Hinthada	490592		Portable
03		Ingapu	328741		Portable
04		Mawgyun	351946		Portable
05		Myaungmya	425568		Portable
06		Ngaputaw	354633		Portable
07		Nyaungdone	257668		X-ray car
08		Phyarpon	264328		Portable
09		Yekyi	285416		Portable
10	Bago Region	Bago	495448		X-ray car
11		Kawa	252884		Portable
12		Nattalin	219091		Portable
13		Paukkhaung	139075		Portable
14		Phyu	281944		X-ray car
15		Thanutpin	191038		X-ray car
16		Thayawaddy	172631		Portable
17	Chin State	Mindat	41230		Portable
18	Kachin State	Moemauk	95123		Portable
19		Myitkyina	260855		Portable
20	Kayin State	Hlaingbwe	359399		Portable
21		Kyarinseikkyi	271730		Portable
22	Magway	Chauk	316012		X-ray car
23	Region	Natmauk	240676		X-ray car
24		Saw	88465		Portable
25		Thayet	107350		Portable
26		Yesagyo	247759		X-ray car
27	Mandalay	Amarapura	190484		X-ray car
28	Region	Kyaukpadaung	394674		X-ray car
29		Kyaukse	249629		X-ray car
30		Mahaaungmyay	214221		X-ray car
31		Myeikhtila	469154		X-ray car
32		Pyawbwei	346162		X-ray car
33		PyinOoLwin	203859		Portable
34		Taungtha	349472		X-ray car
35		Wundwin	299373		X-ray car
36		Yamethin	305217		X-ray car
37	Mon State	Mawlamyine	461532		X-ray car
38		Mudon	204928		X-ray car
39		Paung	236077		X-ray car
40		Thahton	352113		X-ray car

Cluster No.	State/Region	Township	Population in 2008		Remarks
41	Rakhine	Maungdaw	450265		Portable
42		Minbya	203590		Portable
43		Ponnagyun	137061		Portable
44		Yathaedaung	173141		Portable
45	Sagaing	Budalin	190494		Portable
46	Region	Mawleik	61748		Portable
47		Monywa	411989		X-ray car
48		Pinlebu	134083		Portable
49		Sagaing	396784		X-ray car
50		Shwebo	350281		Portable
51		Tabayin	184169		X-ray car
52		Yinmabin	174024		Portable
53	Shan State	Kuitkai	201840		Portable
54	(North)	Kunlon	146974		Portable
55		Mongmeik	75244		Portable
56		Theinni	77361		Portable
57	Shan State	Kalaw	152891		Portable
58	(South)	Namsan	91084		Portable
59		Ywangan	74642		Portable
60	Taninthayi	Bokepyin	64876		Portable
61	Region	Dawei	209834		Portable
62	Yangon	Bahan	116782		X-ray car
63	Region	Hlegu	206711		Portable
64		Kawhmu	160438		Portable
65		Shwepyitha	232343		X-ray car
66		Dagon (S)	172037		X-ray car
67		South Okklapa	269843		X-ray car
68		Taikkyi	297674		Portable
69		Tarmwe	157712		X-ray car
70		Twantay	304392		Portable

Ministry of Health, Myanmar
Department of Health
National Tuberculosis Programme
National TB Prevalence Survey

Household Register (Form 2)

Cluster number : ____ Ward/ Village _____Township _____
District _____ State/Region _____Filled by _____
Contact Person _____ (Health staff /Local authority)

Code (7 digits) Cluster No./ Household No./ Subject No.	Name	Age*		Date of Birth (d/m/y)	Occupation	Reasons of absence (if children, put C)	**Remarks
		M	F				
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							

* Completed age on census day
** Relationship with household leader in remarks

residential without form 10 for permanent stay:
residential without form 10 for temporary stay: > 2 weeks stay

Eligibility: who stay > 2 weeks will be included in household register regardless of availability for the survey

(Please fill up the back)

National TB Prevalence Survey

To report about the house condition of respondent.

1. Type of housing (1. extension of others people house 2. Bamboo and thatch house 3. wooden house 4. brick knocking 5. Brick housing). . . . . ☐

2. No. of room in the house (1) 1 (2) 2 (3) >2 (4) no room). . . . . ☐

3. Possession
   1. Land / farm (1. Yes 2. No) ☐
   2. House/flat (1. Yes 2. No) ☐
   3. Car (1. Yes 2. No) ☐
   4. Farm vehicle (1. Yes 2. No) ☐
   5. Buffalo/Cow (1. Yes 2. No) ☐
   6. TV, fridge (1. Yes 2. No) ☐
   7. Motorcycle (1. Yes 2. No) ☐
   8. Bicycle (1. Yes 2. No) ☐
   9. Rice mill (1. Yes 2. No) ☐
   10. Tractor (1. Yes 2. No) ☐

4. Type of fuel mainly use for cooking?
   (1. Electricity 2. Gas 3. Kerosene 4. Charcoal 5. Wood 6. Animal dung 7. Agricultural crop residue 8. No cooking at home 9. Others _____) ☐

5. Is the cooking usually done in door? (1. in the same room used for living/sleeping 2. in a separate room as kitchen 3. in a separate building used for kitchen 4. outdoors 5. others _____) ☐

6. Ventilation (1. closed room 2.with open windows/doors 3. room with 3 or fewer walls 4. others _____) ☐

7. Do you heat your house when it is cold? (1. Yes 2. No) ☐

8. If yes, type of fuel mainly use for heating? ☐
   (1. Electricity 2. Gas 3. Kerosene 4. Charcoal 5. Wood 6. Animal dung 7. Agricultural crop residue 8. No cooking at home 9. Others _____)

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း
National TB Prevalence Survey

အိမ်ထောင်စုစာရင်း (ပုံစံ ၂)

Cluster number : _____ Ward/ Village _____Township _____ District_____ State/Region _____

Filled by _____ Contact Person _____ (Health staff /Local authority)

လိပ်စာ(အပြည့်အစုံ)----------

သင်္ကေတ မြို့နယ်နံပါတ်/ အိမ်နံပါတ်/ ပါဝင်သူနံပါတ်	အမည်	ပြည့်ပြီး အသက်		မွေးသက္ကရာဇ်	အလုပ်အကိုင်	အိမ်ထောင်ဦးစီး နှင့် တော်စပ်ပုံမေးပါ။	လာရောက်ပါက **အမှတ်စဉ်**ထည့်ပါ။ လာရောက်ခြင်းမရှိပါက အကြောင်းရင်းရေးပါ။ (ကလေးဖြစ်ပါက C ဟုဖေါ်ပြပါ)
		ကျား	မ				
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							
/ /							

တဖက်မှ မေးခွန်းများကို မေးမြန်းရန် ⟶

မိမိသွားရောက်သည့် အိမ်တိုင်းတွင် အောက်ပါအခြေအနေများကို ကြည့်ရှုမေးမြန်းပါ။

၁။ နေထိုင်သည့်အိမ်အမျိုးအစား (၁။ အဖီချပြီးနေ ၂။ဝါး၊သက်ကယ်မိုး ၃။ပျဉ်ထောင်အိမ် ၄။တိုက်ခံပျဉ်ထောင် ၅။တိုက်၊တိုက်ခန်း) ..... ☐

၂။ နေထိုင်သည့်အိမ်တွင် အခန်းဘယ်နှစ်ခန်းရှိသလဲ (၁။ ၁ ၂။ ၂ ၃။ >၂ ၄။ အခန်းမရှိ) ..... ☐

၃။ ပိုင်ဆိုင်မှုများ

လယ်၊မြေပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐		တီဗွီ၊ရေခဲသေတ္တာပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐	
အိမ်၊တိုက်ခန်းပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐		မော်တော်ဆိုင်ကယ်ပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐	
ကားပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐		စက်ဘီးပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐	
ထော်လာဂျီပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐		ဆန်စက်ပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐	
ကျွဲ၊နွားပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐		လယ်ထွန်စက်ပိုင်ဆိုင်မှု (၁။ရှိ ၂။မရှိ) ☐	

၄။ အိမ်တွင် ထမင်းချက်ရန် မည်သည့် လောင်စာသုံးပါသလဲ။ (၁။ လျှပ်စစ် ၂။ ဓါတ်ငွေ့ ၃။ ရေနံဆီ ၄။ မီးသွေး ၅။ထင်း ☐
၆။တိရိစ္ဆာန်အညစ်အကြေး ၇။ ကောက်ပဲသီးနှံရိုးပြတ် ၈။ မိမိအိမ်တွင် ထမင်းမချက်ပါ ၉။ အခြား .....)

