2020

NATIONAL TUBERCULOSIS PREVALENCE SURVEY REPORT

Government of Nepal
Ministry of Health and Population
Department of Health Services
National Tuberculosis Control Center

मा. भानु भक्त ढकाल
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FOREWORD

Tuberculosis remain as a public health challenge in Nepal. It is preventable and curable; however, large number of new Tuberculosis patients are registered and large number of deaths due to Tuberculosis are reported every year. It is unfortunate that most of the TB cases are seen in young and productive age groups (15-54 years). Long duration and high costs of treatment linked with its severe side effects, pose greater burden on household and national economy.

The Ministry of Health and Population (MoHP) is privileged to present the first National TB Prevalence Survey (2018-2019) report. The survey was based on nationally representative sample covering 55 districts. It was paperless and had followed the international standard procedure and protocol suggested by the World Health Organization.

The Survey has provided exact burden of disease and health seeking behavior among TB patients. The actual burden of TB is estimated to be 1.6 times higher than previously thought. The survey findings call for an innovative, effective and targeted response to achieve the END TB targets and Sustainable Development Goals (SDG)

I would like to take this opportunity to express my sincere gratitude to all staffs under Ministry, donor partners, technical and non-technical agencies and other contributors, which has been indispensable to the success of the survey.

March, 2020

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PREFACE

It is our great achievement to carry out National TB Prevalence Survey in the country successfully. The Ministry of Health and Population is implementing TB prevention, control, management, care, and support interventions at all levels in the country. The implementation approach and modalities are guided by the 5-years national strategy plan, prepared in line with the WHO END TB Strategy and Sustainable Development Goals (SDG). Since the adoption of the STOP TB Strategy in 2006, significant efforts and investment had been made to control and prevent TB throughout the country and achieved remarkable progress in the set indicators. However, the Ministry realized and envisioned to estimate the real burden of disease and make a realistic and evidence-based plan to eliminate TB from the country and planned to carry out TB prevalence survey in Nepal.

National TB prevalence survey is the milestone in tuberculosis control history. The prevalence survey 2018-19 is the first-ever TB prevalence Survey of Nepal. The survey reserved the reputation of the Government of Nepal among the global tuberculosis community by maintaining the high standard and quality. Besides, survey implementation led to a change in a conventional paper-based survey to a paperless survey by using hi-tech real-time technology.

This survey, which mainly helped to know the true epidemiology of TB, monitor and ongoing program impact, and collect relevant data on incidence and prevalence, is believed to strengthen the national TB prevention and eliminate TB from the country.

Since reliable baseline information is essential for developing and implementing TB elimination initiatives, the findings of this survey will be of great importance for the overall management of the National TB control program particularly for planning, policy, and decision-making. In addition, the findings will support the sustainable development goal. Therefore, it is my great pleasure to recommend using this survey finding for the planning and decision making of TB prevention and control activity in Nepal.

I would like to take an opportunity to sincerely thank all members engaged in carrying out the survey from different ministries and organizations including MoHP, National TB Control Centre, World Health Organization, RIT/JATA, Save the Children International/Global Fund, LHL International, Damien Foundation, IOM, NATA GENETUP, and JANTRA/INTREPID Nepal.

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FOREWORD

Tuberculosis still remains as one of the leading causes of infectious disease and public health challenges especially in developing countries. This continues to pose significant new challenge to manage tuberculosis response, and the professional communities including policy and public health experts, scientists, clinicians and academicians are constantly exploring effective ways to investigate and eliminate this disease.

In our context, we would like to acknowledge National Tuberculosis Control Centre (NTCC), development partners and technical agencies, who envisioned the idea for conducting the national tuberculosis prevalence survey, invested resources and created enabling environment for successful implementation of the survey activities.

My sincere thanks to WHO country team and Save The Children (GF/SCI) for their invaluable technical and financial supports in conducting this nationwide survey. Many thanks also to WHO consultants and other global experts who carried out midterm review of TBPS and for sharing their experiences that greatly contributed in successful implementation of the survey.

We would also acknowledge for Research Institute of Tuberculosis of Japan for designing, carrying out, monitoring, including laboratory quality control and analyzing the survey data.

Many thanks also to Prevalence Survey Steering Committee, Technical Committee and Technical Working Committee for providing timely policy support, ensuring financial supports, technical guidance, preparation of all the required documents and management of outsourced agencies for field data collection, NTCC and PS secretariat members for professionally handling survey operations in agreement with WHO quality standards, and all levels of governments, organizations and local communities for ensuring successful field operations. We would also like to thanks to all survey participants for their time and support and cooperation

Finally, the survey would have not been possible without support and commitments from all levels and organisations. My special thanks to the World Health Organization (WHO) country team, Save the Children International/Global Fund, LHLI International Tuberculosis Foundation and Damien Foundation, Intrepid and JANTRA, International Organization for Migration, NATA/GENETUP and NTCC Reference Laboratories.

I am confident that the finding of this survey will be useful for policy makers, planners, professionals, donors, technical and funding agencies and all other concerned stakeholders for addressing current tuberculosis situation.

For more information, the detail version, summary version and policy brief of tuberculosis prevalence survey can be available at ww.nepalntp.gov.np

Dr. Anuj Bhattachan
Director and Principal Investigator

ACKNOWLEDGMENT

We are very thankful to the WHO Country office Nepal, RIT/JATA, and Save The Children Nepal for technical assistance and quality assurance for the entire process of the survey. We sincerely appreciate the additional financial support by the Global Fund (PR Save the Children), WHO, LHL International, Damien Foundation for the survey. We also are grateful to Intrepid Nepal and JANTRA for successfully carrying out the entire field data collection. Our sincere thanks also go to GENETUP/NATA and International Organization for Migration Nepal for supporting NTRL at NTCC for carrying out central lab functions. We are also thankful to Info Developers Pvt. ltd for supporting in the development of the data-management software for the survey. We also thank the inputs provided by experts during key review missions, data analysis, and report writeup. Our sincere thanks to all the volunteers, facilitators, and committee members at all levels and especially to the participants who contributed their valuable time to the survey. (Details of the list of contributors are in Annex 8.3.12)

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ABBREVIATION

AIDS	Acquired Immunodeficiency Syndrome
CBS	Central Bureau of Statistics
CDMU	Central Database Management Unit
CLU	Central Laboratory unit
DEFF	Design Effect
D/MCC	District/Municipal Level Coordination Committee
CNR	Case Notification Rate
CXR	Chest X-ray
DoHS	Department of Health Services
D/PHO	District Health/Public Health Office
DCC	District Coordination Committee
DDA	Department of Drug Administration
DMU	Data Management Unit
DoAA	Department of Ayurveda and Alternative Medicine
DR TB	Drug Resistant Tuberculosis
DTLO	District Tuberculosis Leprosy Officer
FCHV	Female Community Health Volunteer
GCC	Gulf Cooperation Council
GDP	Gross Domestic Product
GENETUP	German Nepal Tuberculosis Project
GPS	Global Positioning System
HA	Health Assistant
HF	Health Facility
HFOMC	Health Facility Operation and Management Committee
HMIS	Health Management Information System
HP	Health Post
IC	Informed Consent
ID	Identification
ICF	Inner City Fund International
IOM	International Organization for Migration
IP	Internet Protocol
IPW	Inverse Probability Weight
JANTRA	Japan- Nepal Health and Tuberculosis Research Association
KTM	Kathmandu
LAN	Local Area Network
LJ	Lowenstein Jensen
LQAS	Liaison and Quality Assurance Unit
MGIT	Mycobacteria Growth Indicator Tube
MI	Multiple Imputation
MoHP	Ministry of Health and Population

MTB	Mycobacterium tuberculosis
NAA	Nucleic Acid Amplification
NALC	N-Acetyl-l-Cysteine
NaOH	Sodium Hydroxide
NATA	Nepal Anti-Tuberculosis Association
NDHS	Nepal Demographic and Health Survey
NHRC	Nepal Health Research Council
NIOHS	National Institute for Occupational Safety and Health
NITC	National Information & Technology Center
NTCC	National Tuberculosis Control Center
NTM	Non-Tuberculous Mycobacteria
NTPS	National Tuberculosis Prevalence Survey
OADC	Oelic Albumin Dextrose Catalase
OSA	Outsourced Agency
PHCC	Primary Health Care Center
PI	Principal Investigator
PIN	Personal Identification Number
PPS	Probability Proportional to Size
PR	Principal Recipient
P/RCC	Provincial/Regional Coordination Committee
PS	Prevalence Survey
PSS	Prevalence Survey Secretariat
PSU	Primary Sampling Unit
QA	Quality Assurance
RCC	Regional Coordination Committee
RHD	Regional Health Directorate
RIF	Rifampicin
RIT	Research Institute of Tuberculosis
RMS	Regional Medical Store
SC	Steering Committee
SCI	Save The Children International
SM	Social Mobilizer
SQL	Structured Query Language
SRF	Stock Release Form
TAG	Technical Advisory Group
TAC	Technical Advisory Committee
TDS	Time, Distance and Shielding
TGF	The Global Fund
TL	Team Leader
TPD	Transportation Plan Document
VDC	Village Development Committee
VDCC	Village Development Coordination Committee
WC	Working Committee

EXECUTIVE SUMMARY

Introduction: The National TB prevalence survey 2018-19 was the first-ever nationally representative TB survey carried out to understand the actual TB disease burden in the general population in Nepal. The survey also measured the health-care seeking behaviour and service utilization among survey participants. The survey estimated the prevalence of TB in Nepal based on the direct survey findings of bacteriologically confirmed pulmonary tuberculosis among ≥ 15 years population in Nepal.

Methodology: Multistage cluster sampling was designed along the WHO TB prevalence survey handbook with primary sample size of 57 589 in 99 clusters. Four primary strata were hill, mountain, terai (flat lands), and Kathmandu valley, each of which was further divided into rural and urban clusters, and further into small, medium, or large clusters (based on population size). Probability proportional to size (PPS) was used for clusters sampling. Data was collected from 28th April 2018 to 16th June 2019. All eligible participants were screened using X-ray and symptoms and those suggestive of TB, by either of the screening tool, were eligible for sputum. Spot and morning samples were collected for all eligible for sputum and tested by smear and Xpert MTB/RIF testing and additional morning sample was also collected from 50% of eligible participants and those having TB treatment history for culture.

Results: 91.9% (54 200 out of 58 956) of the eligible population participated in the survey. Among 54 200 who participated, 99.9% had symptom screening results and 96.7% had chest X-ray results, 28.1% (15 212 out of 54 200) among those who participated were eligible for sputum, and 98.6% (15 011 out of 15 212) submitted at least one sample. Xpert MTB/RIF was used as the primary diagnostic tool for all sputum eligible participants and culture was done for 50% of the participants eligible for sputum and among all those with a history of TB. 99.9% of those who submitted sputum had at least one valid result of Xpert MTB/RIF. Results of health-seeking behavior were available for all 3 022 participants who had TB symptoms and results of TB service utilisation were available for all participants with history of TB (58 current TB, 1 767 with past TB)

225 cases (direct cases before imputation) were identified as PS cases (6.2% rifampicin resistance). The average number of cases per cluster was 2.3, but the distribution was not homogeneous. More than 70% (of 225) showed abnormal chest X-ray without any symptoms. Bateriologially confirmed pulmonary TB prevalence aged ≥ 15 years was 374.5 (307.6 - 441.4) per 100 000 population. Based on the survey results, overall TB (all forms and all ages) burden was re-estimated. The revised estimate of prevalence rate was 416.3 (95% CI 314.1 – 518.5) and the incidence rate was 245.1 (95% CI 147.4 – 367.3) per 100 000 population for 2018. Although there was a significant annual decline of 3% incidence over a decade, the TB burden is much higher (1.6 times higher incidence and 1.8 times higher prevalence) than previously estimated.

The majority of symptomatic didn't seek health care services and were mostly from the mountainous region and low socio-economic status. Those not seeking care were higher among survey TB cases (45.0%, 27 out of 60) as compared to non-survey TB cases (43.1%, 1276 out of 2962) and reasons were mostly inconvenient in time and financial reasons. More than 80% took medication at home or health facilities under supervision. Among participants with history of TB, 60% chose government health facilities as the first choice for TB services, followed by the private sector, and health services outside the country. Most males of the working-age group from terai and hill region were the ones who were taking treatment services outside the country.

Conclusion: National TB prevalence Survey 2018-19 suggested a significant impact of efforts on TB epidemiology in Nepal that led to an estimated 3 % annual reduction of TB incidence in the last decade. However, the survey also identified a higher TB burden than previously estimated. The survey also found emerging challenges such as higher TB prevalence in the aging population and TB in hard to reach areas. The survey also indicated that more TB cases could be detected by using screening tools like X-ray and rapid diagnostic tools like Xpert MTB/RIF tests.

CHAPTER 1

INTRODUCTION

1.1 NEPAL COUNTRY CONTEXT

Nepal is a landlocked country bestowed with a rich history, culture and tradition. Home to a large diversity of people, it is a nation with a complex socio-cultural and socio-economic landscape. It shares borders with India to its East, West and South, and China to its North. Topographically, it is divided into three ecological zones: mountain, hill, and terai (flat) with an area of 1,47,181 km^2. Nepal had a population of 26.6 million in 2011 (Central Bureau of Statistics Government of Nepal 2011). Among them, 48.5% were males and 51.5% were females. More than half (50%) of the total population inhabits the terai region, followed by 43% in hill and 6.7% in mountain area. The majority of the population (83%) lives in rural areas. The annual population growth rate is 1.4%, a figure that includes the vast external migration. About 35% of the population is under 14 years and youth aged 15 to 24 years constitute about 20% of the total population. Based on the population projection figures, by December 2016, Nepal's population is projected to be 29 million (Central Bureau of Statistics Government of Nepal 2011).

Between 2000 and 2017 the GDP per capita in Nepal increased about 4 times. However, in most recent years the growth was stagnated and with GDP per capita Nepal remains low by international standards

Following the implementation of its constitution in 2015, Nepal replaced a unitary government with a federal system of government, thus transforming Nepal into a federal democratic republic with three levels of government: a federal level, seven provinces, and 753 local government areas, or palikas, which range from large municipal authorities that are responsible for up to 200 000 people to rural palikas covering wider area but with smaller populations of around 15 000. The 77 districts from the previous in-country structure are retained for interim management. In each province, the Ministry for Social Development is responsible for developing health policies, budgeting, monitoring and evaluation of the health programs as well as guidance to the local levels.

1.2 HEALTH SITUATION IN NEPAL

Nepal population has a life expectancy of 66.6 years (65.5 years for men and 67.9 years for women) (Central Bureau of Statistics of Nepal 2014). The maternal mortality ratio is 239/100 000 live births (MoHP, New Era, ICF International, 2017), which is relatively high compared to the neighboured countries like Bangladesh (173) and India (145 per 100 000 live birth) (World Health Organization, https://www.who.int/gho/maternal_health/mortality/maternal/en/). Communicable diseases are still prevalent, but non-communicable diseases are increasing. Ischaemic heart disease causes the highest mortality in Nepal (Ministry of Health and Population Nepal 2017)

The Ministry of Health and Population (MoHP) guides the Department of Health Service (DoHS) as well as provincial and local level governments to deliver promotional, preventive, diagnostic, curative, and palliative health care services and carries out related policy, planning, human resource, financial management and monitoring, and evaluation functions.

The structure of the MoHP is shown in Figure 1. Department of Health Services (DoHS), the Department of Ayurveda and Alternative Medicine (DoAA), and the Department of Drug Administration (DDA) come under MoHP. These three departments are responsible for formulating and implementing programs, the use of financial resources and accountability, and monitoring and evaluation. The disease control programs fall under the DoHS (Figure 2)

Figure 1: The structure of the Ministry of Health and Population (MoHP)

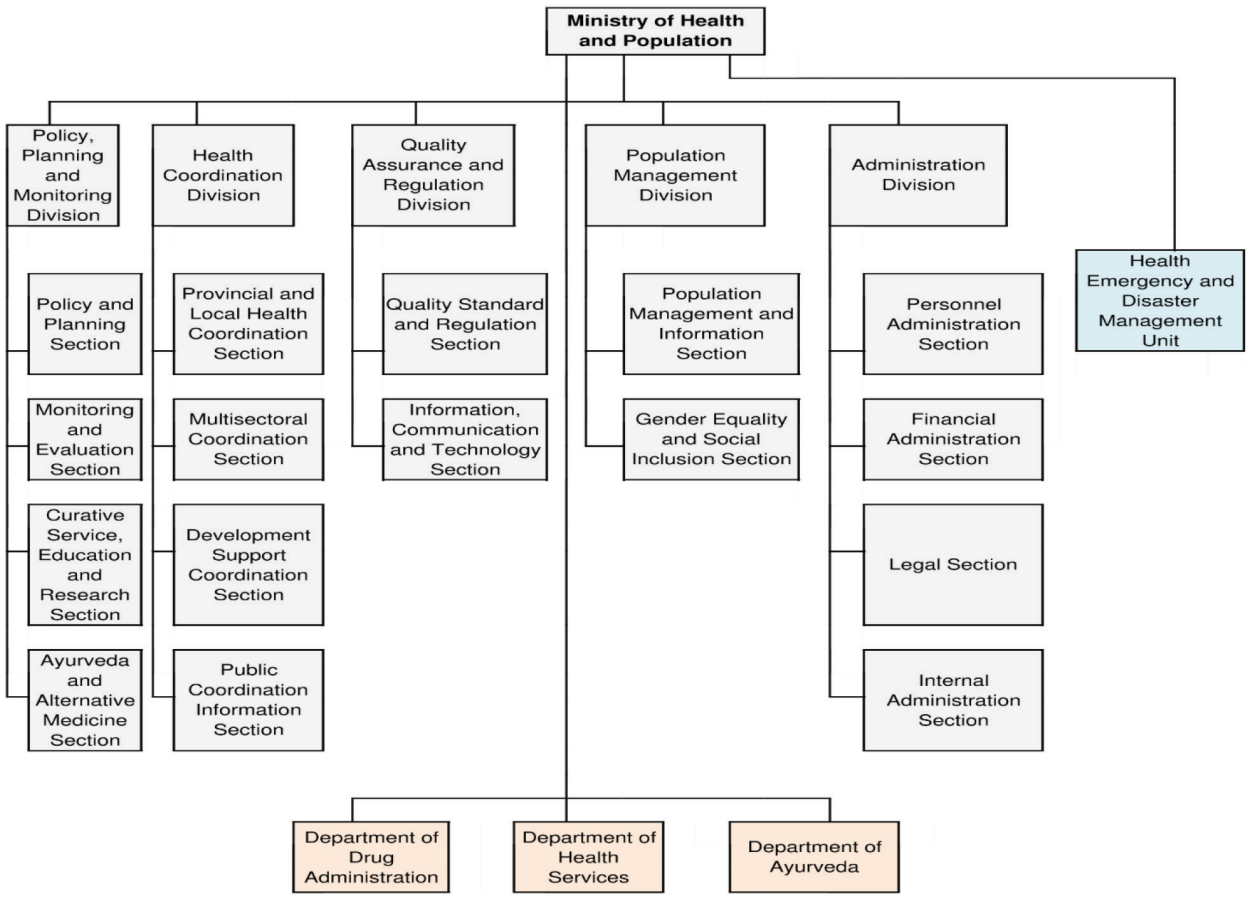
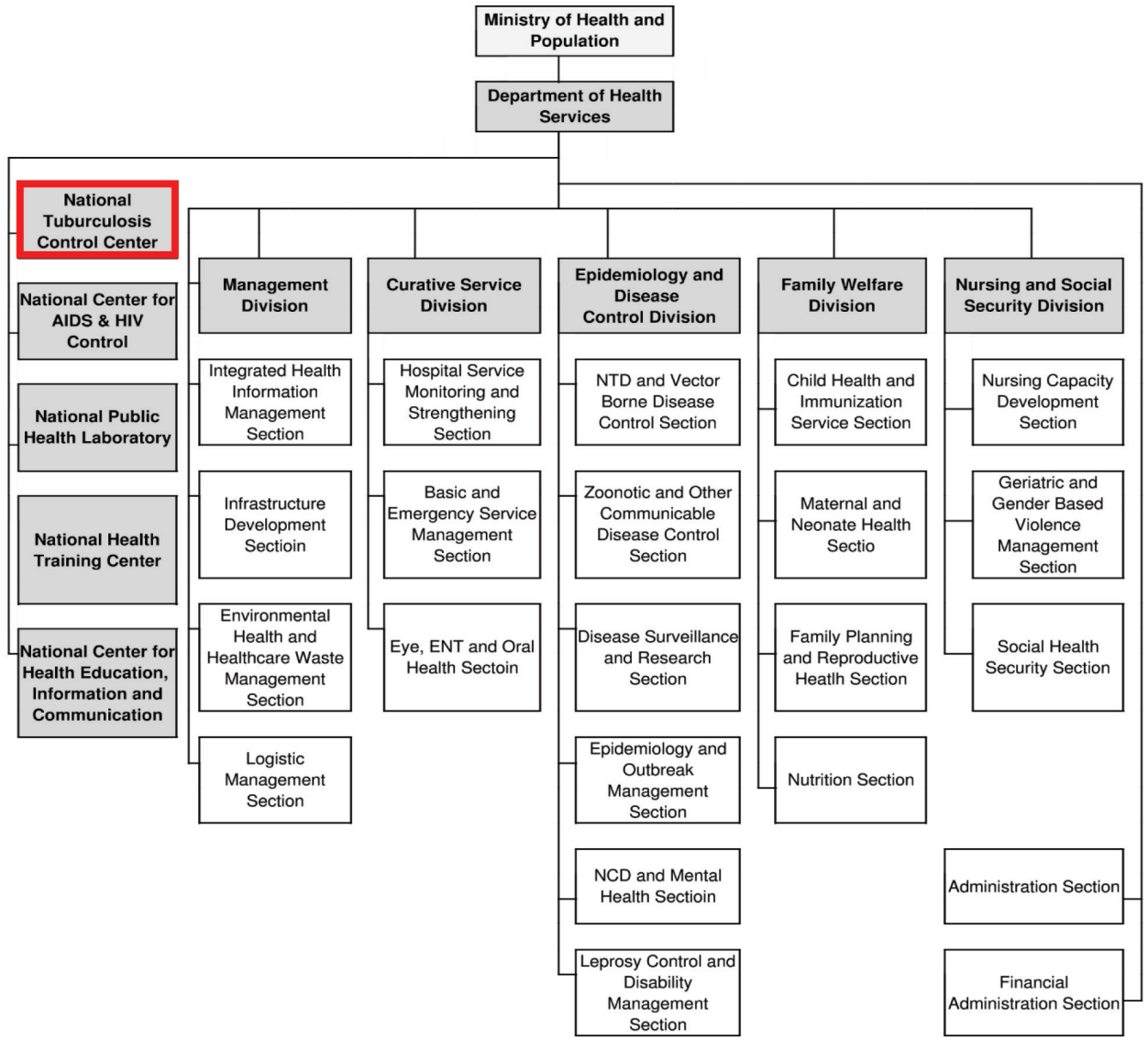


Figure 2: The structure of the Department of Health Service (DoHS) under the MoHP



The population can access the public or private health facilities in their area. In the country, the public health services are delivered by 11 central-level hospitals, 125 provincial hospitals, 77 health offices, 198 primary care centers, 3 808 health posts, 374 urban health centers, 299 community health units, 59 other health units. In addition, 11 974 primary health care and outreach clinics, 15 853 EPI/outreach clinics and 51 420 female community health volunteers provide health service in Nepal (Department of Health Service Ministry of Health of Nepal 2019).

The Government of Nepal has allocated a budget of around 600 million USD for health for the fiscal year 2019/20. Out of the total allocated budget, NPR 16 million USD have been allocated for TB, HIV, and Leprosy. Of those, about 8.7 million USD budget was allocated for tuberculosis (TB) for all levels (federal, provincial and local levels)

1.3 THE NATIONAL TUBERCULOSIS PROGRAMME (NTP)

The NTP has been a priority programme of the Government of Nepal since the introduction of the DOTS Strategy in 1994-1996. The standard case management system was applied nationwide after a high success rate of the DOTS Programme. The expansion of DOTS had to adapt to service decentralization while maintaining a high quality of service. 'DOTS All Over' was achieved in 2001. After five years, in 2006, NTP adopted the Stop TB Strategy to complete DOTS and meet the Millennium Development Goals (MDGs) targets. In 2015, Nepal achieved the MDGs targets for TB control. The estimated TB incidence decreased from 164/100 000 in 1990 to 156/100 000 in 2015. The estimated mortality due to TB decreased from 51/100 000 in 1990 to 17/100 000 in 2015. After 2015, NTP has been adopting the End TB Strategy with the principles of ending TB disease with zero deaths, zero morbidity, and zero suffering from TB in 2050.

The National Tuberculosis Control Center (NTCC) manages the national TB control programme, which is under the authority of DoHS. At the provincial level, the responsible body for TB control is the Provincial Health Directorate.

In recent years, government funding has been increasing, although there is still a huge reliance on the Global Fund for funding the programme. Save the Children International serves as the principle recipient (PR) of Global Fund Grant in the country. WHO is the key international technical agency supporting the NTP.

Currently, the NTP operates with a network of 4 323 TB treatment centers, 96 urban health centers, 624 microscopy centers, and 63 Xpert MTB/RIF centers. Treatment services for drug resistant (DR) TB have been provided through 21 DR-TB treatment centers and 86 sub-centers. For those DR-TB patients needing inpatient facilities (for various reasons including access to treatment centers/sub-centers for daily DOT), 6 DR-TB hostels and 1 DR home are provided throughout the country, which will be gradually incorporated into the hospitals and communities. At the central level, culture and drug susceptibility testing services have been provided by the National TB Control Center (NTCC) Bhaktapur, and GENETUP/NATA, Kathmandu.

1.4 TB EPIDEMIOLOGY IN NEPAL

TB data is obtained by the NTP using WHO standardized surveillance system. Both Public health services and private sectors reported TB cases to the NTP on quarterly basis. The system faced challenges that made questioned the true TB burden, i.e possible under-diagnosis, incomplete or partial reporting from the private sector, recent unexplained declines in TB notifications, and major changes to reporting practices at different administrative levels since the adoption of a new constitution in 2015. TB is advocated to be reported by all sectors by still isn't a mandatorily notifiable disease by country's policy. HMIS was introduced as the tools of reporting for all disease. However, the number of cases reported through HMIS had always been lower than the TB programme reporting.

Based on the epidemiological review conducted in January 2019 and the 2019 Global TB Report, the estimated TB incidence was stable between 2000 and 2010. It declined at an average rate of 0.9% per year from 2010, based on the declining case notifications. TB case notification decreased at an average of 2.6% per year between 2010 and 2018. An estimated 42 000 TB incident cases existed in Nepal in 2018, equivalent to a rate of 151 (133-170) cases per 100 000 population. TB case notifications in the same year were 32 043 (112 cases notified per 100 000 population).

With the introduction of Xpert MTB/RIF in Nepal, the proportion of clinically diagnosed TB decreased from 2012-13 to 2017-18 (nearly 47% declined from 2012-13 to 2017-18). Compared to 2012-13, the notification rate for all forms of TB in Nepal declined by 5%, the rate for bacteriologically confirmed TB

increased by 7%, and the rate of extrapulmonary TB increased by 15%. This pattern does not suggest a reduction of TB burden. Since 2018 onwards Xpert MTB/RIF was used for TB diagnosis in a high-risk population, such as people living with HIV (PLHIV), children, symptomatic contacts of pulmonary and bacteriologically confirmed TB patients, extrapulmonary presumptive cases (from cerebrospinal fluid, lymph node, and other tissues specimen) living in slums, prisoners, internally displaced population (IDPs), and immunocompromised patients. This may have resulted in a slight increase in bacteriological confirmation.

By geographical division, the notification rates are lowest in the mountain areas to the North of Nepal, and highest in the terai in the South (Figure 5). Notification rates are higher in older age groups. The age structure of the TB patient population is consistent from year to year. The proportion of TB cases occurring in children (0-14 years) has increased slightly, from 6.2% in 2014-15 to 7.3% in 2016-17, with variation across the provinces (from 4% to 16%). The ratio of male to female TB patients in Nepal is stable, at 1.8.

Figure 3: Estimated TB incidence rate and TB case notification rate in Nepal (source TB epidemiological review report and WHO global TB report)

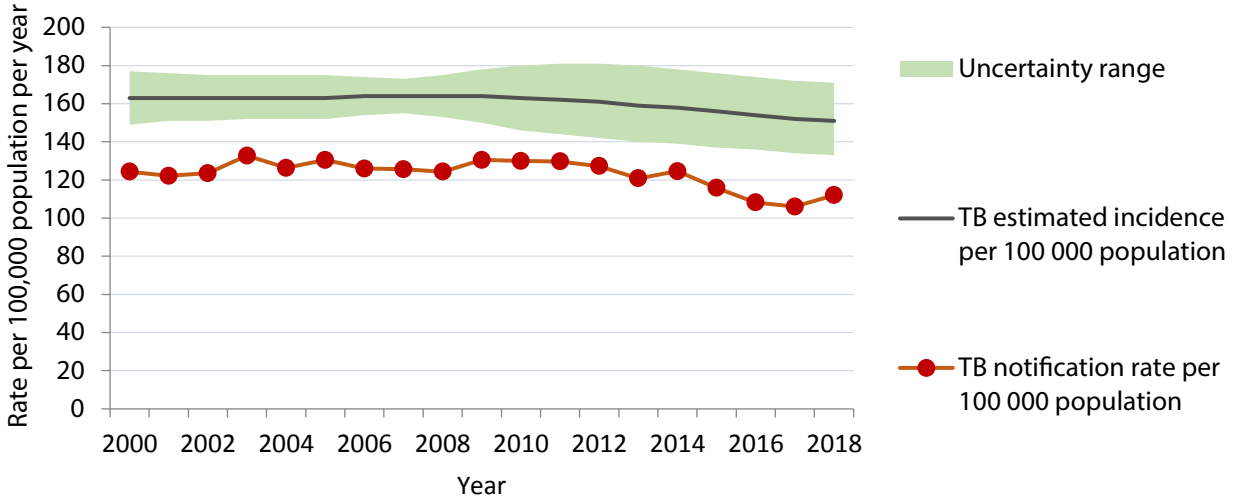


Figure 4: The trend of TB case notification divided by type of TB (from Annual NTP report (2013-2018))

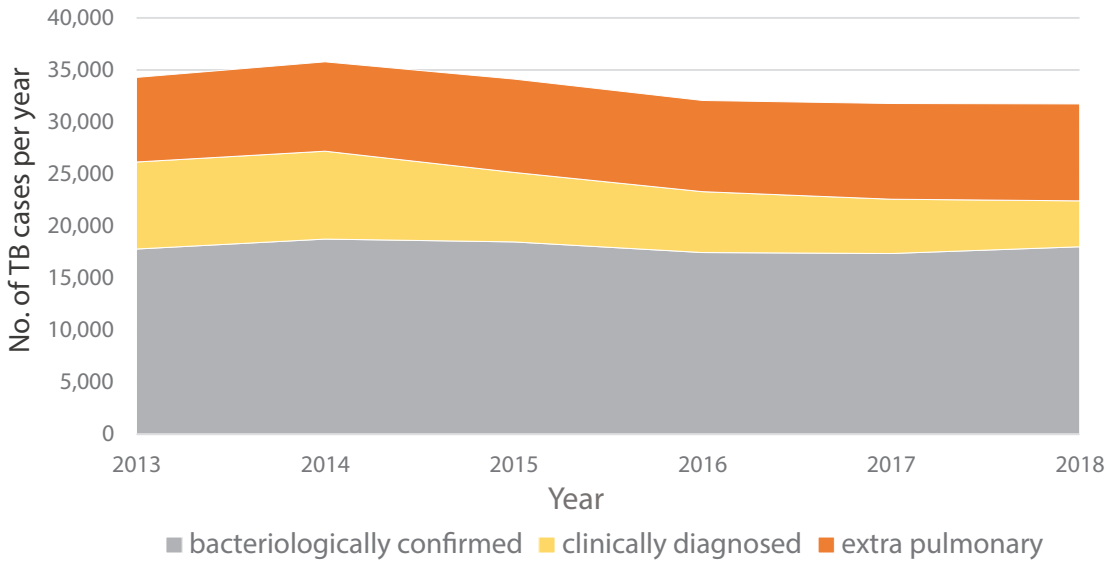
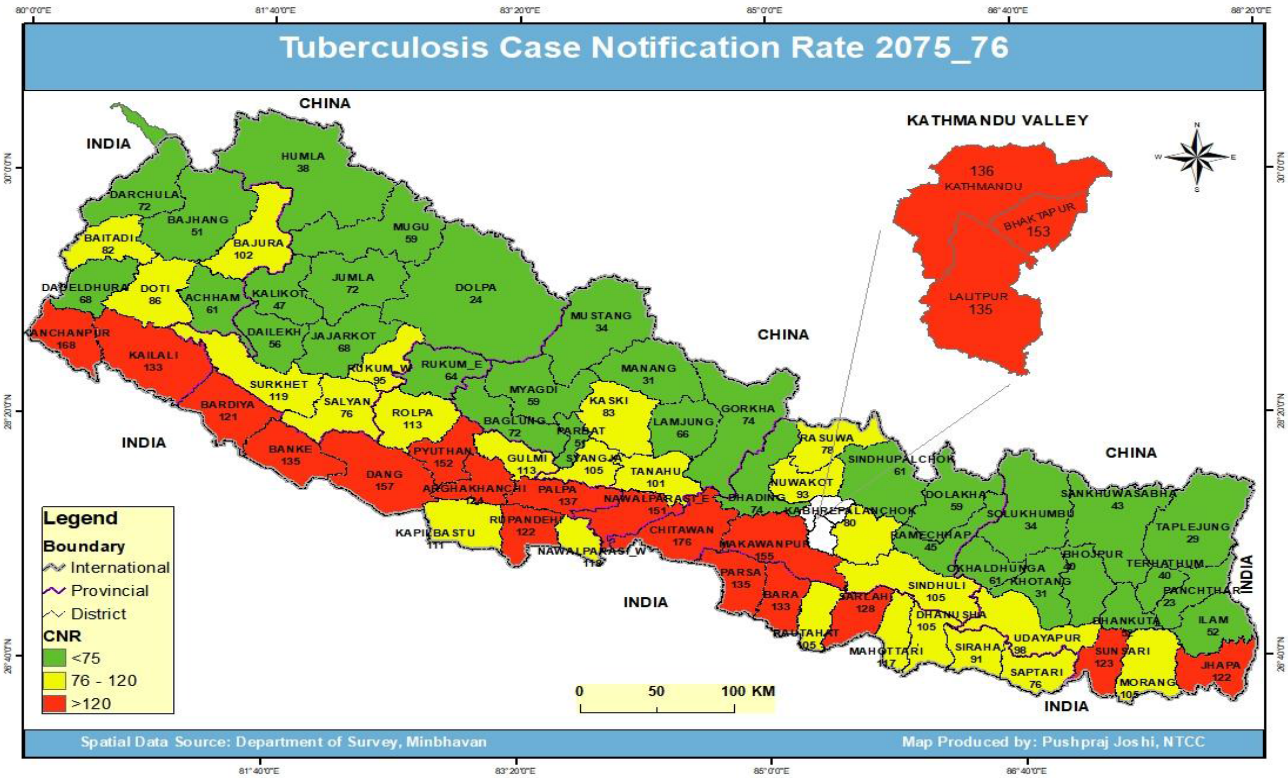


Figure 5: All form TB case notification rate (per 100 000) by district 2016-2017(2074/75 Nepal year)



1.5 THE RATIONALE OF A NATIONAL TB PREVALENCE SURVEY

Over the last 8 years the case notification rate (CNR) of smear positive cases remained essentially stable., despite the efforts of NTP to tackle TB in the country. Since Nepal is a country with considerable uncertainty about the number of TB cases and deaths, due to incomplete coverage of the surveillance systems, due to non-mandatory case notification and lack of vital registration system, the TB prevalence survey was planned to obtain a direct measure of TB burden in Nepal. The survey conducts a direct measure of bacteriologically confirmed pulmonary TB prevalence in the adult population that the current surveillance system misses identifying and recording. The survey also is instrumental in identifying the health-care seeking behaviour of the general population with TB symptoms and health service utilization practices of patients who have or had TB in the past. Overall, the impact of the efforts of the TB Control Program over the years could also be assessed.

While TB burden estimates are mainly derived from routine surveillance data and therefore based on notified cases, a national TB prevalence survey could provide a deeper explanation of the potential gaps of case notification. By understanding the real TB situation, the NTP can plan effective strategies to control TB accordingly.

The survey will describe the health-care seeking behaviour of the population when they had TB symptoms and health service utilization practices of participants with TB history. This will complete TB programme's understanding of the factors that lead to the current TB prevalence.

Ultimately, the survey may indirectly evaluate the TB programme's effectiveness and provide inputs on how to improve its performance.

CHAPTER 2

SURVEY OBJECTIVES AND ORGANIZATIONS

2.1 SURVEY GOAL AND OBJECTIVES

Goal:

Understand the burden of TB disease in the population of Nepal

Main objective:

1. To estimate the prevalence of bacteriologically confirmed pulmonary TB among ≥15 years population in Nepal in 2018.

Secondary objectives

1. To estimate the prevalence of bacteriologically confirmed pulmonary TB confirmed by Xpert MTB/RIF among ≥15 years or older at the national level.
2. To identify the health-care seeking behaviour of people with TB symptoms.
3. To identify the TB service utilization practices of participants with history of TB.
4. To calculate the notification prevalence ratio for bacteriological confirmed pulmonary TB of age >15 years by different groups regarding socio-demographic and geographic factors.
5. To update all population-based TB burden estimates (measured in terms of incidence and prevalence) using results from the prevalence survey in combination with regular surveillance data.

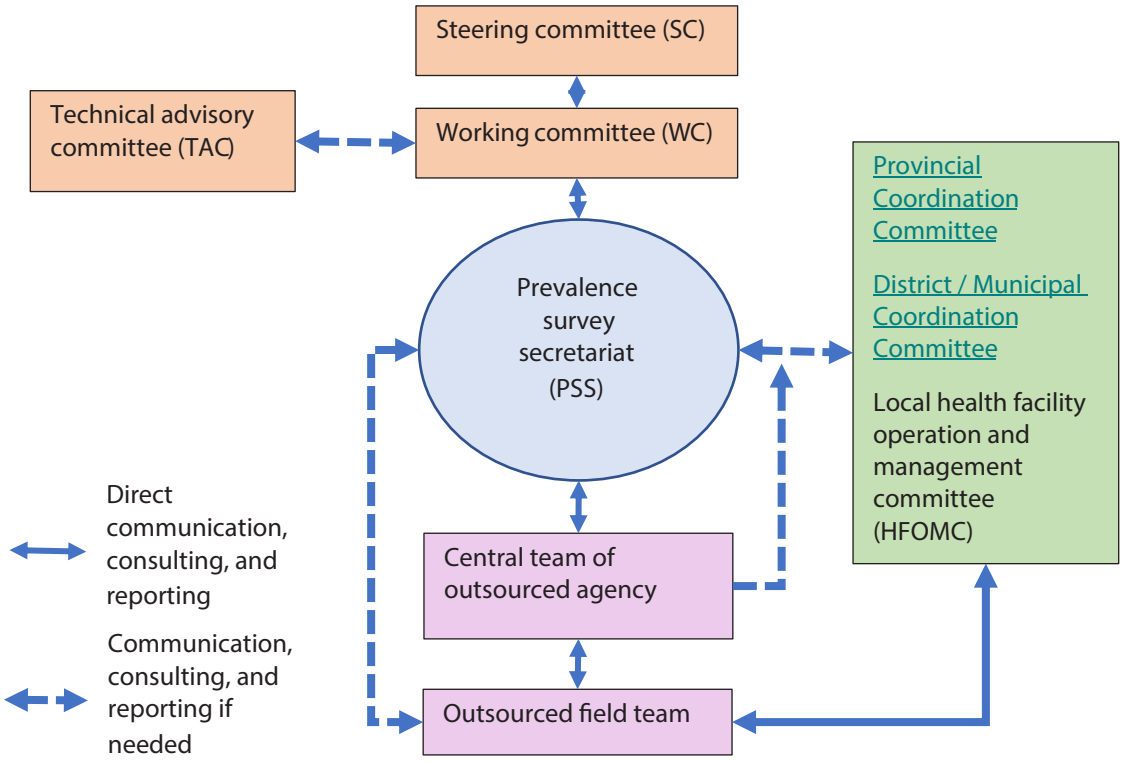
2.2 SURVEY ORGANIZATION

The survey has been coordinated by the NTCC with technical supports from WHO and other partners. The NTCC organized various steering and technical committees and various units of implementation including outsourced agencies. Overall survey organization is shown in Figure 6.

2.2.1 Steering Committee (SC)

Under the chairpersonship of the Secretary of MoPH, the members of SC are the chiefs of different units and sections of the ministry, research council, Save the Children, WHO and NTCC director as the member secretary. SC provided the highest level of direction and stewardship to oversee and guide the overall implementation of the survey. All key documents, processes, and budgets, including the changes during the implementation process, were presented and endorsed by the committee (Annex 8.3.8).

Figure 6: Survey organization and the relation among committees and teams



2.2.2 Technical Advisory Committee (TAC)

Under the chairmanship of the Director of NTCC, and experts from different technical units and organizations; such as the Central Bureau of Statistics (CBS), Research Council, Save the Children, WHO, other technical units at the ministry, this committee was formed to technically guide the survey. Different experts from the committee were consulted rigorously while developing the protocol, especially sample design and methods. During implementation, the working committee consulted TAC regularly for seeking advice on technical issues (Annex 8.3.8).

2.2.3 Working Committee (WC)

Under the chairmanship of the survey coordinator, the working committee comprised of focal points and unit chiefs of different sections at NTCC, eg. laboratory section, administration section, planning section, clinical section, and members from technical agencies supporting the survey. This committee was mainly responsible to develop all protocol and supporting documents for the survey, carry out the survey activity, and conduct supervision to the field and central level implementation (Annex 8.3.8).

2.2.4 Provincial/Regional Coordination Committee (P/RCC)

Based on the Nepal Constitution of September 2015, the country is administratively divided into 753 local government units, 7 provincial governments, and a central government. The federal governance redistributed the decision-making power and resources among the central, provincial and local governments in all sectors including health. Therefore, for facilitation and ownership of the programme at the provincial level as well as the local level, the provincial coordination committees were formed. The provincial chief acted as the chairperson and the members are from different key members of the province (Annex 8.3.8).

2.2.5 District/Municipal Level Coordination Committee

The district coordination committee was chaired by the district health officer and at the municipal level, the chair is the mayor. The committee facilitated the implementation and supervision of the survey activity at the community level (Annex 8.3.8).

2.2.6 Health Facility and Operation Management Committee (HFOMC)

In Nepal, over 4000 government health facilities are serving the population. In any cluster the survey was conducted, at least one health facility was responsible for that population. After identifying the population and the responsible health facility, an HFOMC was established for each cluster operation chaired by the chief of that ward. This committee was responsible for the facilitation, assuring protection, encouraging participation, and local support to the survey implementation at the community level (Annex 8.3.8).

2.3 THE ORGANIZATIONS CONTRIBUTED TO THE SURVEY AND THEIR ROLES

2.3.1 The National Tuberculosis Control Center (NTCC), Ministry of Health and Population

The national tuberculosis prevalence survey was conducted under the overall leadership of NTCC. The NTCC director acts as the principal investigator and the chief of surveillance, monitoring, and evaluation, and research (SMEAR) section acts as the survey coordinator. The prevalence survey secretariat office was established in NTCC with the support of the Global Fund grant (see section 2.7). The secretariat coordinates the central activities, such as radiology, laboratory and data management. In addition, the office coordinates monitoring and evaluation of the survey work, reporting the delivery to the implementing agencies, overseeing logistics management, providing technical assistance to the survey team, and hosting regular meetings/workshops for capacity building and coordination of the team. The MoHP, through NTCC, committed a huge amount of resources (46% of the 4 million USD of the survey budget) and led the steering committee.

2.3.2 World Health Organization (WHO)

WHO provided regular technical support at all stages of the survey: preparation, implementation, analysis and report writing. The country office staff were directly involved from preparation to evaluation and reporting activities. The survey protocol and operational procedures were reviewed and endorsed for the technical quality by WHO. International experts from WHO provided the review of the survey implementation in the midterm review and post-midterm monitoring of the implementation. WHO country office also provided financial support for various activities amounting to more than USD 180 000 to finance critical activities that were not covered from other budgets.

2.3.3 Save The Children/The Global Fund

Save The Children is the principal recipient (PR) of the Global Fund Grant for TB programme in Nepal. They oversee financial management and contribute to different survey committees and activities from preparation to report writing. They financed the outsourced agency that conducted field operations, developed data management software. They paid the salary of human resources for the survey secretariat (11 staff). Then, they supported the cost of administration, monitoring activities, and the technical assistance of international experts and advisors. Save The Children/TGF contributed 1.78 million USD, which is 42% of the total survey budget.

2.3.4 Research Institute of Tuberculosis (RIT) Japan

RIT together with WHO supported the development of the protocol, SOPs, capacity building, quality assurance, data analysis, and report write up. RIT Japan financed the visit of its experts for technical support and monitoring.

The RIT's experts developed the draft of the protocol and other documents, provided training on laboratory procedures and CXR reading, validated the laboratory to participate in the survey, supported data management and analyses.

2.3.5 LHL International

LHL International Tuberculosis Foundation (LHLI), Norway supported the technical assistance costs of the RIT. LHLI financially supported the National PS team for attending international capacity-building workshops in Indonesia in 2014 followed by an exposure visit in Mongolia in 2016. LHLI contributed 0.25 Million USD (around 6% of the total PS budget).

2.3.6 Damien Foundation

Damien Foundation is one of the active partners for NTP Nepal. The organization assigned their medical doctor as a clinical panel member.

2.3.7 INTREPID Nepal in collaboration with Japan - Nepal Health and Tuberculosis Research Association (JANTRA)

Intrepid Nepal Pvt Ltd (INPL) in collaboration with JANTRA, an NGO, is the partner organization outsourced to implement field-level data collection and sputum transportation activity. INPL has proven experience in conducting similar national level population-based surveys, while JANTRA has extensive experience of working in community mobilization for TB care and support.

2.3.8 Others

NTCC, GENETUP/NATA, and the International Organization of Migration (IOM) laboratories were selected to process survey samples. All three laboratories were assessed and validated by RIT Japan. The NTCC laboratory is the national reference laboratory. GENETUP is the laboratory managed by Nepal Anti Tuberculosis Association (NATA). The laboratory in Damak is managed by IOM.

2.4 CENTRAL TEAM ORGANIZATION

The TB prevalence survey secretariat was stationed at the NTCC office. It coordinated different central teams with full-time staff under the supervision of the survey coordinator and the principal investigator (See Annex 8.3.10 for details).

2.4.1 Central Radiology Unit

The major function of the central radiology unit was to make the final decision of the CXR reading and assure the quality of the image. The CXR images from the field were electronically transferred to the central unit read all CXR images were re-read (blindly) by one full-time radiologist for the survey. If any mismatches were identified, the information was sent back to the field and sputum samples were collected (among those who were labelled not eligible for sputum initially) by the mop-up team.

2.4.2 Central Laboratory Unit

The central laboratory unit coordinated three laboratories (NTCC, IOM, GENETUP) involved in the survey and implemented internal quality assurance. Three different labs were selected to minimize the burden of

central lab function to one lab. IOM lab is in the eastern part of the country, whereas NTCC and GENETUP lab in central (in KTM valley). All three laboratories shared the same number of clusters (33 each). Each lab had one microbiologist, laboratory technicians, assistants, and attendants dedicated to the survey.

2.4.3 Training and documentation Unit

This unit organized training, events and workshops. They developed the protocol, SOPs and other documents.

2.4.4 Central database management unit

The central database managing unit developed the electronic data collection, cleaning and validation system. During the implementation, the unit ensured that the system functions properly and securely. At the end of the survey, it cleaned and organized the dataset to be ready for analysis.

2.4.5 Liaison and quality assurance unit (LQAS)

This unit ensured good communication among survey teams, collaborators, communities, and authorities. The unit is led by an LQAS coordinator. Three staffs were under his supervision. LQAS officers carried out a quality check and supervision of all field activities undertaken by field teams.

2.4.6 Central logistics management unit

The unit ensured the timely availability of supplies and equipment needed for the survey. It managed the store and warehouse and organized the logistics delivery to the team.

2.4.7 Central clinical panel

The central clinical panel was composed of central radiologist, microbiologist, TB specialist, supported by the data manager and secretary. The panel reviewed the participants with positive screening results, laboratory, and recommended the TB treatment according to the national guideline (case management function).

2.4.8 Central panel for survey case definition

The panel ascertained the prevalent survey case definition. A case book was developed on all participants with positive Xpert MTB/RIF. After reviewing the CXR, culture, and TB treatment history, the panel agreed on the survey case classification (see Table 4, Table 5 and Table 6). The meeting was conducted at the end of the survey after all the information about the participants listed in the case book became available.

2.5 FIELD ORGANIZATION

The field implementation of the survey was outsourced as a joint venture to Intrepid and JANTRA. They had a central team supervising three field teams formed to conduct all field operations. The outsourced central team included the survey manager, assistant survey manager, survey coordinator, finance, logistics, and administration officers, receptionist and support staff. This team is based in Thapathali, Kathmandu.

Each field unit consisted of a field manager, two medical officers, a logistics officer, two IT officers, three laboratory technicians, two radiographers, three health staffs (nurses or health assistants), a receptionist, a mop-up officer, one maintenance assistant, one security guard, two support staff and thirteen local volunteers/social mobilizers. For timely food logistic support, a dedicated team of three canteen staff per field team was appointed throughout the survey duration. This reduced the time consumed for finding meals and tea, increased work efficiency and forged good teamwork in the field (See Annex 8.3.10 for details).

2.6 FINANCE AND BUDGETING

The TB prevalence survey was carried out with the joint financial support from the Government of Nepal, The Global Fund to Fight AIDS, Tuberculosis and Malaria, LHLI and WHO. The total budget for the Prevalence survey was USD 4 Million, a detailed budget breakdown with the expenditure is shown in Table 1.

Table 1: The survey budget contributed by different sources and its expenditure

No	Source	Total Budget Expenditure (USD)	Proportion of total budget (%)
1	Government of Nepal	1 868 355	46%
2	Save The Children / TGF	1 784 188	44%
3	LHLI	250 000	6%
4	WHO	182 731	4%
Total budget		**4 085 274**	**100%**

The Government of Nepal supported the procurement of Xpert MTB/RIF machines and cartridges, digital chest X-ray (CXR) machines, laboratory consumables and equipment, pre-testing of tools, previsits, supervisions & monitoring costs. The Global Fund through the Save the Children International, supported funding the outsourced agencies for the field operations, development of data collection software, the cost of the survey secretariat (human resources, administrative, and monitoring) and technical assistance and quality assurance costs. LHLI supported the technical assistance cost from RIT Japan and various workshops. Other technical support in capacity development was supported by WHO. Out of the total survey budget, 31.7 % was spent for field operations by the outsourced agency and the remaining 68.3% was for the human resources cost, survey equipment, software development, other preparatory work, survey analysis and report writing costs.

CHAPTER 3

SURVEY DESIGN AND METHODS

3.1 STUDY DESIGN

The first National TB Prevalence Survey was a nationwide, community-based cross-sectional survey that targeted the population aged 15 years and above. The participants were screened for the presence of TB symptoms and CXR abnormality. The positively screened participants submitted sputum samples for Xpert MTB/RIF and microscopy, and culture (50% of positively screened participants along and positively screened participants with history of TB). The TB cases determined in the survey were used to estimate the Xpert based bacteriologically confirmed pulmonary TB prevalence age ≥ 15.

3.2 SURVEY PERIOD

The survey was prepared since 2012. Survey implementation was delayed because of many reasons, such as lack of funding, earthquakes, difficulty to advocate the survey as a priority activity, difficulty to find competent human resources. The field operations were conducted from 28th April 2018 to the 16th June 2019. The complete laboratory results were available by August 2019. The data validation completed by November 2019, case classification and analysis completed by December 2019, and report writing were completed by March 2020 (Annex 8.3.5).

3.3 SURVEY ELIGIBILITY

During the census, only those who stayed at least 1 day in 6 months before census day in selected clusters, were enumerated. UN compounds, religious shelters, army shelters, and others were under the exclusion criteria (as described later) were not enumerated.

Among enumerated persons, eligibility criteria to attend the survey were applied. In principle, the population aged ≥ 15 years who were residents of the selected clusters were declared eligible to participate in the survey. The detailed inclusion and exclusion criteria are explained below.

Inclusion criteria

1. Aged ≥ 15 years AND
2. have stayed in the household for a total of 7 nights or more in the last 2 weeks before census days
    a. Non-Nepalese subjects, other than tourists and diplomats, who stayed in Nepal for at least 5 years in addition to the criteria above

Exclusion criteria (the persons staying in any of the places below are not enumerated)

- Diplomatic areas and compounds (embassies, residence of diplomats, etc.)
- UN Compounds
- Health facilities (health centers/hospitals)
- Any compounds with identified marked boundaries requiring additional permissions, especially the off-limit areas, e.g.
  - Police / Army / Security barracks and compounds
  - Hospitals, factories, education facilities, hotels, etc. which had quarters within the compound, even though the people/staff are living there.
- Hotel/Motel/Lodge and compounds
  - Big hotels.
  - The clients of small motels/Lodge, which are at large in many tourist areas. The owners and staff members were evaluated based on the inclusion criteria
- Congregate settings; e.g. prisons orphanages, geriatric homes, rehabilitation centers
- Monasteries
- Tourists

3.4 SAMPLING PROCEDURES

The survey sampling design was multi-stage cluster sampling. The primary sampling unit (PSU) was Village Development Committee (VDC) or municipality. The secondary sampling unit was ward.

3.4.1 Sample size calculations

To calculate the sample size for the TB prevalence survey with a cluster sample survey design, the following five components were considered:

1. **Relative Precision – *d*:** Relative precision is the width of the confidence interval, expressed as a proportion (or percentage) of the true population prevalence. It is recommended that the value used for relative precision is 25%. This requirement ensures that the 95% confidence interval for the value of true TB prevalence is narrow enough to be useful (≤0.25) but also not impractically too large (≥0.2).
2. **Estimated Prevalence – *p*, Estimated Prevalence in Proportion - π:** Smear-positive PBT data, which are routinely available from TB surveillance from 2011/12 was used for calculation of sample size. The case notification of smear-positive cases in pulmonary TB aged >15 years was 85.0 per /100 000. With the assumption that that PN ratio as 2, and so the estimated prevalence of smear-positive PTB (*p*) would be: smear-positive case notification x 2 = 85 x 2 = 170 / 100,000 population.

   Therefore, the estimated prevalence in proportion (π) = 0.0017

   This survey will still use the estimated prevalence of smear-positive PTB to determine the sample size, though the primary outcome is the Xpert MTB/RIF positive PTB. The details of why this is feasible and acceptable for this survey, in line with new data from 2015/16, is explained in Annex 8.3.17.
3. **Coefficient between cluster variation *(kappa)* – *k* :** This is to take into account the variation among clusters, that causes the clustering effect. Based on the recommendation, $k = 0.6$ is adopted
4. **Participation Rate – *R* :** Minimum 85% of the participation rate is targeted
5. **Cluster size – *m* :** Based on the experiences of other countries, 600 or smaller number of eligible to attend the survey subjects is acceptable. For this survey, the average cluster size was between 500 to 600 depending upon the size of population in the cluster, see Table 3 for details,

6. **Design effect *(DEFF)*:** In cluster sampling, the sample size is a product of sample size for simple random sampling (SRS) and *DEFF*. *DEFF* is determined by the intra-cluster correlation coefficient *(kappa)*, expected prevalence and cluster size.

   DEFF is calculated by $[1+\{(m-1)\ k2\pi / (1-\pi)\}] = 1.36$ for the above assumption.

Table 2: The parameters used to calculate sample size in the TB prevalence survey

Parameter	Symbols	Calculations
Cluster size	*m*	582
Coefficient of between-cluster variation	*k*	0.6
Prevalence of Smear positive PTB per 100,000 among 15+ years old	*P*	170
Prevalence expressed as a proportion	π	0.0017
Design effect	*DEFF* $[1+\{(m-1)\ k^2\pi / (1-\pi)\}]$	1.36
Relative precision	D	0.25
Sample size for SRS	$N1 = 1.96^2 (1-\pi)/ (d^2\pi)$	36 095
SRS adjusted for clustering	*N2=N1*DEFF*	48 951
Participation rate	*R*	0.85
Final sample size adjusted for non-participation	*N2/R*	**57 589**

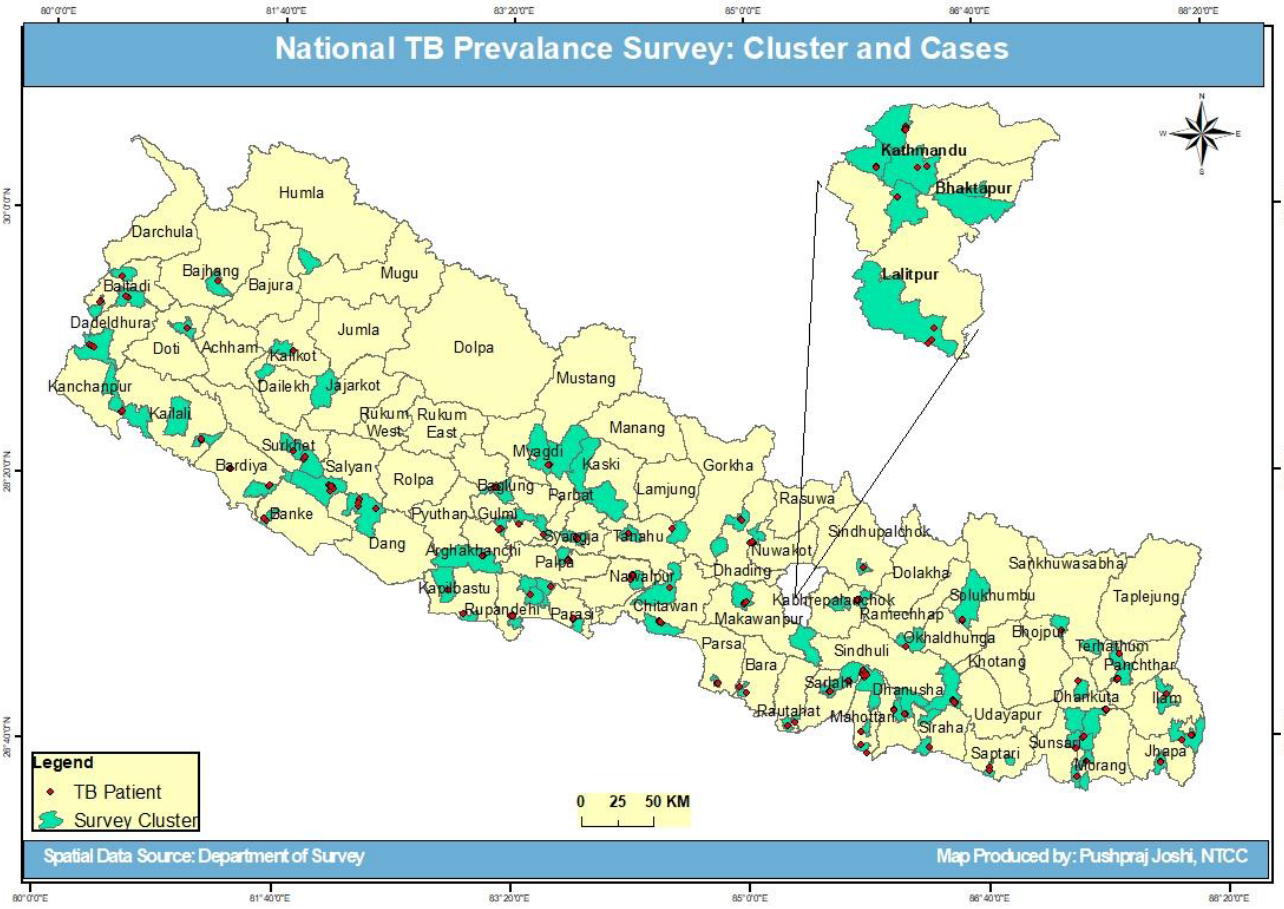
3.4.2 Stratification

Stratification was done based on geographical terrains for maximizing the capture of a representative sample and better precision of the prevalence estimate. mountain, hills, terai and Kathmandu Valley were taken as the main strata. Further stratifications were done, for each of these strata, into rural and urban regions (rural = areas with village development committee and urban= areas with Municipality). As there was no urban region in the mountain, the final strata were mountain, hill (rural and urban), terai (Rural and Urban), KTM valley (Rural and Urban). For better distribution, these strata were further stratified into populations with small, medium, or large sizes. The stratification is described in Table 3.

The no. of cluster allocation for each stratum was made proportional to its population size. The definition of the mountain/hill/terai/Kathmandu valley and urban/rural followed the ones used in the national population census of Nepal in 2011(Central Bureau of Statistics Government of Nepal 2011), whereas, age and sex composition were taken from the report of population projection of 2016, to enable PPS selection(Speringer et al. 2016).

When the samples were allocated, the urban-rural category followed the version of the 2011 census. In 2017 the urban-rural category was modified because many districts became urbanized. Despite the change, the strata allocation remains the same for the survey.

Figure 7: The clusters distribution by districts of the national TB prevalence survey in Nepal



3.4.3 Selection of clusters and households within a cluster

The selection of cluster within the strata:

The clusters (primary sampling units (PSUs)) for the survey were VDCs or municipalities. Within each stratum, all the clusters were first listed and the number of clusters, based on allocation for each stratum, were randomly selected by probability proportional to size (PPS) sampling. The number of PSUs selected followed the ones shown in Table 3.

The selection of a ward within each cluster:

The secondary sampling unit is a ward. In each selected cluster (VDC or municipality), one ward was randomly selected. If the selected ward had less than the cluster size, additional adjoining wards were selected (clockwise) and merged to the selected ward until the total cluster size target of population aged ≥15 years reached.

The selection of households in the wards of the rural region (VDC)

First, a social map was drawn for each selected ward into blocks and areas. In each of these blocks/areas, households were drawn and pointed out in detail.

The average number of estimated households per cluster was 200. If the estimated number of households of the cluster was less than 200, all households in the cluster area were selected and additional households were taken from the nearby wards (with standard selection criteria; taking nearest wards towards 3 o'clock direction from that ward).

If the estimated number of households was more than 200, one of the blocks was randomly selected as the starting point. However, the selected block might not be sufficient for covering the required total sample population, so additional blocks were selected within each cluster using similar standard selection criteria; taking the nearest block towards 3 o'clock direction from that block until the required sample size for that cluster was reached.

The selection of households in the wards of the urban region (municipality)

Each ward in the selected municipality was divided into standard grid areas. Each grid covered approximately 200 households mapped using Global Positioning System (GPS). The first grid was randomly selected. If another grid was required, the additional grid was selected taking the nearest block towards 3 o'clock direction from that grid, until the required sample size for that cluster was reached. See Annex 8.3.6 for details of clusters selected for the survey.

Table 3: Strata and allocated number of clusters

Strata	Rural / Urban	Size of population: Average population size in 2 wards		Average Cluster Size*	No. Clusters	Sample size
Mountain	Rural	Small	<500	500	2	1 000
		Large	≥500	550	7	3 850
Hill	Rural	Small	<500	500	7	3 500
		Medium	≥500 and <600	500	4	2 000
		Large	≥600	600	18	10 800
	Urban	Large	≥600	600	4	2 400
Terai	Rural	Small	<600	530	2	1 060
		Large	≥600	600	38	22 800
	Urban	Large	≥600	600	7	4 200
Kathmandu Valley	Rural	Small	<600	600	4	2 400
	Urban	Large	≥600	600	6	3 600
Total				**582**	**99**	**57 610**

The sample size of 57 610 was more than the minimum required sample size of 57 589 calculated in Table 2 and is acceptable.

*The primary strata (Hill, Mountain, Terai, and Kathmandu valley) were further segregated as rural and urban which was further segregated as small, medium, and large, altogether making 11 strata, to an equal chance of capturing even small population settlements. The cluster samples sizes are taken differently to feasibility reason, as some on areas especially in mountain and hilly regions, getting a population size of 600 (as for those in Terai and Kathmandu valley), would be difficult and not feasible for the survey, even a whole VDC (primary sampling unit) might not sometimes have that much population and could have made the field operation extremely difficult and lengthy. Hence, this survey has a different average cluster size depending upon the strata and its population dynamics.

3.5 TB CASE DEFINITION

Prevalent TB cases were defined primarily based on Xpert MTB/RIF positive results and only those with Xpert MTB/RIF positive results were further considered to discuss for determination of survey cases. Those with culture-positive but Xpert MTB/RIF negative was not considered as a case in this survey because of the following reasons:

- The best sample collected was provisioned for Xpert MTB/RIF testing (1st-morning sputum sample). Each eligible for sputum participant had two Xpert MTB/RIF tests and the best result among the two was used.

- Only 50 % of those eligible for sputum had a culture done using the 2nd-morning sample, in addition to those with TB treatment history.
- For those with history of TB, given that Xpert MTB/RIF may remain positive for a longer duration after treatment, results of X-ray and culture were further considered to determine a case.

Among those with no TB treatment history: Among those with Xpert MTB/RIF positive results, if X-ray was consistent with was active TB or mixed (active and healed), regardless of culture result, it was a case. But, if the X-ray picture was not consistent with active or mixed (and therefore labelled as healed TB, other abnormalities, normal or in case CXR was not taken), then a positive culture result was additionally required to be considered as a case.

Among those with past TB treatment history: Among those with Xpert MTB/RIF positive results, if X-ray was consistent with active TB, then regardless of culture result, it was a case. But, if X-ray was not consistent with active, then a positive culture result was additionally required to be considered as a case.

Currently on TB treatment: Among those with Xpert MTB/RIF positive results on current TB treatment, in case of positive culture result, it is a case, regardless of X-ray.

Table 4: TB case definition for participants without TB treatment history

Number of positive Xpert MTB/RIF result	CXR image according to the panel reading	MTB culture result	Case classification
At least one	Active TB	Regardless	Case
	Mixed appearance (active and healed)		Case
At least one	Healed TB	MTB +ve	Case
	Other lung abnormalities		Case
	Normal lung / Other non-pulmonary abnormality		Case
	No CXR taken		Case

Table 5 TB case definition for participants with past TB treatment history

Number of positive Xpert MTB/RIF result	CXR image according to the panel reading	MTB culture result	Case classification
At least one	Active TB	Regardless	Case
At least one	Mixed appearance (active and healed)	MTB +ve	Case
	Healed TB		Case
	Other lung abnormalities		Case
	Normal lung / Other non-pulmonary abnormality		Case
	No CXR taken		Case

Table 6 TB case definition for participants under treatment at the time of sputum collection

Number of positive Xpert MTB/RIF result	CXR image according to the panel reading	MTB culture result	Case classification
At least one	Regardless	MTB +ve	Case

3.6 SURVEY TOOLS

The survey tools and instruments were designed and developed in reference to the TB Prevalence Survey Guidelines of WHO (the Lime book) and consultation with stakeholders including WHO and RIT/JATA. The questions on socio-economic status were adapted from the national demographic health survey (NDHS). The questionnaire was translated from English to Nepali language and back-translated to English. The final questionnaire was incorporated into the electronic questionnaire as a part of SQL based database management system. (Annex 8.1.3, 8.1.10).

3.7 PROTOCOL AND SOP VALIDATION

The protocol was developed with technical support from WHO and RIT Japan. The protocol was discussed with the Technical Advisory Committee and members of the subgroup of the Task Force on TB impact measurement. The protocol was finally endorsed by the steering committee (the secretary of MoHP as chairperson). SOPs and training materials were developed based on the endorsed protocol. Further revision and amendments of the protocol and SOP were carried out after the pilot test and the mid-term review.

3.8 TRAINING OF SURVEY TEAM

Major trainings were provided at the start of the survey, following the pilot survey and following the mid-term review. RIT experts trained the central core prevalence survey secretariat (PSS) team at the National TB Control Center (NTCC). The core PSS team (radiologist, radiographers, microbiologist, methodology focal person, quality assurance focal person, training focal person, data management focal person under the leadership of survey coordinator and principal investigator and under supervision of RIT expert and WHO trained the field teams of the survey.

3.8.1 Training to government stakeholders

Central PSS team with outsourced agency (OSA) team carried out these trainings. The authority focal persons in the selected province, region, districts, and municipal were targetted for training. However, considering the frequent staff re-shuffling process of the government, the training programme was conducted to focal persons from all regions and districts. Trainings were provided to provincial and district TB focal persons, followed by trainings and orientation to provincial health directorate. Finally, in each pre-visit meetings, orientations were provided to health focal points and other stakeholders at the municipal level, and HFOMC members at the cluster site. See Annex 8.3.9 for details.

3.8.2 Central radiology unit training

First the central radiologist identified for the survey was trained to carry out central X-ray reading and interpretation by RIT radiology expert at NTCC. Following this, together with the central radiologist, 10 medical officers selected for the field X-ray reading were trained to carry out field X-ray reading and interpretation. See Annex 8.3.9 for details. RIT provided regular orientation and feedback to the central radiologist and the central radiologist to the field X-ray readers during the implementation of the survey period.

3.8.3 Radiographer training

Radiographer from RIT provided the training to the central Radiographer at NTCC. Following this, RIT experts together with the central radiographer provided frequent trainings and orientation to the field radiographers. Central radiographer at NTCC also provided onsite coaching and supervision of the field radiographers with regular field supervision.

3.8.4 Central laboratory training

RIT lab expert provided training to the central microbiologist (lab focal point for the survey) and together they provided trainings to lab teams at three different laboratories engaged in the survey. Central microbiologists also provided trainings to all field lab focal points and carried. Under the guidance of the RIT lab expert, central microbiologist carried out regular supervision of all three labs, suggested corrective measures and re-orientation (if required) along with the supervision of the field lab teams. See Annex 8.3.9 for details.

3.8.5 Field team training

Different training packages were developed targeting different field teams. A general overview package was delivered to all, followed by targeted training and orientation based on the functions of the teams. RIT radiology experts together with central radiologist trained the field X-ray readers, RIT radiographer and central radiographer trained the field radiographers, RIT lab expert and central microbiologist trained the field lab person, RIT epidemiologist together with WHO and central PSS team trained the field managers, census takers regarding methodologies and census taking, household mapping. Separate trainings were also conducted. Trainings were conducted for field mobilization, mop up and sputum transport. See Annex 8.3.9 for details.

3.8.6 Orientation to the local field staff

OSA field managers and census takers provided these trainings. Field local staff were hired during the pre-visit of the cluster. In each cluster, 5 social mobilizers and 5 local volunteers were recruited in 99 clusters. They were oriented immediately after hiring to mobilize the population to participate.

3.9 PILOT AND PRE-TESTING

Pre-testing was conducted for 3 days, from 31st August to 2nd September 2017. It was aimed to determine the applicability of the survey methodology, equipment and tools. The pilot testing of field operation was carried out in three sites that had a similar condition to the survey strata but would not participate in the survey, i.e mountainous, terai, and Kathmandu valley. All activities at the field were carried out by Intrepid and JANTRA in coordination and supervision of NTCC. The survey pilot was conducted in Bhaktapur from 1st to 4th February 2018, Dolkha and Sindhuli from 7th to 11th February 2018.

3.10 ETHICAL CONSIDERATION, INFORMED CONSENT, AND CONFIDENTIALITY

The ethical clearance was obtained from the Nepal Health Research Council (NHRC) before the survey. Informed consent was obtained from all participants before they participated in the survey. The informed consent form is attached in Annex 8.1.8

The confidentiality was maintained throughout the study. The data collected in the field operation was stored in the field server, which was closely monitored by the field IT officer and kept safe in an encrypted format. The data was transferred to the central server in an encrypted form. It was received in the central data management unit and stored in the central server by the designated data personnel. The central database server and the database software are password protected and are administered by these data personnel only.

If any participants was found to have any medical emergencies, the medical personnel on the survey team provided emergency care and services and referred to the nearest health facility for further management.

Once the laboratory results were obtained, the clinical panel at PSS discussed regarding each survey case, decided the clinical management plan and communicated back the results (paper forms) to the participants (both with positive and negative results) back to districts to health facilities where the participants collected the report from. Those diagnosed with TB and were further followed by phone also directly by PSS teams to reconfirm regarding the enrolment to treatment. See section 0 for details.

3.11 FIELD IMPLEMENTATION

The field operations in 99 clusters of 55 districts were started on 28th April 2018 and ended on 16th June 2019. The field plans were made by the central team. Seasonal travel plans were put in place to adapt to any seasonal difficulties and geographical barriers. The field operation started from the terai regions (Mahottari and Chitwan) and the hilly region (Dadheldura). In the rainy season, the field operation was carried out in Kathmandu district and other districts which were less affected by the particular season. The activities of the field teams were supervised by a dedicated liaison and quality assurance officer. Frequent technical supervision was done by WHO, NTCC, and other key members of the survey team. The field implementation process is described in Figure 8.

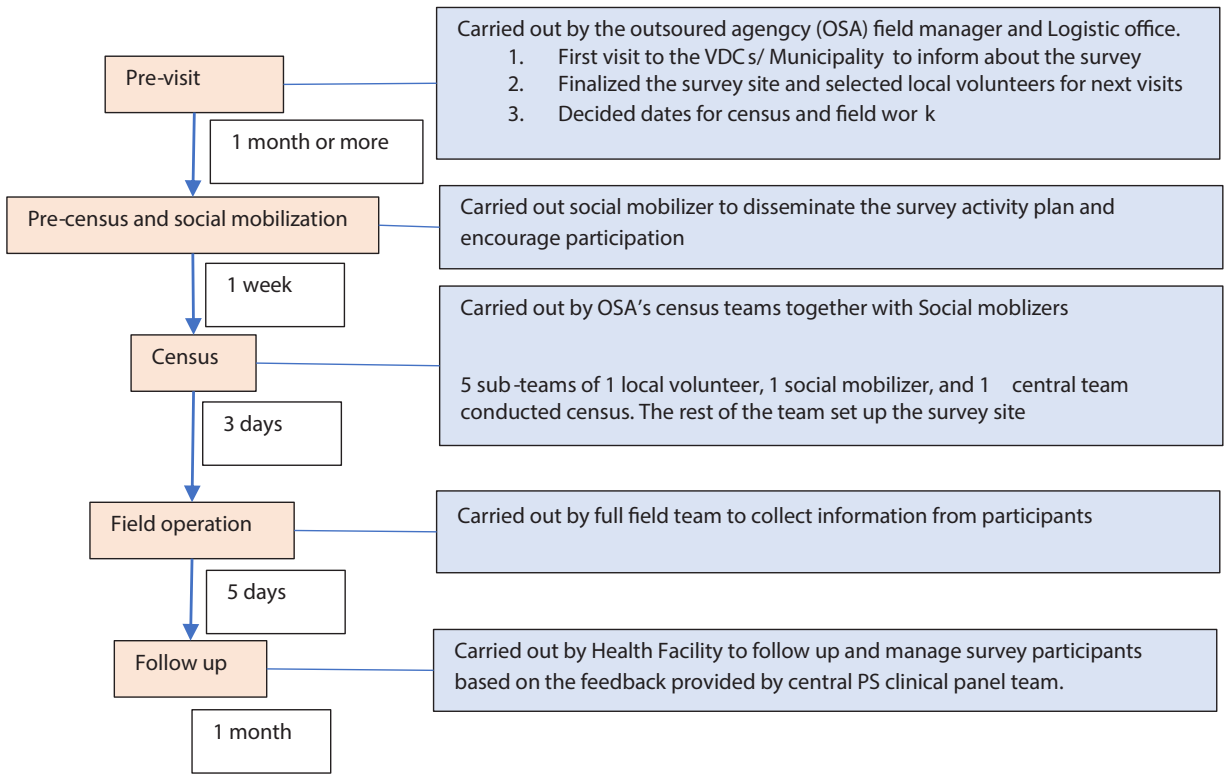
3.11.1 Pre-visit

Pre-visit was the first preparatory visit to the cluster site, where the field operation was intended to conduct. The municipal level meeting was conducted on the first day. On the second day, HFOMC and local staff (mobilizers and volunteers) meeting and orientation were conducted. Local staffs were immediately deployed to the preliminary information collection process (pre-census) in the field. The Municipal/HFOMC members were given the responsibility to randomly select the cluster, finalize the date of field implementation, and coordinated the implementation process.

3.11.2 Pre-census

Pre-census was carried out by 5 locally recruited social mobilizers per cluster. They visited the house to inform the residents about the survey date and activity. All homes that were visited were logged and recorded on paper, and each home was given a sticker to signify the house that had been visited.

Figure 8: Field implementation process



3.11.3 Census

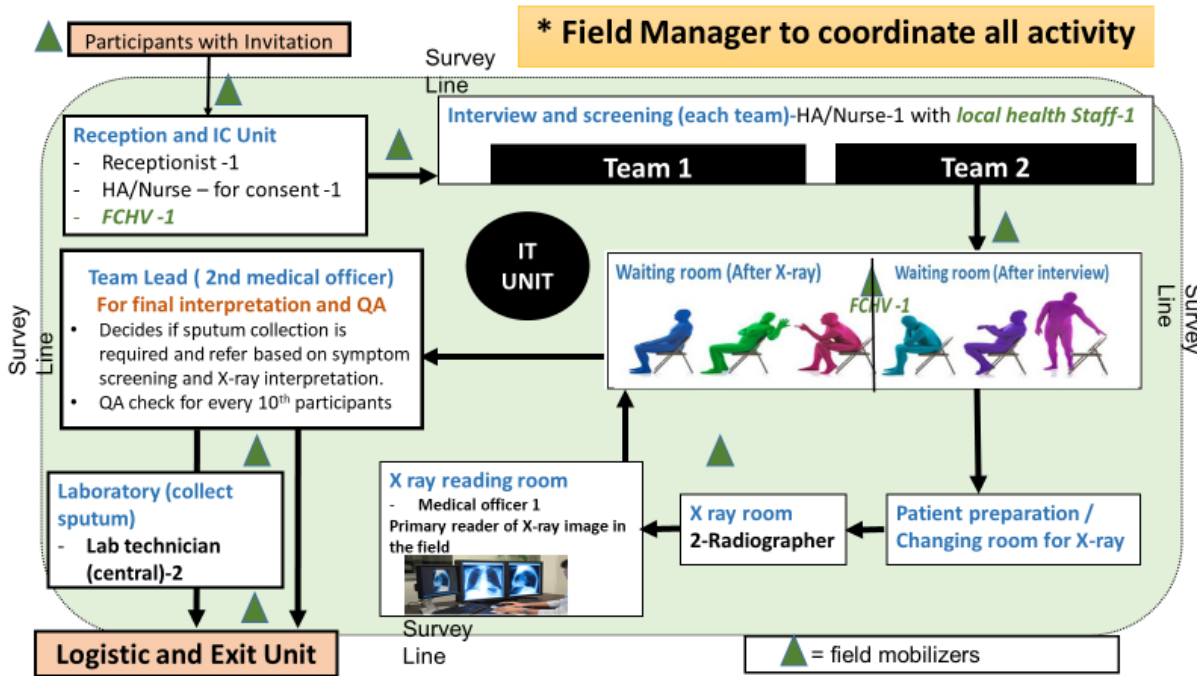
The census was conducted by the field teams in their respective clusters to enumerate the population and assess their eligibility to participate in the survey. Census was conducted for three days by 5 census sub-teams per cluster, consisted of a member of central team, a pre-census member, and a social mobilizer.

The census team visited each home that had been marked during the pre-census and collect the household and individual data with tablets. The team determined survey eligibility for each subject based on eligibility criteria and gave an invitation card to each eligible person, appointing them at the survey site for screening. This process normally took 2-3 days but the Khayarmara cluster of Mahottari district took 4 days to complete.

3.11.4 Field operation

This is the time where invited eligible persons attended the survey sites. The arrangement of the survey site is described in Figure 9. The field site setups were usually done in available open spaces (e.g. schools, social clubs). If such space was not available, temporary tents were placed. In the field site, the reception was installed at the front, followed by the screening desk, X-ray section, and laboratory. All sections were well marked, and volunteers were placed for facilitating the movement of the participants from one section to the other. All field units were provided with laptops and a bar code scanner (bar code printer for reception section and laboratory). All data were entered in a pre-developed software installed on the laptops (except consent forms). The data were accessible to the team members who had access to laptops, this allowed a smooth and easy transition for the participants. The local server allowed all units to connect on the field site. The activities in each unit are explained below in chronological order.

Figure 9: The arrangement of field operation (FCHV = female community health volunteers; HA = health assistants)



Reception

When a person presented the invitation card at the reception on arrival, her/his eligibility to attend the survey was first confirmed by checking their survey ID against the census form (electronic survey master registry). If they failed to bring the invitation card (misplaced, lost, etc.), the field manager would check their names in the master registry, cross-check their residential status with the local volunteer (social mobilizer), to confirm that they are indeed eligible persons. For those who came without any identification card, their identity was verified by using their records stored in the tablet. Those verified of not being eligible were not allowed to participate. After the verification, the receptionist would explain the survey process to the individual and only after proper understanding, he/she was requested to provide the written consent for the survey. Those who consented were provided with a barcode containing encrypted individual ID which was tied around the wrist of the participants and was directed to the symptom screening section.

Symptom screening

There was a minimum of two symptom screening desks per clusters (sometimes three depending on the flow of the participants) and each desk had usually two symptom screeners (trained nurses and/or paramedical staff) supported by a local volunteer (for local language translation if needed). The participants were asked about symptoms of cough and its durations along with additional symptoms (body weight loss, fever, chest pain, loss of appetite, hemoptysis, breathing difficulty, night sweating and tiredness) and their duration. Additional questions on health-care seeking behavior were asked to those with positive symptoms and additional information on health service utilization were asked to those with having history of TB. All data obtained were directly captured in the software installed on the interviewer's laptops that took 2-3 minutes per participant. The computer would automatically generate the information on whether the participant was eligible for sputum collection or not based on symptom screening. If eligible, then the participant would be informed about his/her requirement for sputum collection. After completion of the interview and all this process, the participants were then forwarded to the X-ray unit. The symptom screening questionnaire is provided in Annex 8.1.10.

Chest X-ray unit

A posterior-anterior chest X-ray was taken for all consented participants. In each cluster, a mobile digital X-ray machine was used for this purpose. Two separate changing rooms (male and female) were provided for the participants to change into the provided gowns and remove any metal accessories. Two radiographers and a health volunteer were allocated to this section. After the CXR was taken the image was forwarded to the field medical officer and automatically synchronised with the field server.

Medical officer unit

The X-ray images of the participants were interpreted in the field by a trained medical officer. The CXR image interpretation was divided into:

- Normal
- Abnormal, eligible for sputum examination
- Abnormal, not eligible for sputum examination
- Exempted

Those with an abnormality in the lungs and pleura were eligible to submit sputum specimens in the laboratory unit. Other abnormalities like cardiomegaly, foreign bodies, fractures, etc were considered abnormal, not eligible for sputum examination.

After the CXR was taken, the participant was directed to the desk of the primary reader. The primary reader scanned the barcode of the wrist band and the CXR image appeared on the monitor. A second CXR reading was applied for every 10th CXR image for quality assurance purposes. The reading was done by the second medical officer (team lead) in the field. If the second reader had a different opinion, then it was discussed with the primary reader and final interpretation was made on consensus between the two. But if still, the discrepancy remains then the interpretation made by the primary reader was taken as the final one. In the database, only the final interpretation was captured.