၅။ ထမင်းဘယ်မှာ ချက်သလဲ။ (၁။ အိမ်ထဲမှာ အိပ်တဲ့နေရာ နေတဲ့နေရာအတူတူ ၂။ အိမ်ထဲရှိ သီးခြားမီးဖိုခန်း ၃။ သီးခြားအဆောက်အဦမှ မီးဖိုခန်း ☐
၄။အိမ်အပြင်ဘက် ၅။ အခြား .....)

၆။ အိမ်၏ လေဝင်လေထွက်အခြေအနေ (၁။ ပြူတင်းပေါက်မရှိ ၂။ပြူတင်းပေါက်၊ တံခါးပေါက်ရှိ ၃။ နံရံ (၃)ဖက် သို့မဟုတ် (၂)ဖက်သာရှိ ☐
၄။ အခြား .....)

၇။ ဆောင်းရာသီတွင် အိမ်အတွင်း အပူပေးခြင်းရှိပါသလား (၁။ ရှိပါသည် ၂။ မရှိပါ) ☐

၈။ ဆောင်းရာသီတွင် အိမ်အတွင်း အပူပေးခြင်းရှိပါက မည်သည့် လောင်စာသုံးပါသလဲ။ (၁။ လျှပ်စစ် ၂။ ဓါတ်ငွေ့ ၃။ ရေနံဆီ ၄။ မီးသွေး ☐
၅။ထင်း ၆။တိရိစ္ဆာန်အညစ်အကြေး ၇။ ကောက်ပဲသီးနှံရိုးပြတ် ၈။ မိမိအိမ်တွင် ထမင်းမချက်ပါ ၉။ အခြား .....)

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း
National TB Prevalence Survey

တီဘီစစ်တမ်းကောက်ယူခြင်း (မှတ်ပုံတင်စာအုပ် – ၁)

Survey register, Cluste No. _____ Ward/Village _____Township/District _____State/Region _____

စဉ်	သင်္ကေတ မြို့နယ်နံပါတ်/ အိမ်နံပါတ်/ ပါဝင်သူနံပါတ်	အမည်	ပြည့်ပြီး အသက်		လိပ်စာ	မှတ်ချက်
			ကျား	မ		
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					

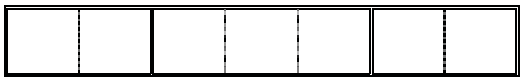
………………………… နံၤသီၣ် (နံၣ် ________) ၂၀၀ /   /

„ဖိလၢၤ်ဧ့ ပှၤ်ဖိးလၢကွံၤ်လ ဖိလၢဃတၢ်ဖျၢဖျလၢဧ့ၤ်ဆၣ်ဆိ“

နံၤဖိဧ့လၢးကၢၤ်ကြၤ်ထၣ်ဒၣ် :ဖျဧ့ကၢ:နံၤဃဲၤ်ထိၣ်ဒၣ်ဂၢ

ကျန်းမာရေးဝန်ကြီးဌာန
ကျန်းမာရေးဦးစီးဌာန
အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

အိမ်ထောင်စုဝင်ကဒ်ပြားနှင့် ဖိတ်စာ



အမည် _____

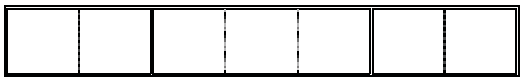
"တီဘီရောဂါရှာဖွေကုသဖို့ သင့်မိသားစုကို ခေါ်လာစို့"

နေ့ရက် / / ၂၀၀ (နေ့) အချိန် .....

ဖော်ပြပါနေ့ရက်တွင် ဤကဒ်ပြားကို ကျန်းမာရေးစစ်တမ်းကောက်ယူရေးအဖွဲ့ထံ ပြသပါရန်၊

ကျန်းမာရေးဝန်ကြီးဌာန
ကျန်းမာရေးဦးစီးဌာန
အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

အိမ်ထောင်စုဝင်ကဒ်ပြားနှင့် ဖိတ်စာ



အမည် _____

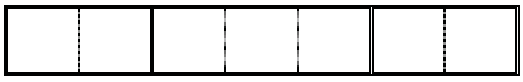
"တီဘီရောဂါရှာဖွေကုသဖို့ သင့်မိသားစုကို ခေါ်လာစို့"

နေ့ရက် / / ၂၀၀ (နေ့) အချိန် .....

ဖော်ပြပါနေ့ရက်တွင် ဤကဒ်ပြားကို ကျန်းမာရေးစစ်တမ်းကောက်ယူရေးအဖွဲ့ထံ ပြသပါရန်၊

ကျန်းမာရေးဝန်ကြီးဌာန
ကျန်းမာရေးဦးစီးဌာန
အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

အိမ်ထောင်စုဝင်ကဒ်ပြားနှင့် ဖိတ်စာ



အမည် _____

"တီဘီရောဂါရှာဖွေကုသဖို့ သင့်မိသားစုကို ခေါ်လာစို့"

နေ့ရက် / / ၂၀၀ (နေ့) အချိန် .....

ဖော်ပြပါနေ့ရက်တွင် ဤကဒ်ပြားကို ကျန်းမာရေးစစ်တမ်းကောက်ယူရေးအဖွဲ့ထံ ပြသပါရန်၊

National Tuberculosis Programme
National TB Prevalence Survey
INDIVIDUAL SURVEY CARD (ပုံစံ ၄) **Sr. No.** ☐

Cluster No.		**Ward / Village**	
Township / Region		**Date**	
Filled by		**Code**	/ /
Participation:	**Agreed with consent**	**Refused**	**Absent, reason . . . .**

၁။ အမည် _____

၂။ အသက် (ပြည့်ပြီးအသက်) ..... ☐☐

၃။ ကျား/မ (၁။ ကျား ၂။ မ) ..... ☐

၄။ ကိုယ်အလေးချိန် ☐☐ ကီလိုဂရမ်

၅။ အရပ် ☐☐☐ စင်တီမီတာ

၆။ အလုပ်အကိုင် (ဖေါ်ပြပါ) _____ (၁။ အတတ်၊အသိပညာရှင် ၂။ ပုဂ္ဂလိကလုပ်ငန်းရှင်
၃။ ကုန်သည် ၄။ ဝန်ဆောင်မှုဝန်ထမ်း ၅။ အရောင်းဝန်ထမ်း ၆။ စိုက်ပျိုးရေး/မွေးမြူရေး/ရေလုပ်သား
၇။ ထုတ်လုပ်ရေးလုပ်သား ၈။ ကျပန်းလုပ်သား ၉။ အိမ်ရှင်မ ၁၀။ ကျောင်းသား ၁၁။ မှီခို
၁၂။ ဘာသာရေးဝန်ထမ်း ၁၃။ အခြား) ..... ☐☐

၇။ ကိုးကွယ်သည့်ဘာသာ (၁။ ဗုဒ္ဓဘာသာ ၂။ ခရစ်ယာန် ၃။ ဟိန္ဒူ ၄။ အစ္စလာမ် ၅။ အခြား _____) ☐

၈။ အိမ်ထောင်ရှိ/မရှိ (၁။ မရှိ ၂။ ရှိ ၃။ အိမ်ထောင်ကွဲ ၄။ မုဆိုးဖို/မ) ..... ☐

၉။ ပညာအရည်အချင်း (၁။ စာမတတ် ၂။ ရေးတတ်ဖတ်တတ် ၃။ မူလတန်း ၄။ အလယ်တန်း
၅။ အထက်တန်း ၆။ တက္ကသိုလ်/ကောလိပ် ၇။ ဘွဲ့ရ) ..... ☐

၁၀။ လွန်ခဲ့သော တစ်လအတွင်း နေမကောင်းဖြစ်ခဲ့ပါသလား။ (၁။ ရှိ ၂။ မရှိ) ..... ☐

၁၁။ **<u>ရှိလျှင်</u>** ဘာဖြစ်သလဲ ပြောပြပါ။

မရှိလျှင် နံပတ် (၁၂) ကို ဆက်လက်မေးမြန်းပါ။

<u>(အောက်ပါလက္ခဏာများပါပါက အချိန်ကာလမေးမြန်းဖေါ်ပြရန်)</u>

				ခံစားခဲ့ရသည့်အချိန်ကာလ
(က)ချောင်းဆိုးခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(ခ) သလိပ်ထွက်ခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(ဂ) သလိပ်တွင်သွေးပါခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(ဃ) တဖြည်းဖြည်းပိန်ချုံးလာခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(င) တငွေ့ငွေ့ဖျားခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(စ) ကျော/ရင်အောင့်ခြင်း	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)
(ဆ) အခြား _____	(၁။ရှိ	၂။မရှိ)	☐	ရှိလျှင် (____ လ၊ _____ ရက်)

၁၂။ နံပတ်(၁၀)တွင် **<u>မရှိလို့ဖြေလျှင်</u>** <u>(က)၊(ခ)၊(ဂ)၊(ဃ) အချက်များကို မေးမြန်း၍ အပေါ်တွင် ဖြည့်ပါ။</u>

မေးခွန်း ၁၁ နှင့် ၁၂ အရ တီဘီသံသယရှိသူ (၁။ ဟုတ် ၂။ မဟုတ်).....

တီဘီသံသယလူနာ ဆိုသည်မှာ (၃)ပတ်နှင့်အထက်ချောင်းဆိုးနေသည့် ဝေဒနာ ခံစားနေရသူ သို့မဟုတ် သလိပ်တွင် သွေးပါနေသူကို ဆိုလိုပါသည်။

၁၃။ ဆေးလိပ်သောက်ပါသလား။ (၁။ လုံးဝမသောက် ၂။ ယခင်ကသောက် ၃။ လက်ရှိသောက်ဆဲ).....

လုံးဝမသောက်ဆိုပါက နံပါတ် (၁၅) ကို မေးမြန်းပါ / ယခင်ကသောက်ဆိုပါက(၁၆)ကိုမေးပါ / လက်ရှိသောက်ဆဲဆိုပါက (၁၄–၁၅) ကိုဆက်မေးရန်။

၁၄။ သောက်ပါက တနေ့လျှင် အလိပ်မည်မျှသောက်ခဲ့ပါသလဲ။ အလိပ်ရေ _____

၁၅။ ဆေးလိပ်သောက်တာ ဘယ်လောက်ကြာပြီလဲ။ နှစ် _____

၁၆။ ယခင်ကသောက်သူဖြစ်ပါက ဆေးလိပ်ဖြတ်တာ ဘယ်လောက်ကြာပြီလဲ နှစ် _____

၁၇။ မိမိမသောက်သော်လည်း အိမ်သို့မဟုတ် လုပ်ငန်းခွင်၊ပတ်ဝန်းကျင်တွင် ဆေးလိပ်သောက်သူများကြောင့် .....
ဆေးလိပ်အခိုးအငွေ့ ရှူမိခြင်း ရှိပါသလား။ (၁။ မရှိပါ ၂။ နေ့တိုင်း မရှူမိပါ ၃။ နေ့တိုင်း ရှူမိပါသည်)

၁၈။ အရက်သောက်ပါသလား။ (၁။ လုံးဝမသောက် ၂။ ယခင်ကသောက် ၃။ လက်ရှိသောက်ဆဲ).....

လုံးဝမသောက်ဆိုပါက နံပါတ် (၂၂) ကို မေးမြန်းပါ / ယခင်ကသောက်ဆိုပါက(၂၁)ကိုမေးပါ / လက်ရှိသောက်ဆဲဆိုပါက (၁၉–၂၀) ကိုဆက်မေးရန်။

၁၉။ လက်ရှိ အရက်သောက်ဆဲ ဖြစ်ပါက (၁။ နေ့တိုင်း သောက်သည် ၂။ နေ့တိုင်းနီးပါး ၃။ တပတ်လျှင် ၃–၄ရက်
၄။ တပတ်လျှင် ၁–၂ ရက် ၅။ တလလျှင် ၂–၃ ကြိမ် ၆။ တလလျှင် ၁ကြိမ်).....

၂၀။ အရက်သောက်တာ ဘယ်လောက်ကြာပြီလဲ။ နှစ် _____

၂၁။ အရက်ဖြတ်တာ ဘယ်လောက်ကြာပြီလဲ။ နှစ် _____

၂၂။ ချောင်းဆိုးရက်ကြာနေလျှင် သင်အရင်ဆုံးဘာလုပ်ခဲ့ပါသလဲ။ (အရင်ဆုံးလုပ်ခဲ့တဲ့တစ်ခုကိုသာရွေးပါ)
(၁။ တစ်ခါမှမဖြစ်ဖူးပါ ၂။ ဘာမှမလုပ်ပါ/လစ်လျူရှုထားသည် ၃။ မိမိဘာသာဆေးသောက် ၄။ ဆေးဆိုင်မှ စပ်ပေးသော ဆေးသောက် ၅။ ပြင်ပဆေးခန်းဆရာဝန်နှင့်ကုသ ၆။ အထူးကုဆရာဝန်နှင့်ကုသ ၇။ ပြည်သူ့ဆေးရုံ ၈။ ကျန်းမာရေးဌာန တွင်ကုသ ၉။ တိုင်းရင်းဆေးဖြင့်ကုသ ၁၀။ အခြား_____)

၂၃။ လောလောဆယ်၊ တီဘီဆေးကုသမှု ခံယူနေခြင်းရှိပါသလား။ (၁။ရှိ ၂။မရှိ) **(မရှိလျှင် (၂၅)ကို မေးပါ)**...

၂၄။ **ရှိလျှင်–** ဘယ်မှာ ကုသနေပါသလဲ။ (၁။မြို့နယ်ကျန်းမာရေးဌာန ၂။ ပြည်သူ့ဆေးရုံ ၃။ပြင်ပဆေးကုခန်း
၄။ ပြင်ပဆေးရုံ ၅။ ဆေးဆိုင် ၆။ အခြား_____).....

၂၅။ ယခင်က တီဘီဆေးကုသမှုခံယူခဲ့ဘူးပါသလား။ (၁။ ရှိ ၂။ မရှိ ၃။ မသေချာ) **(မရှိလျှင် (၂၇)ကို မေးပါ)**

၂၆။ ဆေးကုသခဲ့ဘူးလျှင် ဘယ်နှစ်ကြိမ်တီဘီဆေးကုသဘူးပါသလဲ။ (၁။ တစ်ကြိမ် ၂။ နှစ်ကြိမ် ၃။ နှစ်ကြိမ်အထက်)..

၂၇။ ဘယ်မှာ တီဘီဆေးကုသမှုခံယူခဲ့ပါသလဲ။ (၁။မြို့နယ်ကျန်းမာရေးဌာန ၂။ ပြည်သူ့ဆေးရုံ ၃။ပြင်ပဆေးကုခန်း
၄။ ပြင်ပဆေးရုံ ၅။ ဆေးဆိုင် ၆။ အခြား_____).....

၂၈။ ဘယ်ခုနှစ်က တီဘီဆေးကုသခဲ့ပါသလဲ။ _____ ခုနှစ် (ဥပမာ – ၁၉၉၉ ခုနှစ်)

၂၉။ အတူနေမိသားစုတွင် သလိပ်ပိုးတွေ့တီဘီလူနာရှိခဲ့ပြီး နီးနီးကပ်ကပ်နေခဲ့ဘူးပါသလား။ (၁။ ရှိ ၂။ မရှိ ၃။ မသိပါ)

၃၀။ အခြားရောဂါများရှိပါသလား။ ဆီးချို (၁။ ရှိ ၂။ မရှိ) ☐

အိပ်ချိအိုင်ဗီ (၁။ ရှိ ၂။ မရှိ) ☐

သွေးတိုး (၁။ ရှိ ၂။ မရှိ) ☐

၃၁။ **ဓါတ်မှန်ရိုက်ခြင်း** ၁။ ရိုက်သည် ၂။ ငြင်းဆိုသည်(_____ကြောင့် မရိုက်ပါ) ..... ☐

၃၂(က)။ **ဓါတ်မှန်အဖြေ (X-ray unit)** ..... ☐

1. Normal
2. Active TB
3. TB suspect
4. Healed TB
5. Other Lung diseases
6. Heart disease
7. Other findings in lung
8. Other_____
9. not interpretable

(sputum examination is needed--------1. Yes 2.No) ☐

၃၂(ခ)။ Necessity of any urgent action (1. Yes 2.No) ☐

၃၃။ သလိပ်စစ်ဆေးခြင်း (၁။ စစ်ဆေးပါ ၂။ စစ်ဆေးရန် မလိုပါ) ..... ☐

၃၄။ သလိပ်စစ်ဆေးခြင်းအဖြေ (Sputum Examination results):

Specimen	Collected date	Result of smear exam.			Result of culture					
		Positive	Neg.	Remarks	Positive	Neg.	Contaminated	PNB	Niacin	Capilia
1 (Spot)										
2 (Home)										

For smear examination result - to record either Not collected or Negative or Positive or Not applicable.

If smear positive, grading is to be provided.

For culture result - to record either Not applicable or Negative or Positive or Contaminated.

If culture positive, grading is to be provided.

For identification: to record either Non TB or TB or Not applicable or pending.