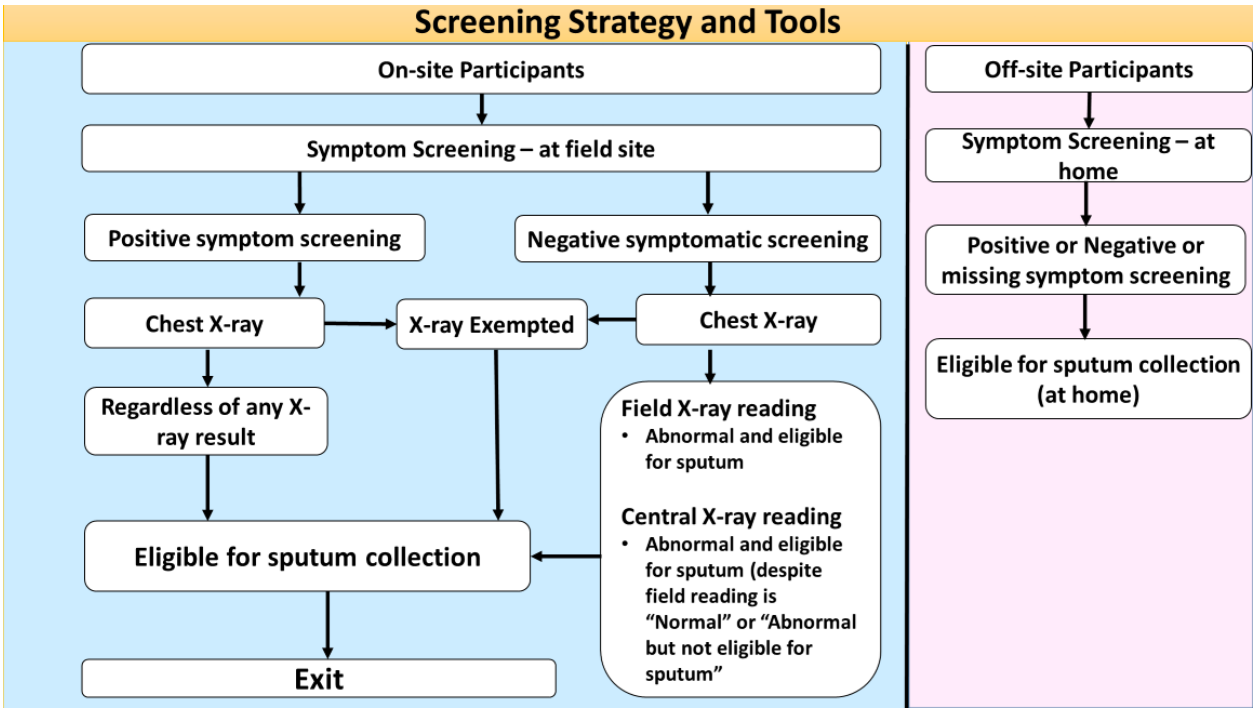
All X-ray images are transferred to central radiology unit at NTCC, where its read by the radiographer (blinded on-field reading interpretation) and software auto-detects the miss-match between field reader and central reader, the report is sent back to field teams which then revises the interpretations only for those who were initially not eligible for sputum by field reading but now recommended as eligible by central reading. Through the mop-up operation, the sputum is collected from these participants. Explained in detail in section 4.12

Eligibility to take sputum

The screening flow is described in Figure 10. The main criteria to be eligible to submit sputum were having

- cough for 2 weeks or more **OR**
- having cough for less than 2 weeks with at least one additional TB symptom (body weight loss, fever, chest pain, loss of appetite, hemoptysis, breathing difficulty, night sweating and tiredness) **OR**
- abnormality in lung and pleura in the CXR image as per field reading OR central reading in case of mismatch **OR**
- CXR exemption or refusal (including all offsite participants), regardless of symptoms

Figure 10: Screening flow to decide eligibility to submit sputum sample



Laboratory unit

The field laboratory unit was responsible for sputum collection, storage, and preparation before transportation of the samples to the designated reference laboratory. Two laboratory technicians managed the activities in each field team. The participants who were eligible for sputum submission were first barcode scanned. The software then generated further barcodes to label the tubes (spot, morning and for culture if eligible) separately, which was printed and labelled in the sputum collection tubes respectively. The participants were given clear instructions on how to produce quality sputum.

Spot and **morning** sputum samples were requested from each eligible participant. Both of them have been used for Xpert MTB/RIF test. A second-morning sputum sample for culture was taken from every 2nd participant eligible to submit sputum and from all those eligible for sputum with TB treatment history.

The process of sputum production on the spot was guided and supervised by the laboratory technician. The participants, equipped with a container and an instruction leaflet, produced the morning sputum samples at home and brought it to the survey site on the next day. The mop-up unit was sent to the household of those who did not submit the morning sputum.

The samples were stored in the refrigerator. Before transportation, each container was tightened and sealed with paraffin tape and packed individually into a zip lock bag to avoid any leakage and placed into a box. The boxes were placed in a biohazard labelled cold chain box with ice gel packs maintaining the temperature of 2 to 8°C. The samples were then transported in a minimum of three batches from the cluster to the designated central laboratory.

Dedicated sputum transporters were assigned for each team. During the survey, 99.9% of sputum samples reached the central laboratories within 5 days of transport. There were 0.7% sputum samples that were received within 5 days but not processed in 5 days. No sputum sample was lost or damaged

between transport. Most of the samples were mucopurulent and of good quality (84%). The samples were processed using positive and negative controls following strict SOPs and quality assurance mechanisms.

Logistic unit

In this unit, the participants after completing all the steps of survey (both eligible or not eligible for sputum samples), were given a token of appreciation in the form of a T-shirt, a packet of biscuit, juice and or recharge card for mobile top-up worth 0.5 USD (instead of biscuit, juice) in urban setup. The participants were then thanked by the logistic officer for their participation in the survey and were directed towards the exit section.

Data management unit

Two field data managers and IT officers worked for each cluster. The IT officer was responsible for setting up a local server, connecting all laptops, and testing the connection before the field operation. The IT officer backed up the collected data twice a day to ensure that no data was lost. At the end of each workday, they uploaded the collected data to the central server. For this purpose, the IT officer had to travel to areas where strong internet access was available. Among the uploaded data, CXR images were included, which would be read by the central radiology unit (blinded) usually on the same day or by early next day. The feedback from central CXR readers was then sent back by email with ID numbers to the field team immediately after the central X-ray reading was done The IT officer also provided a list of participants who did not submit the morning sputum samples and the mop-up team would follow-up as per the list provided.

Mop up operation

One dedicated mop-up officer supported each cluster team. The mop-up operation started immediately after the first day of the field operation. This decision was taken after the pilot activity where the morning sample collection was only 50%. With the mop-up, it increased to 90%. Influential figures, such as community health volunteer, mother's group, the political local leader in the urban set up, the social leader in a rural setup, participated in the mop-up operation. The operation was conducted three times a day depending on the necessity. The purpose of mop-up operation:

- Visit the participants who did not submit the morning samples. If the participants could not go back to the survey site, the samples were collected at home
- Conduct symptom screening and sputum collection to those who had physical difficulty to visit the camp but were eligible to participate
- Encourage participation of those eligible but had not visited the camp.

3.12 CENTRAL UNIT OPERATION

3.12.1 Central radiology

Full-time central radiologists for the survey blindly re-read all CXR images that were sent from the field. The software auto-categorized the interpretations into three categories for identifying mismatch with the field reading as "Normal", "Abnormal and eligible for sputum" and "Abnormal but not eligible for sputum". They categorized the readings into Table 7 and interpretations.

Table 7 The central radiology reading category of CXR images

Interpretations made by Central Reader			Auto Coding by software
Normal			Normal
Lung TB disease suggestive	Cavitary		Abnormal and eligible for sputum
	Non-cavitary	Minimal	Abnormal and eligible for sputum
		Moderate	Abnormal and eligible for sputum
		Advanced	Abnormal and eligible for sputum
Thoracic extra-pul-monary TB suggestive	Hilum and /or mediastinum mass		Abnormal and eligible for sputum
	Pleural effusion etc.		Abnormal and eligible for sputum
Healed TB	Single small calcification		Abnormal but not eligible for sputum
	Healed TB		Abnormal and eligible for sputum
Non-TB ab-normality in the lung	Emphysema and/or air cyst(s)		Abnormal but not eligible for sputum
	Other abnormality in the lung		Abnormal and eligible for sputum
Other abnormality			Abnormal but not eligible for sputum
Uninterpretable			Abnormal and eligible for sputum

The mismatch report was sent to the field immediately after the reading of that day was complete. When the central reading stated "abnormal and eligible for sputum examination" but the field reading stated differently, the central reader's interpretation was taken into consideration and the final interpretation regarding the eligibility of those participants decided. The mop-up team was mobilized to follow up with those participants and collect the sputum samples. But, when the central reader decided the X-ray images were normal, but the field reader's interpretation was abnormal and eligible for sputum, then the participant's field reader's interpretation was taken as the final one and the collected sample were forwarded as usual. The result regarding changed X-ray interpretation (only among the mismatch where X-ray centrally read as abnormal and eligible which was read as normal or abnormal but not eligible from the field) was updated by field IT in the field, making those mismatched participants now eligible for sputum, and mop-up was conducted to collect sputum.

The third reading was conducted on the images of participants with positive Xpert MTB/RIF only, by a panel of radiologists, to get consensus for CXR interpretation for case definition. The CXR interpretation by the panel of radiologists utilized a different image interpretation than the field and central reading. The interpretation of CXR images by the panel reading consisted of five categories:

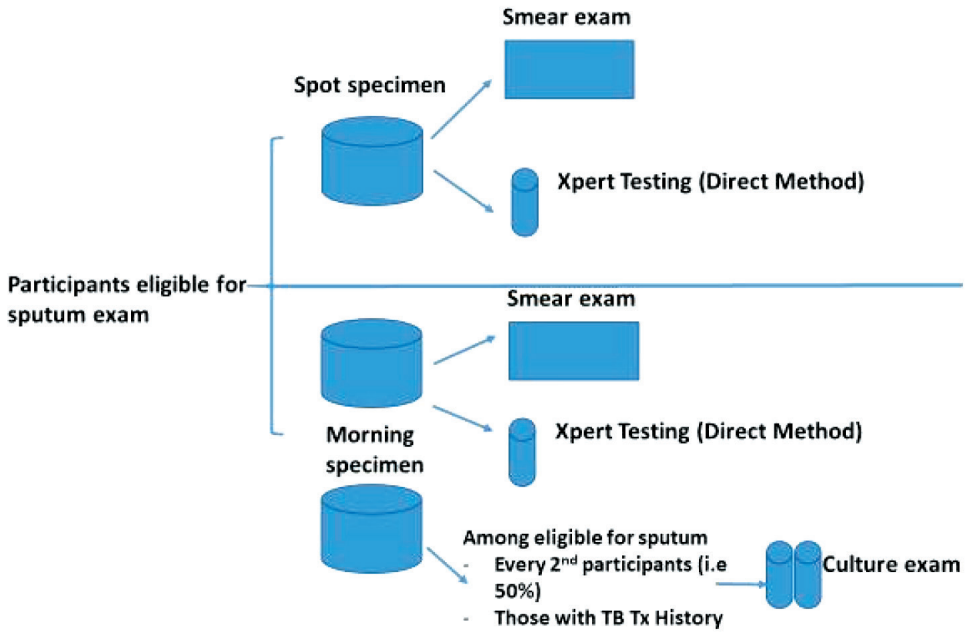
1. Active TB
2. Mixed appearance (active + healed)
3. Healed TB
4. Other lung abnormality
5. Normal or no lung abnormality

3.12.2 Central laboratory

The laboratory unit was lead by a microbiologist supported by central laboratory staff. The unit developed the laboratory protocol, SOPs and quality control procedure. RIT laboratory focal persons trained involved staffs in the three referral laboratories.

Both spot and morning samples were processed for sputum smear and Xpert MTB/RIF testing for all participants eligible for sputum. By survey design, culture testing was done only for half of the sputum eligible participants and all the sputum eligible participants that reported a TB history. Culture test was done on the third sputum sample (Figure 11)

Figure 11: The collection and processing of spot and morning samples for laboratory testing



Specimen reception

Once the samples cold box reached the laboratory, a laboratory technician logged in to the database and scanned the barcode labelling the cold box. Then she/he opened the cold chain box containing the samples and checked for any leakage/missing samples. Each sample's barcode number was verified against the database. Then the temperature of the cold box was recorded in the database. The sample was then stored for further processing.

Smear microscopy

The smear microscopy was performed by fluorescence microscopy on the spot and morning sample. Staining and reading were in line with WHO/IUATLD recommendations. All positive results were re-examined by another examiner. In case of discrepancy external quality assessment in charge at NTCC lab does the final examination and his/her interpretation was taken as final. All slides were stored in the slide box in cluster wise order. The results of smear microscopy were recorded according to the SOP for smear microscopy.

Xpert MTB/RIF

Xpert MTB/RIF assay is a nucleic acid amplification (NAA) test which simultaneously detects DNA of *Mycobacterium tuberculosis* complex and, if present, the mutation of the *rpoB* gene that leads to rifampicin resistance, in less than 2 hours. After the smear examination, the spot and morning samples (direct samples) were both processed for Xpert MTB/RIF. The results of the assay are:

- MTB not detected
- MTB detected, and rifampicin resistance is not detected
- MTB detected, and rifampicin resistance detected
- MTB detected, and rifampicin resistance is indeterminate or
- Error/invalid/no result

All reports were automatically exported in the batch from the Xpert computer to the database daily.

Culture

Lowenstein Jensen (LJ) media was used for culture. Each second-morning sample was digested and decontaminated using NALC NaOH method, whereby equal volume NaOH was added to each specimen (final concentration of NaOH was 1.5%) and the specimen and vortex for 15-30 seconds and left for 15 minutes to decontaminate at room temperature, the exposure time was strictly followed to prevent overkill of tuberculosis bacilli. Decontaminated specimens were inoculated in two tubes of LJ media and incubated at 37°C for 8 weeks or until MTB grew on culture.

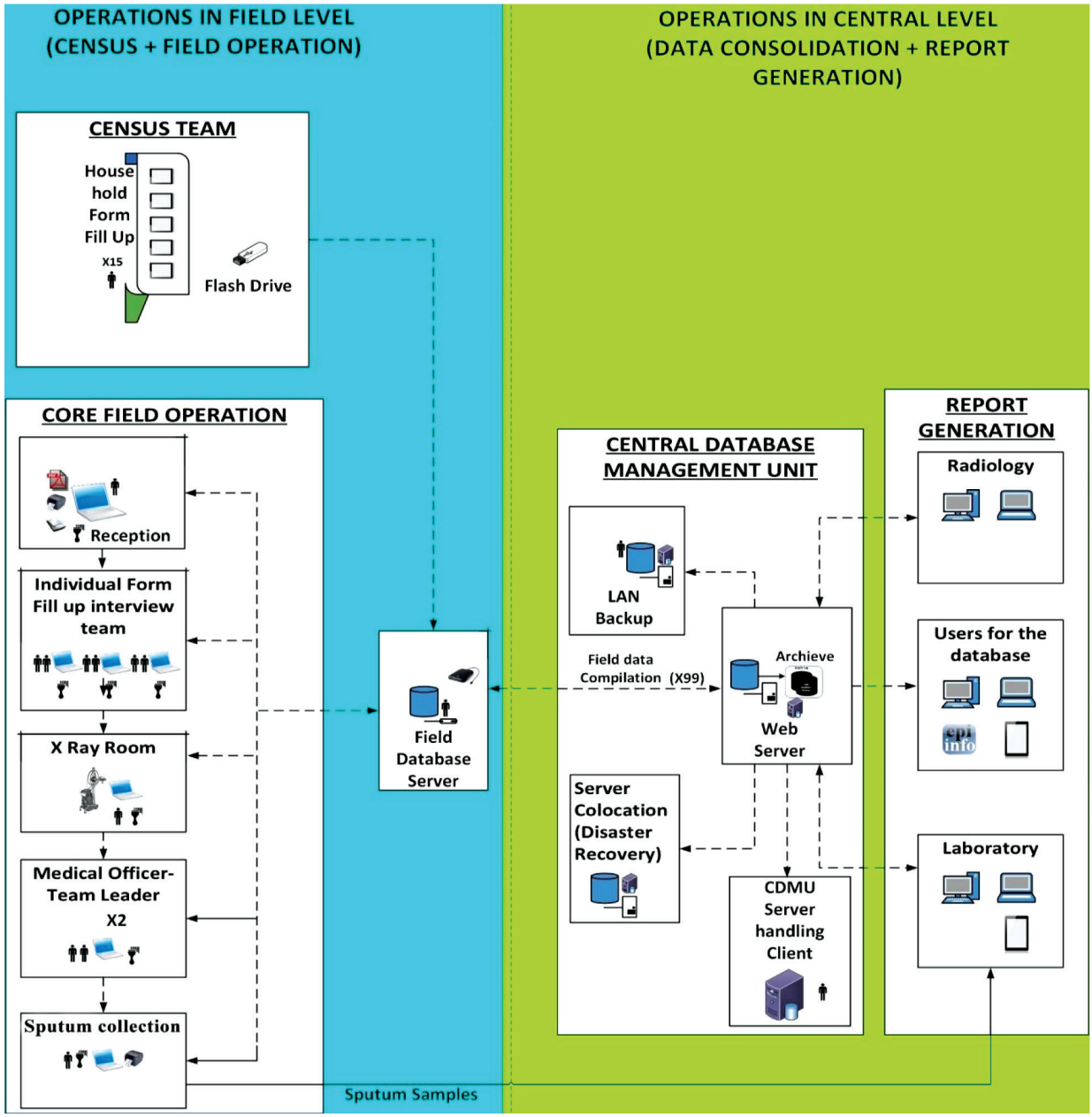
Culture reading was done weekly, and identification of growth was done by using SD TB Ag MPT 64antigen-based rapid test. All isolates, both MTB and non-tuberculosis Mycobacteria (NTM), and sample sediment were stored at -70^{O}C. See Annex 8.1.30 for details.

3.12.3 Data management unit

The data management system was designed using Java 8; the database was designed using MySQL 5.7 and developed for both the collection of data from the field and central level and the management data management in the central database management unit. The system was developed by Info developers Pvt Ltd, under the direct supervision of database and IT management focal point for the survey. The system involved various IT equipment with IT personnel in the field and central level. It had to go through a systematic application development model with rigorous quality assurance. The operationalization of the system was tested through piloting. Modifications were done during the survey following the recommendations from the field and external reviews.

The core database application was divided into census module (field), field operation module (field), central data management, and reporting module (central) at the National TB Control Center. The database operation of the field data collection was independent of the central data management operation. All the information was stored in the central server located at the data management unit at PSS and backed up at two other sites (away from the PSS site). The flow of data is described in Figure 12.

Figure 12: The data flow during the TB prevalence survey



3.12.4 Clinical panel

Based on the case book developed by the data management unit, the clinical panel conducted a weekly meeting to decide the clinical management of participants. First discussed were all the participants with positive laboratory results (All Xpert MTB/RIF positive cases, followed by those Xpert MTB/RIF negative but Culture positive and/or smear-positive), followed by those with negative laboratory results but having CXR images consistent with active TB and or positive by symptoms screening. In the end, the panel also discussed cases other than TB (requiring for the management), identified during X-ray reading.

The case book contained the following participant's information age, sex, symptoms, TB treatment history. The panel consisted of a radiologist, a microbiologist, a TB expert, the data manager, a secretary, and a team member according to the needs.

Based on available information and laboratory results, the panel advised either re-screening, follow-up, or consultation to a health facility or a specialist. At the end of each meeting, a written list of survey participants with TB, presumptive TB, or other diseases, including CXR results were developed and sent to the respective health facilities with a recommendation to start treatment or other disease management. NTCC staff was responsible to transfer the information to the respective TB staff in health facilities. An immediate phone call to the patients and TB focal person of concern health institution was initiated in case the participant was in an emergency condition or rifampicin resistance was detected. A second verification regarding the treatment enrolment status was also carried out, the results mentioned in section

3.12.5 Logistic management

The main function of logistic management was to ensure that all logistic activities were implemented safely. The logistic management team consisted of the central store focal person, the logistic coordinator of the outsourced agency, and three field logistic officers. The unit received, stored, dispatched, and recorded the survey's materials. They tracked the supplies in the pipeline.

Logistic management software was developed to record survey equipment and supplies. The stock of each material for the survey was automatically updated in the system. The out-source agency used the software with one user to request materials at field level and update the consumed items in that software.

The valuable logistics used in the survey were insured and managed by the NTCC.

3.13 DATA ANALYSIS

3.13.1 Estimating pulmonary TB prevalence among population aged ≥ 15 years old

The analytical method followed the recommendation (Model-3: inverse probability weighting and multiple imputation) by WHO Global Task Force on TB Impact Measurement (Floyd et al. 2013; World Health Organization 2010).

Prevalence estimation was made by taking into account missing outcomes due to the non-submission of sputum or laboratory examination failure (e.g. culture contamination) by multiple imputation (MI). For adjustment of non-participation, inverse probability weight (IPW) was adopted. For adjustment for the population structure (2018 Population projection), post-stratification adjustment was applied. The statistical analysis was carried out by Stata 16 (Stata Corp., Texas).

The survey case definition was firstly based on positivity of Xpert MTB/RIF (first requirement). However, taking into account the risk of false-positive Xpert MTB/RIF, among all those with positive Xpert MTB/RIF, other criteria were taken into consideration; history of TB treatment, results of MTB culture and X-ray image interpretation deciding prevalent final TB case classifications. See Table 4, Table 5 and Table 6.

Because only 50% of the eligible for sputum examination those with TB treatment history had culture test processed and some of the eligible for sputum examination with TB treatment history had missing culture results and some of the eligible for sputum examination had missing Xpert results, the final case determination for estimating the prevalence of TB was made by applying the case definition to participants after the imputation for missing Xpert and culture results with some exceptions as motioned in the below 2) and 3).

Following steps were used for analysis:

1) The dataset including all participants consisting of the on-site and off-site participants[1] are divided into a multiple imputation subset and a non-imputation subset. The imputation subset consists of participants meeting eligibility by symptom and/or CXR (including corrective action by central CXR reading results). The non-imputation subset consists of the rest.
2) The Stata "ice" command was used for MI to the imputation subset: taking into account the possible problem of stability of MI, 50 imputations were applied. The following are variables as shown below in Table 8 were included to do the imputation.

Table 8 Variable considered for imputation

Variables	Values	Imputing for missing data
1st Xpert Results	2 categories: Positive or Negative	Yes
2nd Xpert Results	2 categories: Positive or Negative	Yes
MTB culture results	2 categories: Positive or Negative	Yes
Smear positivity	2 categories: Positive or Negative	Yes
Sex	2 categories: female or male («others» is combined with male)	No
Age Group	6 categories: 15-24, 25-34, 35-44, 45-54, 55-64, ≥65 years	No
Strata	6 categories: Mountain, Hilly rural, Hilly urban, Terai rural, and Terai urban, Kathmandu valley (Kathmandu rural and Kathmandu urban were merged as one)	No
Treatment history	3 categories: No, Past or Current. Missing is combined with «No»	No
Symptom	3 categories: No TB symptom, TB symptom without cough lasting 2 weeks or longer, TB symptom with cough lasting 2 weeks or longer	No
Final field CXR reading	2 categories: Normal/abnormal not eligible for sputum exam, abnormal eligible for sputum exam,	Yes
Central CXR reading	2 categories: non-TB suggestive/TB suggestive	Yes
Occupation	10 categories: professional/technical/managerial, clerical, sales and services, skilled manual, unskilled manual, agriculture, student, housewife, other/missing or NULL	No
Socio-economic status	Ordered 3 categories: low, medium or high	No
Usage of liquefied petroleum gas for cooking	2 categories: Yes or No	No
Corrective action of field CXR reading	2 categories: Yes or No	No

3) The case definition is applied to the multiple imputation file: Following the case definition, active TB CXR image with any Xpert positive or culture-positive with Xpert positive are coded as Xpert-based bacteriologically confirmed cases. There were two types of participants to which the case definition was not applied because panel CXR decision was not applied on them; 1) For participants who had CXR exempted and have positive Xpert results, they were categorized as "TB cases" if culture results (observed or imputed) are positive. 2) For those with undetermined Xpert results before imputation (i.e. both Xpert missing, the combination of negative and missing), they are defined as TB cases if both Xpert and culture results are positive after the imputations.

1 Onsite participants – Participants who attended the survey at the field survey site offsite participants- eligible to participate but for medical, physical reasons (e.g. pregnancy, inability to walk etc.) who can't come to field sites

4) In the non-imputation subset, there were 6 participants with Xpert positive. They were not included in the imputation file because they did not meet the criteria of inclusion in the imputation subset mentioned in the above 2). Because imputation was not applied to them, the determination of TB cases was based on observed culture results. One of 6 cases was defined as TB case. 50 sets of the subset were made.
5) The files of 3) and 4) are combined as "participants file with MI results". The final case definition applied to this dataset is shown in Table 9.1 and the number of cases before and after imputation are shown in the result section in
6) Table 36 and details in Annex 8.3.15

Table 9 TB PS final case definition (before and after imputation) applied in the dataset for analysis

Section A. Participants without any history of treatment			
A-1. Confirmed Xpert Results, No Treatment History		**MTB Culture status**	
Observed Xpert results	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both of two negative	NA	Not Case	Not Case
At least one positive	Active/Mixed (*)	Case	Case
	Not Active/Mixed (*)	Case	Not Case
	Not Available (Exempted) (**)	Case	Not Case

*: healed shadow with shadow suggesting active
**: Xpert positive without CXR is categorized as TB case if culture (observed or imputed) positive

A-2. Undetermined Xpert Results (Both missing or combination of negative and missing), No Treatment History		**MTB Culture status**	
Xpert results (including imputed results)	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both Negative after imputation	Not applied	Not Case	Not Case
At least one positive after imputation	Not applied	Case	Not Case

Section B. Participants with Past history of treatment			
B-1. Confirmed Xpert Results, Past History		**MTB Culture status**	
Observed Xpert results	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both of two negative	NA	Not Case	Not Case
At least one positive	Active	Case	Case
	Not Active	Case	Not Case
	Not Available (Exempted)	Case	Not Case
B-2. Undetermined Xpert Results (Both missing or combination of negative and missing), Past History		**MTB Culture status**	
Xpert results (including imputed results)	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both Negative after imputation	Not applied	Not Case	Not Case
At least one positive after imputation	Not applied	Case	Not Case

Table 9 : (Continue)

Section C. Participants with current treatment			
C-1. Confirmed Xpert Results, Current Treatment		**MTB Culture status**	
Observed Xpert results	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both of two negative	Not applied	Not Case	Not Case
At least one positive	Not applied	Case	Not Case
C-2. Undetermined Xpert Results (Both missing or combination of negative and missing, Current Treatment		**MTB Culture status**	
Xpert results (including imputed results)	**Panel-Chest X-ray Reading**	**Positive**	**Negative**
Both of two negative after imputation	Not applied	Not Case	Not Case
At least one positive after imputation	Not applied	Case	Not Case

Section D : Participants not for imputation (*)			
Xpert Results (Observed)	**Panel-Chest X-ray Reading**	**MTB Culture status**	
		Positive	**Negative**
Both negative	Not applied	Not case	Not Case
At least one positive	Not applied	Case	Not Case
Undetermined	Not applied	Not case	Not Case

**: Only cases with observed culture-positive are categorized as TB case*

7) Weights file were prepared:

1 Weight for difference in eligible population = expected sample size / eligible population for each cluster

2 Weight for participation rate: eligible population / number of participants for each combination of cluster/sex/age group

3 Weight for implementation status is calculated by "Weight for the difference in eligible population" x "Weight for participation rate"

4 Weight for adjustment to population structure under new categorization for the demographic surveys: Populations captured by population census are re-categorized for currently adopted categorization of urban/rural. Age and sex sub-population structures for each of 7 strata are tabulated by The Nepal PS Survey Team.

8) Estimation among the eligible population of the prevalence survey: After applying "weight for implementation" to "participant file with MI results", estimation of prevalence among the survey eligible population by Stata "*mim*" command.

9) Estimation adjusted for the population structure of the 2018 projected population: With the post-stratification option, the estimate was obtained.

3.13.2 Socioeconomic status classification

The socioeconomic status was based on household information (see Annex 8.1.3). Household wealth index was derived using the household-level consumer goods that the participated households own. Heads of listed households were asked whether they own ten types of household-level consumer goods including television, fan, chair, cupboard, sofa, table, household use electricity or liquid petroleum gas as cooking fuel. Then we asked whether the household had cemented floor, cemented roof, and cemented wall. All responses were dichotomized by recoding the responses in 0 (no) and 1 (yes) and these variables representing ownership of the goods were standardized. Weights for each of the 10

household consumer goods were generated by using principal component analysis (the first principle components were used as weight for the corresponding goods). The wealth scores for the household were derived from the sum of the linear combination of the product of the standardized values of the goods and corresponding weights. The wealth scores were then divided into five groups called wealth quintile (the individuals falling into the lowest quintile were called as poorest, the second quintile were called poorer the third quintile as middle, the fourth quintile as richer, and the fifth quintile as richest. The wealth quintile was further recoded into three groups, recoding poorest and poorer as low and the richest and richer as high.

3.13.3 Extrapolating the prevalence into all TB form prevalence for all age population

The detailed calculation is presented in Annex 8.3.1. The prevalence of all forms of TB among all ages was calculated using the proportion of extrapulmonary TB and the proportion of paediatric TB cases notified to NTP since 2014.

3.13.4 Estimating TB incidence

The prevalence survey is not completely designed to estimate incidence. However, this is the only method that is feasible to obtain population data. Incidence estimation is done by developing two models, the basic one and based on notification data. The process incorporates the distribution characteristics of disease duration and the impact of HIV infection and antiretroviral coverage (Glaziou et al. 2019).

From the basic model, the incidence is estimated as the prevalence of TB divided by the average duration of disease assuming epidemic equilibrium. From the literature reviews that provided estimates of the duration of disease in untreated TB cases before anti TB treatment was invented (before the 1950s), the best estimate of the mean duration of untreated disease (for smear-positive cases and smear-negative cases combined) in HIV-negative individuals is about three years.

The second model is based on estimating disease duration using three compartments: susceptibles (S), untreated for TB (U) and treated for TB (T). The size of U and T is obtained from the results of the prevalence survey. This method requires a sufficient number of cases on treatment at the time of the survey (as a rule of thumb, at least 30 cases) to generate relatively stable estimates. When both methods can be applied (so far only in selected low-HIV settings), results from two methods may be combined in a statistical ensemble approach.

In the Nepal prevalence survey, the second model was dropped because the sample was too small and uninformative.

CHAPTER 4

QUALITY ASSURANCE

Quality Assurance is a planned system of procedures, performance checks, quality audits, and corrective actions to ensure that the products produced throughout the survey lifecycle are of the highest achievable quality. Quality assurance planning involves the identification of key indicators of quality used in quality assurance. The lifecycle of the prevalence survey study incorporates QA from the design of survey protocol, field implementation, data analysis to report dissemination. All steps conducted in the prevalence survey were quality assured. See Annex 8.2 for all checklists used for QA purposes.

4.1 PROTOCOL DEVELOPMENT

The protocol was developed by a team in the country based on WHO guidelines on TB Prevalence Survey (Lime book). The protocol draft was reviewed by three independent reviewers and revised accordingly.

All key documents (protocols, SOPs including methods, implementation modality, training modules) were developed by NTCC in collaboration with RIT and WHO country office. They were further validated by international experts, members from the WHO Global Task Force on TB impact measurement, and endorsed by the steering committee before implementation.

4.2 DATA MANAGEMENT

Data validation SOP was developed to ensure data validation at each level (field, radiology, laboratory, central data management). In the field, a validation checklist was developed. Based on this checklist, the field IT unit checked the data stored in the field server before transferring the data to the central server.

At the central level, another checklist was developed for data cleaning, validation, and verification of data after the end of each cluster operation. The final validation was done under the supervision of the WHO quality assurance team and RIT Japan. Periodic validation was conducted by RIT on the cluster data that were regularly sent by the data management unit.

The survey data was consolidated and stored in the server in the central database management unit at NTCC. The data backup for the central server was created in three different locations. The first backup was the NAS (network-attached storage) which was located in the central database management unit along with the central server. The second backup was created in the NTCC training building. The third backup was located in the National Information and Technology Center (NITC).

The cleaning of the database was conducted thoroughly before data analysis to prevent the misclassification of variables.

4.3 CHEST X-RAY

Field and central CXR readers were trained by RIT. Only certified doctors who participated in the training were eligible to do field reading.

All field CXR images were blindly reread by central readers. When central readers stated "Abnormal and eligible for sputum examination" and the field readers stated otherwise, the field team took the central readers' value and searched the participants to request a sputum sample.

A technical assistant from RIT Japan trained and supervised regularly. Chest X-ray images that were labeled abnormal by a central radiologist were 100% re-read, along with 10% of images labeled as normal re-read by the RIT radiologist

4.4 LABORATORY

Regular supervision visit was conducted during the survey in the field laboratory and the central laboratory by RIT/JATA laboratory specialist, central microbiologist, and other experts to ensure adherence to the methods. In the two review visits made, the technical experts from WHO reviewed overall laboratory activities and validated the results.

To maintain the laboratory quality in general, the steps below were taken during the survey:

- Standardization of equipment, media, reagents, sterilization, and waste disposal.
- Cross-validation of the results was updated in the database and the hard copy register.
- Regular inventory to prevent stock out
- Standardize the laboratory documents, i.e procedure manuals, instrument log, calibration log, reagent lot testing, media quality control
- Onsite supervision and regular monitoring of collected and processed sample

4.4.1 Smear microscopy

- Before testing, the identity (Barcodes) of the submitted samples was checked against the database.
- Positive and negative control was included for each new batch of reagents. The reagents were checked regularly including the expiry date.
- Doubtful and positives slides were rechecked by the second controller and any discrepancies were resolved.
- Blinded rechecking method: The entire positive slides and 10% of negative slides from each cluster were rechecked by the NTCC quality assurance officer the slides were stocked in the slide box.

4.4.2 Culture

- Regular monitoring of quality indicators (contamination and recovery rate) cluster wise
- Sterility check and quality control of media with the standards (M.fortuitum and H37RV) in every new lot of media.

4.4.3 Xpert MTB/RIF

- Each new lot of the Xpert cartridges was checked using positive control (H37Rv) and negative control. Plain sample processing reagent was used.
- 'Xpert check' calibration was done annually.
- Number and proportion of Xpert positive, error, invalid, and no results were monitored cluster wise.

4.4.4 Field laboratory

- The laboratory technicians were trained for sample collection, storage, packaging and dispatch of the sample according to the SOP
- The liaison officer and the central team member monitored the collected samples in the field. They checked the quantity and quality of the samples collected.
- Onsite supervision of sample collection, storage, packaging and transportation by the central team.

4.5 FIELD OPERATION

All field team members were trained in each of their respective components. Retraining followed after piloting by the survey core team in coordination with RIT and WHO. Only after completing the training, they were engaged in the survey.

In each cluster, a liaison and quality assurance officer from central NTCC accompanied the field teams, to monitor the progress and implementation of each of the cluster operations. He/she used standard checklists (Annex 8.2.2 for previsit, Annex 8.2.3 for pre-census, Annex 8.2.4 for the census, and Annex 8.2.5 for field operation) to monitor the progress of each unit in the field. After completion of each cluster or if required (for incident reporting), the checklist and cluster summary were submitted to the central NTCC team, which was reviewed by the LQAS unit, and necessary correction/suggestion was given back to them.

4.6 EXTERNAL REVIEW

External review of the survey was conducted with the support of WHO and global experts for TB prevalence surveys including members of the WHO Global Task Force on TB Impact measurement. The external review and quality monitoring were conducted twice during the survey period. The first external review was conducted after completion of 24 clusters and the second after the completion of the 68th cluster. All recommendations from the external reviewers were immediately addressed following each review. Overall, the Nepal TB prevalence survey was graded as one of the best and high-quality surveys in the world with the use of innovations such as paperless data systems and the use of homegrown software.

CHAPTER 5

RESULT

5.1 ENUMERATED, ELIGIBLE POPULATION

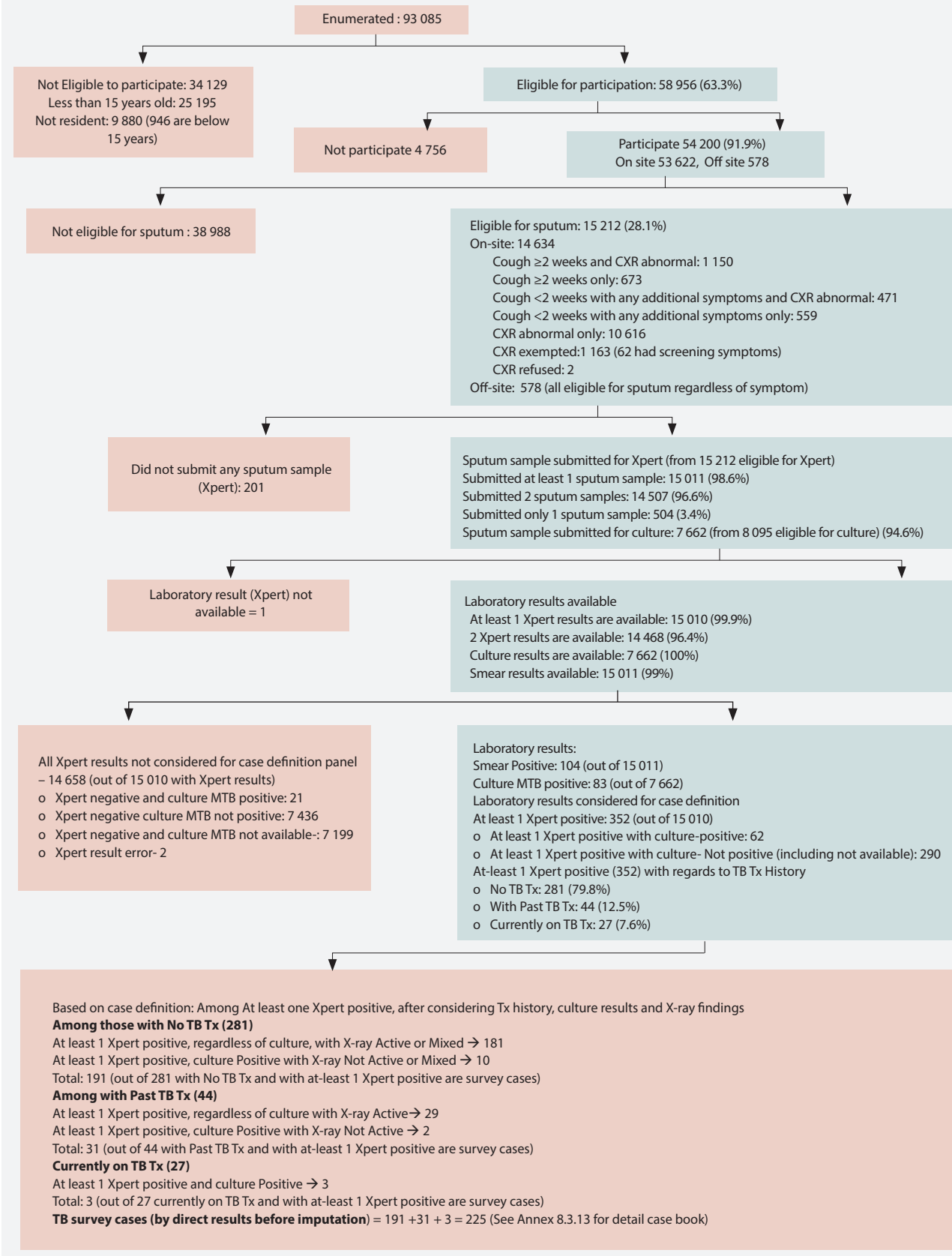
During the survey period, the country was transitioning to federalization. Due to the political changes, the administrative boundaries were also redefined. In doing so, while the population projections and terrain (hill, mountain, terai, KTM valley) remained the same, the definition of rural and urban changed significantly. That is why rural/urban segregation was dropped from both results and analysis purposes, which is a limitation of this survey. Also, as the number of the third gender was very small, it was incorporated in male for both results and analysis purposes.

There are 93 085 people enumerated from the selected clusters. Among the enumerated population, 58 956 (63.3%) were eligible to participate in the survey. Among 37% not eligible to participate, mostly were agreed of younger age (15-24 yrs., 25-34 yrs.), mostly male (43.2%) and higher in mountain (40.9%). Their characteristics are described in Table 10.

Table 10 Eligibility of enumerated persons by age, sex, and geographical characteristics

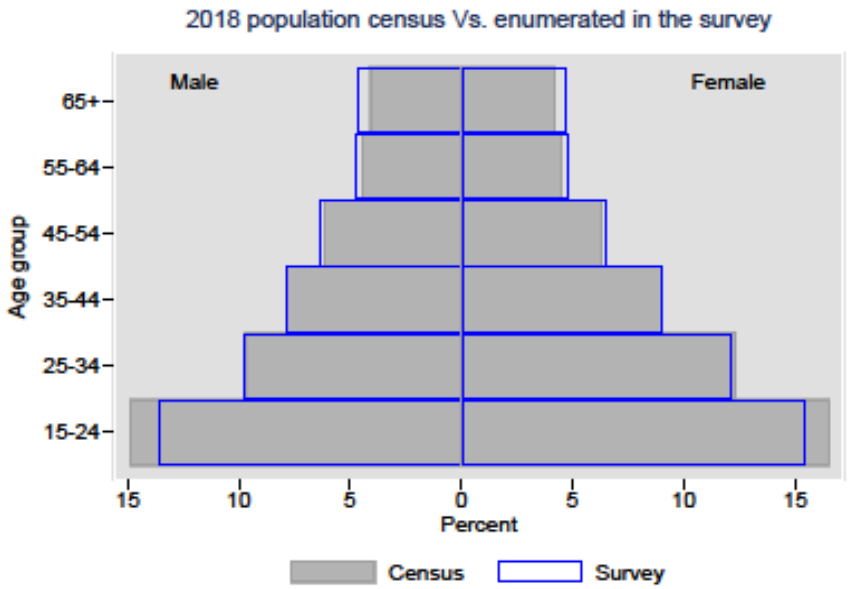
Characteristics	Eligible to participate		Not Eligible to participate		Total
	n	%	n	%	
Age group (years)					
0-4	0	0	7 183	100	7 183
5-9	0	0	8 444	100	8 444
10-14	0	0	9 568	100	9 568
15-24	15 978	80.9	3 778	19.1	19 756
25-34	12 213	82	2 673	18	14 886
35-44	10 209	88.3	1 349	11.7	11 558
45-54	8 166	92.9	626	7.1	8 792
55-64	6 259	95.9	270	4.1	6 529
65+	6 131	96.3	238	3.7	6 369
Sex					
Male	25 655	56.8	19 551	43.2	45 206
Female	33 301	69.6	14 578	30.5	47 879
Strata category					
Hill	19 218	61.8	11 855	38.2	31 073
Kathmandu Valley	6 121	75.4	1 997	24.6	8 118
Mountain	5 055	59.1	3 494	40.9	8 549
Terai	28 562	63	16 783	37	45 345
Socioeconomic status					
Low	22 520	60.4	14 745	39.6	37 265
Medium	11 553	61.5	7 219	38.5	18 772
High	24 883	67.2	12 165	32.8	37 048
Overall (Total)	**58 956**	**63.3**	**34 129**	**37**	**93 085**

Figure 13: Consort Diagram of national TB Prevalence Survey



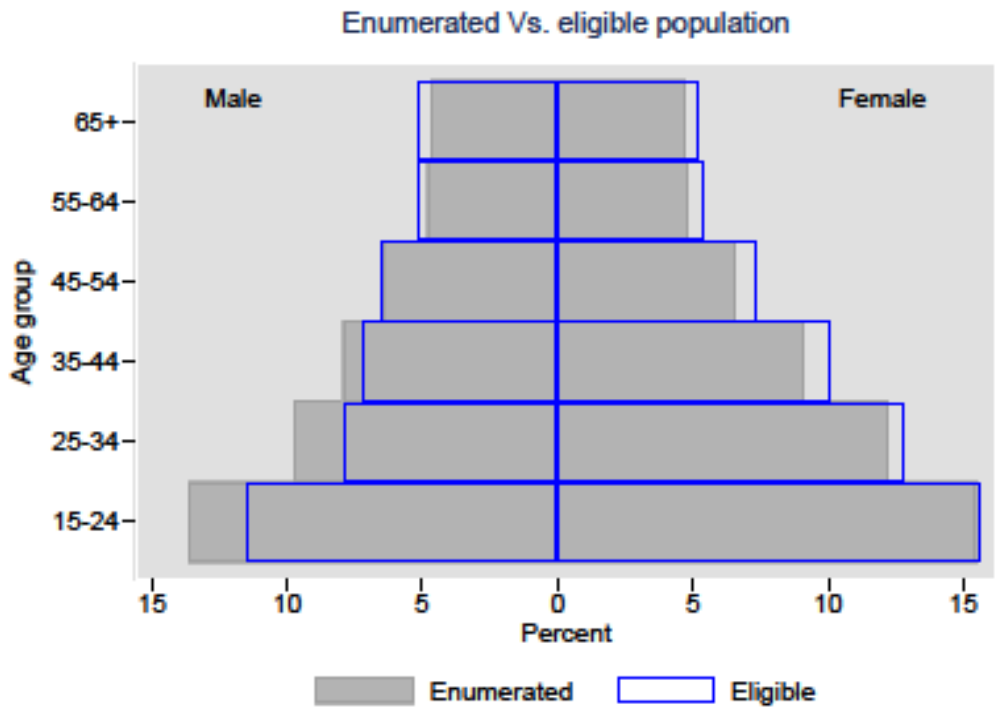
The National population in 2018 in Nepal was 29,022,774 (Annual Health Report 2018, DoHS, GoN), while the total population for 15 years and older was 20,352,218. Percent distribution by age-group (≥ 15 years) and sex of the National population compared with the enumerated population of the survey is shown in Figure 14. The proportion of enumerated population for age group years 15-24 was lower compared to the national population for both male and female (National census – 15% male, 17% female compared to enumerated - 14% Male, 15% female) and the proportion of enumerated population was higher than of national population among male and female for age groups years 45-55 and above. The proportion of enumerated population for age groups 25-34 and 35-44 were similar to the national population for both male and female. There is 47% male and 53% female among age ≥15 years in the national population as well as enumerated were similar.

Figure 14: National population census vs enumerated population in the Survey



Proportion of eligible was higher among female (70%) than male (57%) for all age groups except for those aged 55 or more. While the proportion of eligible population is less than enumerated population for male in age groups from 15-44 years, it is more than enumerated among female of all age groups. Figure 15

Figure 15: The pyramid of the enumerated and eligible population



Among 58 956 eligible persons, 54 200 (91.9%) participated in the survey. The participation rate was high through all age groups, but lower in men than women. Kathmandu rural (87.6%) and urban (88.9%) had the lowest participation rate but were still higher than the target of 85.0%. Those with the highest level of education, professionals/managerial/technical, and high economic status had the lowest participation rate. Table 11

Table 11 The participants and non-participants characteristics

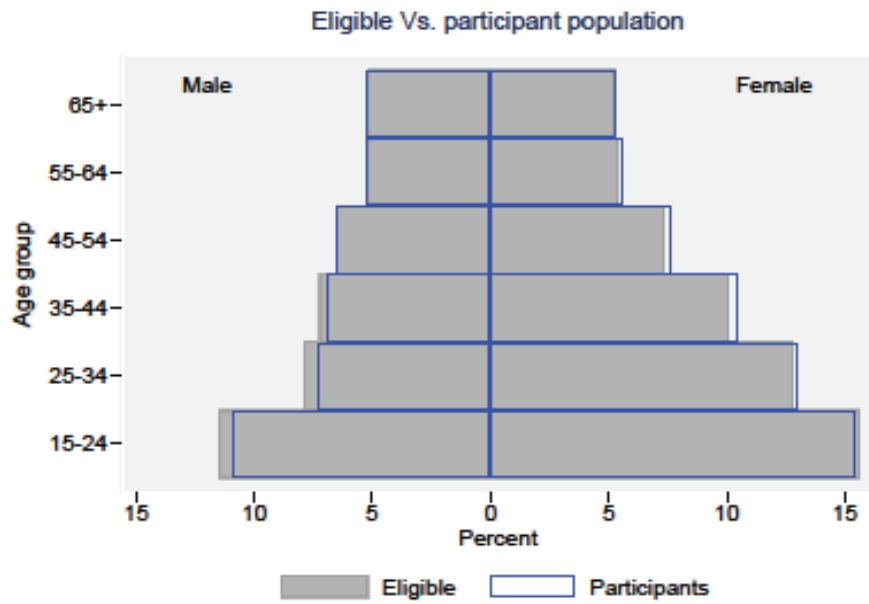
Characteristics	Eligible	Participated		Not Participated	
	N	n	%	n	%
Age group (years)					
15-24	15 978	14 319	89.6	1 659	10.4
25-34	12 213	11 015	90.2	1 198	9.8
35-44	10 209	9 453	92.6	756	7.4
45-54	8 166	7 699	94.3	467	5.7
55-64	6 259	5 922	94.6	337	5.4
65+	6 131	5 792	94.5	339	5.5
Sex					
Male	25 655	22 977	89.6	2 678	10.4
Female	33 301	31 223	93.8	2 078	6.2

Table 11 The participants and non-participants characteristics (Continue)

Characteristics	Eligible	Participated		Not Participated	
	N	n	%	n	%
Strata category					
Hill	19 218	17 808	92.7	1 410	7.3
Kathmandu Valley	6 121	5 432	88.7	689	11.3
Mountain	5 055	4 713	93.2	342	6.8
Terai	28 562	26 247	91.9	2 315	8.1
Education					
No education	18 145	17 167	94.6	978	5.4
Some primary	14 234	13 198	92.7	1 036	7.3
Completed primary	6 708	6 086	90.7	622	9.3
Some secondary	8 937	8 113	90.8	824	9.2
Completed secondary	5 159	4 617	89.5	542	10.5
More than secondary	5 729	4 978	86.9	751	13.1
Missing	44	41	93.2	3	6.8
Occupation					
Professional/technical/ managerial	1 828	1 563	85.5	265	14.5
Clerical	1 448	1 244	85.9	204	14.1
Sales and services	3 254	2 870	88.2	384	11.8
Skilled manual	2 828	2 440	86.3	388	13.7
Unskilled manual	1 699	1 493	87.9	206	12.1
Agriculture	15 781	14 787	93.7	994	6.3
Student	7 706	6 927	89.9	779	10.1
Housewife	18 182	17 198	94.6	984	5.4
Other/no occupation	6 184	5 636	91.1	548	8.9
Missing	46	42	91.3	4	8.7
Socioeconomic status					
Low	22 520	20 903	92.8	1 617	7.2
Middle	11 553	10 725	92.8	828	7.2
High	24 883	22 572	90.7	2 311	9.3
Overall (Total)	**58956**	**54 200**	**91.9**	**4 756**	**8.1**

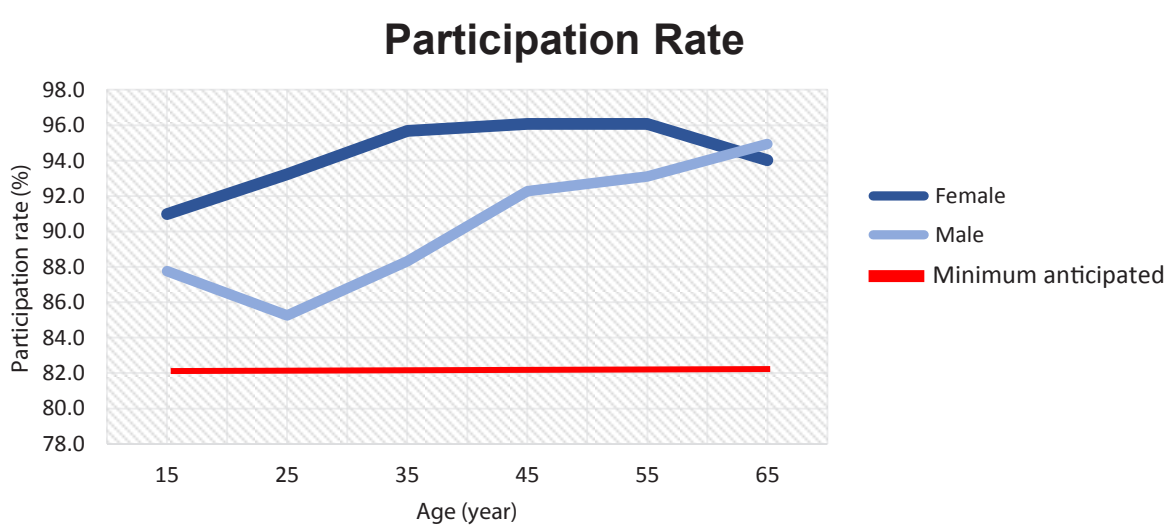
Similar to the eligibility rate, the participation rate was also higher among female (94%) than among male (90%). Among the eligible population for all age groups except for age 55 years and more, the rates of both eligible and participation were lesser among male than female, while the proportion of participation rate was lower eligible proportion among male of age groups 15 to 44 years. This proportion was higher among female of age groups 25 to 64 years. (Figure 16)

Figure 16: The number of people eligible to participate versus those who participated



When we observed the participation rate by sex and age group, men aged 25-34 years had the lowest participation rate (Figure 17).

Figure 17: The participation rate by age group and sex



98.9% (53 622 out of 54 200) were onsite participants and the remaining 1.1% (538 out of 54 200) participated off-site. Among 538 offsite participants, 36.6% (212 out of 578) were elderly, followed by 31.1% with a disability, 21.1% of health issues, and 10% with pregnancy. Table 12

Table 12 Types of participant based on their presence to the survey site

Types of participant	Number	%
Onsite	53 622	98.9
Offsite[2]	578	1.1
Old age	212	
Disability	180	
Health issue	122	
Pregnancy	58	
Others	6	
Total	**54 200**	

96.6% (52 375 out of 54 200) participants had no history of TB. 3.2% (1767 out of 54 200) of participants had a history of TB and mostly (1343 out of 1767) with TB treatment history of ≥ 2 years. 0.1% (58 out of 54 200) of participants were currently on TB treatment. Table 13

Table 13 The TB treatment history of participants

TB treatment history	No	%
No TB treatment history	52 375	96.6
Current TB treatment	58	0.1
Previous TB treatment history	1 767	3.2
< 6 months after treatment completed	76	
≥ 6 months until < 2 years after treatment completed	348	
≥ 2 years after treatment completed	1 343	
Total	**54 200**	**100**

5.2 SCREENING

Among 54 200 participants, 54 131 (99.9%) participants had symptoms screening results (onsite – 53 622, offsite - 509). Among them, most had tiredness (14.9%) and chest pain (12.3%) and only 3.6% had classical TB symptoms of cough for 2 weeks or more. Detailed symptoms screening results are summarized in Table 14 and Table 15

2 offsite – among enumerated population, those who were eligible to participate in survey but couldn't come to screening field site because of medical reasons (e.g. Physical or mental disability or illness, late pregnancy). All of them were directly considered as participants and directly eligible to submit sputum at home regardless of symptom screening result carried out at home.

Table 14 Symptoms screening results of each symptom [3] distributed with age and sex

Symptoms	Sex		Age group (years)						Total	% symptoms among total screened (N= 54 131)
	Male	Female	15-24	25-34	35-44	45-54	55-64	≥ 65		
	%	%	%	%	%	%	%	%	N	Col %
Tiredness	33.4	66.6	17.8	16.7	15.8	15.0	15.5	19.2	8 087	14.9
Chest pain	36.4	63.6	14.9	14.7	17.4	16.9	17.2	18.9	6 666	12.3
Body weight loss	37.4	62.6	21.8	16.6	14.4	14.6	14.4	18.2	4 937	9.1
Loss of appetite	33.8	66.2	22.8	17.1	15.3	14.5	14.2	16.1	4 608	8.5
Breathing difficulty	34.2	65.8	12.5	11.6	14.1	16.0	18.2	27.6	4 270	7.9
Less than two-week cough	41.2	58.8	28.6	16.1	15.5	12.3	12.3	15.2	2 882	5.3
Cough for 2 weeks or more	42.8	57.2	8.0	7.0	9.2	14.7	22.2	39.0	1 934	3.6
Fever	28.2	71.8	19.1	14.9	15.1	13.9	17.3	19.6	1 874	3.5
Night sweating	37.4	62.6	15.6	14.2	16.8	18.9	18.2	16.3	1 542	2.8
Haemoptysis	45.7	54.3	18.8	12.3	13.8	16.7	17.9	20.5	414	0.8
No symptoms	45.2	54.8	29.7	22.4	18.2	13.7	9.0	6.9	34 067	62.9

Out of 54 200 participants, 53 622 were onsite participants and 578 were offsite participants. Among 53 622 onsite participants, 50 707 (94.6%) had no TB symptoms, and only 1 853 (3.5%) with cough ≥ 2 weeks. Among 578 offsite participants, 69 (11.9%) weren't screened, 402 (69.9%) had no TB symptoms, whereas 81 (14.0%) had cough ≥ 2 weeks. Table 15

Table 15 Participants (onsite and offsite) with symptoms screening results

Site of participation	Symptom screening results								Total participants
	Cough ≥ 2 weeks		Cough < 2weeks with Additional symptom		Not having TB symptoms		Not screened		
	n	%	n	%	n	%	n	%	N
Among on-site participants	1 853	3.5	1 062	2.0	50 707	94.6	0	0.0	53 622
Among off-site participants	81	14.0	26	4.5	402	69.6	69	11.9	578
Total	**1 934**	**3.6**	**1 088**	**2.0**	**51 109**	**94.3**	**69**	**0.1**	**54 200**

Among 54 200 participants, 52 457 participants had field X-ray taken, 2 participants refused, and 1163 participants were exempted in the field (total exempted including 578 offsite participants = 1741). Out of 52 457 number of X-ray done, X-ray results are available for 52 457 participants (100%), as mentioned in Table 16. 22.3% (11 718 out of 52 457) were abnormal and eligible for sputum examination. The proportion of those abnormal and eligible for sputum was highest among those age group of 65+ years (70.4%), and among male (26.5%). Whereas Kathmandu valley had the lowest proportion (19%) amongst other terrains. Table 16

3 The symptoms are mutually exclusive from each other

Table 16 Field CXR reading results

Characteristics	Field CXR reading						
	Normal		Abnormal and eligible for sputum examination		Abnormal but not eligible for sputum examination		Total (N)=
	n	%	n	%	n	%	52 457
Age group (years)							
15-24	12 859	94.2	678	5	113	0.8	13 650
25-34	9 467	89.8	901	8.6	174	1.7	10 542
35-44	7 593	81.1	1 499	16	269	2.9	9 361
45-54	5 092	66.5	2 182	28.5	382	5	7 656
55-64	2 740	46.7	2 671	45.5	455	7.8	5 866
65+	1 148	21.3	3 787	70.4	447	8.3	5 382
Sex							
Male	16 111	70.9	6 026	26.5	590	2.6	22 727
Female	22 788	76.7	5 692	19.2	1 250	4.2	29 730
Strata category							
Hill	12 514	72.9	3 962	23.1	699	4.1	17 175
Kathmandu Valley	4 089	77.5	1 035	19.6	152	2.9	5 276
Mountain	3 284	72.4	1 055	23.3	197	4.3	4 536
Terai	19 012	74.6	5 666	22.3	792	3.1	25 470
Total	**38 899**	**74.2**	**11 718**	**22.3**	**1 840**	**3.5**	**52 457**

All field X-ray (52 457) were also 100% read by a central reader. The observed agreement between field and central reading was 79.9% with a *kappa* score of 0.35 (Table 17). 7 608 (65%) overreading was done by field reader regarding abnormal and eligible for sputum examination compared to central reading. Whereas, 519 participants (12.6%) were under-read compared to central reading. 27 among those under-read (519) participants were already eligible for sputum via symptom screening and sputum were collected. Among 472 remaining participants, they were made eligible for sputum, and out of the 366 (nearly 77.5%) participants sputum were collected. For other discrepancies, sputum examination eligibility followed the field CXR reading. Table 17

Table 17 The comparison between field and central CXR reading

Field CXR reading	Central CXR Reading			
	Normal	Abnormal and eligible for sputum examination	Abnormal and not eligible for sputum examination	Total
Normal	38 056	462	381	38 899
Abnormal and eligible for sputum examination	7 487	3 591	640	11 718
Abnormal and not eligible for sputum examination	1 617	57	166	1 840
Total	**47 160**	**4 110**	**1 187**	**52 457**
Observed agreement – 79.9%, *kappa* score – 0.35				

Among on-site participants, 14 634 (27.3%) were eligible for sputum examination. Most sputum eligible participants had abnormal CXR (83.6%), a small proportion (8.4%) had positive symptoms without abnormal CXR and 7.9% of eligible participants were either exempted or refused to take the X-ray. Table 18.

Table 18 The on-site participants eligible for sputum examination based on positive CXR or symptom screening

Chest X-ray	Symptom		Eligible for Sputum	
	Cough ≥2 weeks	Cough < 2 weeks with any additional symptom[4]	n	%
Abnormal[5]	No	No	10 616	72.5
Abnormal	Yes	No	1 150	7.9
Exempted	No	No	1 101	7.5
Normal[6]	Yes	No	673	4.6
Normal	No	Yes	559	3.8
Abnormal	No	Yes	471	3.2
Exempted	Yes	No	30	0.2
Exempted	No	Yes	32	0.2
Refused	No	No	2	0.01
Refused	Yes	No	0	0.0
Refused	No	Yes	0	0.0
Total eligible for sputum examination (on-site) :			**14 634**	**100.0**

With regards to off-site participants, regardless of symptoms screening, all 578 were eligible for sputum (Table 15).

Among 99 clusters, 87 clusters (87.8%) transported sputum samples 3 times per cluster operations as desired. But with 11 clusters (11.1%) had 2 transports per cluster whereas one cluster from extremely hard to reach areas had 1 transport only. Among 908 sputum transports in total from all clusters, the average sputum transportation time was 0.9 days. 96.8% (879 shipments) reached the central labs within 3 days of transport, 1.3% (12 shipments) between 3 to 5 days, and 1.5% (14 shipments) between 5 to 7 days. The duration of shipment was not available for 3 shipments. Among 37 232 sputum samples collected, 78% were mucopurulent. See Annex 8.2.9 for details.

Out of 15 212 sputum eligible subjects (14 634 on-site + 578 off-site), 15 011 participants (98.7%) submitted at least one sputum sample. Most submitted two sputum samples for Xpert (96.6%)[7]. Most of the participants selected for culture examination submitted a sputum sample (94.7%). Table 19

4 Additional symptoms – weight loss, chest pain, loss of appetite, hemoptysis, breathing difficulty, night sweating, and tiredness of any duration.
5 Abnormal : Abnormal and eligible for sputum
6 Normal : Normal (including Abnormal but Not eligible)
7 Those who are sputum eligible for Xpert are also eligible for smear microscopy

Table 19 The number of participants who submitted sputum samples among sputum eligible

Sputum specimen collected	Number of participants eligible to submit sputum	Number of participants who collected the sample	Missing
	n	n	n (%)
2 Xpert and 1 culture	8 095	7 626	469 (5.8%)
2 Xpert only	7 117	6 881	236 (3.3%)
1 Xpert and 1 Culture		36	
1 Xpert only		468	
Total	**15 212**	**15 011**	**201 did not submit samples**

From 15 010 participants with at least one Xpert result, 352 participants had at least one positive Xpert MTB/RIF, 2.0% (304/15 010) rifampicin susceptible, 0.1% (21/15 010) rifampicin resistance and 0.2 % (27/15 010) rifampicin resistance indeterminate. Among 14 468 participants with results of both morning and spot samples, the agreement rate was 98.2 % with *kappa* 0.54 when cross-tabulation was done between spot and morning Xpert MTB/RIF results (Table 20). The agreement rate was 97.7% with *kappa* 0.41 when spot and morning grading of Xpert MTB/RIF results were compared. Table 21).

However, the discordant results showed that nearly 107 more positives (mostly with very low grade) were found among the morning sample which could have been missed by the spot sample alone. Among those 107 additional cases, there were 6 cases of MDR/RR-TB that were missed by the spot sample. This reiterates the value of two Xpert MTB/RIF tests.

Table 20 The Xpert MTB/RIF results from spot and morning specimen, from participants having both results

	Xpert MTB/RIF results MTB not detected	Morning					Total
		MTB detected, Rif resistance not detected	MTB detected, Rif resistance detected	MTB detected, Rif resistance indeterminate	Invalid, Error		
Spot	MTB not detected	14 053	87	6	14	35	14 195
	MTB detected, Rif resistance not detected	66	144	5	3	2	220
	MTB detected, Rif resistance detected	5	1	3	0	0	9
	MTB detected, Rif resistance indeterminate	2	5	2	0	0	9
	Invalid, Error	32	1	0	0	2	35
	Total	**14 158**	**238**	**16**	**17**	**39**	**14 468**

Agreement - 98.2%
kappa - 0.54

Table 21 The cross-tabulation of spot and morning sample's Xpert MTB/RIF positive results with gradings, among those having both spot and morning samples results

Xpert MTB/RIF results			Morning						Total
			MTB not detected	MTB detected				Invalid, Error	
				Very low	Low	Medium	High		
Spot	MTB not detected		14 053	72	32	3	0	35	14 195
	MTB detected	Very low	46	27	22	6	0	1	102
		Low	22	12	23	22	4	1	84
		Medium	5	3	11	17	5	0	41
		High	0	0	0	3	8	0	11
	Error, Invalid		32	1	0	0	0	2	35
Total			**14 158**	**115**	**88**	**51**	**17**	**39**	**14 468**

Agreement - 97.7%
Kappa - 0.41

Among 7 662 samples processed for culture, 6 962 were negative, 82 (1.1%) samples were positive for MTB, 226 were positive for NTM and 392 (5.1%) were contaminated. Among contaminated samples, reprocessing was from the stored sediments. Among 392 contaminated samples, it resulted in the addition of 1 MTB, 2 NTM, 388 Negative, and 1 contaminated. Table 22

In the survey, 6% NaOH (initial concentration before dilution process) was used from the beginning but when we found a low recovery rate, we switched it to 4% NaOH. But using 4% NaOH (in 13 clusters), the contamination rate increased to 17.5% (tube wise). The final NaOH concentration after dilution was between 1-1.5%. Hence, the concentration of NaOH was again increased to 6% to control the contamination rate (which came down to 9%).

Among 83 culture MTB positives, 62 (75%) had at least 1 Xpert MTB/RIF positive. Of these 62, 40 (65%) culture-positive samples were positive in two Xpert MTB/RIF specimens; and 22 (35%) culture-positive samples were positive in one Xpert MTB/RIF specimen only.

The overall contamination rate was 392/7662(5.11%) case wise and in each lab NTCC (9.5%), GENETUP (9.6%), and IOM (11%) as per tube wise.

Table 22 Culture results[4]

Culture result	Before Reprocessing		After Reprocessing (final culture result)	
	n	%	n	%
Negative	6 962	90.9	7 350	95
MTB[8]	82	1.1	83	1.1
NTM[9]	226	2.9	228	3
Contaminated	392	5.1	1	0
Total	**7 662**	**100**	**7 662**	**100**

8 MTB- Mycobacterium Tuberculosis
9 NTM- Non-Tuberculous Mycobacteria

When we compare the Xpert MTB/RIF and culture result using the highest Xpert grade among 2 samples; among 204 Xpert MTB/RIF positive results, 62 (30.2%) were also culture positive, and among 7457 Xpert MTB/RIF negative, 21 (0.3%) were culture positive. Whereas, among 83 culture positive, 62 (75%) were Xpert MTB/RIF positive, and 2% out of 7350 with negative culture were also Xpert MTB/RIF positive. (Table 23)

Table 23 The comparison between Xpert MTB/RIF (the highest degree of positive results among the two samples) and culture results.

Highest Xpert results among two sample used			Culture Results				Total	MTB culture positivity rate among Xpert (%)
			Negative	MTB	NTM	Contaminated		
Xpert MTB/RIF	MTB not detected		7 222	21	213	1	7 457	0.3
	MTB detected	Very Low	64	20	4	0	88	30.4
		Low	43	19	6	0	68	
		Medium	17	17	4	0	38	
		High	3	6	1	0	10	
	Error, Invalid, No Result		1	0	0	0	1	0.0
Total			**7 350**	**83**	**228**	**1**	**7 662**	
Xpert MTB/RIF positivity rate among culture (%)			1.7	74.7	6.6	0.0		

Among those with no TB treatment history, 52 (36%) out of 145 Xpert MTB/RIF positive also had culture positive, whereas, 0.3% (18 out of 6254) Xpert MTB/RIF negative also had culture-positive. 74% (52 out of 70) culture-positive also had Xpert MTB/RIF positive and 1% (81 out of 6154) culture-negative also had Xpert MTB/RIF positive. (Table 24)

Among those with TB Treatment history, only 17% (10 out of 59) of Xpert MTB/RIF positive had culture-positive and 0.2% (3 out 1203) Xpert MTB/RIF negative had culture-positive. Whereas 77% (10 out of 13) culture-positive had Xpert MTB/RIF positive, and 4% (44 out of 1196) culture-negative also had culture-positive. (Table 24)

Table 24 The comparison between Xpert MTB/RIF (the highest degree of positive results among the two samples) and culture results segregated among those having TB Tx history and with no TB Tx history.

Highest Xpert results among two sample used			Among those with TB Tx history (current or past TB)						Among those with no TB Tx history					
			Culture results					MTB culture positivity rate among Xpert (%)	Culture results					MTB culture positivity rate among Xpert (%)
			Negative	MTB	NTM	Contaminated	Total		Negative	MTB	NTM	Contaminated	Total	
Xpert MTB/RIF	MTB not detected		1 150	3	50	0	1 203	0.2	6 072	18	163	1	6 254	0.3
	MTB detected	Very Low	19	2	1	0	22	16.9	45	18	3	0	66	35.9
		Low	18	7	0	0	25		25	12	6	0	43	
		Medium	6	1	1	0	10		9	16	3	0	28	
		High	1	0	1	0	2		2	6		0	8	
	Error, Invalid, No Result		0	0	0	0	0	0.0	1	0	0	0	1	0.0
Total			**1 196**	**13**	**53**	**0**	**1 262**		**6 154**	**70**	**175**	**1**	**6 400**	
Xpert MTB/RIF positivity rate among culture (%)			3.7	76.9	5.7	0.0			1.3	74.3	6.9	0		

Only morning Xpert MTB/RIF results were also compared with culture results for more direct comparability (as both are morning samples). 31% (49 out of 157) of Xpert MTB/RIF positive were Culture positive and 0.4% (32 out of 7440) Xpert MTB/RIF negative also had culture-positive. Whereas, among 59% (49 out of 83) culture-positive had Xpert positive and 1% (94 out of 7350) culture-negative also had Xpert MTB/RIF positive. (Table 25)

Table 25 The comparison between Xpert MTB/RIF (morning sample results) and culture results.

Morning Xpert results used among two sample			Culture Results				Total	MTB culture positivity rate among Xpert (%)
			Negative	MTB	NTM	Contaminated		
Xpert MTB/RIF	MTB not detected		7 197	32	210	1	7 440	0.4
	MTB detected	Very Low	44	18	4	0	66	31.2
		Low	33	16	7	0	56	
		Medium	14	10	3	0	27	
		High	3	5	0	0	8	
	Error, Invalid, No Result		59	2	4	0	65	0.0
Total			**7 350**	**83**	**228**	**1**	**7 662**	
Xpert positivity rate among culture (%)			1.3	59.0	6.1	0.0		

Among those with no TB Treatment history, 37% (41 out of 110) Xpert MTB/RIF positive were culture positive and 0.4% (27 out of 6232) Xpert MTB/RIF negative were also culture positive. Whereas, 59% (41 out of 70) of culture-positive had Xpert MTB/RIF positive and 1% (58 out of 6154) culture-negative also had Xpert MTB/RIF positive. (Table 26)

Among those with TB treatment history, 17% (8 out of 47) Xpert MTB/RIF positive were culture positive and 0.4% (5 out of 1208) Xpert MTB/RIF negative were also culture positive. Whereas, 62% (8 out of 13) of culture-positive had Xpert MTB/RIF positive and 3% (36 out of 1196) culture-negative also had Xpert MTB/RIF positive. (Table 26)

Table 26 The comparison between Xpert MTB/RIF (morning sample results) and culture results, disaggregated by TB treatment history.

Morning Xpert results used among two sample			Among those with TB Tx history (current or past)						Among those with no TB Tx history					
			Culture results						Culture results					
			Negative	MTB	NTM	Contaminated	Total	MTB culture positivity rate among Xpert (%)	Negative	MTB	NTM	Contaminated	Total	MTB culture positivity rate among Xpert (%)
Xpert MTB/RIF	MTB not detected		1 155	5	48	0	1 208	0.4	6 042	27	162	1	6 232	0.4
	MTB detected	Very low	11	2	1	0	14	17.0	33	16	3	0	52	37.3
		Low	18	5	0	0	23		15	11	7	0	33	
		Medium	6	1	2	0	9		8	9	1	0	18	
		High	1	0	0	0	1		2	5	0	0	7	
	Error, Invalid, No Result		5	0	2	0	7	0	54	2	2	0	58	0.0
Total			**1 196**	**13**	**53**	**0**	**1 262**		**6 154**	**70**	**175**	**1**	**6 400**	
Xpert positivity among Culture (%)			3.0	61.5	5.7	0			0.9	58.6	6.3	0		

Among Xpert MTB/RIF results available 90.3% (13 561 out of 15 010) had no history of TB, 0.3% (56 out of 15 010) were currently on TB treatment and 9.2% (1 393 out of 15 010) had past TB treatment history. Among those with at-least one Xpert MTB/RIF positive results, 79.8% (281 out of 352) had no history of TB, 7.7% (27 out of 352) were currently on TB treatment and 12.5% (44 out of 352) had past TB treatment history. (Table 27).

Among those with past TB treatment history and with at-least one Xpert MTB/RIF positive results, 4.5% (2 out of 44) had TB treatment history of <6 months, 34.1% (15 out of 44) had TB treatment history between 6 months to 2 years and 61.4% (27 out of 44) had TB treatment for 2 years or more. (Table 27).

Among 21 cases with rifampicin resistance detected, 17 had no TB treatment history, whereas 4 had history of TB.

Table 27 TB treatment history of the survey participants and the result of Xpert MTB/RIF (Xpert MTB/RIF results take the highest degree of positive results among two samples)

TB Treatment History			Xpert MTB/RIF Results						Total
			MTB Not Detected	MTB Detected				Error, Invalid, no result	
				Very Low	Low	Medium	High		
With No History			13 278	125	83	55	18	2	13 561
With TB History	Current TB		29	8	7	11	1	0	56
	Past TB	<6 Months	56	0	2	0	0	0	58
		6 Months - <2 Years	263	4	10	0	1	0	278
		≥2 Years	1 030	14	11	2	0	0	1 057
		Total past TB	1 349	18	23	2	1	0	1 393
Total			**14 656**	**151**	**113**	**68**	**20**	**2**	**15 010**

There were 21 MTB positive culture results with negative Xpert MTB/RIF results. Among those 21 cases, 18 cases had active TB lesions (14 minimal [10] and 4 moderate [11]). 38.1% smear-positive and 28.8% smear-negative had minimal active lesion on CXR. 18.8% of those with cough ≥ 2 weeks and 12.9% of those with cough <2 weeks with additional symptom had minimal active lesion on CXR. Males had more active lesions in CXR than women, along with those among older age groups compared to the younger age groups. The details are provided in Table 28.

10 Minimal : Lung TB disease suggestive with non-cavitary changes with summation of extents of lesions is approximately within a circle of 20 mm diameter
11 Moderate : Lung TB disease suggestive with non-cavitary changes with other than «Minimal» and «Advanced»

Table 28 The central chest X-ray reading of participants having Xpert MTB/RIF and culture, smear, symptom, age and sex

Central CXR reading			Xpert and culture			Smear		Symptom			Sex		Age Group (years)					
			Xpert +ve, Culture MTB +ve	Xpert +ve, Culture MTB not +ve	Xpert -ve, Culture MTB+ve	Smear -ve	Smear +ve	cough ≥ 2 weeks	cough <2 weeks with additional symptom[12]	No symptom	Male	Female	15-24	25-34	35-44	45-54	55-64	65+
			n	n	n	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)	% (col)
Normal			1	37	1	65.5	10.3	66.8	79.5	91.0	87.5	91.7	97.4	95.7	92.5	88.9	80.7	66.7
Lung TB disease suggestive	Cavitary		0	9	0	0.2	6.2	0.8	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.2	0.3
	Non-cavitary	Minimal	42	135	14	22.5	38.1	18.8	12.9	5.3	7.3	4.9	1.3	2.4	4.2	6.7	11.8	20.3
		Moderate	12	70	4	3.2	28.9	5.9	1.8	0.7	1.2	0.6	0.1	0.2	0.5	0.9	1.8	3.7
		Advanced	4	17	0	0.9	9.3	1.6	1.2	0.2	0.3	0.2	0.0	0.0	0.1	0.2	0.6	1.1
Thoracic extra-pulmonary TB suggestive	Hilum and /or mediastinum mass		1	3	0	0.6	2.1	0.5	0.3	0.2	0.1	0.2	0.0	0.1	0.1	0.2	0.4	0.7
	Pleural effusion etc.		0	1	0	0.9	2.1	0.3	0.4	0.2	0.4	0.1	0.1	0.2	0.2	0.3	0.4	0.5
Healed TB	Single small calcification		0	0	0	0.3	0.0	0.2	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.1	0.4	0.3
	Healed TB		0	1	0	0.8	2.1	0.6	0.3	0.2	0.3	0.2	0.0	0.2	0.3	0.3	0.3	0.6
Non-TB abnormality in the lung	Emphysema and/or air cyst(s)		0	0	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Other abnormality in the lung		0	0	0	0.2	0.0	0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.1
Other abnormality			0	9	0	4.7	1.0	4.4	3.2	2.0	2.6	1.8	1.0	1.2	1.8	2.4	3.4	5.8
Uninterpretable			0	0	0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total			**60**	**282**	**19**	**13 225**	**97**	**1 823**	**1 030**	**49 604**	**22 727**	**29 730**	**13 650**	**10 542**	**9 361**	**7 656**	**5 866**	**5 382**

12 Additional symptoms: body weight loss, fever, chest pain, loss of appetite, hemoptysis, breathing difficulty, night sweating and tiredness

Among 15 010 with both smear and Xpert MTB/RIF results, Xpert MTB/RIF positive rate among smear-positive was 82.7%, and 1.8 % of smear-negative were Xpert MTB/RIF positive as well. Whereas, only 24.4 % of Xpert MTB/RIF positive were smeared positive. (Table 29)

Table 29 Comparison between Smear result and Xpert MTB/RIF results (both results take the highest degree of positive results among the two samples)

Smear result (most positive result)	Xpert MTB/Rif Results (Most positive result)						Total	Xpert positivity among smear (%)
	MTB Not Detected	MTB Detected				Error, Invalid, no result		
		Very Low	Low	Medium	High			
Negative	14 638	137	103	25	1	2	14 906	1.8
Positive								
Scanty	12	14	9	23	0	0	58	79.3
1 +	5	0	0	13	6	0	24	79.2
2 +	1	0	0	7	6	0	14	92.9
3 +	0	0	1	0	7	0	8	100
Total	18	14	10	43	19	0	104	82.7
N/A	0	0	0	0	0	0	0	0.0
Total	**14 656**	**151**	**113**	**68**	**20**	**2**	**15 010**	
Smear positivity rate among Xpert (%)	0.1	9.3	8.8	63.2	95.0	0.0		
					24.4			

The sputum samples collected for smear and culture were separate. 7662 participants with culture results had smear results (most positive result among the two samples) and the MTB culture recovery rate was 37.7%. When culture results compared with smear results of the morning sample (among 7624, for more head to head comparison), the recovery was nearly the same (41.3%).(Table 30, Table 31)

Table 30 Smear results (Smear results considering the highest degree of positive results among two samples) vs culture results

Smear result (most positive result)	Culture Results				Total	MTB culture recovery rate among smear (%)
	Negative	MTB	NTM	Contaminated		
Negative	7 320	60	221	1	7 602	0.8
Positive						
Scanty	21	8	3	0	32	25.0
1 +	3	8	2	0	13	61.5
2 +	4	5	1	0	10	50.0
3 +	2	2	1	0	5	40.0
Total	30	23	7	0	60	38.3
N/A	0	0	0	0	0	0
Total	**7 350**	**83**	**228**	**1**	**7 662**	
Smear positivity rate among culture (%)	0.4	27.7	3.1	0.0		

Table 31 Smear results (Smear results on morning samples) vs culture results

Smear result (highest result among two samples)	Culture Results				Total	MTB culture recovery rate among smear (%)
	Negative	MTB	NTM	Contaminated		
Negative	7 298	63	223	1	7 585	0.8
Positive						
Scanty	16	8	3	0	27	29.6
1 +	3	6	0	0	9	66.7
2 +	3	3	1	0	7	42.9
3 +	1	2	0	0	3	66.7
Total	23	19	4	0	46	41.3
N/A	1	0	0	0	1	0.0
Total	7 322	82	227	1	7 632	
Smear positivity rate among culture (%)	0.3	23.2	1.8	0.0		

5.3 SURVEY TB CASES

Among 352 participants with at least one Xpert MTB/RIF positive, following case definition (section 4.50), 225 were decided as TB cases based on directly observed results before imputation. 225 cases included 191 New, 31 with past TB history, and 3 currently on treatment cases. Out of 225 cases, 14 (6.2%) cases had rifampicin resistance (5.7% among new cases 8.8% among TB treatment history cases). (Table 32). Only 68 (30.2%) out of 225 cases had positive smear results.

Table 32 TB cases defined from participants ; cases with at least 1 Xpert MTB/RIF result positive and regardless of symptom

Among 352 participants with at-least one Xpert positive, direct survey TB cases based on TB treatment history								
CXR by Panel Reading	No TB Treatment		Past TB Treatment					Current TB treatment
	MTB culture result	TB case	MTB culture result	TB case				TB cases
				< 6 months	≥6 months to <2 years	≥2 years	Total	
Active TB	Regardless of culture	119	Regardless of culture	1	10	18	29	Regardless of X-ray, MTB culture positive = 3
	MTB positive	37	MTB positive	0	1	4	5	
	MTB negative	40	MTB negative	1	6	13	20	
	NTM	10	NTM	0	1	1	2	
	Contamination	0	Contamination	0	0	0	0	
	Result not available	72	Result not available	0	2	0	2	
Mixed appearance (active and healed)	Regardless of culture	22	Positive	0	0	1	1	
	MTB positive	5						
	MTB negative	7						
	NTM	1						
	Contamination	0						
	Result not available	9						
Healed TB	Positive	6	Positive	0	1	0		
Other lung abnormalities	Positive	4	Positive	0	0	0		
Normal lung / other non-pulmonary abnormality	Positive	0	Positive	0	0	0		
Exempted CXR	Positive	0	Positive	0	0	0		
Total PS survey case	**191 (11 Rif resistance)**		**31 (3 Rif resistance)**					**3 (0 Rif resistance)**
	225 (14 Rif resistance)							

The proportion of TB cases was higher in older ages, men, living in hilly clusters, having no education, having no occupation or working in agriculture, and having low socioeconomic status.