၃၅။ **Central X-ray unit ၏ဓါတ်မှန်အဖြေ** ..... ☐

1. Normal
2. Active TB
3. TB suspect
4. Healed TB
5 .Other Lung diseases
6. Heart disease
7. Other findings in lung
8. Others_____
9. Not interpretable

၃၆။ **Final Diagnosis:** ..... ☐

(၁။ No ၂။ Smear positive TB ၃။ Smear negative /culture positive TB ၄။ Bacteriologically negative, active TB suggested ၅။ TB suspect (inactive) ၆။ Healed TB)

၃၇။ **Other findings:**

(၁။ No abnormality ၂။ Other lung disease (active) ၃။ Other finding (inactive) ၄။ Heart disease ☐
၅။Other _____)

National Tuberculosis Programme
National TB Prevalence Survey **Sr. No.** ☐
INDIVIDIAL SURVEY CARD (FORM-4)

Cluster No.		**Ward / Village**	
Township / State/Region		**Date**	
Filled by		**Code**	/ /
Participation:	**Agreed with consent**	**Refused**	**Absent, reason . . . . . .**

1. Name _____

2. Age (completed years) ☐☐

3. Sex (1.Male 2. Female) ☐

4. Body weight ☐☐ Kg

5. Height ☐☐☐ Cm

6. Occupation _____ (please specify) ☐☐

(1.Professional and technical worker 2.Own Business 3. Merchant 4. Service worker (including Government servant) 5. Sale worker 6. Agricultural, animal husbandry and forestry worker, fisherman and hunter 7.Production and related worker, transport, equipment operator and laborers 8.Workers not classified by occupation 9.House wife 10.student 11.Dependent 12. Religious person 13. Others _____)

7. Religion (1.Buddhist 2.Christian 3.Hindu 4.Islam 5.Others _____) ☐

8. Marital status (1.Single 2.Married 3.Separated/divorced 4.Widow/Widower) ☐

9. Education (1.Illiterate 2. can read/write 3.Primary school 4.Middle school 5.High school 6.College and University 7.Graduate) ☐

10. Do you suffer any illness/symptom within one month? (1. Yes, 2. No) ☐

11. If Yes, What are the symptoms?

If No, continue No. 12

			Duration of symptom
1) Cough	(1.Yes 2.No) ☐	if yes	_____ months_____ days
2) Expectoration	(1.Yes 2.No) ☐	if yes	_____ months_____ days
3) Blood in sputum	(1.Yes 2.No) ☐	if yes	_____ months_____ days
4) Weight loss	(1.Yes 2.No) ☐	if yes	_____ months_____ days
5) low grade fever	(1.Yes 2.No) ☐	if yes	_____ months_____ days
6) Chest pain	(1.Yes 2.No) ☐	if yes	_____ months_____ days
7) Others _____	(1.Yes 2.No) ☐	if yes	_____ months_____ days

12. If No. 10 is NO, ask about any cough, expectoration, blood streak sputum and weight loss and fill up in above boxes. According to No. 11, 12, please write your opinion that person is a TB suspect or not.

TB suspect means a person who has cough more than 3 weeks and / or have haemoptysis.

Opinion: TB suspect (1.Yes 2.No) ☐

13. Smoking status (1.Never smoked 2.Smoked in the past 3.Current smoker) ☐

If never smoked, continue to No. 17 / Smoked in the past continue to No.16 / current smoke continue to No. 14-15)

14. If smoker, how many cigarette / day do you usually smoke? _____ Cigarettes

15. How long have you been smoking? _____ years

16. If you are an ex-smoker, how long have you stopped smoking? _____ years

17. Although you are not smoker, any chance of being a passive smoker either at home / work place and environment? (1. No 2. Very few times in a week 3. Few times in a week 4. Very few times daily 5. few times daily 6. Most of the time daily 7.don't know) ☐

18. Alcohol drinking (1. Never drink 2.drunk in the past 3. current drinker) ☐

If never drink, continue to No. 22 / drink in the past continue to No. 21 / current drink continue to No. 19-20

19. How long have you been drinking? _____ years

20. If you are a current drinker, frequency of drinking (1.daily 2.almost daily 3.3-4 days per week 4. 1-2 days per week 5.2-3 times per month 6. Once a month) ☐

21. If you are an ex-drinker, how long have you stopped drinking? _____ years

22. What do you usually do if you have any of above TB symptoms (1-8)? Only first action. (1 Nothing or neglect the symptom 2. .Self treatment 3. Pharmacy 4. Private GP 5. Specialist clinic 6. Public hospital 7. Govt. Health Centre 8.Traditional healer 9.Others _____) ☐

23. Any current TB treatment? (1.Yes 2.No) **If no continue to No. 25** ☐

24. If yes, from where are you taking treatment? (1.Township health center 2. public hospital 3.Private clinic 4. private hospital 5. pharmacy 6.others _____) ☐

25. Any previous TB treatment was taken. (1.Yes 2. Not sure 3. No) **(If No, continue to No.29** ☐

26. If yes, how many times treated for TB? (1.One time 2.Two times 3. More than two times) ☐

27. From where have you been treated? (1.Township health center 2. public hospital 3.Private clinic 4. private hospital 5. pharmacy 6.others _____) ☐

28. When was your last anti-TB treated? _____ year. (for eg. 1999)

29. Any contact with sputum (+) TB patient in your family at home? (1.Yes 2.No 3.Don't know) ☐

30. Any associated medical diseases Diabetes Mellitus (1.Yes 2.No) ☐

HIV (1.Yes 2.No) ☐

Hypertension (1.Yes 2.No) ☐

31. Chest X-ray examination (1.taken X-ray 2.refused X-ray (reason _____) ☐

32. (a) Chest X-ray field reading result: ---------- ☐

1. Normal
2. Active TB
3. TB suspect
4. Healed TB
5. Other Lung diseases
6. Heart disease
7. Other findings in lung
8. Other_____
9. not interpretable

(sputum examination is needed----------1.Yes 2.No) ☐

32. (b) Necessity of Any urgent action (1. Yes 2. No) ☐

33. Request for sputum collection from CXR and/or symptom (1.Yes 2.No) ☐

34. Sputum Examination results:

Specimen	Collected date	Result of smear exam.			Result of culture					
		Positive	Neg.	Remarks	Positive	Neg.	Contaminated	PNB	Niacin	Capilia
1 (Spot)										
2 (Home)										

For smear examination result - to record either Not collected or Negative or Positive or Not applicable.

If smear positive, grading is to be provided.

For culture result - to record either Not applicable or Negative or Positive or Contaminated.

If culture positive, grading is to be provided.

For identification: to record either Non TB or TB or Not applicable or pending.

35. Result of central X-ray unit ☐

1. Normal
2. Active TB
3. TB suspect
4. Healed TB
5. Other Lung diseases
6. Heart disease
7. Other findings in lung
8. Other_____
9. Not interpretable

36. Final Diagnosis: ☐

(1.No 2. Smear positive TB 3. Smear negative /culture positive TB 4. Bacteriologically negative, active TB suggested 5. TB suspect (inactive TB) 6. Healed TB)

37. Other findings: ☐

(1. No abnormality 2. Other lung disease (active) 3. Other finding (inactive) 4. Heart disease

5. Other _____)

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Chest X-Ray Register (Register 2)

Read by .....

Cluster Number: ..... Ward/Village .....

Township ..... District .....

State/Region .....

Date taking X-Ray ....../....../..........X-ray reading date ..../......../.........Read by ....Signature ....

Sr. No.	Code	Name	Age		Result	Remarks	Sputum examination requested	Central reading
			M	F				
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	
	/ /				1 2 3 4 5 6 7 8 9		Yes No	

(1. Normal 2. Active TB 3. TB suspect 4. Healed TB 5 .Other Lung diseases 6. Heart disease
7. Other findings in lung 8 . Others______________________________9. Not interpretable)

Date taking X-Ray ...../...../.....X-ray reading date ...../...../.....Read by.....Signature.....

Chest X-Ray Report by cluster (Form 5)

1. No. of people to take chest x-ray: …….....

2. No. of people taken chest x-ray: ……..... (Male: ……., Female: …….)

3. Result Analysis

1. Normal ……
2. Active TB ……
3. TB suspect ……
4. Healed TB ……
5. Other lung diseases ……
6. Heart disease ……
7. Other findings in lung ……
8. Other ……
9. Not interpretable ……

4. No. of people requested for sputum examination ……

Reporter:……

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Sputum Smear collection List (Form 6)

Cluster Number _____ Ward/Village _____ Date: ……./……./ 200

Township_____District _____ State/Region _____

Survey LabNo.	Code	Name	Age		Sputum collection date		Remarks
			M	F	Day1 (S)	Day2 (H)	
1	/ /						
2	/ /						
3	/ /						
4	/ /						
5	/ /						
6	/ /						
7	/ /						
8	/ /						
9	/ /						
10	/ /						
11	/ /						
12	/ /						
13	/ /						
14	/ /						
15	/ /						
16	/ /						
17	/ /						
18	/ /						
19	/ /						
20	/ /						

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Sputum Examination request/transportation form (Form 7)

Code Number: / /
Cluster Number: ..... Ward/Village ……
Township: …… District: ……..... State/Region: ……..
Name: …… Age: …… Sex: Male ☐ Female ☐

Survey Lab. Number: .....