Table 33 The characteristics of prevalent TB cases identified in the survey

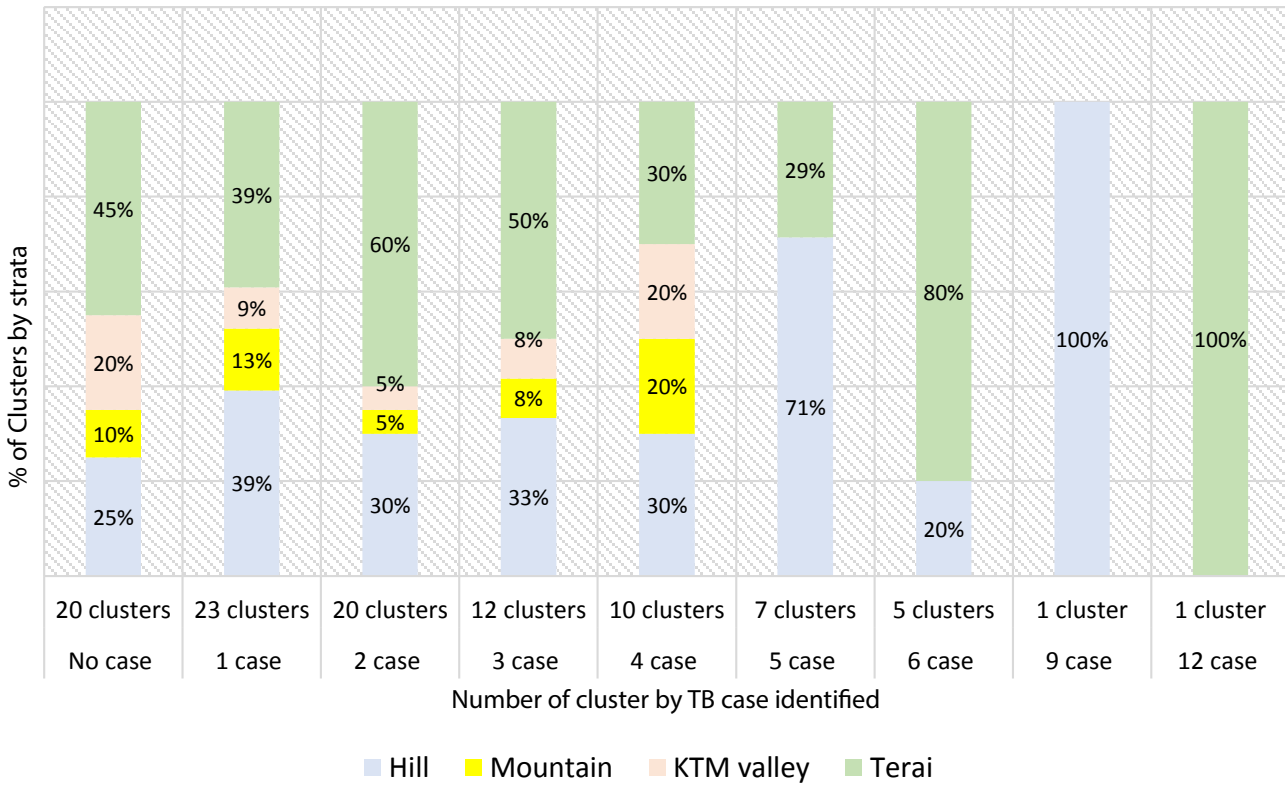
Characteristics	Cases		Non-cases		Total
	n	%	n	%	N
Age group (years)					
15-24	19	0.1	14 300	99.9	14 319
25-34	15	0.1	11 000	99.9	11 015
35-44	25	0.3	9 428	99.7	9 453
45-54	34	0.4	7 665	99.6	7 699
55-64	48	0.8	5 874	99.2	5 922
65+	84	1.5	5 708	98.6	5 792
Sex					
Male	151	0.7	22 826	99.3	22 977
Female	74	0.2	31 149	99.8	31 223
TB treatment history					
No history	191	0.4	52 184	99.6	52 375
Current treatment	3	5.2	55	94.8	58
Past history	31	1.8	1 736	98.3	1 767
Strata category					
Hill	83	0.5	17 725	99.5	17 808
Kathmandu Valley	15	0.3	5 417	99.7	5 432
Mountain	16	0.3	4 697	99.7	4 713
Terai	111	0.4	26 136	99.6	26 247
Education					
No education	141	0.8	17 026	99.2	17 167
Some primary	37	0.3	13 161	99.7	13 198
Completed primary	14	0.2	6 072	99.8	6 086
Some secondary	15	0.2	8 098	99.8	8 113
Completed secondary	6	0.1	4 611	99.9	4 617
More than secondary	11	0.2	4 967	99.8	4 978
Missing	1	2.4	40	97.6	41
Occupation					
Professional/ technical/ managerial	3	0.2	1 560	99.8	1 563
Clerical	2	0.2	1 242	99.8	1 244
Sales and services	7	0.2	2 863	99.8	2 870
Skilled manual	8	0.3	2 432	99.7	2 440
Unskilled manual	3	0.2	1 490	99.8	1 493
Agriculture	108	0.7	14 679	99.3	14 787
Student	8	0.1	6 919	99.9	6 927
Housewife	32	0.2	17 166	99.8	17 198
Other/no occupation	53	0.9	5 583	99.1	5 636
Missing	1	2.4	41	97.6	42

Table 33 The characteristics of prevalent TB cases identified in the survey (Continue)

Characteristics	Cases		Non-cases		Total
	n	%	n	%	N
Socioeconomic status					
Low	118	0.6	20 785	99.4	20 903
Middle	49	0.5	10 676	99.5	10 725
High	58	0.4	22 514	99.7	22 572
Total	**225**	**0.4**	**53 975**	**99.6**	**54 200**

The distribution of TB cases by the cluster is shown in Figure 18. Out of 99 clusters, 79 clusters (80%) had at least one TB case and two clusters had more than 9 cases. The number of cases per cluster on an average was 2.3. See Annex 8.3.14 for the survey cluster summary.

Figure 18: The distribution of clusters based on the number of TB cases identified in the survey



Of the total 225 cases identified, almost 99% had CXR interpreted as "abnormal and eligible for sputum examination" regardless of symptom screening results. Of the 225 cases, 165 (72.9%) were sputum eligible by CXR only. Table 34 and Figure 19

Figure 19: Symptom screening and CXR findings of TB cases (N=225)

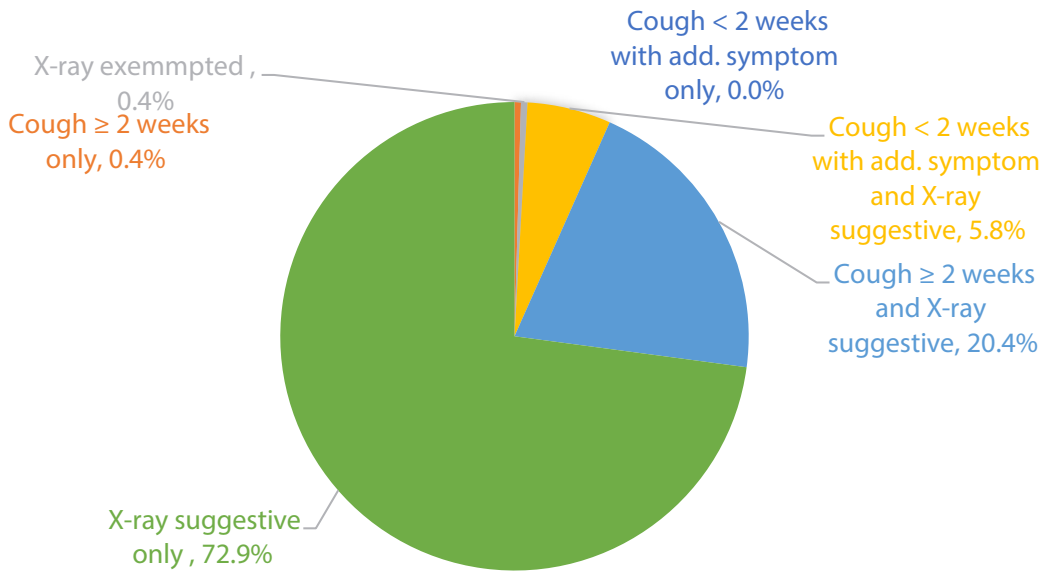


Table 34 Symptom screening and CXR findings of TB cases

Screening symptoms	CXR	Number screened positive	Number of survey TB cases	
			n	%
Yes	Yes	1 621	59	26.2%
Yes	No	1 403	1	0.4%
No	Yes	10 616	164	72.9%
No	Exempted, refused, missing	1 574	1	0.4%
Total		15 212	225	100.0%

Table 35 shows that among 352 Xpert MTB/RIF positive, 255 (72.4%) were only CXR positive, and 8 (2.3%) were symptom positive only. Among 352 Xpert MTB/RIF cases, the final PS cases decided were 225, where nearly 127 Xpert MTB/RIF positives were not considered as PS case.

Table 35 The screening symptoms (for onsite and offsite participants) and CXR related to the best results of Xpert results, smear and culture results.

Screening symptoms	CXR	Xpert MTB/RIF positive		Smear positive		Culture MTB positive	
		n	% (col)	n	% (col)	n	% (col)
Yes	Yes	83	23.6	34	32.7	17	20.5
Yes	8No	8	2.3	5	4.8	1	1.2
No	Yes	255	72.4	61	58.7	62	74.7
No	Exempted, refused, missing	6	1.7	4	3.8	3	3.6
Total		352	100.0	104	100.0	83	100.0

In addition to TB survey cases, clinical panel for survey based on the participant's history, X-ray findings, symptoms, and all bacteriological results (Smear, Xpert, and Culture), decided to refer for initiation of TB treatment 274 cases. It was verified that 248 were initiated on TB treatment as suggested by the panel except 26 (10%) of them who could not be reached and put on treatment.

5.4 TB PREVALENCE

5.4.1 Pulmonary TB Prevalence among population aged ≥ 15 years old

After the direct cases were obtained as shown in section 81, imputation was done based on the criteria as explained in the Data analysis section (page 51). Before imputation, there were 225 survey TB cases, whereas after imputation there were 236 survey TB cases. (Table 36)

For details see Annex 8.3.15

Table 36 Total TB PS cases (before and after imputation)

Section A. Participants without any history of treatment				**Imputation**	
A-1. Confirmed Xpert Results, No Treatment History				**Before**	**After**
Observed Xpert results	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both of two negative	NA	Not Case	Not Case	-	-
At least one positive	Active/Mixed	Case	Case	181	181
	Not Active/Mixed	Case	Not Case	10	18
	Not Available (Exempted)	Case	Not Case	0	1
A-2. Undetermined Xpert Results (Both missing or combination of negative and missing), No Treatment History					
Xpert results (including imputed results)	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both Negative after imputation	Not applied	Not Case	Not Case	-	-
At least one positive after imputation	Not applied	Case	Not Case	0	1

Section B. Participants with Past history of treatment				**Imputation**	
B-1. Confirmed Xpert Results, Past History				**Before**	**After**
Observed Xpert results	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both of two negative	NA	Not Case	Not Case	-	-
At least one positive	Active	Case	Case	29	29
	Not Active	Case	Not Case	2	2
	Not Available (Exempted)	Case	Not Case	0	0
B-2. Undetermined Xpert Results (Both missing or combination of negative and missing), Past History					
Xpert results (including imputed results)	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both Negative after imputation	Not applied	Not Case	Not Case	-	-
At least one positive after imputation	Not applied	Case	Not Case	0	0

Table 36 Total TB PS cases (before and after imputation) (Continue)

Section C. Participants with current treatment				Imputation	
C-1. Confirmed Xpert Results, Current Treatment				**Before**	**After**
Observed Xpert results	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both of two negative	Not applied	Not Case	Not Case	-	-
At least one positive	Not applied	Case	Not Case	2	3
C-2. Undetermined Xpert Results (Both missing or combination of negative and missing, Current Treatment					
Xpert results (including imputed results)	Panel-Chest X-ray Reading	MTB Culture status			
		Positive	Negative		
Both of two negative after imputation	Not applied	Not Case	Not Case	-	-
At least one positive after imputation	Not applied	Case	Not Case	0	0

Section D : Participants Not included for imputation				Imputation	
Xpert Results (Observed)	Panel-Chest X-ray Reading	MTB Culture status		**Before**	**After**
		Positive	Negative		
Both negative	Not applied	Not case	Not Case	-	-
At least one positive	Not applied	Case	Not Case	1	1
Undetermined	Not applied	Not case	Not Case	-	-

Summary and Total cases	Number of cases	
	Before imputation	**After imputation**
Section A: Participants without any history of treatment	191	201
Section B: Participants with past history of treatment	31	31
Section C: Participants with current treatment	2	3
Section D: Participants Not included for imputation	1	1
Total case	**225**	**236**

Analysis followed recommendation (Model-3) by the WHO Global Task Force on TB Impact Measurement (Floyd et al. 2013). 2018 Population projection was used to adjust for population structure and post-stratification adjustment was applied. The statistical analysis was carried out using Stata 16 (Stata Corp., Texas). From this, the national prevalence of pulmonary bacteriological confirmed TB among 15 years or more was calculated to be 374.5 (307.6 - 441.4) per 100 000 population. If prevalence was estimated by treatment history, the prevalence of TB cases without treatment history and TB cases past TB treatment history (excluding currently on treatment) was estimated as 323.0 (265.4-380.5) and 44.6 (25.1-64.18) respectively. The prevalence of smear-positive TB was estimated at 112.7 (78.7-146.7). Table 37.

Table 37 Estimated TB prevalence

Prevalence	Point estimate
Prevalence among the eligible population (crude, unweighted)	434.2 (357.3 - 511.2)
Prevalence among the eligible population	426.5 (350.1 - 502.9)
Prevalence adjusted for the 2018 projection (aged 15 years or over)	374.5 (307.6 - 441.4)

For the P/N ratio, the notification refers to reported pulmonary TB cases (BC and CD) to NTP which are new and relapse TB cases, along with cases of other categories (e.g. treatment after loss-to-followup). The prevalence of the oldest age group (65+) was almost 10 times higher than the youngest group (15-24), the P/N ratio [13] was also 3 times more in the oldest age group as compared with the youngest group.

Male had significantly higher TB prevalence than female (Male/Female ratio 2.25), while the P/N ratio for both is similar (3.5: 3.6).

Prevalence was also higher in hill followed by terai, mountain, and least in KTM valley (although not statistically significant). Similarly, the P/N ratio was also highest in hill and mountain (around 5 each) and least in KTM valley (2.6).(Table 38)

13 P/N ratio: Prevalence / Notification Ratio, which is ratio of estimated prevalence of TB for 2018 projected by the survey results and notification of TB as reported in Annual TB report 2018.

Table 38 Bacteriologically confirmed pulmonary TB prevalence among age ≥ 15 years in different strata and demographic characteristics

Characteristics	Pulmonary bacteriological confirmed TB prevalence (aged 15 or more) per 100 000 by direct measure (after imputation and adjustments)			Pulmonary TB (BC+CD) [14]	
	Point prevalence	95% confidence interval			
		LL	UL	CNR**[15]	P/N ratio
Overall (≥15 years)	374.5	307.6	441.4	106.5	3.5
Age group (year)*[16]					
15-24	144.2	82.2	206.2	68.0	2.1
25-34	148.5	73.6	223.3	82.8	1.8
35-44	276.0	161.0	390.9	95.5	2.9
45-54	487.5	292.4	682.5	141.3	3.4
55-64	813.0	520.5	1 105.5	176.2	4.6
65+	1 426.9	1 085.4	1 768.3	212.1	6.7
Sex* (p -value <0.001)					
Male (including the others)	530.1	428.3	631.8	152.1	3.5
Female	235.2	171.4	299.1	65.8	3.6
Strata category					
Hill	400.5	286.8	514.2	78.8	5.1
Kathmandu	276.1	96.5	455.6	105.4	2.6
Mountain	306.9	112.9	500.9	60.9	5.0
Terai	392.8	292.9	492.7	125.7	3.1

2.9.2 Estimated all form TB prevalence among all age population

After applying the proportion of paediatric TB and extrapulmonary TB (Global TB Report, 2018), all forms of TB prevalence among all age populations are estimated to be 416.35 (95% CI, 314.13 - 518.58) per 100,000 population. All forms of TB reported in 2018 to TB programme was 32 043 (CNR 111.9 / 100,000). The National P/N ratio for all ages and all forms of TB was 3.71. The details are in Annex 8.3.1

2.9.3 Estimated incidence

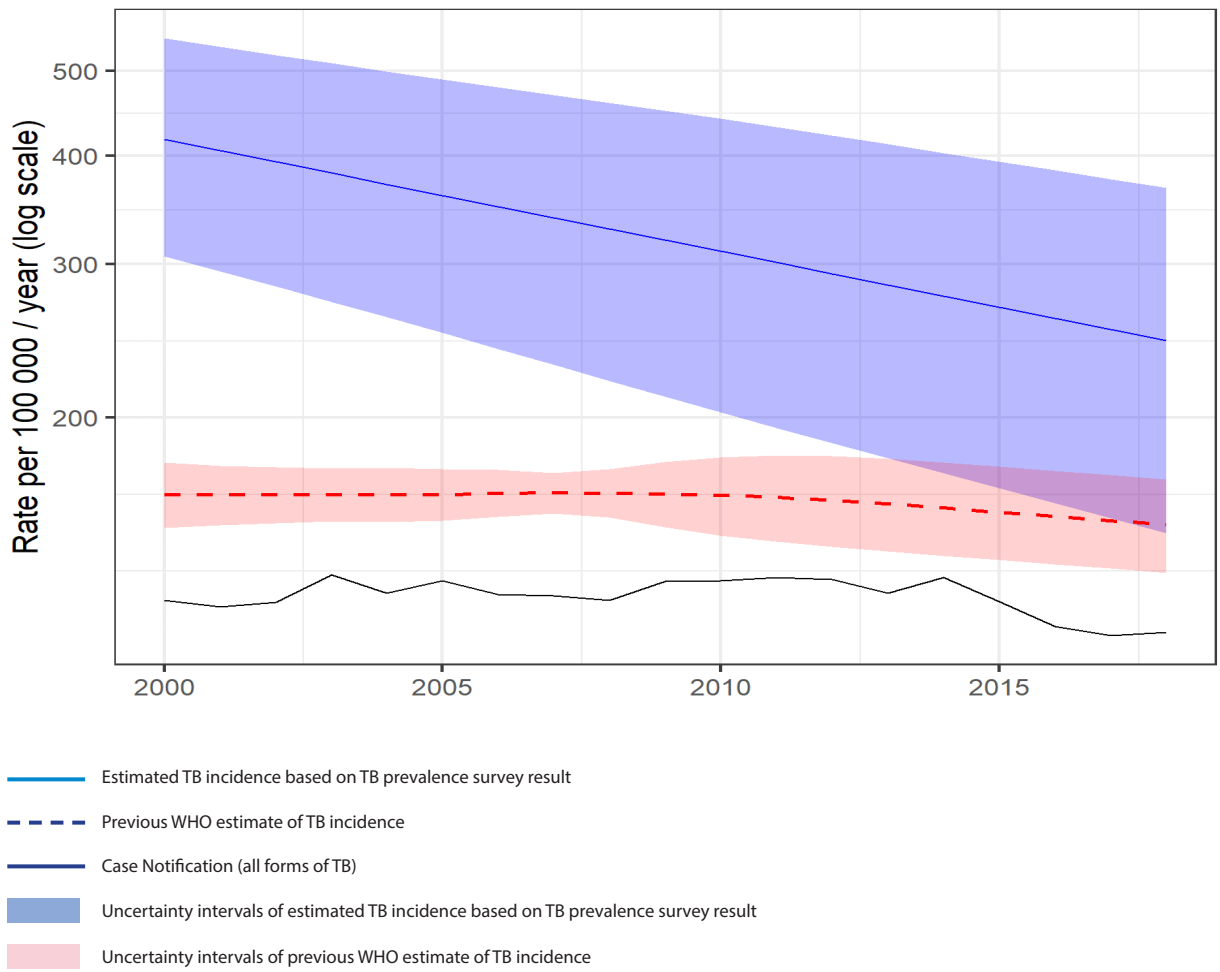
The incidence is estimated to be 245.1 (147.4 - 367.3) per 100,000 population. The incidence is higher than the previous estimate but is declining by around 3% annually. The Notification / Incidence Ratio (all forms of TB) is 45.6 % for 2018. Figure 20

An assumption of a 3% rate of decline in incidence over the period 2000-2018 was used, supported by a steep gradient in prevalence rates over groups of increasing age, suggesting a decline in transmission, and an average 8%/year growth in GNI/capita (Global TB Programme, 2019), page 7-10.

The details are in Annex 8.3.1

14 TB (BC+CD) : (bacteriologically confirmed + clinically diagnosed) of pulmonary (New and all retreatment cases)
15 **: Source: Annual TB report, 2018 (data reported between July 2017-July 2018)
16 *: p<0.001

Figure 20: Estimated TB incidence based on the TB prevalence survey result, compared to the previous WHO estimate and case notification



5.5 HEALTH-CARE SEEKING BEHAVIOUR

All participants who reported having symptoms (cough ≥ 2 weeks or cough <2 weeks with additional symptoms) were asked for health-seeking behavior.

Among 54 131 participants with symptoms screening results, 3 022 participants were eligible by symptoms (cough ≥ 2 weeks and cough <2 weeks with additional symptoms). Among them, 2 962 (out of 3 022) were Non-survey TB cases and 60 (out of 3 022) were survey TB cases. Table 39

Among the 2 962 survey non-TB cases, 1 276 (43.1%) did not seek health care. The main reason being was other (which was not further explored) followed by the inconvenience of time and for financial reasons. Among those who sought health services, 868 (29.3%) sought government health services (main reason being easily accessible), 368 (12.4%) private health services (the main reason being faith towards the service) and 262 (12.3%) sough non-medical services (main reason being "others" which was not further explored). Table 39

Among the 60 survey TB cases, 27 (45%) did not seek health care. The main reason being was other (which was not further explored) followed by the inconvenience of time and for financial reasons. Among those who sought health services, 16 (26.5%) sought services from the government health facilities (main reason being easily accessible), 10 (16.6%) private health services (main reason being easily accessible) and 5 (8.3%) sough non-medical services (main reason being faith towards the service). Table 39

Table 39 First choice of Health facility for seeking care, among TB cases and non-TB cases with positive symptoms (cough for 2 weeks or more and cough <2 weeks with additional symptoms)

Health facility	Among survey Non-TB cases, symptom +ve participants (out of 2 962 Non-TB cases among 3 022 symptoms positive)			Among survey TB cases, symptom +ve participants (60 out of 3 022 symptoms positive)		
	% first choice		Main reason	% first choice		Main reason
	n	%		n	%	
Government health facility	868	29.3	1. Near/easily accessible 2. Faith towards the service 3. Good behavior of the service provider	16	26.5	1. Near/easily accessible 2. Faith towards the service
• Government hospital	312	10.5		8	13.3	
• Urban health clinic	5	0.2		1	1.6	
• Government health centers (PHCC/HP)	551	18.6		7	11.6	
Private health facility	368	12.4	1. Faith towards the service 2. Near/easily accessible 3. Good quality	10	16.6	1. Near/easily accessible 2. Good behavior of the service provider 3. Faith towards the service
• Medical College	34	1.1		4	0	
• Private hospital	161	5.4		6	6.6	
• Private clinics	173	5.8			10	
Non-medical facilities	363	12.3	1. Others 2. Faith towards the service 3. Near/easily accessible	5	8.3	1. Faith towards the service 2. Near/easily accessible
• Pharmacy	205	6.9		5	8.3	
• Self-medication	106	3.6		0	0	
• Traditional healer,	25	0.8		0	0	
• Uncategorized/Others	27	0.9		0	0	
No attention	1 276	43.1	1. Others 2. No convenient time 3. Financial reasons	27	45.0	1. Others 2. Financial reasons 3. No convenient time
Missing	87	2.9		2	3.3	
Total	2 962	100.0		60	100	

Among 54 131 with symptoms screening results, 1 934 participants (not segregated as TB cases or non-TB cases) had chronic cough (cough for two weeks or more), Among those with chronic cough, 38.7% (749 of 1 934) who did not seek care. The main reason being was "others" (which was not further explored) followed by the inconvenience of time and for financial reasons. Among those who sought health services, 598 (30.9%) sought government health services (main reason being easily accessible), 263 (13.7%) private health services (the main reason being faith towards the service) and 262 (13.5%) sough non-medical services (main reason being "others" which was not further explored).

Table 40 First choice of Health facility for seeking care among those with cough ≥ 2 weeks with main reasons

Health facility	Respondent's first choice		Main reason
	n	%	
Government health facility	598	30.9	
• Government hospital			1. Near/easily accessible
• Urban health clinic	254	13	2. Faith towards the service
• Government health centers (PHCC/HP)	4 340	0.2 17	3. Good behavior of the service provider
Private health facility	263	13.7	
• Medical College			1. Faith towards the service,
• Private hospital	28	1.6	2. Near/easily accessible,
• Private clinics	118 117	6.1 6.0	3. Good quality
Non-medical facilities	262	13.5	
• Pharmacy	142	7.3	1. Others
• Self-medication	77	4.0	2. Faith towards the service
• Traditional healer,	18	0.9	3. Near/easily accessible
• Uncategorized/Others	25	1.3	
No attention	749	38.7	1. Others 2. Financial reasons 3. No convenient time
Missing	62	3.2	
Total	**1 934**	**100**	

The characteristics of participants with regards to health-seeking behaviour are presented below. (Table 41 and Table 42)

Among 2 962 participants (survey Non-TB cases) with symptoms, the proportion of seeking care was higher among men (63.9%, 933 out of 1 460), among age >65 years (58.1%, 577 out of 993), in terai (58.4%, 701 out of 1 200) and among those with high socioeconomic status (57.9%, 491 out of 848). The proportion of not seeking care was higher among women (52.1%), among the age group 25-34 (47.6%), among those from mountains (50.6%), and those with low socioeconomic status (45.5%). (Table 41)

Whereas, among 60 participants (Survey TB cases) with symptoms, the proportion of seeking care was higher among women (63.6%, 14 out of 22), among age 25-34 years (100%, 4 out of 4), in Kathmandu valley (100%, 4 out of 4) and among those with high socioeconomic status (73.3%, 11 out of 15). The proportion of not seeking care was higher among men (50.0%), among the age group 45-54 (80.0%), among those from mountains (60.0%), and those with medium socio-economic status (72.7%). (Table 41)

Table 41 The characteristics of participants (survey TB cases vs survey non-TB cases) with positive symptoms (cough >2 weeks and cough <2 weeks with additional symptoms) in relation to care-seeking

Characteristics	Among symptom +ve participants (survey non-TB cases)						Among Symptom +ve participants (survey TB cases)					
	Seeking medical service		Not- seeking		Missing	Total	Seeking medical service		Not-seeking		Missing	Total
	n	%	n	%	n	N	n	%	n	%	n	N
Sex												
Female	666	44.3	783	52.1	53	1 502	14	63.6	8	36.4	0	22
Male	933	63.9	493	33.8	34	1 460	17	44.7	19	50.0	2	38
Age												
15-24	184	53.0	157	45.2	6	347	4	80.0	1	20.0	0	5
25- 34	129	48.3	127	47.6	11	267	4	100.0	0	0.0	0	4
35-44	171	50.7	151	44.8	15	337	2	50.0	2	50.0	0	4
45-54	219	52.5	180	43.2	18	417	1	20.0	4	80.0	0	5
55-64	319	53.1	266	44.3	16	601	4	36.4	5	45.5	2	11
≥65	577	58.1	395	39.8	21	993	16	51.6	15	48.4	0	31
Strata												
Hill	668	53.1	572	45.5	17	1 257	10	41.7	14	58.3	0	24
Kathmandu Valley	93	52.0	84	46.9	2	179	4	100.0	0	0.0	0	4
Mountain	137	42.0	165	50.6	24	326	2	40.0	3	60.0	0	5
Terai	701	58.4	455	37.9	44	1 200	15	55.6	10	37.0	2	27
Socioeconomic status												
Low	810	51.0	722	45.5	56	1 588	17	50.0	15	44.1	2	34
Medium	298	56.7	219	41.6	9	526	3	27.3	8	72.7	0	11
High	491	57.9	335	39.5	22	848	11	73.3	4	26.7	0	15
Total	**1 599**	**54.0**	**1 276**	**43.1**	**87**	**2 962**	**31**	**51.7**	**27**	**45.0**	**2**	**60**

The characteristics of 1 872 (out of 1 934) participants with chronic cough (cough for two weeks or more) who sought health care, the proportion of seeking care was higher among men (61.7%, 495 out of 802), among the age group 15-24 years (59.7%, 77 out of 129), in terai (68.7%, 535 out of 779) and among those with high socioeconomic status (69.2%, 366 out of 529). The proportion of not seeking care was higher among women (41.3%), among the age group 55-64 years (43.4%), among those from mountains (55.4%), and those with low socioeconomic status (44.9%). (Table 42)

Table 42 The characteristics of participants with chronic cough (cough for two weeks or more), in relation to care-seeking (only 1 872 of 1 934 provided answers

Characteristics	Seeking medical service		Not seeking medical service		Total
	n	Row %	n	Row %	N
Sex					
Female	628	58.7	442	41.3	1 070
Male	495	61.7	307	38.3	802
Age					
15-24	97	64.7	53	35.3	150
25- 34	77	59.7	52	40.3	129
35-44	101	59.8	68	40.2	169
45-54	158	58.1	114	41.9	272
55-64	235	56.6	180	43.4	415
≥65	455	61.7	282	38.3	737
Strata					
Hill	442	54.9	363	45.1	805
Kathmandu	55	65.5	29	34.5	84
Mountain	91	44.6	113	55.4	204
Terai	535	68.7	244	31.3	779
Socioeconomic status					
Low	552	55.1	449	44.9	1 001
Medium	205	59.9	137	40.1	342
High	366	69.2	163	30.8	529
Total	**1 123**	**60**	**749**	**40**	**1 872**

5.6 HEALTH SERVICE UTILIZATION AMONG PARTICIPANTS WHO WERE UNDER TREATMENT OR HAD BEEN ON TREATMENT BEFORE THE SURVEY

Among the participants with current or past TB, government health facilities were the first choice for most TB patients (60% or more) to seek both TB diagnosis and treatment services, followed by the private sector, and those taking services outside the country. Non-medical services utilization was higher among past TB patients, whereas the use of medical facilities (both Government and private health facilities) are higher among current TB patients. (Table 43)

Table 43 The choice of health facilities for taking TB treatment services (treatment and diagnosis) by the participants who had TB treatment history (current or past)

Health facility	Currently on TB Treatment (N=58)		Past TB Treatment (N=1 767)	
	First Choice for		First choice for	
	Treatment n (%)	Diagnosis n (%)	Treatment n (%)	Diagnosis n (%)
Government health facility	48 (83)	38 (66)	1 237(70)	1 064 (60)
Private health facility	5 (9)	13 (22)	187 (11)	273 (16)
Non-medical facilities	0 (0)	0 (0)	36 (2)	24 (1)
Service is taken from outside the country	4 (7)	6 (10)	290 (16)	330 (19)
Missing	1 (2)	1 (2)	17 (1)	76 (4)
Total (N)	**58**		**1 767**	

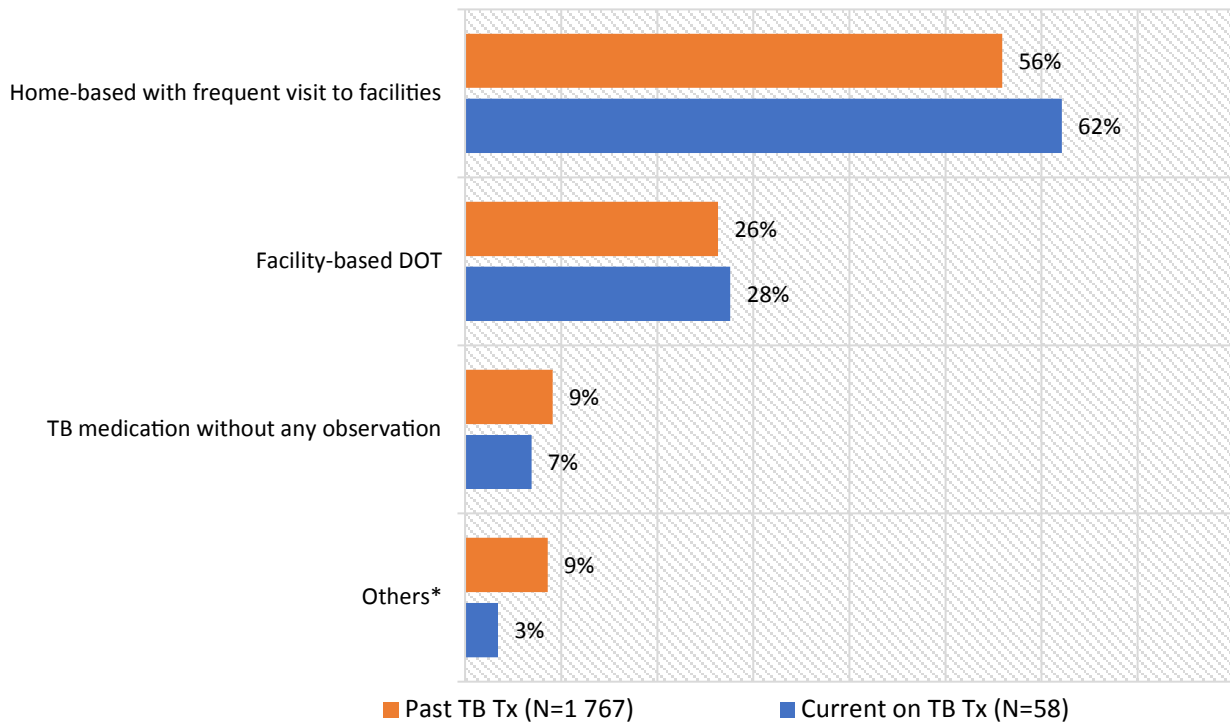
Among those who were taking treatment services outside the country, the likelihood was higher among men (17.7%), among early productive age groups (years 25-34, 18.2%), and among those from terai (18.2%) and hills (17.7%) regions and low socioeconomic status. (Table 44)

Table 44 The characteristics of participants with TB history taking TB treatment abroad

Characteristics	Taking treatment abroad (current and past) n (row %)	Not taking treatment abroad n (row %)	Total participants with TB treatment history N
Sex			
Male	199 (17.7)	925 (82.3)	1 124
Female	95 (13.6)	606 (86.4)	701
Age group (year old)			
15-24	31 (17.9)	142 (82.1)	173
25-34	41 (18.2)	184 (81.8)	225
35-44	46 (14.2)	277 (85.8)	323
45-54	53 (15.7)	284 (84.3)	337
55-64	56 (15.6)	302 (84.4)	358
65 and above	67 (16.4)	342 (83.6)	409
Regional strata			
Hills	88 (17.7)	410 (82.3)	498
Kathmandu valley	14 (6.4)	206 (93.6)	220
Mountains	11 (10.0)	99 (90.0)	110
Terai	181 (18.2)	816 (81.8)	997
Socio-economic status			
Low	102 (26.1)	289 (73.9)	391
Medium	54 (8.4)	586 (91.5)	640
High	138 (17.3)	656 (82.6)	794
Total	**294 (16.1)**	**1 531 (83.9)**	**1 825**

More than 80% of participants with TB treatment history took treatment either under the supervision of health workers or at the health facilities or taken at home under supervision with frequent visits to the health facilities. Only less than 10 % took treatment without any observation. Figure 21

Figure 21: The type of TB treatment observation reported by participants with current and past TB history



*took medicine outside the country, but the type of DOT not known known

CHAPTER 6

DISCUSSION

6.1 ENUMERATED, ELIGIBLE POPULATION TO PARTICIPATE, AND PARTICIPANTS

To measure the burden of TB disease in the general population, the national TB prevalence survey was carried out from 28th April 2018 to 16th June 2019. Ninety-nine clusters from 55 districts were selected, and on average 582 people were selected from each cluster based on eligibility criteria to participate in the survey.

The proportion of the enumerated population is similar compared to the national population proportion, except for the youngest and oldest age groups. This means that the population of those individuals who participated in the survey does not differ much from the national population among both male and female. As the national population used for the analysis is based on the 2011 population census, the observed difference of the proportion of the enumerated and national population for the youngest age group could be due to the labour migration outside the country among the young population. (Figure 14).

Out of 93 085 enumerated population, 58 956 (63.3%) were eligible to participate in the survey. The proportion of the eligible population in Nepal is lower compared to other surveys in Asia. In Myanmar (2018), Indonesia (2013-2014), and the Philippines (2016), the eligible proportion was 91%, 66.2%, 68.2%, and 68.6% respectively (Ministry of Health of Myanmar & World Health Organization 2019; Ministry of Health Republic of Indonesia 2015; Department of Health Republic of Philippines 2017).

The pattern of the age distribution of the proportion of enumerated and eligible populations differs among male and female. While the proportion of eligible for age groups years 15-24, 25-34, and 35-44 was less than enumerated among men, the proportion of eligible for the age groups was more than enumerated among women. The low proportion of the eligible population among men for the working-age group may be caused by the high male migration for working abroad or out of the area where they were registered. Migration for foreign employment has become a major source of income for many Nepali households. It is evident that from 2008 to 2017, Nepal issued some 3.5 million labor permits to migrant workers, predominantly for travel to Malaysia and nations of the Gulf Cooperation Council (GCC). In 2017 alone, Nepal received remittances worth NPR 699 billion (USD 6.56 billion) from its citizens employed overseas, more than one-quarter of national GDP. Men dominated the overseas employment among the Nepal population (Ministry of Labour and Employment Government of Nepal 2018). The absent population reported in 2011 was 1 921 494, a big jump from the number of 762 181 of the census of 2001 (Khatiwada 2014)

From eligible individuals, 54 200 (92%) participated in the survey. The participation rate in the survey was higher compared to the other Asian countries conducting a TB prevalence survey (Onozaki, I. et al., 2015). The participation rate in Bangladesh was 91%, Indonesia was 89% (Ministry of Health Republic of Indonesia 2015), it was 89% in Cambodia (Mao et al. 2014), 88% in Myanmar(Ministry of Health of Myanmar & World Health Organization 2019), and 76% in the Philippines(Department of Health Republic of Philippines 2017).

The participation rate was high and increased by age, but it was lower among men (89.6%) than women (93.8%). The lower participation rate among men could be due to high mobility and behaviour, migration, profession (student and daily workers). The lowest participation rate was among the 15-24 year-population.

The participation rate of Kathmandu is the lowest of the region-wise strata. Urban strata had a lower participation rate than rural. These were observed also in the other TB prevalence surveys in Asia (Ministry of Health Republic of Indonesia 2015; Department of Health Republic of Philippines 2017; Ministry of Health of Myanmar & World Health Organization 2019)

The higher rates of participation in this survey could be due to repeated household visits (eg. In pre-census then at census) and also due to the introduction of an intensive and dedicated mop-up operations unit carried out by a mop-up officer and supervised by field manager for each field teams, who would follow up missing participants at the end of each day, encouraging them to participate the next day until the minimum target of 85% participation was reached in each cluster. In areas where participation was lesser (eg. in urban set up), mop-up operations were carried out multiple times a day, by team members and by using local and social leaders, which improved the participation.

6.2 SCREENING

Setting up a screening site, was key in this survey. Most of the sites were indoor sites; schools, clubs, health facilities, etc. All field teams had a dedicated generator back-up to keep all IT equipment and X-ray functioning at all times, which was vital for the survey. Different units in the screening sites were marked and managed by volunteers. The use of different colored invitation cards was also key in maintaining the flow of participants per day (completing most field operation in 3 days) and a dedicated last day for mop-up operation if needed. Because of the IT-based survey, with all information collected in software that was immediately uploaded and stored in the local server from each field unit, the field operation and participants flow through each section became easier and efficient. This was also made easier by having a dedicated field manager who coordinated all field activities and screening set-up and medical officers and others could focus on technical work.

The main symptom screening criteria were cough for two weeks or more. The criteria were enlarged to cough less than two-weeks with at least one additional symptom, such as body weight loss, fever, chest pain, loss of appetite, hemoptysis, breathing difficulty, night sweating, tiredness, which was the NTP screening protocol in a clinical setting as well. Only a quarter of survey cases had symptoms (60 of 225), and most of them (47 of 60) had to cough more than 2 weeks, but still including cough <2 weeks with additional symptoms in the screening tool yielded 13 more cases. The increased sensitivity by adding the symptoms for screening when CXR was not added was presented in several journals (Chadha et al. 2019; van't Hoog et al. 2014), which was also appreciated in this survey. (Table 34)

However, the use of CXR as a screening tool was important and resulted to be more sensitive than symptoms screening, as 99% of all survey cases were X-ray suggestive regardless of any positive symptom and 72.9% were CXR suggestive only. If symptom screening alone were used as a screening tool, then the survey could have missed nearly 179 (79%) of prevalent TB cases identified

Among the participants, 3.6% reported cough ≥ 2 weeks with a similar proportion among male and female participants (3.6% and 3.5% respectively) and increased with age. In the TB prevalence survey of Indonesia, the proportion of cough ≥ 2 weeks was higher in men than women (Ministry of Health Republic of Indonesia 2015). Studies have shown a positive relationship between smoking and duration of cough (Zmirou et al. 1997; Escamilla & Roche 2014; Koo et al. 2016), the proportion of men and women smoking in Indonesia was 67% and 2.7% respectively. In Nepal, the proportion of smoking among men and women was 27% and 10.3% respectively (Factsheet 2018 Nepal, WHO SEARO). Since the difference in smoking proportion is lower than in other countries, this may explain the small difference of cough ≥ 2 weeks among men and women. Women are also exposed to indoor pollution, as firewood is the primary fuel used for cooking food in most parts of the country. Overall, 64% of households use firewood as their main source of cooking fuel. (Central Bureau of Statistics of Nepal 2011) In our survey, it was seen that 55.5% of the household uses firewood as a source of cooking fuel.

CXR images of the participants were interpreted by a trained medical officer in the field and those with an abnormality were eligible to submit sputum. Almost 22% of the participants had abnormal X-rays, which made participants for sputum examination which is slightly higher than the one of Indonesia (16.5%), Mongolia (15.9%), and Myanmar (13.8%). However, among 11 718 CXR images that were read "abnormal and eligible for sputum examination" by the field reader, 7 487 (63.9%) were considered normal by the central reader (over-reading in the field). This may explain the high percentage of sputum eligibility based on CXR, though the over-reading was encouraged to minimize the risk of missing potential participants with TB.

The central reader was blinded of the field readings to avoid bias. Among 39 673 CXR read as "Normal" or "Abnormal but not eligible for sputum examination" in the field, 1.3% were found abnormal and eligible for sputum examination by central reading. This mismatch is comparable with the finding of Myanmar and Indonesia. When the central reading stated "abnormal and eligible for sputum examination" but the field reading stated differently, the central reader's results were taken as the correct reading and the participant was declared sputum eligible. With this process, 472 participants further required to submit sputum. With intensive mop-up process, 77% (366 out of 472) participant's sputum samples (at least 1 Xpert sample) were collected. Among those, 6 participants with Xpert positive were identified, and out of them, 5 were classified TB prevalent cases. These cases would have been missed if only field reading was taken into consideration, which highlights the importance of real-time reading by central readers and feedback along with a strong mop up system in the field in these surveys.

Of survey participants, 28% were positively screened, consistent with other surveys, where a high proportion of cases (40–79% across all surveys) did not report TB symptoms (Onozaki, I. et al., 2015.). The proportion of participants who were eligible for sputum collection by symptom screening only was 2.5%, both symptoms and CXR were 3% and CXR only was 19.6%.

Chest X-ray contributed to the addition of 164 TB cases who were negative to symptoms screening. If CXR had not been used as the screening tool, the survey might have missed almost 72% of survey cases. Therefore, CXR screening highly increased the case detection among those who did not report symptoms and NTP needs to prioritize the use of CXR in regular programs where feasible (eg. in screening at-risk population like PLHIV, Diabetics, children, contacts, etc, in hospitals or ACF in the community).

6.3 LABORATORY

The recovery rate of conventional culture was lower than in routine settings; it might be due to possible hyper decontamination or low bacillary load in survey samples compared to routine settings.

The ratio of positive Xpert and positive culture for MTB of morning samples was 2.2. When the participants with treatment history were removed, the ratio became 1.7 (Table 26) which is comparable to other neighbouring countries. In Bangladesh, Myanmar, and the Philippines, the ratio was 2.0, 1.7, and 1.6 respectively. Among Xpert negative, 3% culture was positive and 4% culture-positive among Xpert negative with history of TB treatment (Table 23-Table 26).

The culture recovery rate among smear-positive was 49.2% (when best results among smear were used) and nearly 50% when compared with the results of the morning sample for more direct comparison with culture. Among smear-negative results, culture was recovered from 3.7% among the best results of smear and 3.8% in smear results of morning sample.

Because of the difficulty of terrains (mountainous and hilly), sample transportation from the field to central labs was anticipated to be difficult (average 5 days times). To address this, a dedicated sputum transportation mechanism was developed, where each field team had 2 transporters per transport, a dedicated central focal point to track and coordinate all sputum being transported to central labs. Each team also had a freezer functioning throughout the period, the power line supported by a generator at all sites, which was used to store the transport and make ice gel packs to be used for all transports. Because of this, good quality sputum collection (78% mucopurulent) and transportation (96.8% of sputum transported within 3 days to central labs) were achieved in the survey (Section 6.2). Further, it was also seen that the transportation of sputum maintaining the highest level of acceptable quality is possible from even the hardest to reach areas up to the laboratories. This is why sputum transportation from those areas throughout the nation should also be strengthened. But, in an extremely difficult and hard-to-reach areas, sputum transportation 3 times a week may not be possible, which was experienced in one of the mountainous cluster in this survey.

When we investigate the Xpert MTB/RIF results and TB treatment history, 2.6% of those who had completed TB treatment more than 2 years before the survey had positive Xpert. Among those who finished the TB treatment less than or equal to 2 years before the survey, the Xpert positive proportion is double (5.1%). The literature shows that Xpert MTB/RIF specificity decreased among presumptive TB cases with past treatment history (Acunã-Villaordunã et al. 2017; Shi et al. 2018). Xpert MTB/RIF test accurately detected culture-proven pulmonary TB and might remain positive years after the patients were declared cured (Shenai et al. 2016), therefore positive results must be interpreted with caution in such cases.

6.4 CASE CLASSIFICATION

As per the protocol, a survey case is when an eligible survey participant has at least one Xpert MTB/RIF+ve result, given that the result is not regarded as cross-contaminated, among any of the two specimens tested (spot and morning). In February 2019, as per the Global Task Force on TB Impact Measurement recommendations, following results from similar prevalence surveys using Xpert MTB/RIF in other countries, suggested revising the case definition taking into consideration, CXR, culture results and history of TB treatment.

A case panel was formed and considered CXR findings, culture results, and treatment history for defining a case. From this process, 85% (191 of 225) cases were identified from participants without TB treatment history, 13.7% (31 of 225) cases with past TB treatment history and 1.3% (3 of 225) cases from those under treatment during data collection (Table 32). 6.2% (14 of 225) cases had rifampicin resistance (5.7% among new cases, 8.8% among TB treatment history cases), which is different from the last drug resistance survey 2012 carried out in Nepal, where RR/MDR was 2.2% among the new TB cases and 15.4% among the those with history of TB treatment. The higher RR/MDR seen among new cases seen in the survey in 2018 as compared to DR Survey 2012, highlights the need for scaling up rapid diagnostic testing for all TB suspects for early identification of drug resistance, ensuring proper diagnosis and adherence to treatment. DR survey is planned for 2021 may provide better estimates.

Out of 99 clusters, there were 79 clusters with at least one TB case. Among those, 48.1% of clusters were terai, 35.4% in hills, 8.8% in clusters were mountains and 7.5% in Kathmandu. This indicates that TB cases are widely distributed in Nepal. About 20.9% of the cases reported cough for two weeks or more and around 5.7% of the cases had symptoms other than cough for two weeks or more. However, more than 72.9% of the cases did not report any symptoms but were identified only using chest X-ray, which highlights the higher sensitivity of CXR in comparison to symptom screening alone.

Of the total of 54 200 survey participants, 58 participants were on treatment at the time of the survey, of which, 3 participants were culture-confirmed and classified as prevalent cases (out of total 225 cases) in the survey while 55 had no viable bacilli in the sputum. Only 3 surveys confirmed cases reported being under treatment (i.e. 1.3%), highlighting that there are significant undetected cases in the community that is currently being missed.

We observed that the proportion of TB cases increased by age group and higher among men. This is consistent with the observation in other countries in Asia (Ministry of Health Republic of Indonesia 2015; Ministry of Health of Myanmar & World Health Organization 2019). The shift to the older age group indicates that the active transmission of the bacilli in the community started to reduce and that TB cases are more likely to be the reactivation of a TB infection acquired many years ago, rather than the progression of recent infection.

The case proportions were higher among those in terai and hills, higher among those Low socioeconomic status, with no education, with no occupation, and those with agricultural work. This may suggest that access to TB care and treatment may be problematic among those with lower socioeconomic status. In other Asian countries, TB cases load were higher in the urban area because of congestion (Ministry of Health Republic of Indonesia 2015; Ministry of Health of Myanmar & World Health Organization 2019; Department of Health Republic of Philippines 2017)

The number of cases per cluster on an average was 2.3, but distribution was not consistent, with two clusters having at least 9 cases (Figure 18). This might indicate that TB cases may be widely distributed in Nepal with some hot spot areas.

6.5 PREVALENCE

Based on the survey findings of the prevalence of bacteriological confirmed PTB aged >15 years of 374.5 (307.6 – 441.4) per 100 0000, the estimated TB prevalence rate (TB of all forms and all age groups) of the country was 416.35 (95% CI, 314.13 - 518.58)/ 100,000 for the year 2018. When the prevalence is compared with notification of TB cases to NTP, large gaps are observed. The national P/N ratio (all forms

TB) was 3.71, which is lower as compared to Indonesia (5.1), and more than Myanmar (1.7). The P/N ratio of pulmonary TB was much higher in older age groups (4.6 in age 55-64 and 6.7 in age >65).

The possible reasons for the gaps are, delay in accessing diagnosis and treatment and under notification of those TB cases that are treated in health facilities either government or private sector. This under notification needs to be verified by inventory study and delay in accessing missed early diagnosis, and treatment must be addressed through creating more awareness and increasing access to high-quality TB services at all levels.

The high P/N ratio in older age groups suggests poor access to TB service by elder populations and a long delay in diagnosis. As they are often caregivers to grandchildren, TB among elderlies should be assessed wherever possible such as in the elderly clinic, NCD clinic, and when they visit a hospital for any reason. Male had significantly higher TB prevalence than female (Male/Female ratio 2.25), which was also higher than what we observed in the case of notification in 2018 (1.7:1), while the P/N ratio for both is similar (3.5: 3.6), which indicates lower cases as well as lower notification among women. Those observations are coherent with the notification rate that increased by age group and higher in men (Annual TB report 2018, Nepal). This distribution is also found in all surveys in Asia (Department of Health Republic of Philippines 2017; Ministry of Health Republic of Indonesia 2015; Ministry of Health of Myanmar & World Health Organization 2019).

The higher burden of TB among men may be the result of true higher incidence of the disease among men, more person-to-person interaction and social contacts, higher rates of smoking and their poor interaction with primary health care facilities as well as long delays in seeking treatment for various illnesses including TB (Mbuthia et al. 2018) The higher TB burden among men was also found in other TB prevalence surveys in Asia (Department of Health Republic of Philippines 2017; Ministry of Health Republic of Indonesia 2015; Ministry of Health of Myanmar & World Health Organization 2019)

Though not statistically significant, the prevalence higher in hill followed by terai, mountain, and least in KTM valley. Similarly, the P/N ratio was also highest in hill and mountain and least in KTM valley, which indicates KTM valley has better access to health services. Besides poor access in high mountains and hilly areas, the fact that there is a higher proportion of persons with cough 2 weeks or more who did not seek care in mountains and hills may lead to a high prevalence of TB and a wide gap in identification in such areas.

6.6 HEALTH-CARE SEEKING BEHAVIOR

According to survey findings, among participants with symptoms (cough >2 weeks or those with cough <2 weeks but with additional symptom), the first choice of seeking care was in the government facilities, either hospitals or health centers, unlike in other countries where most sought care in drugs shops or pharmacies, such as in Bangladesh (National Tuberculosis Prevalence Survey Bangladesh 2015-2016), in Indonesia (Ministry of Health Republic of Indonesia 2015) and in Nigeria (Ukwaja et al. 2013). The proportion of seeking care among survey cases compared to non-survey cases was also higher in government health facilities, followed by private sectors but among the private sector.

However, most of the participants with symptoms did not seek care, which was even higher among survey TB cases (45%) as compared to non-survey TB cases (43.1%), similar to the findings of Bangladesh (National TB Prevalence survey 2015-16), where, not seeking care among survey TB cases was higher (64%) as compared to other participants (51.8%). However, among the participants with chronic cough (cough for 2 weeks or more), only 38.7% did not seek care. This shows the practice of the population

to wait to reach out to seeking care, until chronicity of the symptoms, limiting in early diagnosis and management of the disease. Most of them who didn't seek care cited reason was "Others", followed by "no convenient time" and financial reasons. "Others" might represent the non-consideration of the problem as serious, though it was not explored in this survey. Stigma and fear to be diagnosed with TB are some factors preventing care-seeking in Nepal (Bansola 2012).

This high proportion of not seeking health-care is alarming as those populations, in case of TB, will remain undiagnosed in the community and may contribute to the spread of infection. The proportion of not seeking care was higher among women, higher working-age (mostly among 25-64 years of age), mountains, and Low socioeconomic status groups. Women may have limited money and spare time to seek care (Bansola 2012). This situation is different than in most of the other contexts, where men did not seek care as much as women (Mbuthia et al. 2018). Also, a higher proportion of not seeking care in, mountains, and low socioeconomic status groups suggest that access to care for those populations is problematic. Although a cross-sectional study among TB patients in Western Nepal showed no difference among different social economy status(Kc et al. 2018), other studies in the region showed that income, education status, and time is taken to go to the health facilities contributed to the delay (Yang et al. 2019; Ehsanul Huq et al. 2018; Getnet et al. 2017).

Uneven geographical situations accompanied by poor roads and long-distance to health facilities are among the other barriers to accessing TB service in Nepal. Other than access problems, behavioural problems such as not perceiving the problem as serious, perceived inability to pay, stigma, perceived significant opportunity cost for those with daily wages, are potential reasons for giving less priority for treatment-seeking (Getnet et al. 2017).

6.7 HEALTH SERVICE UTILIZATION

The majority of the participants who were currently on TB treatment (66%) or had a past history (60.2%) of TB treatment selected government health facilities as the first choice for the diagnosis. About a quarter (22.4% for current TB and 16% for past TB) selected private health facilities, and a substantial number (10% for current TB and 19% for past TB) of participants were diagnosed from outside country. The choice of health facilities for TB treatment showed also a similar proportion. The preference of government facilities is similar to the finding in the prevalence survey in the Philippines (Department of Health Republic of Philippines 2017). The reason for selecting government facilities as the first choice could be due to free TB diagnostics and treatment services, easily accessible, and trust in government services.

In South Asia, the increasing private health providers that provide TB care and treatment are observed (Basnyat et al. 2018). On one hand, this provides easy access, on the other hand, the monitoring of diagnosis and treatment quality became challenging. The prevalence survey in Indonesia, as well as patient pathway analysis, found an important proportion of TB patients treated in private sectors (Ministry of Health Republic of Indonesia 2015; Surya et al. 2017). In Nepal, people still used government services the most.

Among those who received diagnosis and treatment in foreign countries, the proportion was higher among men, among early productive age groups (years 25-34), and among those from terai and hills regions. Nepal has a free open border with India where the population migrates freely across borders in large numbers for daily business including seeking health care. Additionally, a large number of the working population migrate mostly to Golf countries for labor work. This is somehow supporting the assumption of a high proportion of migrant workers among those with TB treatment history. As many

workers migrated abroad, TB may be identified and treated abroad. Some articles mentioned the high prevalence of TB among migrants from Nepal. For example, in Western Sydney, TB incidence was as high as 223 per 100 000 among people born in Nepal (Norton et al. 2019). Cross border collaboration between countries needs to be strengthened to address TB in migration.

More than 80% of the participants with TB treatment history admitted that the treatment was taken under the supervision of health workers in the health facilities or taking the treatment at home with frequent visits to facilities. Less than 10% took treatment without observation. This indicated that DOT is still being effectively implemented and practiced for TB treatment.

6.8 PROGRAMME IMPLICATION

According to survey results, the TB burden in Nepal (prevalence and incidence) is higher than previously estimated. With the revised burden estimates of the prevalence rate of 416.35/100,000 (95% CI, 314.13 - 518.58), the incidence rate of 245.1/100,000 (147.4 - 367.3) versus the notification rate of 112/100,000 population (Notification/Incidence Ratio - 45.6%), while the gap trend between incidence and notification is decreasing, the actual gap is larger in older age group than previously estimated. *Missing cases* are now nearly 54.4% of the estimated incident cases by the program in 2018. The gap may come either from undetected TB cases in the community or under-reported diagnosed cases in various health facilities. More efforts such as using sensitive screening tools (X-ray), expansion of sensitive diagnostic tool (Molecular tests), active case finding in hotspot areas, improving quality of care, introducing mandatory recording and reporting, etc. should be scaled up to reduce the case detection/case notification gap.

CXR for screening and Xpert MTB/RIF for diagnosis detected more TB cases in the survey. The use of X-ray also as a primary screening tool (where feasible, e.g. in major hospitals, to vulnerable population) and shift from smear microscopy to the rapid diagnostic tool (e.g Xpert MTB/RIF) as the rapid diagnostic tool for TB detection in Nepal will improve case finding and put more people on treatment, where the programme still relies mostly on symptom screening and mostly on smear microscopy for detection of TB.

High TB prevalence despite good case detection among symptomatic smear-positive cases suggests a limitation of classical case detection strategy relying on symptom screening alone.

When CXR is applied for screening, the demand for laboratory tests will increase. Therefore, planning and expansion of laboratory services must be critical components of the revised national strategic plan, which should be fully funded and implemented.

6.8.1 Access to TB care in all areas of Nepal should be increased

The survey found 43.1% of those with any cough symptoms did not seek medical care, even with chronicity (cough 2 weeks or more), 38.7% (749 of 1 934) of them did not seek care. The reason for not seeking care was mostly 'others' followed by financial reasons and accessibility. The 'others' was not further explored in this survey. Further studies may be recommended to explore the barriers in detail. Among, those who sought care, government health facilities were mostly the 1st choice followed by private sectors. Access to TB care in all areas should be strengthened, either government or private service. There is an opportunity that private health providers can complement government services in hard to reach areas when they are regulated. When the private health providers partner with the government, the service will follow good quality standards that increased the care access of the population (Hudson et al. 2018; Uplekar 2016).

6.8.2 Awareness on the availability of free TB service should be improved

The survey revealed a high proportion (around 50%) of those with symptoms did not seek treatment. In addition to the access problem, people may not have been aware of the availability of free TB diagnosis and treatment. This question was not asked here. However, the survey in Indonesia found that a high percentage of the participants were not aware that TB treatment is available for free (Ministry of Health Republic of Indonesia 2015)

6.8.3 The quality of care in government service should be strengthened while regulating the engagement of private health providers

People still rely mainly on government service. These findings offer an opportunity to improve access to patient-centered TB diagnosis, care, and treatment in the public facility. Moreover, it is still not too late to engage and regularize private and alternative care providers. Therefore, they can be good partners of the government to improve access, and ensure high-quality service and in line with standards of care and develop meaningful engagement with the TB program including recording and reporting of cases.

6.8.4 TB screening among people before working and after return from abroad is necessary

There is a high proportion of the participants with TB treatment history who accessed TB treatment services abroad (16.1%, 294 out of 1 531). The proportions of men and those in productive ages were high. They came mostly from terai and hill regions. The introduction of TB screening among people requesting the work permit at the Ministry of Labor (before departing abroad) may be explored. Workers seeking permits can be a targeted group for CXR screening. Funding should be searched to screen for latent TB infection among those migrant workers to whom active TB disease has been excluded. Then TB preventive treatment for those with latent TB infection should be explored. A similar approach should also be taken from those returning to the country.

Nepal also has an open border with India, where people from either country cross freely for many different activities including seeking health care services. Programmes should also be developed to address TB screening and management at these crossings including cross-border referral and information sharing.

6.9 SURVEY STRENGTHS, CHALLENGES, AND LIMITATIONS

6.9.1 Strengths

- Excellent leadership from the Government of Nepal. The TB programme was deeply involved during the planning, preparation, implementation, data analysis and report writing. This allows ownership of the survey results by the government, which will support advocacy to higher ministerial and government level, and other sectors.
- Multi-partners collaboration, technically and financially. The survey faced challenges before starting because of limited funding. However, by the time the survey started, different partners contributed to the technical and financial supports. The survey finished on time and in good quality.
- Technically competent teams. The team members were selected based on relevant competencies. Before being engaged in the survey, multiple training was provided to ensure smooth survey implementation, in line with SOPs.
- Good communication between central and field teams and between different implementing agencies
- Excellent community engagement, with the participation rate higher than the expectations. High sputum collection rate from sputum eligible participants. High sputum quality.

- Quality assurance measures in place. All steps of the survey were quality assured, including internal process and external quality assessment during the mid-term review. Therefore, the data collected in the survey is considered reliable and the methods used were valid.
- Real-time central CXR reading and timely correction of central/field reading mismatches, allowing reading errors made at the field level have been minimized
- Good quality and efficient electronic data collection system. The innovative data collection system was created by the IT officer. The automatic system reduced human error, improve time efficiency and data reliability
- All survey procedures and activities were very well documented, allowing further utilization as references

6.9.2 Challenges and limitation

- The new federal structures lead to the revision of the strata which affected the clear distinction of rural and urban, leading to dropping the rural and urban classification from results and analysis is a key limitation.
- Geographical condition to accessing certain areas was not easy
- Not having culture done for all sputum eligible participants but only for 50% of them, is another limitations due to the limited physical capacity for central labs to carry out that many cultures in the given time frame. This was substituted with double Xpert MTB/RIF testing for participants (on two different samples).
- The culture recovery rate is low. It was most likely due to harsh decontamination and because of the use of solid culture. If primarily based on culture results only, then this might have led to the underestimation of prevalent TB cases in the survey.
- Insufficient exploration of health facility utilization questions. The distinction between hospitals and health centers may not be clear for the participants. When it is not explored, it may lead to misclassification. In the analysis, we merged the hospital and health center and set the categories based on the government, private, and alternative health facilities only.
- To minimize the possible risk of reduced participation possibly because of testing for HIV as well, and also considering that Nepal is a low HIV prevalence country, HIV testing was not implemented in the survey.

6.10 CONCLUSION

Nepal's first-ever high quality and innovative TB prevalence survey was carried out using WHO-recommended methods, with systematic use of digital X-ray and bacteriological examination using molecular technology (Xpert ® MTB/RIF). Locally developed software was used for overall data-management in the survey. This survey was labelled as one of the high-quality TB prevalence surveys by members of the WHO Task Force on TB Impact Measurement. The country now has a better understanding of the TB disease burden based on evidence from this survey.

The survey found the prevalence of bacteriological confirmed pulmonary TB ≥ 15 years to be 374.5 (307.6 - 441.4) per 100 000 population, based on which the overall burden in terms of prevalence and incidence of all forms of TB for all ages were estimated. Based on re-estimates, around 117,000 people with TB disease are living in Nepal (prevalence of all forms and all ages 416/100,000) and around 69,000

people developed TB (incidence of 245/100,000) in 2018, which indicates that the TB burden was found to be much higher, around 1.6 times more than previously estimated. National TB prevalence survey (2018–2019) suggested that there was significant impact of programme efforts on TB epidemiology in Nepal, that had led to an estimated annual reduction of TB incidence by 3% in the last decade. This decline is better than the global annual decline rate of 1.5%–2%. However, this decline needs to be accelerated further to meet End TB targets. In addition to higher annual incidence decline (3%), TB prevalence increased with increasing age group (highest in >65 years 1427 / 100,000). This is a good sign in TB epidemiology and might suggest a significant improvement in the TB Programme's long-term efforts to control TB. TB among men was found to be twice or more than in women and prevalence was higher in hills followed by terai, mountain and KTM valley.

The survey also highlights the importance of the use of digital X-rays as a screening tool and not to only rely on symptoms alone screening and use of rapid diagnostic tools such as Xpert MTB/RIF testing, to increase TB case detection. The survey results also indicated that most of TB symptomatic still didn't seek care and were mostly from lower socioeconomic status and remote areas (mountains). Those with a history of TB treatment, most had good trust in government health services but may also indicate a lack of alternative services that people can access. This presents a good opportunity to improve access to quality TB diagnosis, care, and treatment in the public facility to complement government health services with regulated private sectors.

The survey also indicates that the quality of care is acceptable as 80% of the participants with TB treatment history had reported having taken treatment under the supervision of health workers either in the health facilities or at home with frequent visits from the health workers. And, high prevalence of TB in older age groups (>65 yrs.) also suggests poor access to TB services by the elderly population and long delay. As they are often caregivers to the grandchildren, TB in the elderly should be addressed adequately.

A significant number of the population sought TB services outside the country. Nepal has an open border with India where the population travels across borders for daily business, work opportunities in large numbers and for seeking health care. Therefore, cross border collaboration to address TB screening and management between the two countries needs to be established.

Following are the five priority actions, the National TB programme needs to address to meet the End TB targets

1. Ensure high-level political commitment to END TB.
   - TB burden is much higher than previously estimated. It is essential to mobilize other sectors beyond health such as industries, education, finance, private sectors, communities, etc. for coordinated and joint efforts to end TB.
   - Sustain the TB and MDR-TB response through high-level political commitment, strong leadership across multiple government sectors, partnerships and adequate investments in TB, including cross border collaboration.

2. Improve access to quality TB service.
   - Ensure better access to more sensitive screening and diagnostic tools such as (chest X-ray and Xpert MTB/RIF, LPA, TB-LAMP etc.) to ensure early detection of TB.
   - Ensure quality and patient-friendly treatment services both at health facilities and in communities (e.g. Community Based DOT, family-based DOT etc.)

3. Engage private sector in the provision of high-quality TB services
   - Improve roles of the private sector and hospitals in TB control to deliver high-quality TB care and services.
   - Implement mandatory case notification.

4. Increase awareness and create demand for quality TB services
   - Empower communities with proper knowledge of TB and generate demand for quality TB services.
   - Address TB problem among migrants by conducting appropriate screening and care where necessary.
   - Provide patients and their families with appropriate supports including social support and contact tracing.

5. Ensure increased investment in TB, both financial and human resources, to meet the Global commitment to #END TB#
   - Commit to increase domestic investment for TB.
   - Advocate for increased donor investment for TB.
   - Ensure adequate human resources at all levels for high-quality TB service delivery.
   - Ensure no out of pocket expenditure by TB affected families.

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8. ANNEXES

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ANNEX 8.1: FORMS AND FORMATS

8.1.1: Pre-visit cluster information collection sheet

Cluster Information form (Preliminary visit) -Sheet								
1	General information							
	Cluster-ID Number	District	VDC/Municipality	Ward/s No.	Block No.	Date of Cluster visit	GPS Location (Field Screening Camp)	
2	Cluster Information							
	Is cluster size adequate? (Yes/No)	S.N	If no, number of ward/s to be adjusted	Total Population of the selected ward/s *2016 estimates VDC record*	Total No. of House-hold in the selected ward *2016 est. VDC record*	Total eligible (≥15 years) *2016 est. VDC record*	Type and name of settlement in the cluster. (Scat-tered / Dense)	No. of major settlement (Tole) with avg. walking distance
3	In Case of Municipality							
	No. of segments of selected ward made	Number of segments randomly selected for study	Name of the Tole select-ed for study	Total Population of the selected ward/s	Total No. of House-hold in the selected ward	Total eligible (≥15 years)		
4	Field Operation site							
5	Access Route to the cluster							
	Is there road access to the select-ed cluster? (Yes/No)	If yes, Connecting point from the high-way From …… To……	Usability of the road (Round the year/ Sea-sonal)	Type of Road (Black-topped/Graveled/ Muddy) & Distance in Km	Mode of transport	Duration (Time Taken)	Nearest Airport	Availability of public trans-port? (Yes/No)
6	Communication and internet							
	Availability of telecommunica-tion service? (Yes/No)	Telecommunication Service provider Name	Reliable service provid-er (Best Connectivity)	Coverage of internet service? (Yes/No)	Internet Service provider's Name	Reliable Internet service provider (Best Connectivity)		
7	Electricity							
8	Availability of local staff							
	Total no. of existing health staff	No. of health staff that can be available for the PS	Total no. of FCHV in the VDC/ward of the mu-nicipality	Name of FCHV	Contact No.			
9	Name of HF with Contact in-formation of Health facility in charge and other key persons							
10	Sanitation and water supply							
	Availability of toilet in the field operation area (Yes/No)	If yes, no. of available toilets?	If no, is there appropri-ate site to locate tem-porary toilets? (4 sites)	Is there water supply system in the field op-eration site? (Yes/No)	If no, what can be possible alterna-tive?	Availability of drinking water in the area (Yes/No)	If yes, does it re-quire treatment? (Yes/No)	
11	Availability of furniture							
	Possibility of getting required furniture for field operation. (Yes/No)	Chair:30	Table:15	Bench:4	Folding Screen: 2	Stool:5		
12	Other Information							
	Availability of hotels/lodges near the field operation? (For accommodation of field team members) (Yes/No)	If no, is there possibil-ity of getting house in rent? (within 15 mins walking distance)	Is there market place nearby? (Yes/No)	Nearest police station from field site. (Km/ Time)	Language mostly spoken in the area	Most convenient time for household visit for census	Most convenient time for field operation	Socio-cultural information(lo-cal festivals, hatt bazar) which may affect timings of the census and field operation
13	Local stakeholders							
14	Form Filled by							

8.1.2: Pre-Census Household Registration Form

Name of Cluster _____ Tole/Street _____ District _____

Municipality/VDC _____ Ward No _____ Household No _____ Family No:. _____

Name of Head of the Household _____ Contact No _____

Fill up the following details for all household members								
Line No.	**Name**	**Age in year (completed years of age)**	**Sex 1.Male 2.Female 3. Others**	**Status of Residence 1.Permanent residence 2.Guest**	**Do he/she is stayed in this household from past two weeks?**	**Nepalese citizen 1.Yes 2.No**	**Any difficulties for participating in screening camp (Disable, Illness, age factors) 1.yes 2.No** (Do not ask a question for less than 15 years of age)	**Remarks**
1								
2								
3								
4								
5								
6								
7								
8								
9								
10								

Total number of listed household member ☐☐

Total number of 15 years or above and people who stay in the same household for two weeks. ☐☐

Summary

Name of interviewer _____ Signature _____ Date _____

Verified by: _____ Signature _____ Date _____

Result of Household Registration (If cannot registrar the household from three visits Please fill up the following details)

Completed _____

No one at the household or no one able to respond at household during registration period _____

During the registration period could not meet any household member _____

Refused _____

Vacant house _____

Damage house _____

8.1.3: Survey census form

National Tuberculosis Prevalence Survey 2018-2019
Ministry of Health and Population
National Tuberculosis Centre
Census Form

Group A: Cluster Information

Cluster No:	**Ward:**
Tole:	H/H ID (Tab Generated): Cluster-ID User ID Household ID

Group B: Family Information

Full Name of head of H/H	Contact No. Of head of H/H	No. of member in the Family
_____	_____	_____

Socio-Economic Status of Family :

1. Does your household have Television? Yes ☐ No ☐	6. Does your household have a table? Yes ☐ No ☐
2. Does your household have a Fan? Yes ☐ No ☐	7. What Type of Fuel does your household mainly use for cooking? Wood ☐ LPG ☐ Other ☐
3. Does your household have a chair? Yes ☐ No ☐	8. What is the main material of the floor in your household? Earth, Sand, Dung Other
4. Does your Household Have a Cupboard? Yes ☐ No ☐	9. What is the Main material of the roof in your household? Cement ☐ Other ☐
5. Does your household Sofa? Yes ☐ No ☐	10. What is the main material of the walls in your household? Cement ☐ Other ☐

Family Identification No:

_ _ _

Group C: Individual Information

Individual ID	First Name	Last Name	Age	Nationality 1.Nepali 2. Non-Nepali	If non-Nepali 1.Diplomat 2. Tourist 3. Others	If others 1.>=5yrs 2. <5Yrs	Education 1.No education 2.Some Primary (incomplete primary) 3.Completed primary 4. Some Secondary(incomplete secondary) 5. Completed Secondary 6. More than Secondary	Occupation 1.Professional/ Technical/Managerial 2.Clerical 3.Sales and service 4.Skilled manual 5.Unskilled manual 6.Agriculture 7.Student 8.Housewife 9.Other / missing	Duration of Stay in last 2 weeks 1. Stayed 7 days or more 2. Stayed 1-6 days 3. Not stayed at all Yes/No	Gender 1.Male 2.Female 3.Others	Eligibility Based on (Age/ Duration of stay) Yes/No	Ability to participate in the field operation site. Yes/No	If No. Reason 1.Age factor 2.Disability 3.Pregnancy 4.Health issue 5.Others	If Yes Agreeableness to visit the field operation Yes/No	Date and Time to visit field operation site
01															
02															
03															
04															
05															
06															
07															
08															
09															
10															

Name of Interviewer: _____

Date: _____ Signature: _____

8.1.4: Field screening invitation card

INVITATION CARD

Individual ID Number _____ Household Number _____

Mr./Mrs._____

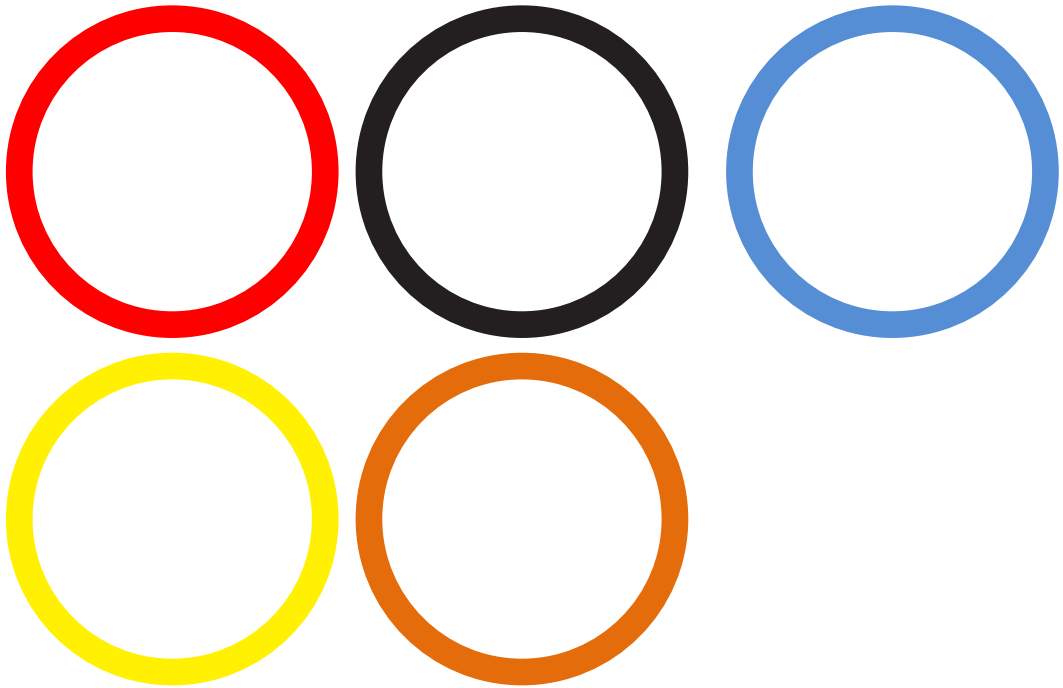
Date _____years_____ Month _____ Day, TO _____ Month _____Day. On this VDC/ Municipality _____Ward no. _____ Place _____ Would like to invite you to participate on National Tuberculosis Prevalence Survey.

Date: _____

Time: _____ Survey Team Leader. _____

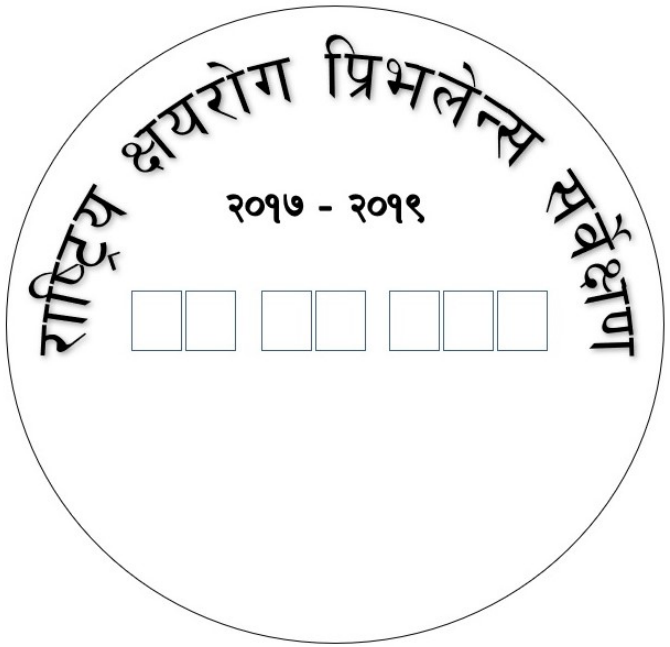
8.1.5: Household number form (sticker format pre-census and census)

Household sticker for pre-census number marking (plain sticker with color rings)



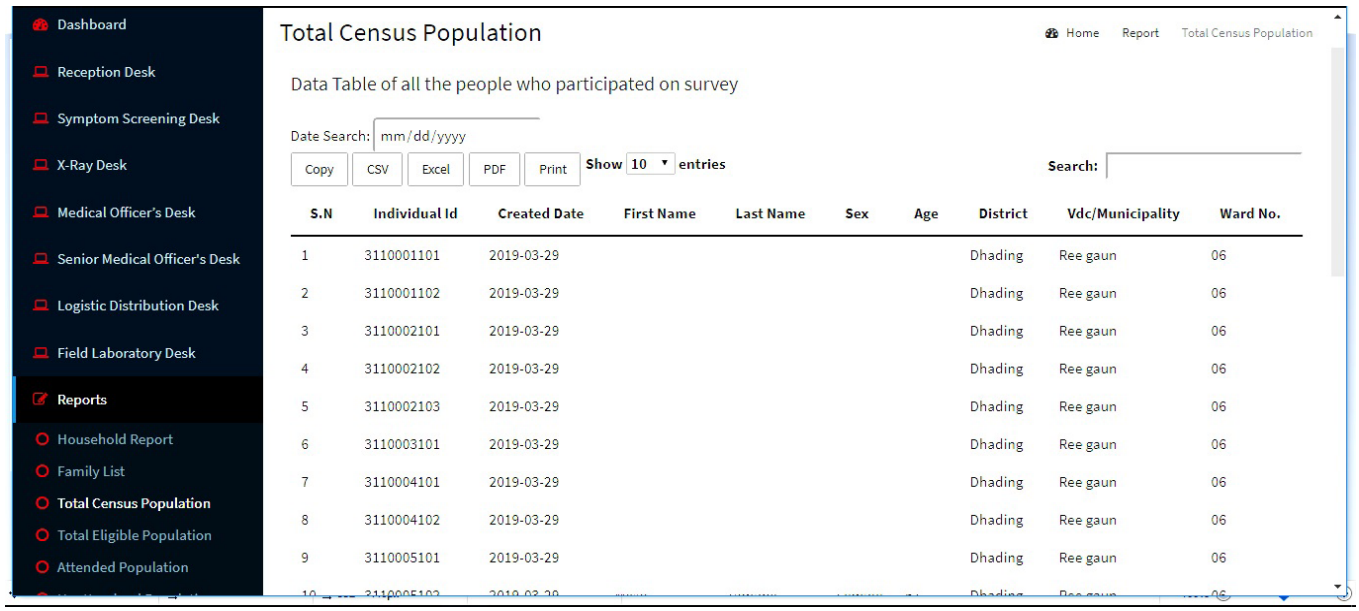
Note: To use different colour rings by different mobilizers (one colour to assign to one mobilizer only) in pre-census HH listing

HH number format in census sticker

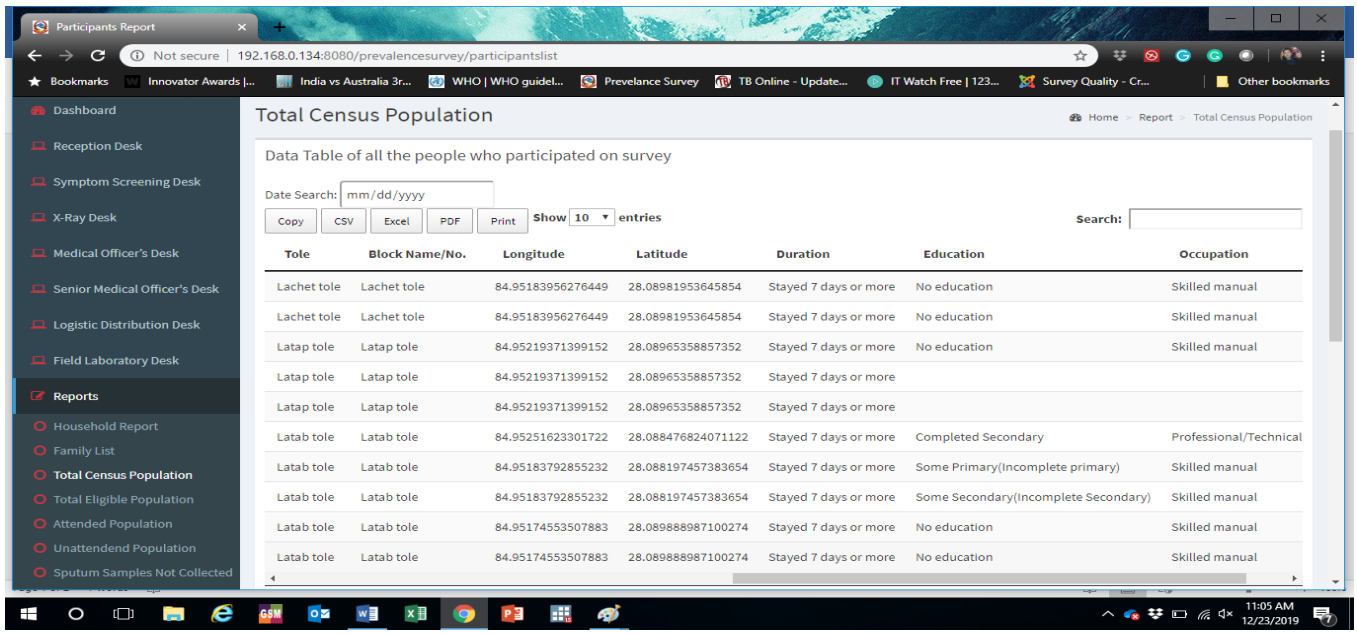


Note:
First two digits – Cluster ID
Send two digits two digits – Enumerators ID
Last three digits – House hold ID

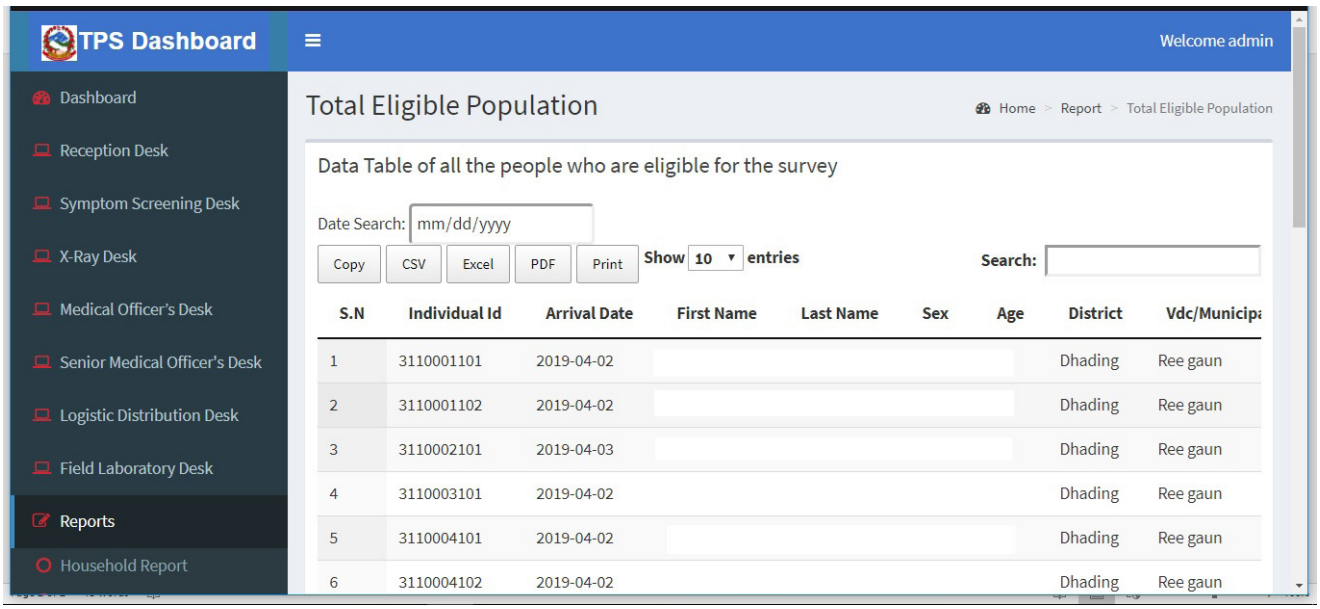
8.1.6: Census Register



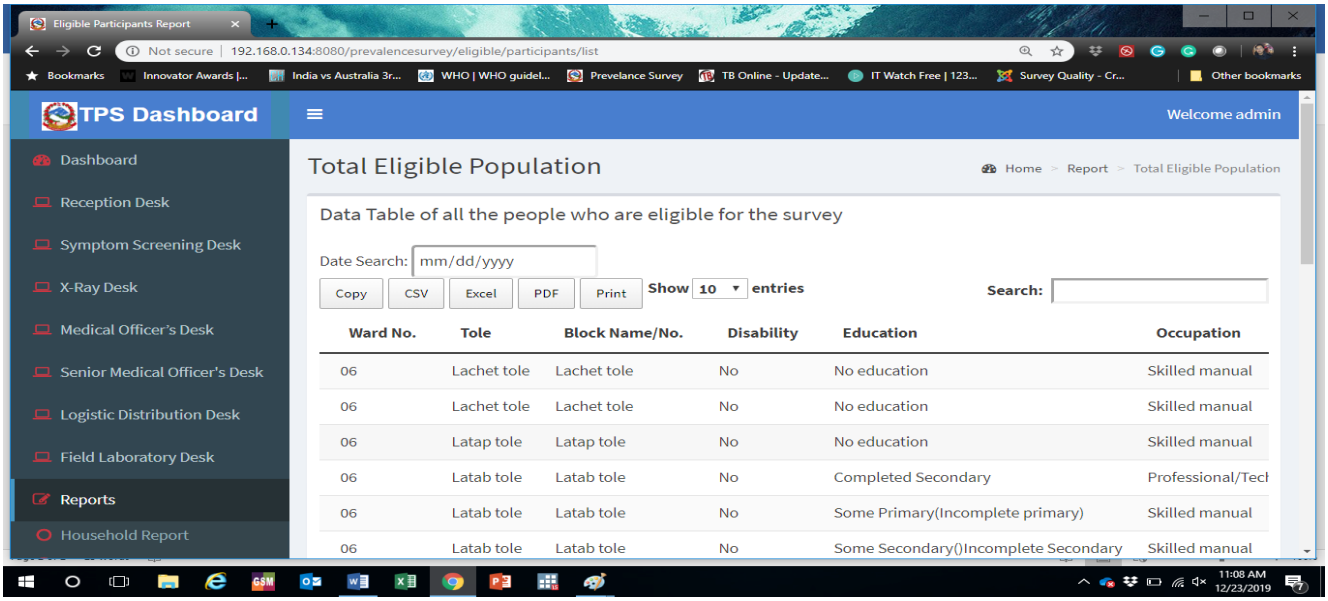
Census register continue



8.1.7: Eligible census population register



Eligible census population register Continue



8.1.8: Survey field screening informed consent form

Government of Nepal
Ministry of Health and Population
Department of Health Services
National Tuberculosis Centre
National Tuberculosis Prevalence Survey Program

Consent Form

(Section A: Consent for Adult Participants)

I _____ Resident of _____ District _____ Metropolitan City/ Sub-Metropolitan City/ Municipality/ Village Development Committee Ward No _____ had read/listened to information on the Prevalence survey provided by the survey team and acknowledge the objectives of the survey test method, interview, chest x-ray, and symptom eligibility case, sample examination procedure, and its result dissemination process. I understand the benefits and risks of participation in the survey and ensured all the collected personal information will keep confidential. I hereby signed the consent and ready to participate in the National Tuberculosis Prevalence Survey.