Sputum Container: Day 1 ☐ Date: …… Spot specimen ☐

Day 2 ☐ Date: ……. Home specimen ☐

Signature/Name of sputum Collector name:……

SPUTUM SMEAR EXAMINATION RESULTS (TO BE FILLED AT CENTRAL LABATORY)

Code Number : / / No. of sputum containers: ……..

Received date: …… Culture No: ……

Sputum smear examination:

Date	Specimen	Appearance	Results				
			Negative	1-9	1+	2+	3+
	Day 1(S)						
	Day 2(H)						

Examined by: …… Signature: …… Date: ……

Sputum culture:

Sputum	Result						Examination Date
	Positive	Negative	Contaminated	PNB	Niacin	Capilia	
Day 1(S)							
Day 2(H)							

Done by: …… Signature: …… Date: ……

Code No. / /

အမည် .....

အသက် .....

ဒုတိယ၊ သလိပ် နမူနာစစ်ဆေးရန်ယူဆောင်လာရမည့်နေ့ .....

တာဝန်ခံလက်မှတ် .....

နေ့စွဲ .....

Code No. / /

အမည် .....

အသက် .....

ဒုတိယ၊ သလိပ်နမူနာစစ်ဆေးရန်ယူဆောင်လာရမည့်နေ့ .....

တာဝန်ခံလက်မှတ် .....

နေ့စွဲ .....

Code No. / /

အမည် .....

အသက် .....

ဒုတိယ သလိပ်နမူနာစစ်ဆေးရန်ယူဆောင်လာရမည့်နေ့ .....

တာဝန်ခံလက်မှတ် .....

နေ့စွဲ .....

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Cluster summary Report (Form 8)

Ward/Village : ……..... Cluster Number: .....
Township: …… District: ……
State/Region: ……...
Date of survey: From……../……./…….. To ……./……./…….

Census Activities:

- Number of houses ……
- Number of people registered in the household register ……
- Symptoms suggestive of TB

Radiology Activities:

- Number of people to take chest X-ray ……...
- Number of people taken-CXR ……
- Number of people not taken CXR ……...
- Number of people with abnormal CXR result ……

Laboratory Activities:

- Number of people requested for sputum ……
- Number of people collected sputum in Day 1 ……...
- Number of people collected sputum in Day 2 ……

TB patients:

- Number of TB patients on current anti-TB treatment ……
- Number of people with previous anti-TB treatment ……

Other:……
……
……

Date: ……../……./200...
Leader of survey team
(Name and Signature)

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Interview sheet for previously treated TB participant (Form 9)

1. **Survey code**. ☐

2. Name _____

3. From where were you taking TB treatment? (1. Township health/TB Centre 2. Public Hospital 3. GP 4.private hospital 5.Pharmacy 6.Other _____) ☐

4. What was the sputum examination results (1. positive 2. negative 3. don't know) ☐

5. Type of TB (1. Pulmonary 2. Extra pulmonary) ☐

6. Treatment outcome (1. cured 2. completed 3. defaulted 4. failure 5. don't know) ☐

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Interview sheet for participant on TB treatment (Form 10)

1. **Survey code**. ☐

2. Name _____

3. Are you a native? (1.Yes 2.No) ☐

4. How long have you been living in this address? _____ ☐

5. How many times treated for TB? (1. one time 2. 2 times 3. more than 2 times) ☐

Current treatment

6. To whom you consult about your illness? (1. Township health/TB Centre 2. Public hospital 3. GP 4. private hospital 5. Pharmacy 6. Other _____) ☐

7. Where were you diagnosed as TB? (1. Township health/TB Centre 2. Public hospital 3. GP 4. private hospital 5. Pharmacy 6. Other _____) ☐

8. From where are you taking TB treatment? (1.Township health/TB Centre 2.Public hospital 3. GP 4. private hospital 5. Pharmacy 6. Other _____) ☐

9. What was the sputum examination results (1. positive 2. negative 3. don't know) ☐

10. Type of TB (1. Pulmonary 2. Extra pulmonary) ☐

11. What regimen you are on? _____/ _____ (write down the drugs for IP and CP)

12. Duration of treatment you took? _____ /_____ months (write down the duration for IP and CP)

13. 19. Did you regularly take the treatment? (1. regular 2. with some missed dose but completed 3. not completed the treatment) ☐

14. Do you have a DOT provider (1. Yes 2. No 3.Don't know) ☐

15. Why did you choose that place for seeking treatment?

_____

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Laboratory register (Register 3)

S. N.	Date	Survey code	Name	Age / Sex	Smear result	Smear result		Culture result (Week)								Identification Results				Date recorded	Remarks
						1st	2nd	1	2	3	4	5	6	7	8	PNB	Niacin	Capilia	Final Results		

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Sputum smear positive examination report for cluster _____ (Form 11)

Date-

S. N.	Date	Survey code	Name	Age	Sex	Fathers' Name	Address	Smear result	Culture result	Remarks

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Positive case list (Form 12)

S. N.	Survey code	Name	Age	Sex	Smear Result		Culture Result		CXR result	Type of TB	Remarks
					1st	2nd	1st	2nd			

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Report of the Prevalence Survey – Smear positive TB case notification report (Form 13)

Date . . . . . .

To,

Township Medical Officer, ... Township, ... Region

Cluster No. . . . . ., Site . . . . . .

As following participant(s) is diagnosed as **Smear Positive TB**, your kind collaboration to arrange proper treatment is requested:

Survey No.	Name	Age	Sex	Smear results	X-ray findings	Address

Though we are waiting the result of culture examinations, we would like to have your medical attention to following participants. They are **most likely to have active TB** with necessity of immediate treatment.

Survey No.	Name	Age	Sex	Smear results	X-ray findings	Address

Culture results will be sent later.

Team Leader of the survey . . . . . .

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Report of the Prevalence Survey – Culture positive TB case notification report (Form 14)

Date . . . . . .

To,

Township Medical Officer, ... Township, ... Region

Cluster No. . . . . ., Site . . . . . .

Following participants of the survey were **confirmed as culture positive tuberculosis**. Your arrangement to inform and treat those cases is kindly requested.

Survey No.	Name	Age	Sex	Smear results (reassessed)	Culture result	X-ray findings	Address

Though the following participants had a **culture positive result, their clinical status is not typical as TB patients**. We could not exclude a possibility of contamination. Please examine the patient again, and provide treatment if they are sick.

Survey No.	Name	Age	Sex	Smear results (reassessed)	Culture result	X-ray findings	Address

Team Leader of the survey . . . . . .

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Report of the Prevalence Survey – Suspected active TB patients notification report

(Form 15)

Date . . . . . .

To,

Township Medical Officer, ... Township, ... Region

Cluster No. . . . . ., Site . . . . . .

Though we **could not identify TB germs by smear and/or culture examinations in following participants, active TB diseases are highly suspicious by X-ray**. We strongly recommend reassessment of cases and provision of treatment if they are sick/symptomatic or other clinical evaluation such as smear examination and X-ray shows active tuberculosis.

Survey No.	Name	Age	Sex	Smear results (reassessed)	Culture result	X-ray findings	Address

Team Leader of the survey . . . . . .

Ministry of Health

Department of Health

National Tuberculosis Programme

National Tuberculosis Prevalence Survey

Individual TB case notification report (Form 16)

To,

. . . . , Survey No. . . . .

Address . . . . . .

, ... Township, ... State/Region

Thank you for your participation in the survey.

Our doctors examined your survey results and concluded that "**You have active TB disease**". Most of TB is curable with proper treatment/medication and treatment is free of charge.

You are kindly advised to visit . . . . . Township TB center as early as possible.

Smear Results:	**1st**	**2nd**
Culture Result:		
Chest X-ray result:		

Team Leader of the survey . . . . . .

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Post survey questionnaire for the TB smear positive / culture positive cases (Form 18)

1. Survey number. Tsp ☐☐ Household ☐☐☐ Individual ☐☐☐
2. Name _____
3. Age ☐☐
4. Sex (1. Male 2.Female) ☐
5. Address _____
6. Occupation _____
7. Marital status (1.Married, living together 2. Married, living separately 3. Divorced 4.Widowed 5. Never married 6.Other (Specify) ☐
8. How many family members living together including patient? ☐☐
9. Position in a household (1. Head of household 2.spouse of head 3.Parents of the household head 4.sibling or grandchild of the household head 5. non family member 6.Other _____) ☐
10. Distance from home to any TB diagnostic center under NTP _____ mile
11. Cost for one way transportation _____ Kyats
12. Time spent for one visit to TB clinic _____ hours
13. Are you a native? (1.Yes 2.No) ☐
14. How long have you been living in this address? _____ ☐
15. Status of bacteriological examination (1.S+ 2.S neg. C+) ☐
16. Type of TB patient (1.New 2.Relapse 3.Treatment after default 4.Failure) ☐
17. Category put on (1.Cat I 2. Cat II 3.Cat III) ☐
18. Did you know you had TB (during interview)? (1.Yes, diagnosed before the survey 2.Yes, I suspected I had TB, 3. Yes, I suspected but think I have other disease 4. No. 5. Other _____) ☐
19. Were you ill at the survey time? (1.Yes, very ill, could not work, 2.Yes, ill, difficult to work, 3.Yes, ill but could work 4.Yes, a little 5. No, I was health 6. Other _____) ☐
20. If ill what was your illness, please mention : -

    _____

    _____
21. How long had you been ill before the survey : _____ days ☐
    (1. a few days 2. a week 3.less than 2 weeks 4. 2-4 weeks 5.3 months or less 6.a year or less 7. more than a year 8. Well)
22. Is there any interruption of treatment during this treatment after survey? (1.Yes 2.No) ☐

ကျန်းမာရေးဝန်ကြီးဌာန ပုံစံ ၁၆

ကျန်းမာရေးဦးစီးဌာန

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်း စီမံချက်

စာအမှတ်

နေ့စွဲ . . . . . .

မှတဆင့်

မြို့နယ်ကျန်းမာရေးဦးစီးဌာနမှူး၊ . . . . . မြို့နယ်၊ . . . . . ပြည်နယ် / တိုင်း

သို့

အမည် . . . . . အသက် . . . . . Survey No. . . . . .

လိပ်စာ . . . . . .

<u>တီဘီလူနာအတွက် အကြောင်းကြားစာ</u>

သင့်အနေဖြင့် ဤ တီဘီရောဂါစစ်တမ်းကောက်ယူရာတွင် ပါဝင်ခဲ့သောကြောင့် အထူးကျေးဇူးတင်ရှိအပ်ပါသည်။

သင်၏ အောက်ပါဆေးစစ်တမ်းများအပေါ် သက်ဆိုင်ရာဆရာဝန်များ၏ သုံးသပ်ဆုံးဖြတ်ချက်အရ၊ တီဘီရောဂါဖြစ်ပွားနေကြောင်း တွေ့ရှိရပါသည်။

သင့်လျော်မှန်ကန်သော တီဘီဆေးကုထုံးဖြင့် အချိန်ကာလတိကျစွာ လိုက်နာကုသပါက တီဘီရောဂါသည် ကုသ၍ ပျောက်ကင်းနိုင်သောရောဂါဖြစ်ပါသည်။ မြို့နယ်ကျန်းမာရေးဌာနမှ တီဘီရောဂါကို အခမဲ့ "တိုက်ရိုက်ကြည့်ရှု၊ အချိန်တိုနှင့်ကု" နည်းဖြင့် ကုသမှုပေးလျက်ရှိပါသည်၊

ထို့ကြောင့် သင့်အနေဖြင့် . . . . . မြို့နယ်ကျန်းမာရေးဌာနသို့ အလျင်အမြန်သွားရောက်၍ ဆေးကုသမှုကို ခံယူနိုင်ပါရန် အကြောင်းကြားအပ်ပါသည်။

သလိပ်စစ်ဆေးခြင်းအဖြေ	ပထမသလိပ်နမူနာ	ဒုတိယသလိပ်နမူနာ
သလိပ်ပိုးမွှားခြင်းအဖြေ		
ရင်ခေါင်းဓါတ်မှန်အဖြေ		

. . . . . .

အဖွဲ့ခေါင်းဆောင်

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

ကျန်းမာရေးဝန်ကြီးဌာန **ပုံစံ ၁၇**

ကျန်းမာရေးဦးစီးဌာန

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်း စီမံချက်

စာအမှတ်

နေ့စွဲ . . . . . .

မှတဆင့်

မြို့နယ်ကျန်းမာရေးဦးစီးဌာနမှူး၊ . . . . . မြို့နယ်၊ . . . . . ပြည်နယ်/တိုင်း

သို့

အမည် . . . . . အသက် . . . . . Survey No. . . . . .

လိပ်စာ . . . . . .

<u>တီဘီသံသယလူနာအတွက် အကြောင်းကြားစာ</u>

သင့်အနေဖြင့် ဤ တီဘီရောဂါစစ်တမ်းကောက်ယူရာတွင် ပါဝင်ခဲ့သောကြောင့် အထူးကျေးဇူးတင်ရှိအပ်ပါသည်။

သင်၏ အောက်ပါဆေးစစ်တမ်းများအရ၊ သလိပ်စစ်ဆေးရာတွင် တီဘီပိုးတွေ့ရှိခြင်းမရှိသော်လည်း၊ ရင်ခေါင်းခါတ်မှန်အရ တီဘီရောဂါဟု ယူဆနိုင်သောအရိပ်များတွေ့ရှိရပါသည်။ ထို့ကြောင့် မြို့နယ်ကျန်းမာရေးဌာနမှ ဆရာဝန်နှင့် ပြသစစ်ဆေးရန်လိုအပ်ပါသည်။ သင့်အနေဖြင့် တီဘီရောဂါလက္ခဏာများဖြစ်သော ချောင်းဆိုးရက်ရှည်ကြာခြင်း၊ သလိပ်ထွက်ခြင်း၊ သလိပ်တွင်သွေးပါခြင်း၊ တင်ခွေခွေဖျားခြင်း တို့ဖြစ်ပါက . . . . . မြို့နယ်ကျန်းမာရေးဌာနသို့ အလျင်အမြန် သွားရောက်၍ စမ်းသပ်စစ်ဆေးမှု ခံယူနိုင်ပါရန် အကြောင်းကြားအပ်ပါသည်။

အကယ်၍ သင့်တွင် တီဘီရောဂါရှိသည်ဟု စမ်းသပ်စစ်ဆေးတွေ့ရှိပါက သင့်လျော်မှန်ကန်သော တီဘီဆေးကုထုံးဖြင့် အချိန်ကာလတိကျစွာ လိုက်နာကုသပါက တီဘီရောဂါသည် ကုသ၍ ပျောက်ကင်းနိုင်သောရောဂါဖြစ်ပါသည်။ မြို့နယ်ကျန်းမာရေးဌာနမှ တီဘီရောဂါကို အခမဲ့ "တိုက်ရိုက်ကြည့်ရှု၊အချိန်တိုနှင့်ကု"နည်းဖြင့် ကုသမှုပေးလျက်ရှိပါသည်။

သလိပ်စစ်ဆေးခြင်းအဖြေ	**ပထမသလိပ်နမူနာ**	**ဒုတိယသလိပ်နမူနာ**
သလိပ်ပိုးမွှေးခြင်းအဖြေ		
ရင်ခေါင်းခါတ်မှန်အဖြေ		

. . . . . .

အဖွဲ့ခေါင်းဆောင်၊ အဖွဲ့ ( )

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

ကျန်းမာရေးဝန်ကြီးဌာန

ကျန်းမာရေးဦးစီးဌာန

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

- ကျန်းမာရေးဦးစီးဌာန၊ အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်းမှဦးစီး၍ မြန်မာနိုင်ငံ ပြည်သူလူထုတွင် တီဘီရောဂါဖြစ်ပွားမှုအခြေအနေကို သိရှိနိုင်ရန်အတွက် ကွင်းဆင်းဆောင်ရွက်ခြင်း ဖြစ်ပါသည်။
- ဤနေရာဒေသ၏ လက်ရှိတီဘီရောဂါဖြစ်ပွားမှုအခြေအနေကို အမှန်အတိုင်းသိရှိနိုင်ရန် ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- ထို့ကြောင့် သက်ဆိုင်ရာမြို့နယ်၏ တာဝန်ရှိပုဂ္ဂိုလ်များ၊ ကျန်းမာရေးဌာနမှ ကျန်းမာရေးဝန်ထမ်းများနှင့်အတူ ပြည်သူလူထု၏ ပူးပေါင်းပါဝင်မှုသည် အရေးကြီးပါသည်။
- တီဘီရောဂါစစ်တမ်းကောက်ယူရာတွင် လူကြီးမင်း၌ တီဘီရောဂါရှိ၊မရှိစစ်ဆေးရန်အတွက်၊ ရင်ခေါင်းဓါတ်မှန်ရိုက်ပြီး မေးခွန်းများမေးမြန်း၍ ရောဂါရှိ၊မရှိရှာဖွေဖော်ထုတ်မည်ဖြစ်ပါသဖြင့် လူကြီးမင်း၏ သဘောတူညီချက်အရ လူကြီးမင်း ၏ ကျန်းမာရေးအခြေအနေကို မှန်ကန်စွာ စစ်ဆေးပေးနိုင်ရန်အတွက်၊ ချိန်းဆိုဖိတ်ကြားသည့်နေ့ရက်၊ အချိန်တွင် တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ရှိရာ စုရုပ်သို့ မပျက်မကွက်လာရောက်စစ်ဆေးခံပြီး မေးမြန်းချက်များအား ပြည့်စုံမှန်ကန်စွာ ဖြေဆိုပေးပါရန် လေးစားစွာ ပန်ကြားအပ်ပါသည်။
- တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့သို့ လာရောက်၍ ပူးပေါင်းဆောင်ရွက်သည့်အတွက် ကျေးဇူးတင်ပါသည်။