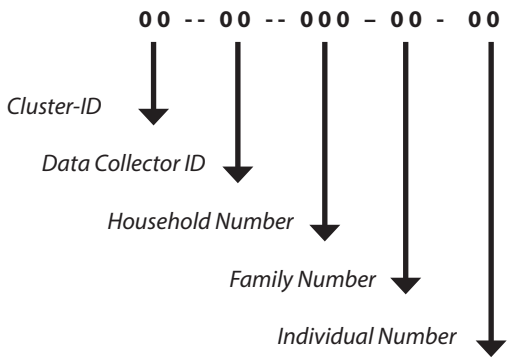
_____
Signature of Participant
Name _____
Date _____

Section B: Consent from Guardian in case of minor participants
The above participant is a minor (from 15 to 18 years), as his / her guardian / local guardian, I hereby agree to allow him/her to participate in the survey process (such as interview, chest x-ray, and cervical examination) of the National Tuberculosis Prevalence Survey.

_____
Signature of a guardian for consent
Name _____
Relationship with the minor participants
Date _____

8.1.9: Individual ID number format

Household and Individual ID:



8.1.10: Individual survey questionnaire form

National Tuberculosis Prevalence Survey 2018-2019

Individual Survey Screening Form **Form No:** ☐☐☐

A:CLUSTER INFORMATION	
1.Cluster No:	
2.District:	
3.VDC/Municipality:	
4.Ward No:	

B:INDIVIDUAL INFORMATION	
1.Name:	
2.Sex:	
3.Age:	
4.Occupation:	
5.Individual ID No:	
Participation:	Eligible for On-site : ☐ Eligible for Off-site: ☐

C: RECEPTION AND CONSENT DESK:					
1.Consent Given	Yes ☐ No ☐	2.Receptionist Name	_____	Signature	_____

D: SYMPTOM SCREENING DESK		
I: Symptom(current) and Duration		
1. Cough	Yes ☐ No ☐	***If Yes (note down the duration)*** *……..…day/…….week/……..…month /…..…year*
2.Sputum (Productive)	Yes ☐ No ☐	*……..…day/…….week/……..…month /…..…year*
3. Loss of body weight	Yes ☐ No ☐	
4. Evening rise of fever	Yes ☐ No ☐	
5. Chest Pain	Yes ☐ No ☐	
6. Loss of appetite	Yes ☐ No ☐	
7. Hemoptysis	Yes ☐ No ☐	
8. Difficulty in breathing	Yes ☐ No ☐	
9. Night sweating	Yes ☐ No ☐	
10. Increasing tiredness / Fatigue	Yes ☐ No ☐	
Eligible for sputum collection based on symptom screening	Yes ☐ No ☐ *If Yes, then move to next section health-seeking behavior.* *If No, then move to X-Ray Section*	*Eligibility Criteria (Any of the two criteria mentioned below)* *1. Cough duration of 2 weeks or more (Q1).* *2. Cough less than 2 weeks with any other additional TB symptoms (Q2-Q10)*

II. Health Seeking Behavior for current TB symptom			
Health Service Provider (Order the preference for selected Health Service providers)	Chronology order (1-11)	Reason for selecting particular health services (Select number from Annex 1)	ANNEX 1
1. Government Hospital			Reason for selecting particular health facility 1. Faith towards the service 2. Near /Easily accessible 3. Good behavior of service provider 4. Financial reason 5. Quality 6. Convenient time 7. Other
2. Medical College			
3. Private Hospital			
4. Private Clinic			
5.Urban Health Clinic			
6. Gov. Health Center (PHC, HP)			
7. Pharmacy			
8. Self-Medication			
9. Traditional Healer			
10. No attention			
11. Uncategorized/Others			

III. TB Treatment History (Health service utilization for TB)		
Currently on Treatment.	Yes ☐ No ☐	If yes: Duration: Days…. Months …..... Year……..…
Past Treatment	Yes ☐ No ☐	If yes: Duration: Days…. Months …..... Year……..…
IF No history of TB treatment (current or past) then go to *X-Ray Section*		

IV. From where service taken for Diagnosis (Select in chronological order): (Multiple Selection)

Service Provider	Current Treatment		Past Treatment		
	Chronology order(1-8)	Reason *(Select number from annex 1)*	Chronology order(1-8)	Reason *(Select number from annex 1)*	
1.Governmental Hospital					
2.Medical College					
3.Private Hospital					
4. Private Clinic					
5. Urban Health Clinic					
6. Government Health Facility (PHC,HP,)					
7 .Pharmacy					
8.Self-Medication					
9.Traditional Healer					
10.No attention					
11.Uncategorized/Other					
12. Service Taken from outside the country					

V. From where service is taken for Treatment (Select in chronological order): (Multiple Selection)					
Service Provider	Current Treatment		Past Treatment		
	Chronology order(1-11)	Reason *(Select from annex 1)*	Chronology order(1-11)	Reason *(Select from annex 1)*	
1.Governmental Hospital					
2.Medical College					
3.Private Hospital					
4. Private Clinic					
5. Urban Health Clinic					
6. Government Health Facility (PHC,HP,)					
7 .Pharmacy					
8.Self-Medication					
9.Traditional Healer					
10.No attention					
11.Uncategorized/Other					
12. Service Taken from outside the country					

VI. Types of DOTS					
DOTS Types Chronology order(1-5) Reason *(Select from annex 1)*	Current Treatment		Past Treatment		
	Chronology order(1-5)	Reason *(Select from annex 1)*			
1.Facility based Daily DOTS					
2.Anti TB treatment taken at home with frequent visit to facilities					
3.Home family-based DOTS					
4.Taken Anti-Tuberculosis Treatment (ATT) without any observation					
5.Commumnity based DOTS					
6.Service taken from outside the country					

X-Ray Exemption	Yes: ☐ No: ☐	Pregnancy Status: (female)	Yes: ☐ No: ☐

If X-ray Exemption – Yes and/or pregnancy status – Yes, then go to (section G) *2nd MEDICAL OFFICER UNIT*

VII. Interview Status	
1. ☐ Completed 2. ☐ Not Completed	
Name of Staff (screening desk):	Signature: _____

E. RADIOLOGY UNIT

1.Chest X-ray Taking	2. Reasons for Exempted	3. Urgent Medical attention required or not?	4. X-ray Taker:
i. X-Ray Taken ☐ ii. Refuse ☐ iii. Exempted ☐ iv. Others ☐	i. Disability ☐ ii. Bedridden patient ☐ iii.Pregnancy ☐ iv.Machine malfunction ☐ v. Others ..... ☐	i. Yes ☐ ii. No ☐	i. Name:_____ ii. Signature_____

F. MEDICAL OFFICER UNIT

1.Chest X-ray result	4. Medical Officer :
i. Normal ☐ ii. Abnormal and Eligible for Sputum ☐ iii. Abnormal but not eligible for sputum ☐ Remarks:	i. Name: _____ ii. Signature_____

G. SECOND MEDICAL OFFICER UNIT

1. Symptom Screening result	2. X-ray Result
i. No TB Symptom ii. With TB symptom a. Cough => 2weeks b. Cough<2 weeks with additional TB symptom	i. Normal ii. Abnormal and eligible for sputum iii. Abnormal but not eligible for sputum iv. Exempted v. Eligible for Sputum
3. Recommend for Sputum Collection i. Yes ☐ a. Onsite participant – Symptom Only ☐ b. Onsite participant – Xray Only ☐ c. Onsite participant – Symptom and X-ray both ☐ d. Offsite participant – Eligible by default ☐ ii. No ☐ *IF "Yes" go to Laboratory, If "No" go to I. Logistic Unit.* 5. Medical Officer : i. Name: _____ ii. Signature_____	4. Eligible for culture Yes ☐ No ☐

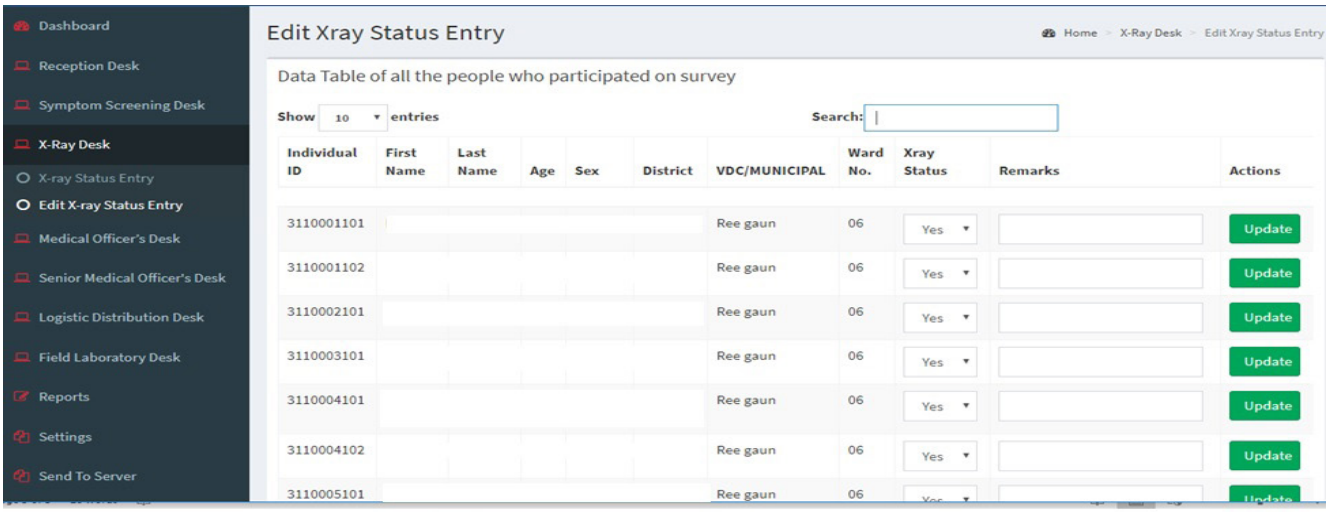
H. LABORATORY UNIT

Sputum Sample	Sample collected	Date/Time	Quality of Sputum
Specimen(D1x) (Spot)	Yes ☐ No ☐	201__/__/__ Time:	Saliva ☐ Mucopurulent ☐ Blood ☐
Specimen(D2x) (Morning)	Yes ☐ No ☐	201__/__/__ Time:	Saliva ☐ Mucopurulent ☐ Blood ☐
Specimen(D2c) (Morning)	Yes ☐ No ☐ N/A ☐	201__/__/__ Time:	Saliva ☐ Mucopurulent ☐ Blood ☐

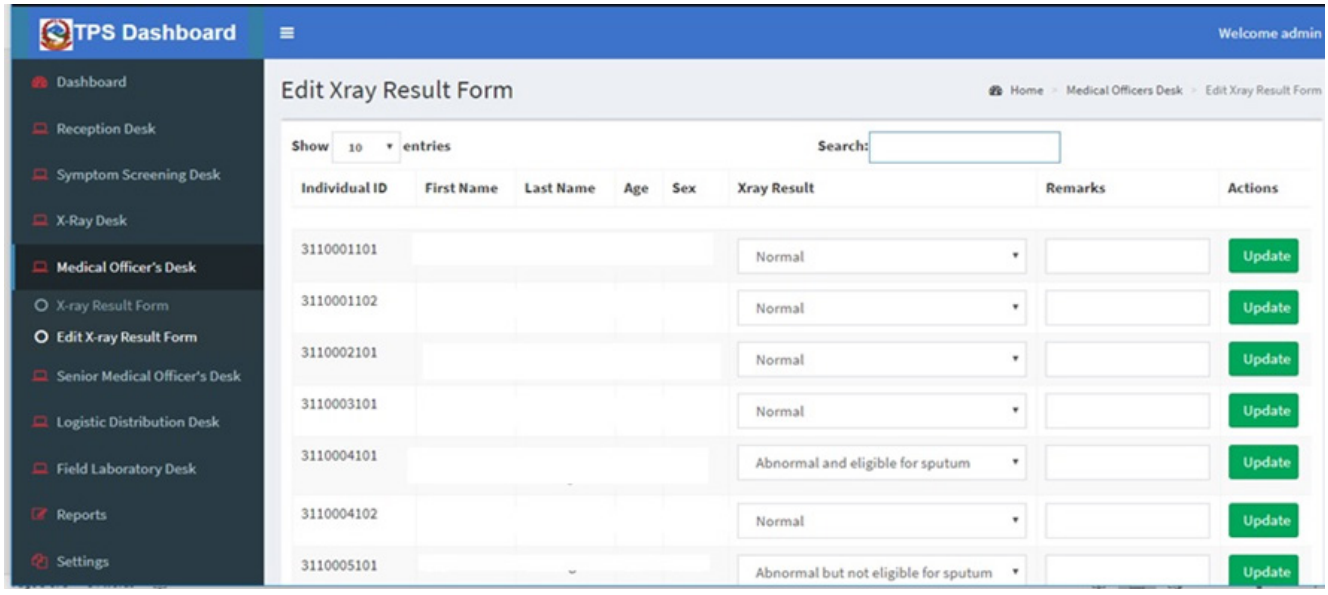
Name of Lab person: _____ Signature: _____

I. LOGISTIC UNIT
Received of the following Item by Participant 1. T-Shirt ☐ 2. Juice and biscuit ☐ 3. Top-up card ☐ Signature/thumb of participant _____ Name and signature of Logistic Officer _____

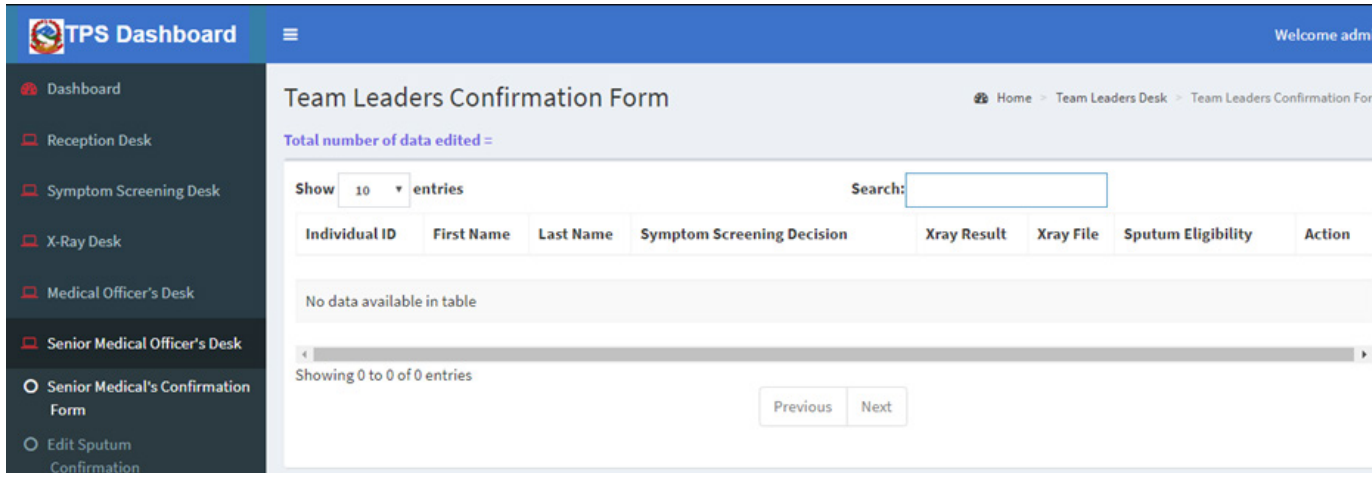
8.1.11: X-ray Status register 8.1.12: Field X-ray result register



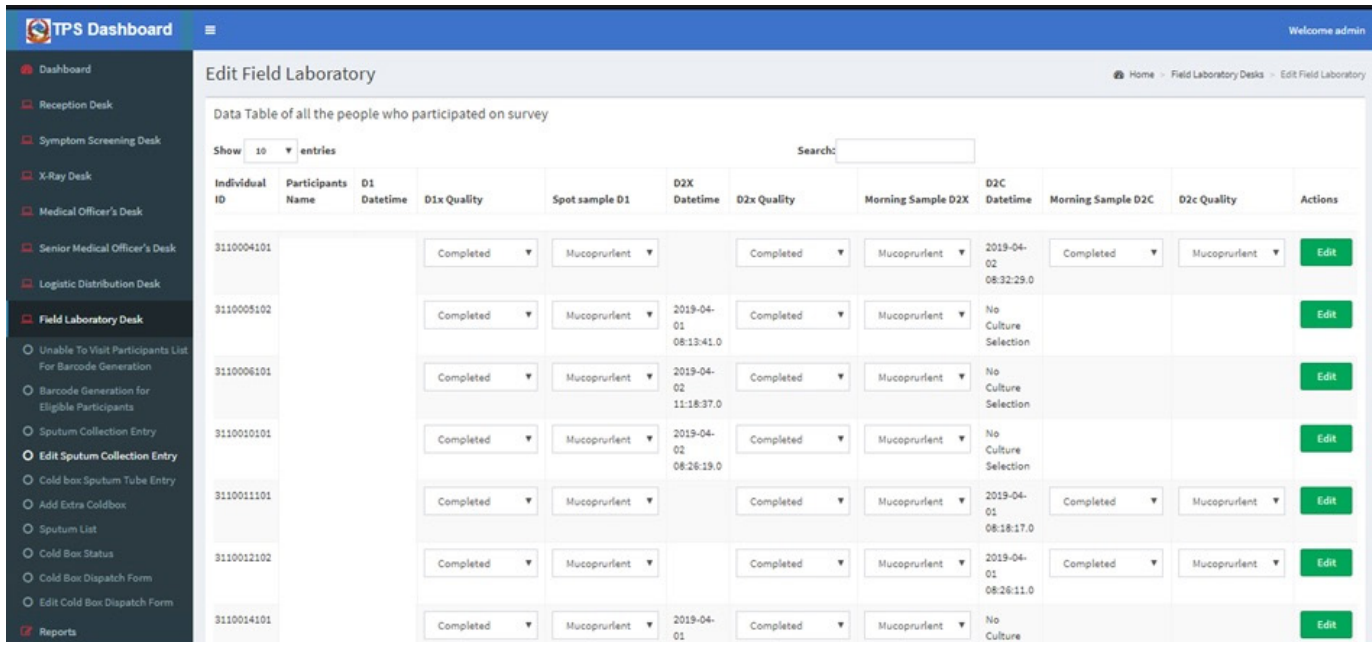
8.1.12: Field X-ray result register



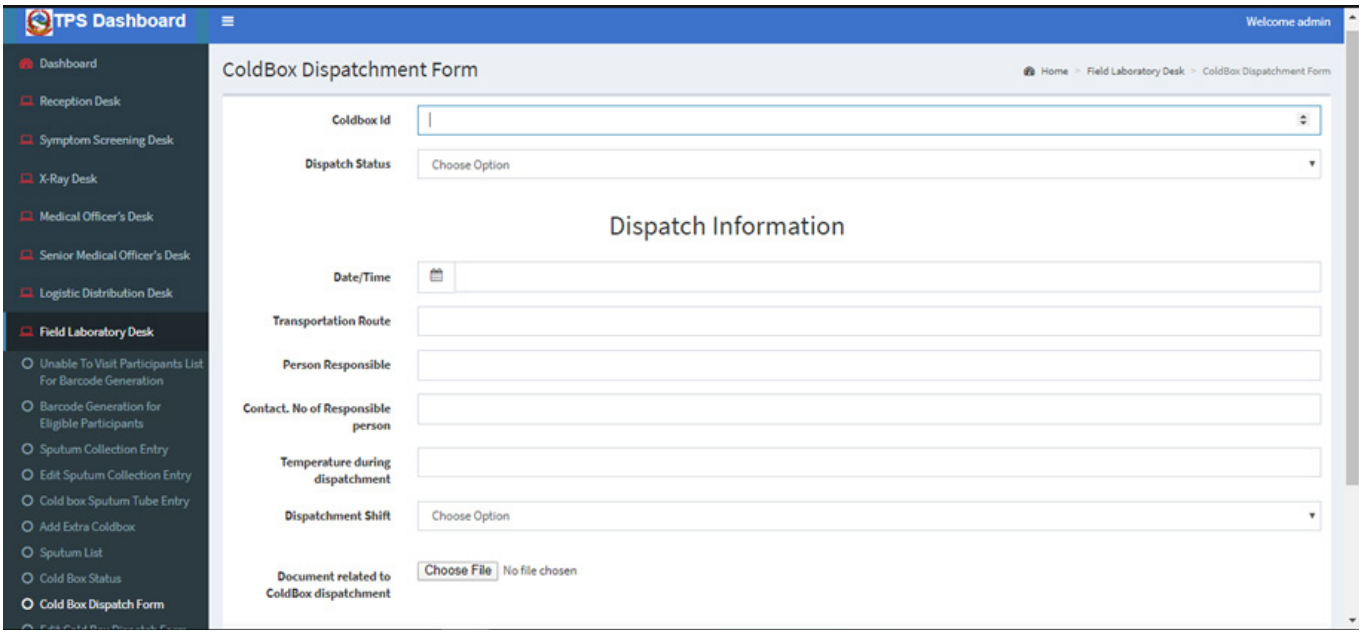
8.1.13: Sputum eligibility Register



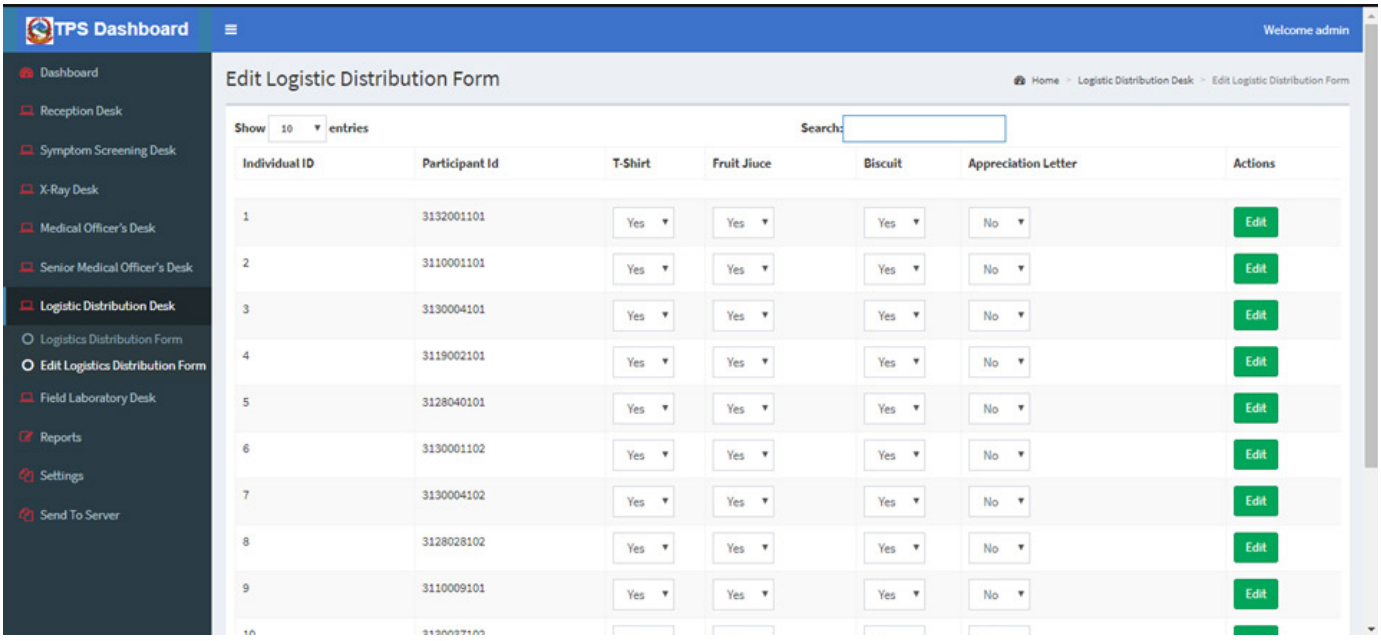
8.1.14: Sputum collection register



8.1.15: Cold box dispatch form



8.1.16: Field logistic distribution register



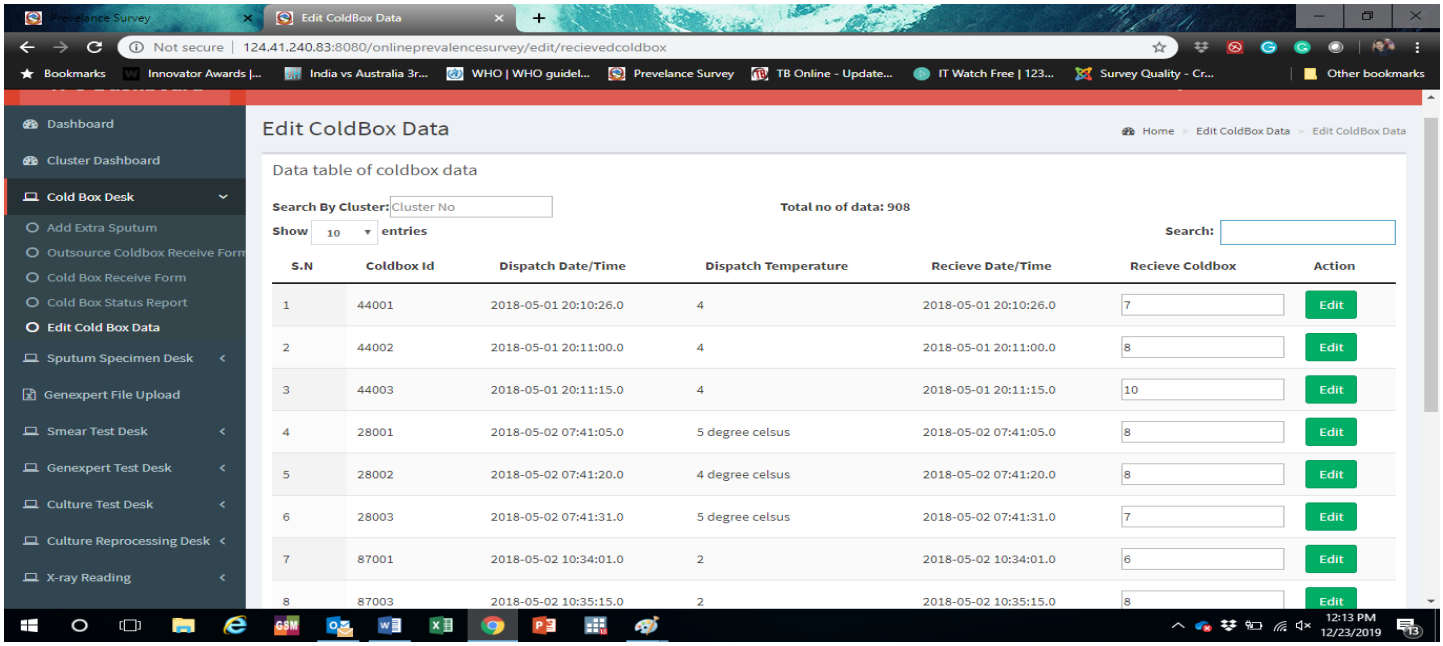
8.1.17: Field cluster summary report

National TB Prevalence Survey
Field Operation Preliminary Summary Report

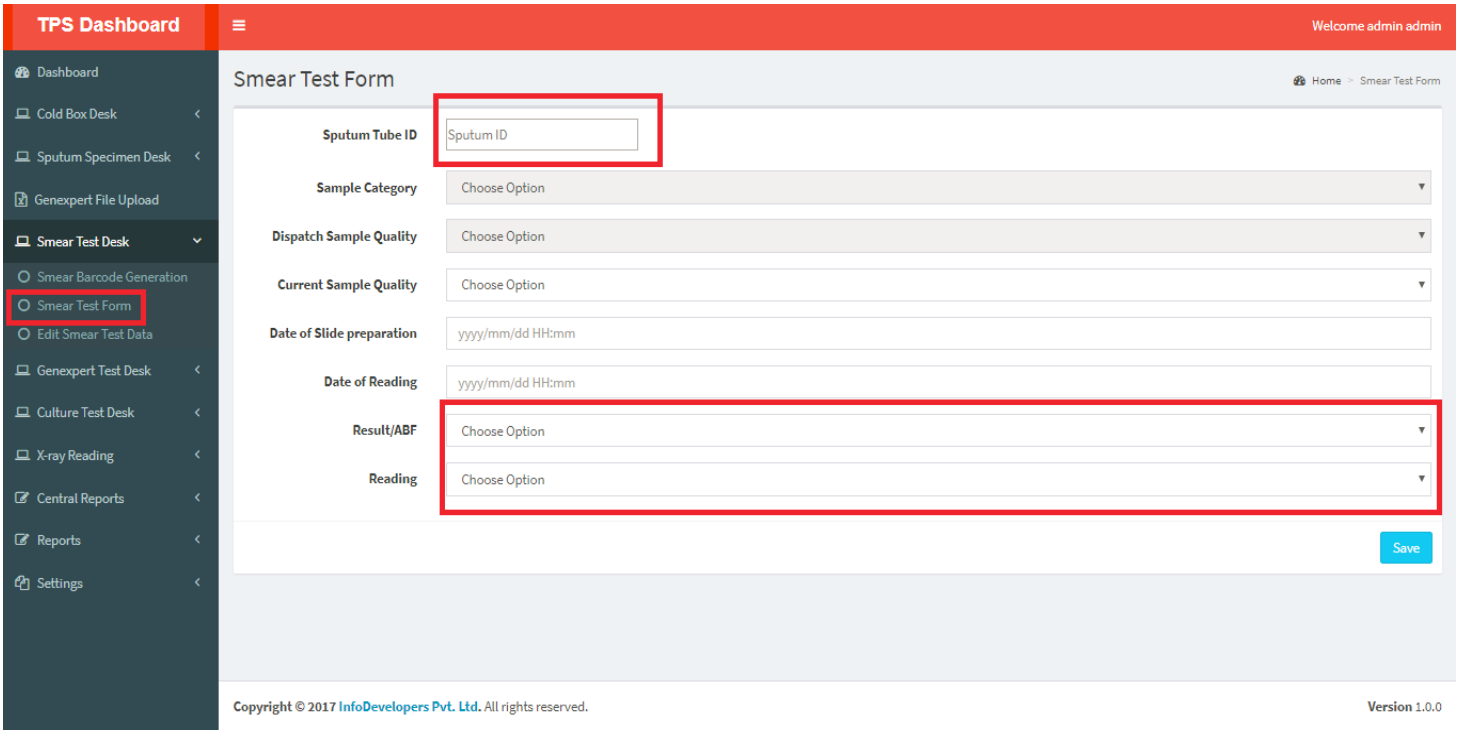
Day:
Participation Rate:

Census Detail:	Cluster name and No:
Total Household number	
Total Family Number	
Total Census population	
Total Eligible population	
Total Eligible population unable to visit	
Field Operation	Summary
Total population with consent given	
Unattended population	
No. of participants screened by symptom screening	
No. of participants screened by chest X-Ray	
Sputum Eligibility:	
Sputum eligible by X-ray only	
Sputum eligible by symptoms screening only	
Sputum eligible by both (X-ray and symptoms screening)	
Sputum eligible by X-ray Exemption	
Participants eligible for sputum collection	
Sputum Collection Detail:	
Spot sample(D1x) to be collected	
Spot sample collected	
Morning sample (D2x) to be collected	
Morning sample collected	
Morning sample (D2c) to be collected	
Collected (D2c)	
Sputum Transportation	
Total Sputum tubes dispatched (1st Dispatch)	
Total Cold Box dispatched	
Total Sputum tubes dispatched (2nd Dispatch)	
Total Cold Box dispatched	
Total Sputum tubes dispatched (3rd Dispatch)	
Total Cold Box dispatched	
Total Sputum tubes dispatched (4th Dispatch)	
Total Cold Box dispatched	

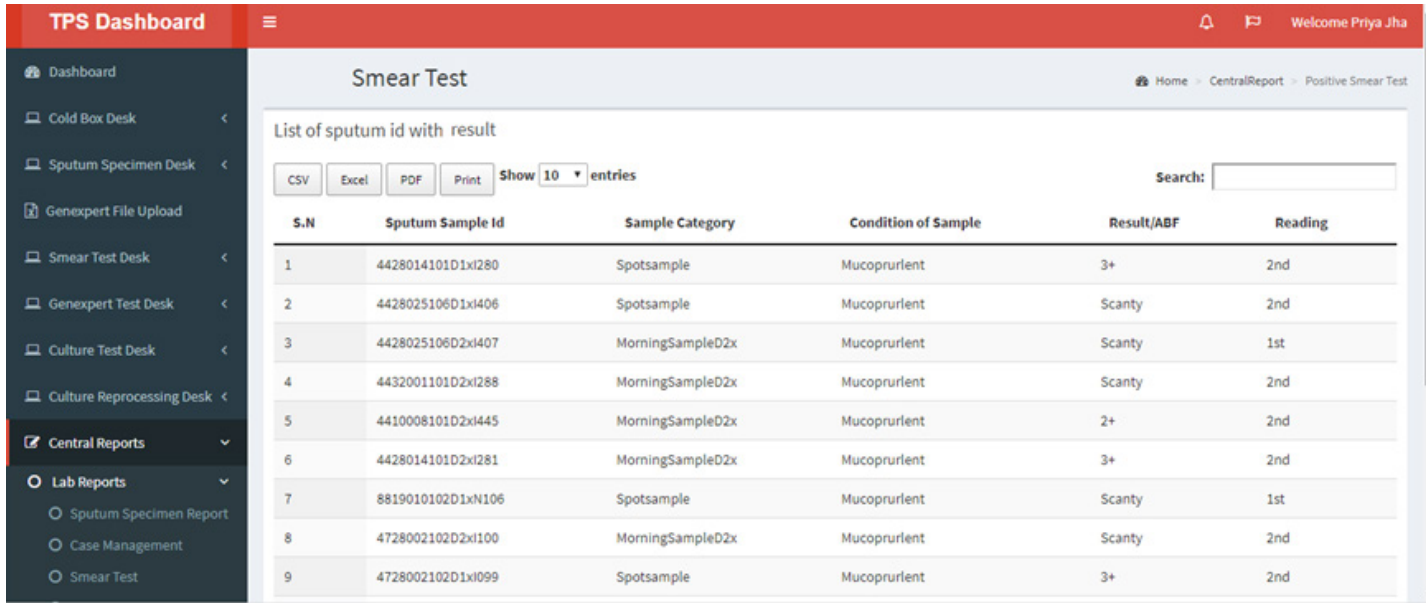
8.1.18: Cold box receive register (central Laboratory)