အဖွဲ့ခေါင်းဆောင်ဆရာဝန်၊တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ ( )

ကျန်းမာရေးဝန်ကြီးဌာန

ကျန်းမာရေးဦးစီးဌာန

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း

တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

- ကျန်းမာရေးဦးစီးဌာန၊ အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်းမှဦးစီး၍ မြန်မာနိုင်ငံ ပြည်သူလူထုတွင် တီဘီရောဂါဖြစ်ပွားမှုအခြေအနေကို သိရှိနိုင်ရန်အတွက် ကွင်းဆင်းဆောင်ရွက်ခြင်း ဖြစ်ပါသည်။
- ဤနေရာဒေသ၏ လက်ရှိတီဘီရောဂါဖြစ်ပွားမှုအခြေအနေကို အမှန်အတိုင်းသိရှိနိုင်ရန် ဆောင်ရွက်မည် ဖြစ်ပါသည်။
- ထို့ကြောင့် သက်ဆိုင်ရာမြို့နယ်၏ တာဝန်ရှိပုဂ္ဂိုလ်များ၊ ကျန်းမာရေးဌာနမှ ကျန်းမာရေးဝန်ထမ်းများနှင့်အတူ ပြည်သူလူထု၏ ပူးပေါင်းပါဝင်မှုသည် အရေးကြီးပါသည်။
- တီဘီရောဂါစစ်တမ်းကောက်ယူရာတွင် လူကြီးမင်း၌ တီဘီရောဂါရှိ၊မရှိစစ်ဆေးရန်အတွက်၊ ရင်ခေါင်းဓါတ်မှန်ရိုက်ပြီး မေးခွန်းများမေးမြန်း၍ ရောဂါရှိ၊မရှိရှာဖွေဖော်ထုတ်မည်ဖြစ်ပါသဖြင့် လူကြီးမင်း၏ သဘောတူညီချက်အရ လူကြီးမင်း ၏ ကျန်းမာရေးအခြေအနေကို မှန်ကန်စွာ စစ်ဆေးပေးနိုင်ရန်အတွက်၊ ချိန်းဆိုဖိတ်ကြားသည့်နေ့ရက်၊ အချိန်တွင် တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ရှိရာ စုရုပ်သို့ မပျက်မကွက်လာရောက်စစ်ဆေးခံပြီး မေးမြန်းချက်များအား ပြည့်စုံမှန်ကန်စွာ ဖြေဆိုပေးပါရန် လေးစားစွာ ပန်ကြားအပ်ပါသည်။
- တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့သို့ လာရောက်၍ ပူးပေါင်းဆောင်ရွက်သည့်အတွက် ကျေးဇူးတင်ပါသည်။

အဖွဲ့ခေါင်းဆောင်ဆရာဝန်၊တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ ( )

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း
တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

<u>သလိပ်စစ်ဆေးရန်လိုအပ်သူများသိသာရန်</u>

- လူကြီးမင်းအနေဖြင့် တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့သို့ လာရောက်၍ ပူးပေါင်းဆောင်ရွက်ပြီး တီဘီရောဂါရှိ/မရှိ လာရောက် အစစ်ဆေးခံသည့်အတွက် ကျေးဇူးတင်ပါသည်။
- လူကြီးမင်း၏ ရင်ခေါင်းဓါတ်မှန်ရိုက်၍ စစ်ဆေးခြင်းအဖြေ (သို့မဟုတ်) ရောဂါရာဇဝင်မေးမြန်းချက်အဖြေအရ လူကြီးမင်းတွင် တီဘီရောဂါရှိနိုင်သည်ဟု ယူဆရပါသဖြင့် ဆက်လက်၍ လိုအပ်သော စမ်းသပ်စစ်ဆေးမှုကို ပြုလုပ်ပေးမည်ဖြစ်ပါသည်။ လူကြီးမင်းထံမှ သလိပ်နမူနာ (၂)ခွက်ယူ၍ စစ်ဆေးပေးမည်ဖြစ်ပါသည်။ သလိပ်နမူနာယူနည်းကို သက်ဆိုင်ရာဓါတ်ခွဲဝန်ထမ်းမှ သင်ကြားပေးမည်ဖြစ်ပါသည်။ ယခုချက်ချင်းထွေး သလိပ်နမူနာကို တစ်ခွက် ပေးရန်နှင့် မနက်ဖန် နံနက်စောစောအိပ်ယာထထခြင်း သလိပ်နမူနာတစ်ခွက်ကို ပေးရန် လိုအပ်မည်ဖြစ်ပါသည်။
- ထို စစ်ဆေးချက်အဖြေများကို လူကြီးမင်းထံဆက်သွယ်၍ ပြန်လည်အကြောင်းကြားပေးမည်ဖြစ်ပါသည်။
- အကယ်၍ တီဘီရောဂါရှိကြောင်း အဖြေထွက်လာပါကလည်း စိုးရိမ်ပူပန်စရာမလိုပါ။ တီဘီရောဂါသည် ကုသ၍ ပျောက်ကင်းသည့် ရောဂါဖြစ်ပါသည်။
- မြို့နယ်ကျန်းမာရေးဌာနတွင် ချက်ချင်းမှတ်ပုံတင်၍ တီဘီရောဂါကို ပျောက်ကင်းသည်အထိ ထိရောက်သော ဆေးဝါးများဖြင့် **<u>အခမဲ့</u>** ကုသပေးမည်ဖြစ်ပါသည်။
- အကယ်၍ မေးခွန်းတစ်စုံတစ်ရာ မေးမြန်းလိုပါက အောက်ပါ အတိုင်းဆက်သွယ်နိုင်ပါသည်။
  အဖွဲ့ခေါင်းဆောင်ဆရာဝန်၊တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ ( ) နေပြည်တော် ဝဖရ ၄၂၁၂၀၁
  ရန်ကုန်မြို့ ဖုန်း ၀၁ ၃၈၀၉၅၁၊ ၀၁ ၃၈၀၉၅၃၊ မွန္နလေးမြို့ ၀၂ ၈၈၃၅၊

အမျိုးသားတီဘီရောဂါတိုက်ဖျက်ရေးစီမံကိန်း
တီဘီရောဂါစစ်တမ်းကောက်ယူခြင်းစီမံချက်

<u>သလိပ်စစ်ဆေးရန်လိုအပ်သူများသိသာရန်</u>

- လူကြီးမင်းအနေဖြင့် တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့သို့ လာရောက်၍ ပူးပေါင်းဆောင်ရွက်ပြီး တီဘီရောဂါရှိ/မရှိ လာရောက် အစစ်ဆေးခံသည့်အတွက် ကျေးဇူးတင်ပါသည်။
- လူကြီးမင်း၏ ရင်ခေါင်းဓါတ်မှန်ရိုက်၍ စစ်ဆေးခြင်းအဖြေ (သို့မဟုတ်) ရောဂါရာဇဝင်မေးမြန်းချက်အဖြေအရ လူကြီးမင်းတွင် တီဘီရောဂါရှိနိုင်သည်ဟု ယူဆရပါသဖြင့် ဆက်လက်၍ လိုအပ်သော စမ်းသပ်စစ်ဆေးမှုကို ပြုလုပ်ပေးမည်ဖြစ်ပါသည်။ လူကြီးမင်းထံမှ သလိပ်နမူနာ (၂)ခွက်ယူ၍ စစ်ဆေးပေးမည်ဖြစ်ပါသည်။ သလိပ်နမူနာယူနည်းကို သက်ဆိုင်ရာဓါတ်ခွဲဝန်ထမ်းမှ သင်ကြားပေးမည်ဖြစ်ပါသည်။ ယခုချက်ချင်းထွေး သလိပ်နမူနာကို တစ်ခွက် ပေးရန်နှင့် မနက်ဖန် နံနက်စောစောအိပ်ယာထထခြင်း သလိပ်နမူနာတစ်ခွက်ကို ပေးရန် လိုအပ်မည်ဖြစ်ပါသည်။
- ထို စစ်ဆေးချက်အဖြေများကို လူကြီးမင်းထံဆက်သွယ်၍ ပြန်လည်အကြောင်းကြားပေးမည်ဖြစ်ပါသည်။
- အကယ်၍ တီဘီရောဂါရှိကြောင်း အဖြေထွက်လာပါကလည်း စိုးရိမ်ပူပန်စရာမလိုပါ။ တီဘီရောဂါသည် ကုသ၍ ပျောက်ကင်းသည့် ရောဂါဖြစ်ပါသည်။
- မြို့နယ်ကျန်းမာရေးဌာနတွင် ချက်ချင်းမှတ်ပုံတင်၍ တီဘီရောဂါကို ပျောက်ကင်းသည်အထိ ထိရောက်သော ဆေးဝါးများဖြင့် **<u>အခမဲ့</u>** ကုသပေးမည်ဖြစ်ပါသည်။
- အကယ်၍ မေးခွန်းတစ်စုံတစ်ရာ မေးမြန်းလိုပါက အောက်ပါ အတိုင်းဆက်သွယ်နိုင်ပါသည်။
  အဖွဲ့ခေါင်းဆောင်ဆရာဝန်၊တီဘီရောဂါစစ်တမ်းကောက်ယူရေးအဖွဲ့ ( ) နေပြည်တော် ဝဖရ ၄၂၁၂၀၁
  ရန်ကုန်မြို့ ဖုန်း ၀၁ ၃၈၀၉၅၁၊ ၀၁ ၃၈၀၉၅၃၊ မွန္နလေးမြို့ ၀၂ ၈၈၃၅၊

Ministry of Health
Department of Health
National Tuberculosis Programme
National Tuberculosis Prevalence Survey

Post survey questionnaire for the TB smear positive / culture positive cases (Form 18)

1. Survey number. Tsp ☐☐ Household ☐☐☐ Individual ☐☐☐
2. Name _____
3. Age ☐☐
4. Sex (1. Male 2.Female) ☐
5. Address _____
6. Occupation _____
7. Marital status (1.Married, living together 2. Married, living separately 3. Divorced 4.Widowed 5. Never married 6.Other (Specify) ☐
8. How many family members living together including patient? ☐☐
9. Position in a household (1. Head of household 2.spouse of head 3.Parents of the household head 4.sibling or grandchild of the household head 5. non family member 6.Other _____) ☐
10. Distance from home to any TB diagnostic center under NTP _____ mile
11. Cost for one way transportation _____ Kyats
12. Time spent for one visit to TB clinic _____ hours
13. Are you a native? (1.Yes 2.No) ☐
14. How long have you been living in this address? _____ ☐
15. Status of bacteriological examination (1.S+ 2.S neg. C+) ☐
16. Type of TB patient (1.New 2.Relapse 3.Treatment after default 4.Failure) ☐
17. Category put on (1.Cat I 2. Cat II 3.Cat III) ☐
18. Did you know you had TB (during interview)? (1.Yes, diagnosed before the survey 2.Yes, I suspected I had TB, 3. Yes, I suspected but think I have other disease 4. No. 5. Other _____) ☐
19. Were you ill at the survey time? (1.Yes, very ill, could not work, 2.Yes, ill, difficult to work, 3.Yes, ill but could work 4.Yes, a little 5. No, I was health 6. Other _____) ☐
20. If ill what was your illness, please mention : -

    _____

    _____
21. How long had you been ill before the survey : _____ days ☐
    (1. a few days 2. a week 3.less than 2 weeks 4. 2-4 weeks 5.3 months or less 6.a year or less 7. more than a year 8. Well)
22. Is there any interruption of treatment during this treatment after survey? (1.Yes 2.No) ☐

23. For how long? _____ days
24. What was the problem? _____

If patient is a retreatment case

25. To whom you consult about your illness? (1. NTP 2. Public health center including hospital 3. GP 4.private hospital 5.Pharmacy 6.Other _____) ☐
26. Where were you diagnosed as TB? (1. NTP 2. Public health center including hospital 3. GP 4.private hospital 5.Other _____) ☐
27. From where are you taking TB treatment? (1. NTP 2. Public health center including hospital 3. GP 4.private hospital 5.Pharmacy 6.Other _____) ☐
28. Why did you choose that place for seeking treatment?

    _____

Department of health
Informed consent form for National TB Prevalence Survey

This informed consent form is for the community members who are invited to participate in TB prevalence survey in the selected clusters of Myanmar.

Part I: Information sheet

(1) Introduction

I am from National TB Programme. We are conducting survey to know the burden of TB disease in the community. I am going to give you information and invite you to participate in this survey. This consent form will explain you about the survey we are conducting and if you have questions you can ask me.

(2) Purpose of the research

The aims of this survey is to estimate the disease burden of active pulmonary TB as smear positive and culture positive TB among people aged 15 years and above, to know occurrence of TB suggested symptoms, patients behaviours against TB symptoms as well as utilization of TB service in private sector and to know the risk factors such as nutrition, smoking, gender, housing conditions and socio-economic factors related to TB in community. The survey findings will be used to revise the current strategies to develop a future plan.

(3) Type of research intervention

To fulfill above aims, the community from the selected clusters will be screened for TB by interviewing about the TB symptoms and using Chest X-ray examination. The screening process will take about 30 minutes. If a participant is suspected of having TB followed by sputum smear microscopy and sputum culture and result will be given back later.

(4) Participant selection

You are being invited to take part in this survey.

(5) Voluntary participation

Your participation in this survey is entirely voluntary. It is your choice whether to participate or not. If you choose not to participate all the service you receive from health center will continue and nothing will change.

(6) Procedure

1. If you decided to participate in this survey, you will be interviewed about your socio demographic information, about TB suggestive symptoms, past or current anti-TB treatment history and health seeking behaviors related to TB suggestive symptoms. The information recorded is confidential.
2. The respondents who give informed consent from the selected cluster will be examined for TB by using Chest X-ray and interview using structured questionnaire. Those who are suspected of having TB will be sent for sputum smear examination and sputum culture. If a participant has an active TB, he/she will be treated according to the NTP guidelines.

(7) Risks and discomforts

There are no psychological, social and physical hazards except the radiation exposure, which is negligible. There are no risks or possible hazards for respondents included in this survey since the average actual effect of the radiation exposure is 0.05mSv (Sievert). The surrounding will be out of bound within 3 meters radius. If respondent is a woman and having pregrancy, she will be exempted from X-ray screening due to risk of radiation.

(8) Benefits

This study will be beneficial to the community as well as TB programme for the improvement of programme management and evaluation of programme impact. The findings of the survey would provide valuable information

express the programme impact and to develop the appropriate plan and strategies for efficient implementation of the National TB Programme according to the real situation. The respondents are entitled to the medical benefits and treatment for tuberculosis.

(9) Incentives or compensation

No compensation for any risk, but some goods will be provided for participating in this survey as a compensation of their time spending for the screening process.

(10) Confidentiality

We are not be sharing information about you to anyone outside of the survey teams. The information that we collect from this survey will be kept private.

(11) Publication or sharing the results

The results of this survey will be published and made available to the National TB Programmes elsewhere. The anonymity of the subjects will be protected and no identifying information will be included in these publications.

(12) Right to refuse or withdraw

All the respondents are free to withdraw and discontinue their participation at any time during the survey including women with pregnancy to refuse for X-ray screening.

(13) Who to contact

Any question regarding this survey may be directed to Dr. Thandar Lwin, Assistant Director (TB), National TB Programme, Department of Health, Yangon, Myanmar. (Telephone: 95-67-421201)

This proposal has been reviewed and approved by the institutional Ethical Review Committee, Department of Health, which is a committee whose task is to make sure that research respondents are protected from harm. If you wish to find more about the Committee, contact the secretary of the committee at the Department of Health, Building 4, Naypyitaw.

Part II: Certificate of consent

I have read the foregoing information, or it has been read to me. I have had the opportunity to ask question about it and any questions that I have asked have been answered to my satisfaction. I have been informed that the risks are minimal. I know that if I have TB, I will get treatment from township TB center. I consent voluntarily to participate as a respondent in this survey and I understand that I have right to withdraw from the study at anytime without in anyway affecting my further medical care.

Name of respondent . . . . . .
Signature of respondent . . . . . .
Date . . . . . .

If illiterate: I have witnessed the accurate reading of the consent form to the potential respondents, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.
A literate witness must sign (if possible, this person should be selected by the Respondents and should have no connection to the research team). Respondents who are illiterate should include their thumb print as well.

Name of witness . . . . . and thumb print of respondent
Signature of witness . . . . . .
Date . . . . . .

This survey was supported by the following organizations:

3DF

JICA

psi
Myanmar

RIT/JATA

USAID
FROM THE AMERICAN PEOPLE

World Health Organization