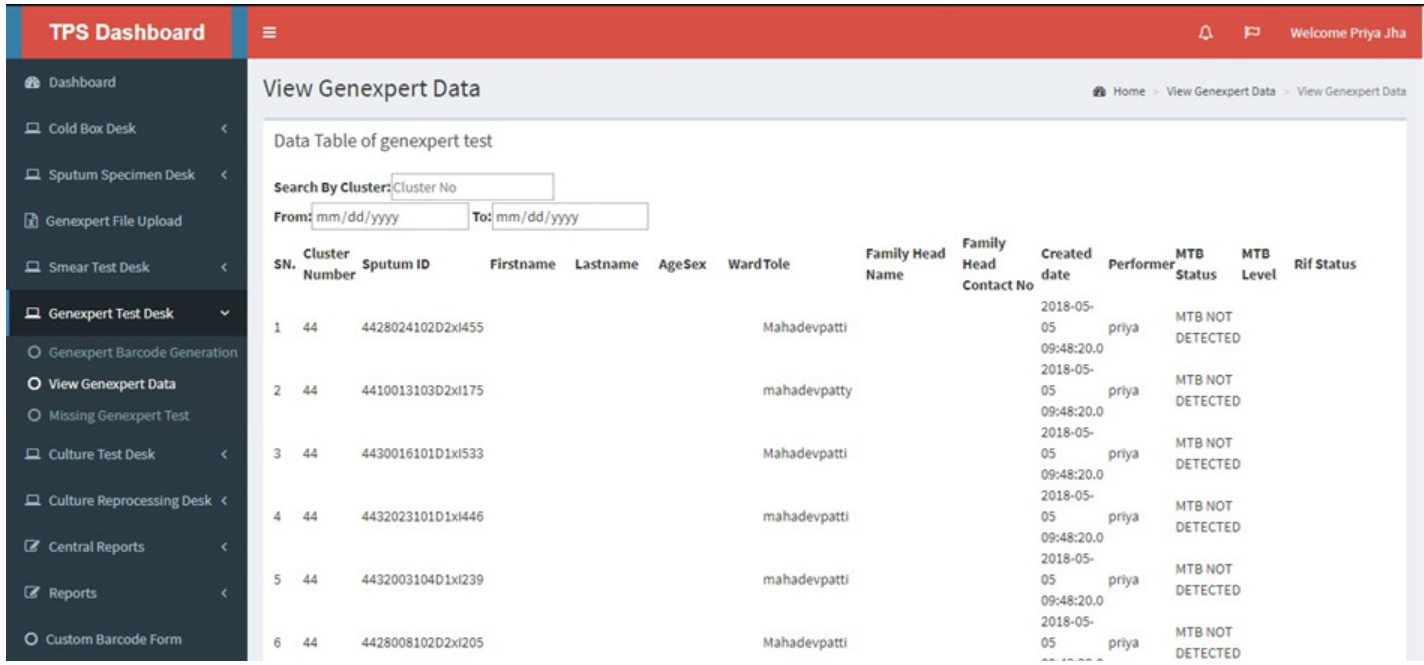
8.1.19: Smear test form



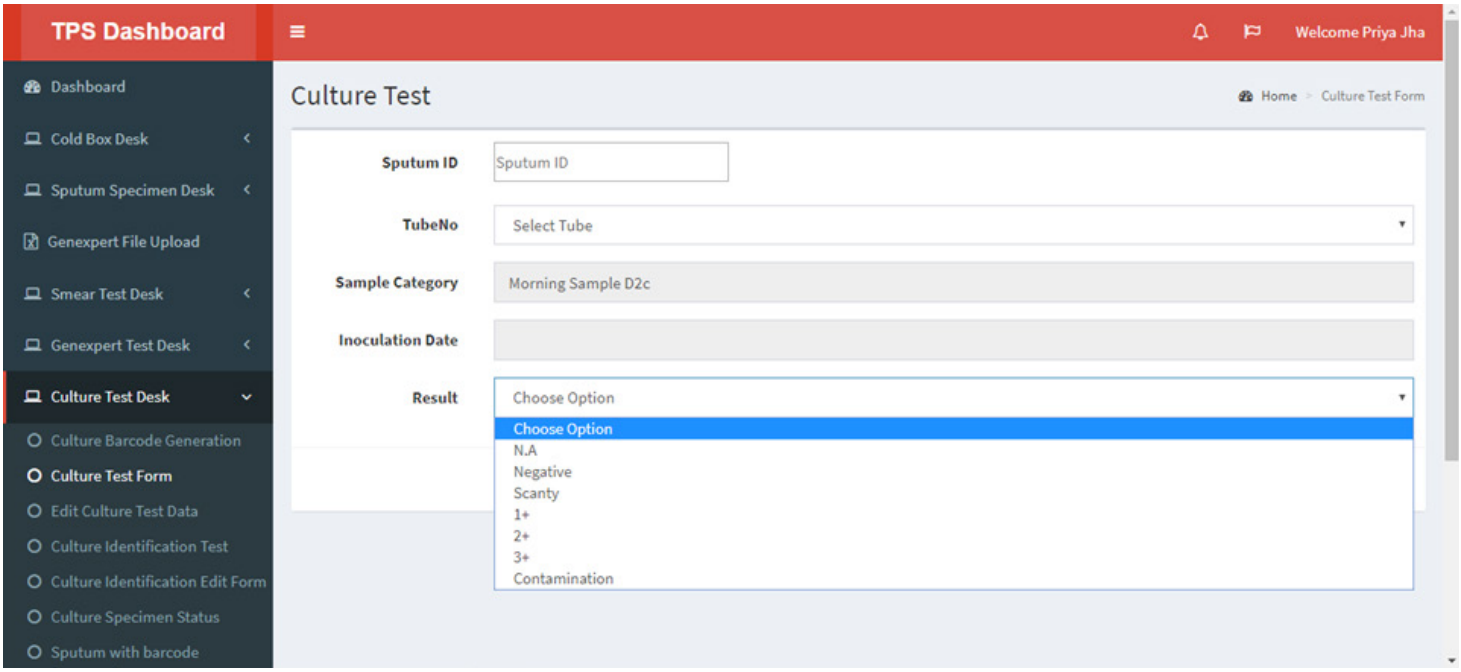
8.1.20: Smear result register



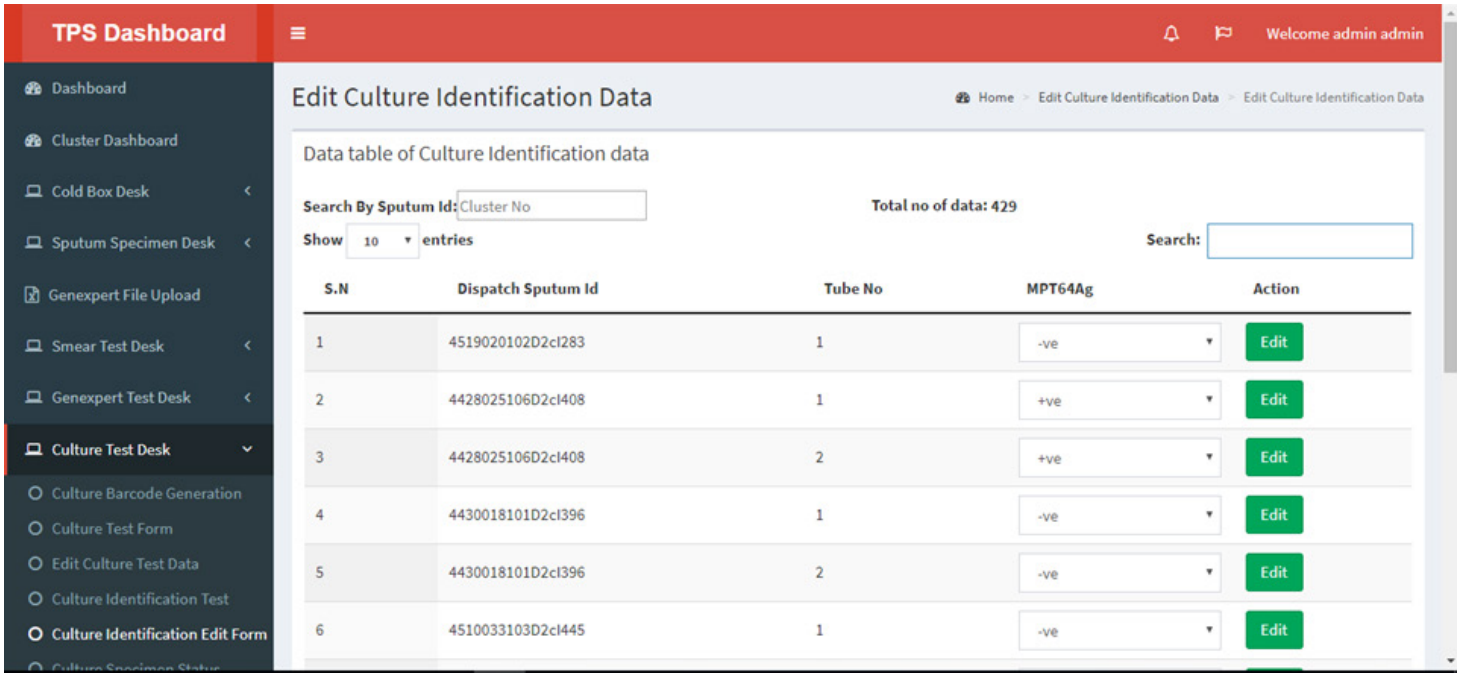
8.1.21: GeneXpert Result Register



8.1.22: Culture test form



8.1.23: Culture identification test form

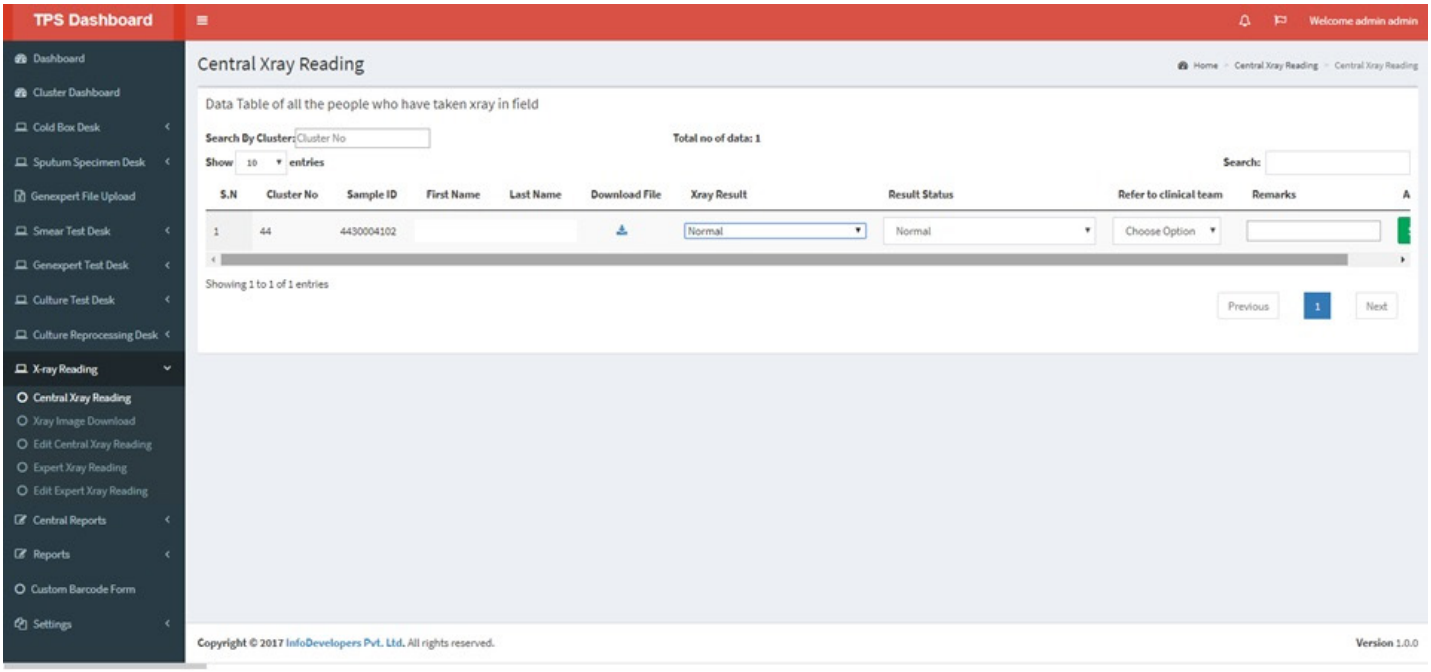


8.1.24: Culture and identification result register

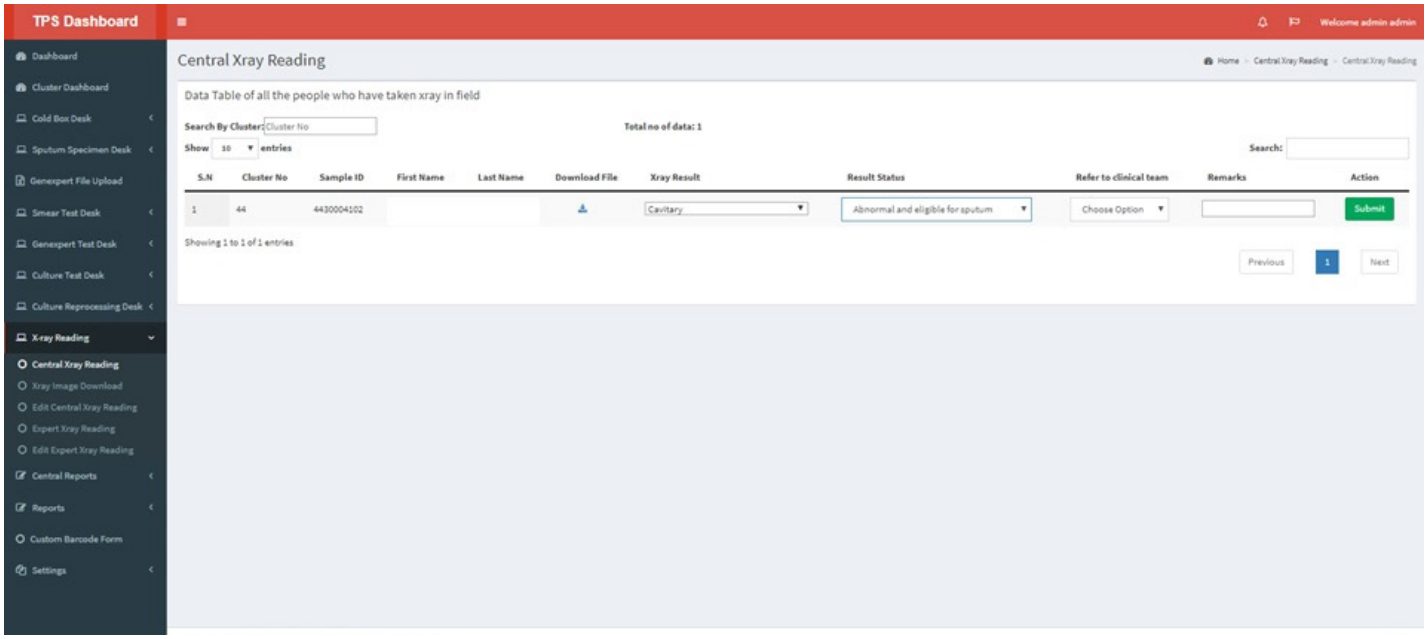
Culture (Positive and Contamination) Cluster No.							
S.N	**ID NO**	**Tube 1/Tube 2**	**MPT64**	**Reprocess Date**	**Reprocess Result**	**Final Result**	**Remarks**
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

8.1.25: Central X-ray reporting format

For Normal category



For cavitary Category



8.1.26: Clinical panel review and feedback register

Clinical panel review form

CLINICAL PANEL REVIEW FORM											
District			Cluster No		VDC/ Municipality						
Head of the Family					Contact No. Head of family						
Sl. No	Individual ID	Name	Age	Sex	GeneXpert result	Smear result	Culture Result	Radiological Impression	Management decision	Enrolment Yes/No	Treatment Date

Clinical panel feedback form

CLINICAL PANEL FEEDBACK FROM										
District:		Cluster No.		VDC /Municipality		Ph No. of In-charge				
Name of health facility				Name of the In-charge						
Sl. No	Participant's ID	Full Name	Gender	Age	HH Chief Name	HH Chief_Ph._ Number	GeneXpert result	Smear result	Central_Xray_ Report	Management decision
---------- PS Medical microbiologist				---------- Radiologist					---------- Chest physician	

8.1.27: Clinical panel case book

CASE BOOK												
Sl. No	Partici-pant's ID	No. of GeneXpert +ve	GeneXpert load	Culture result	Cough >=14 days	X-Ray Panel reading result	X-Ray cen-tral reader result	Field read-er result	Tx. history status	Current tx.status	Past Tx. status	Case OR No case

8.1.28 Logistics forms

Stock status form

National TB Control Center
Thimi, Bhaktapur

Office Name:

Date:

Category	Description	Specification	Expiry Date	Warehouse/ location	Unit	Destination(clus-ter)	Opening Balance	Total in	Total Out	Other Out/loss/ damage	Closing Balance
Prepared by:				Verified by:						Approved by:	

Logistic requisition form

						SRF No		
						SRF / OFFICE / YEAR / SEQUENTIAL NO.		
Date:				Date goods are required:		Deliver to:		
Requestor:				Consumable /Non-consumable		Address:		
Purpose						Contact Name & Tel No:		
							Store use only	
Line item	Code No	Description of goods				Unit	Qty Requested	Total Qty Supplied	Waybill No. (if applicable)
Remarks									
Authorization **Sent By:**				Release of goods authorized by			Goods received by	
				Receiver:				
Name:								
Signature:								
Date:								

Central (NTCC) Logistic dispatch/release form

FROM:		TO:			
From (Warehouse Location):		**Consignee:**		**Waybill no.**	
Date Raised:		**Address:**			*WB / OFFICE / YEAR / SEQUENTIAL NO.*
Sender's Email:		**Phone:**			
Sender's Tel No.:		**Email:**			
		Primary Contact			
		Primary Phone/Email			

TRANSPORT DETAILS:		TRANSPORT TYPE:		MEANS OF TRANSPORT:				DATES OF TRANSPORT:	
Transporter Name			☐	**Road**	☐		☐	**Date of Dispatch**	
Transporter's Tel No.		**Other**	☐	**Hand Carry**			☐	**ETD**	
Driver's Name			☐	**Air**	☐			**ETA**	
Vehicle Registration No.									

Item Description	Unit	Pack type	Quantity	Unit Value (Indicate currency	Total Value (Indicate currency)	Total Weight (Kgs)	Total Volume (CBM)	Qty Received	Remarks
TOTAL WEIGHT (KGS) and Volume (CBM)						0	0		

	Name	Position	Signature	Date	Condition
Loaded by (Sender):					
Transported by (Transporter):					
Received by (Consignee):					

Consignee Comments: (Include details on any missing/damaged items received - please be specific & state exact quantities)

Maintenance/repair request form

MAINTENANCE / REPAIR REQUEST FORM

This form should be filled by the logistic officer from the field and it should be transferred to the central logistic officer at NTCC.

DATE: ---------- TIME: ----------

NAME OF EQUIPMENT:

PROBLEM / WORK REQUIRED

Inspected BY: ----------
Logistic officer (Field)

Approved BY:----------
Logistic Coordinator (Central)

8.1.29: Clinical panel CXR reading result interpretations categories

Red italic letters indicate the corresponding category in local level reading

1. Normal = *Normal (not eligible for sputum)*

△Normal variants such as the followings should be classified as normal;

* Right side aortic arch
  - Azygos lobe
  - Dextrocardia, etc.

△Apical fibrosis (so-called apical cap) without other abnormality in the lung should be classified as normal.

2. Lung TB disease suggestive = *Abnormal, eligible for sputum*

2.1. Cavitary

2.2. Non-cavitary

2.2.1. Minimal：summation of extents of lesions is approximately within a circle of 20 mm diameter

2.2.2. Moderate：other than "Minimal" and "Advanced"

2.2.3. Advanced：summation of extents of lesions is approximately more than a unilateral lung field

3. Thoracic EXPTB suggestive = *Abnormal, eligible for sputum*

3.1. Hilum and/or mediastinum mass (without lung abnormal shadow suggestive active TB)：including LN swelling

3.2. Pleural effusion etc. (without lung abnormal shadow suggestive active TB)：including chronic empyema and/or plural mass

※ Thoracic EXPTB means pleural TB and hilum and/or mediastinum LN TB

4. Healed TB

4.1. Single small calcification：of less than 10 mm diameter ⇒ *Abnormal, not eligible for sputum*

4.2. Healed TB：all other abnormality suggestive of healed thoracic TB, including calcification of mediastinal lymph node(s) without swelling, plural thickness and/or plural calcification ⇒*Abnormal, eligible for sputum*

5. Non-TB abnormality in the lung

5.1. Emphysema and/or air cyst(s)⇒*Abnormal, not eligible for sputum*

5.2. Other abnormality in the lung⇒*Abnormal, eligible for sputum*

6. Other Abnormality＝*Abnormal, not eligible for sputum*

Abnormalities, such as the followings, should be also classified into this category

△Abnormal not in lung, such as cardiac, musculoskeletal abnormality, thyroid mass

△Pleural adhesion at a cost-phrenic angle(s) —however slight pleural adhesion at costophrenic angle(s) might be classified as normal.

△Pneumothorax without lung field abnormal shadow

7. Uninterpretable

8.1.30 Laboratory Result Classification/Interpretation Categories (Smear, Culture, and MTB/RIF)

Fluorescent Microscope (FM)
The grading of fluorescent microscopy (FM) follows the WHO/IUATLD recommendation.

No of AFB (200X)	No. of AFB (400X)	Result
No AFB in one length	No AFB in one length	Negative
1-4AFB in one length	1-2 AFB in one length	Confirmation required
5-49 in one length	3-24 AFB in one length	Scanty (exact number)
3-24 AFB in one field	1-6 AFB in one field	1+
25-250 AFB in one field	7-60 AFB in one field	2+
>250 AFB in one field	>60 AFB in one field	3+

The grading of Culture follows the WHO/IUATLD recommendation.

No of colonies	Result
0	Negative
1-9	Scanty
10-100	1+
100-200	2+
>200 or confluent growth	3+
Contamination	C

Xpert MTB/ RIF result

- M. TB not detected: which means test is negative or
- M. TB detected with rifampicin susceptible or
- M. TB detected with rifampicin resistance or
- M. TB detected with rifampicin indeterminate or
- Error/Invalid/No result

ANNEX 8.2: QUALITY ASSURANCE CHECKLIST (QAC)

8.2.1: Pre-departure checklist

Quality Assurance (QA) Checklists/tools, TB Prevalence Survey

Pre-departure Checklists

Cluster Name: Date:

Venue: Cluster ID:

1. Census team trained on using survey questionnaire and methods (tablets-based interview) for conducting the survey	Yes	No	Pre-departure check-lists
1. Logistics checked by the respective focal person before transportation to the field (tents, rooms, tables/desks, IT equipment, Laptops, Bar-code printer, scanner, X-ray equipment, Ice-packs, cold chain maintenance, and lab equipment)	Yes	No	
2. Medical officer trained for X-ray reading, image data storage and image data management (IT person role)	Yes	No	Other individuals as well
3. Training/orientation provided to a laboratory worker • Safety precaution, • Infection prevention and • Waste management	Yes	No	
4. Have pre-plan set for transporting the collected sputum specimens	Yes	No	Ensure before arrival and on arrival
5. Employ the qualified and trained personnel for taking X-ray	Yes	No	Same as 4

Completed by:

……

Post:

Verified by:

……

Survey Team Leader

8.2.2: Survey pre-visit checklist

Quality Assurance (QA) Checklists/tools, TB Prevalence Survey

Survey Pre-visit

Cluster Name: Date:
Venue: Cluster ID:

Pre-Visits	Status		Remark
1. Number of members included in the team for Pre-Visit			
2. Meeting and planning conducted with local authorities and leaders *(Rural Municipality In-charge/Ward In-charge/Health Post In-charge/Local leaders/Teachers/FCHVs/ Mother groups)- other relevant participants who could play crucial part in increasing participation*	Yes	No	
3. Orientation conducted with HFOMC/ Local Leaders/ Other Participants *(Rural Municipality In-charge/Ward In-charge/Health Post In-charge/Local leaders/Teachers/FCHVs/ Mother groups)- other relevant participants who could play crucial part in increasing participation*	Yes	No	
4. Number of participants attended in the orientation (Specify types of participants) • Elected Municipality/ Ward members • Local leaders • Health Facility members • FCHVs/ Mothers' groups • Other participants			
5. Decided the section/sector wards if the population is large *(Ensure if selection of part of the final sampling unit required)*	Yes	No	
6. Cluster/Household mapping conducted	Yes	No	
7. Finalized the local staff recruited for PS	Yes	No	
8. Identified social mobilizers (5 per cluster)	Specify Name/ contact detail 1. 2. 3. 4. 5.		
9. Identify types of social mobilization events/activities for improving participation	Specify activities: 1. 2. 3. 4. 5.		
10. Orientation provided on Social Mobilizers to conduct pre-census with standard forms	Yes	No	
11. Finalized the tentative date of census and field operation	Yes	No	Specify date:
12. Selection of appropriate site for field operation	Yes	No	Specify Venue:
• Testing of the Internet connectivity in the field	Yes	No	
• Telephone Network checked	Yes	No	
• Internet data card checked	Yes	No	
• Local Internet service availability checked	Yes	No	
• Availability of electricity			(Regular/Interrupted)
• Availability of water supply/toilets for field operation			
• Building availability for the Field Operation			
• Furniture available for the field operation o Desk o Table o Long waiting chair			Provide the number available
• Local staff detail for availability during field operation (Designation) o Doctor o HA o Sr AHW/ AHW o ANM	Number …….. …….. …….. ……..		Provide designation and total person available
13. Checked availability of the hotels/lodging near field operation	Yes	No	
14. Ensure the information collection sheet is filled and verified	Yes	No	
15. Conducted location mapping using GPS	Yes	No	Specify GPS Location:
16. Total days required for Pre-Visit			

Completed by:

....
Survey Pre-visit team leader

Verified by:

.....
Survey Team Leader

8.2.3: Social mobilization checklist

Quality Assurance (QA) Checklists/tools, TB Prevalence Survey
Social mobilization (Field level)

Cluster Name: Date:
Venue: Cluster ID:

Social Mobilization	Status		Remark
1. Participation from the DHO/DTLO for planning social mobilization at targeted cluster.	Yes	No	
2. Orient local leaders or stakeholders on the detail survey plan and operations when only part of a cluster/village is selected	Yes	No	
3. Planned to conduct the community mobilization activities	Yes	No	
4. Orientated local health workers or equivalent personnel for preparing household lists of survey area *(If local population data are not reliable and local capacity to prepare the population list is doubtful, the pre-visit team may include census takers)*	Yes	No	
5. Distributed campaign materials and TB information sheets during the door to door visits	Yes	No	
6. Social Mobilizers collect the tentative household number and eligible participants during door to door visits.	Yes	No	
7. Informed about the date and venue for tentative census and field operation to public.	Yes	No	
8. Mechanism of reporting the summary information for planning the field operation	Yes	No	

Completed by: Verified by:

…… ……

Name:

Post: Survey Team Leader

8.2.4: Household census checklist

Quality Assurance (QA) Checklists/tools, TB Prevalence Survey
Household census conduction

Cluster Name: Date:
Venue: Cluster ID:

Pre-census checklist (To be completed before household census)

Census	Status		Remark
1. Census team trained on using survey questionnaire and methods (tablets-based interview) for conducting survey	Yes	No	
2. Preparation for the survey at-least one day before the survey • Checked the tablet working condition and battery • Arranged the required materials *(Household number stickers, invitation cards, TB information sheets, Pen and Diary)*	Yes	No	
3. Have the back-up plan (Printed questionnaire) in case of tablet malfunction	Yes	No	
4. Census day and time planned accordingly to local settings to maximize the participation *(Morning, Afternoon or Evening; Weekends or Weekdays)*			

Census Check-lists (Completed during the census)

Census	Status		Remark
1. Total number of teams planned for conducting household survey			
2. Number of participants in each group			
3. Conducted the census as per the sampling plan or selected household	Yes	No	
4. Follow the standard procedure for conducting interview *(Greetings, explaining the purpose of the survey, benefits of participating in the survey, asking for permission to start the interview, avoiding the leading questions, avoiding technical jargons, etc.)*	Yes	No	
5. Provide the individual invitation cards to each eligible participant with purposed date, time and venue for examination	Yes	No	
6. Mop-up the interview Daily *(Following up for non-attendants and plan for their participation next day)*	Yes	No	
7. Household census information back-up created after every five household samples collection.	Yes	No	
8. Cross-validating/ quality assurance of collected household census information randomly/purposively by team leader	Yes	No	

Completed by: Verified by:

....
Post: Survey Team Leader

8.2.5: Field operation checklist

Quality Assurance (QA) Checklists/tools, TB Prevalence Survey Field Operation checklists:

Cluster Name: Date:

Venue: Cluster ID:

Field Set-up			
1. Arranged/planned for the field operation sites at-least one day before the field operation	Yes	No	
2. Arranged the logistics for the field operation (tents, rooms, tables/desks, network)	Yes	No	
3. Checked LAN connections, equipment, and logistics (laptops, bar-code printer, scanners, X-ray machine, Ice-packs, cold chain maintenance) at least one day before the field operation.	Yes	No	
4. Availability of both male and female interviewer (At-least one female)	Yes	No	
Reception			
1. Checked participants invitation card against the census	Yes	No	
2. If participants forget the invitation card, verify with the name, mobile phone			
Informed consent desk			
1. Explained the survey procedure, risks, and benefits of the participation	Yes	No	
2. Inform consent form signed	Yes	No	
3. If children, get the informed consent signed from the guardians/care-taker	Yes	No	
4. Generating unique barcode number for wrist band	Yes	No	
Chest X-ray			
1. X-ray machine Installed in-line with X-ray manual (Open and closed scenario) • The area enclosed with lead protection • Enclosed area are 12*6 square feet of 0.5mm lead curtain	Yes	No	
2. X-ray section clearly distinguished from other areas	Yes	No	
3. Radiation hazard signs displayed appropriately	Yes	No	
4. Radiation safety measure in place for workers and public (Lead protectors)	Yes	No	
5. Ensured eligibility for the X-ray	Yes	No	
6. Display of the visual aids for the procedure for chest X-ray for participants	Yes	No	
7. At-least two dressing spaces with curtains available (male and female) If not available, ensure separation timing	Yes	No	
8. Privacy of the participants ensured	Yes	No	
Data check and completion of screening			
1. Medical officer inspect X-ray and carries out basic QA (Patient positioning, Image Density, Contrast, Sharpness, Artifacts)	Yes	No	
2. Provision of repeated X-ray if the standard is not maintained	Yes	No	
3. Findings recorded on the X-ray datasheet	Yes	No	
Sputum Collection (Field level)			
1. Visual aid displayed for the producing sputum for participants	Yes	No	
2. Staffs with all the protective measure (gloves, masks, other safety measures)	Yes	No	
3. Provided counseling and clear instruction to produce spot sputum	Yes	No	
4. Sputum quality checked • Adequate quantity (2-5ml) • Good quality	Yes	No	
5. Provided instruction on how to collect the morning sputum specimens	Yes	No	
6. Providing sputum collection cups for morning samples	Yes	No	
7. Clear instruction/ marking (labeling) for the sputum container belongs to whom if multiple persons	Yes	No	
8. Instruction provided for collection of either 2/3 sputum per individual	Yes	No	
9. Appropriate colors on cap for collecting sputum • Gene-Expert (Red) • Culture (Blue)	Yes	No	
10. Temperature maintained for the cold chain (2-8 C)	Yes	No	

Information Technology (IT) Personal			
1. Adequate back-up file created and achieved for census	Yes	No	
2. Household list compiled to count total eligible samples after each day census activity	Yes	No	
3. X-ray Image data stored in appropriate back-up	Yes	No	
4. Generate cluster summary and list of unattended participants daily	Yes	No	
Mop-up operations			
1. Review cluster summary and daily attendance by the team leader to monitor the participation of eligible people.	Yes	No	
2. Mobilizing the community leaders and community mobilizers for facilitating absent participants	Yes	No	
3. Arranging for sputum collection for those who could not attend the field operation	Yes	No	

Completed by:

Verified by:

……

Name:
Post:

……

Survey Team Leader

8.2.6: Field laboratory checklist

Sputum Collection			
Laboratory personnel directly supervise sputum collection	Yes	No	
1. Visual aid displayed for the producing sputum for participants			
2. Staffs with all the protective measure (gloves, N95 masks,			
other safety measures)			
3. Provided counselling and clear instruction to produce spot sputum			
4. Sputum quality checked			
• Adequate quantity (2-4ml) • Good quality (Mucopurulent)			
5. Provided instruction on how to collect the morning sputum specimens			
6. Providing sputum collection cups for morning samples			
7. Clear instruction/ labelling for whom the sputum container belongs to if multiple persons are involved			
8. Instruction provided for collection of either 2/3 sputum per individual			
9. Appropriate colors on cap for collecting sputum			
• GeneXpert & Smear (Red) • Culture (Blue)			
10. Temperature maintained for the cold chain (2-8 C)			
11. Proper packing of sample and number			
12. Information provided to the central laboratory of sample arrival date and time			

8.2.7: Central laboratory checklist

Central Laboratory

Quality Assurance Monitoring Check-list

Lab: …… Date: …… Address: …….....

Laboratory	Status		Remark
1. Laboratory staff in place to receive the samples	Yes	No	Specify the time: 24 hours/ Office hour
2. Recording mechanism in place for recording (Barcode scan, time, receiving date, temperature, total sample number) the arrival of the samples	Yes	No	
3. Ensure enough space is available to store the samples safely at required temperature	Yes	No	
4. Checked the incoming cold chain temperature	Yes	No	
5. Safety manuals are available with information on all safety, emergency (handle spillage), and waste management regulations. (Implementation part) Ensure Lab staff are following the safety manual	Yes	No	
6. Training/orientation provided to laboratory workers			
• Safety precautions, • Infection prevention and • Waste management • Database management (IT)	Yes	No	
7. Proper stock and supply system in place for laboratory supplied	Yes	No	
8. Laboratory has the appropriate and well-maintained biosafety level (2+)	Yes	No	
9. Laboratory use the certified equipment (Especially BSCs and centrifuges with safety buckets) with lab good practices	Yes	No	

10. Availability of the Personal Protective Equipment (PPE)	Yes	No	
11. Laboratory has the daily logbooks to record			
• Daily temperatures of refrigerators, freezers, incubators • Inflow and down-flow of biosafety cabinets every week • Daily and monthly maintenance of Xpert	Yes Yes Yes	No No NO	
12. Sputum smear microscopy			
• Each batch of reagent include one unstained known positive preferably (1+) (positive control) and one unstained known-negative smears (Negative control) • All positive smears reconfirmed by another microscopy in the same lab. • All slides are stored appropriately in the slide box.	Yes Yes Yes	No No No	
13. Culture			
• NALC is added on daily basis (Freshly prepared). • Sample and NALC –NaOH mix 30 second and kept 15 minutes (No more than 20 minutes) • Proportion of AFB smear-positive samples which grew (M.tb.) (should be at least 85%) • Contamination rates in solid media within acceptable limits (5 to 10% on solid media) • Proportion of NTM isolated • Check the quality indicator log • Stock isolated to be kept in the cryovial at deep freezer • Back sample to be preserved in deep freezer	Yes Yes Yes Yes Yes Yes	No No No No No No	
14. GeneXpert			
The error rate should be less than 5%	Yes	No	

Completed by: …….. Verified By: ……

Post: ……..

8.2.8: Checklist of media and reagent

Internal QC of Auramine O stain

Stain	*LOT*	*Pro-duction date*	*Producer's Signature*	*Expiring date*	*Internal Quality Controls*				*LOT released (date signature)*	*comments*
					date	*sign*	*Expected Result*	*results*		
						Neg	Pos	Pos Neg		
							Pos Neg			
						Neg	Pos	Pos Neg		
							Pos Neg			

Internal Quality Control of GeneXpert

Date	LOT No	Positive Control	Negative Control	Signature	Remarks

Positive Control: 0.5 McFand its 10 times dilution by PBS of H37Rv

Negative Control: use only Sample Processing Buffer.

Quality control of L-J Media

Date	LOT no.	Sterility Check (Indicate Pass /Fail)	*M. fortuitum*	
			McF no. 1 (10^{-3})	McF no. 1 (10^{-4})

8.2.9: Sputum transportation; duration, quality and culture recovery

Cluster No.	Terrain	Total no. of sputum transportation per cluster (expected 3 per transport)	Average days/transport/ cluster (expected less than 3 days)	% of mucopurulent samples	Contamination rate (in %) per participants culture results per cluster	Culture recovery rate (vs Xpert MTB/RIF best result)	Cluster No.	Terrain	Total no. of sputum transportation per cluster (expected 3 per transport)	Average days/transport/ cluster (expected less than 3 days)	% of mucopurulent samples	Contamination rate (in %) per participants culture results per cluster	Culture recovery rate (vs Xpert MTB/RIF best result)
1	Hill	2	0.6	77%	1.8%	50.0%	51	Hill	3	0.6	79%	8.0%	100.0%
2	Hill	3	0.2	78%	3.2%	0.0%	52	Terai	3	0.9	86%	9.1%	0.0%
3	Terai	3	0.1	79%	1.6%	100.0%	53	Terai	3	0.7	87%	4.4%	0.0%
4	Terai	3	0.1	81%	12.3%	50.0%	54	Terai	3	0.8	82%	9.3%	0.0%
5	Terai	3	0.1	85%	8.9%	50.0%	55	Terai	3	0.9	74%	4.7%	16.7%
6	Terai	3	0.1	82%	3.6%	100.0%	56	Terai	3	1.0	58%	8.8%	40.0%
7	Terai	3	0.1	86%	0.0%	0.0%	57	Mountain	3	0.4	85%	1.5%	50.0%
8	Terai	3	0.1	83%	0.0%	33.3%	58	Hill	2	1.0	92%	2.1%	100.0%
9	Terai	3	0.1	84%	3.3%	0.0%	59	Hill	3	1.5	71%	2.3%	80.0%
10	Terai	3	0.3	88%	1.5%	0.0%	60	Hill	2	1.0	92%	3.0%	100.0%
11	Hill	3	0.8	69%	7.4%	50.0%	61	Hill	2	1.2	91%	1.2%	0.0%
12	Terai	3	0.2	79%	18.7%	0.0%	62	Hill	3	1.8	92%	4.1%	0.0%
13	Terai	3	0.2	71%	19.3%	0.0%	63	Mountain	3	0.8	64%	0.0%	0.0%
14	Mountain	2	1.5	75%	0.0%	0.0%	64	Hill	3	0.9	50%	2.0%	0.0%
15	Terai	3	0.3	80%	3.8%	0.0%	65	Hill	3	0.7	39%	5.7%	0.0%
16	Terai	3	0.4	80%	3.8%	33.3%	66	Terai	3	0.9	93%	3.3%	0.0%
17	Mountain	3	2.3	74%	0.0%	66.7%	67	Terai	3	0.9	92%	15.8%	0.0%
18	Terai	3	0.1	85%	10.4%	0.0%	68	Hill	3	1.7	61%	1.3%	0.0%
19	Terai	3	0.1	79%	6.6%	0.0%	69	Terai	3	1.4	61%	2.3%	20.0%
20	Terai	3	0.2	89%	4.5%	0.0%	70	Terai	3	1.4	56%	1.4%	50.0%
21	Hill	2	1.0	75%	2.8%	0.0%	71	Hill	3	1.1	70%	6.4%	100.0%
22	Hill	3	0.5	71%	3.5%	100.0%	72	Terai	3	0.9	88%	12.5%	25.0%
23	Terai	3	0.8	69%	0.0%	100.0%	73	Terai	3	0.9	80%	2.0%	0.0%
24	Terai	3	1.0	69%	1.1%	0.0%	74	Terai	3	0.9	91%	9.1%	0.0%
25	Kathandu Valley	3	0.5	72%	0.0%	0.0%	75	Terai	3	0.9	97%	9.4%	0.0%
26	Kathandu Valley	3	0.3	76%	0.0%	0.0%	76	Hill	3	1.8	64%	28.4%	14.3%
27	Terai	3	0.9	72%	8.1%	25.0%	77	Hill	3	1.0	55%	7.5%	0.0%
28	Terai	3	0.7	59%	10.9%	0.0%	78	Hill	3	1.4	94%	2.3%	33.3%
29	Terai	3	0.9	70%	8.0%	0.0%	79	Hill	3	0.9	83%	20.8%	0.0%
30	Mountain	3	0.4	78%	3.1%	0.0%	80	Hill	3	3.3	81%	0.9%	0.0%
31	Mountain	2	1.1	77%	1.4%	0.0%	81	Mountain	3	1.1	98%	3.5%	0.0%
32	Terai	3	1.0	66%	0.0%	25.0%	82	Terai	3	1.1	88%	7.1%	100.0%
33	Terai	3	0.9	80%	0.0%	40.0%	83	Terai	3	0.7	88%	6.8%	50.0%
34	Kathandu Valley	3	0.4	68%	0.0%	0.0%	84	Terai	3	1.3	86%	5.1%	0.0%
35	Kathandu Valley	3	0.3	72%	0.0%	0.0%	85	Hill	2	1.0	99%	2.5%	33.3%
36	Kathandu Valley	3	0.5	60%	0.0%	0.0%	86	Hill	2	1.7	87%	12.7%	0.0%
37	Kathandu Valley	3	1.0	81%	0.0%	0.0%	87	Hill	3	0.9	53%	16.2%	0.0%
38	Kathandu Valley	3	0.8	90%	1.6%	66.7%	88	Hill	3	0.9	69%	5.5%	33.3%
39	Kathandu Valley	3	0.6	83%	0.0%	0.0%	89	Hill	3	0.9	91%	3.3%	0.0%
40	Hill	3	0.7	60%	13.7%	20.0%	90	Mountain	3	5.7	38%	11.9%	0.0%
41	Hill	3	0.2	88%	0.0%	0.0%	91	Hill	1	1.2	93%	2.7%	0.0%
42	Kathandu Valley	3	2.5	71%	6.9%	50.0%	92	Terai	3	0.8	87%	1.7%	0.0%
43	Kathandu Valley	3	0.4	73%	0.0%	100.0%	93	Terai	3	0.5	83%	0.0%	100.0%
44	Terai	3	0.5	100%	1.3%	50.0%	94	Terai	3	0.9	86%	7.7%	0.0%
45	Terai	3	0.6	98%	0.0%	0.0%	95	Mountain	2	1.7	87%	6.7%	25.0%
46	Terai	3	0.6	70%	0.0%	50.0%	96	Terai	3	0.8	72%	2.2%	0.0%
47	Terai	3	0.7	89%	0.0%	0.0%	97	Hill	2	0.6	86%	9.0%	0.0%
48	Hill	3	1.9	58%	3.2%	50.0%	98	Hill	3	0.8	61%	7.2%	0.0%
49	Hill	3	0.7	81%	5.2%	66.7%	99	Hill	3	0.6	67%	0.0%	33.3%
50	Terai	3	0.9	67%	1.1%	0.0%	Total	National	138	1.2	78%	5.1%	30.4%

ANNEX 8.3: OTHER ANNEXES

8.3.1: Illustration for extrapolating the prevalence into all TB form prevalence for all age population

Calculation of Prevalence

- The prevalence of pulmonary Xpert positive cases in adults (15 years and above) obtained directly from the prevalence survey was 374 (95%CI 307.6-441.3) per 100 000 population. The calculation considered the direct finding of survey TB cases, those with a treatment history of 58, and cases on the current treatment of 3.
- Prevalence was measured based on case definitions that included X+ results. Approx 50% of individuals eligible for bacteriological examination had a culture done, adding 21 X-C+ that were considered TB and put on treatment. Those 21 cases are not accounted for among the 225 survey cases and suggest that the sensitivity of Xpert against a standard of culture was approximately 1 - 21 / (225 * 0.5) = 81%, close to the pooled value calculated at the GDG meeting held in Geneva in December 2019, after accounting for the gain in sensitivity when repeating xpert in a separate sputum sample. In the survey, two xpert tests on two separate samples were performed in such a way that the interpretation of the two combined tests was positive whenever at least one of the two tests was positive. The combination of two tests thus improves sensitivity, estimated at 91.3% (SD 6.4%). The adjustment for imperfect sensitivity was based on a Bayesian approach. Prevalence of bacteriologically confirmed pulmonary TB after adjustment for the sensitivity of two xpert tests was 414 (330 - 531) / 100 000 and found close to the survey prevalence estimates based on imputed culture results: 466.12 (382.69 - 549.56).
- The prevalence of all forms of TB among all ages was extrapolated, accounting for the proportion of extrapulmonary TB using notifications data since 2014 and for the risk ratio of TB among children (*vs* adults) as estimated by WHO[1]. The prevalence of all forms and all ages was 416 (314 - 519) / 100,000 population.

Estimation of Incidence

- HIV prevalence ratio (HIV among prev TB / HIV among inc TB) assumed = 0.8 in the absence of data on HIV prevalence among prevalent TB cases in Nepal or other settings with low-level or concentrated HIV epidemics.
- Assuming a stable state equilibrium of the TB epidemic, two models were developed according to WHO methods[2]. Model 1 is the basic model whereas Model 2 uses data on treated cases.

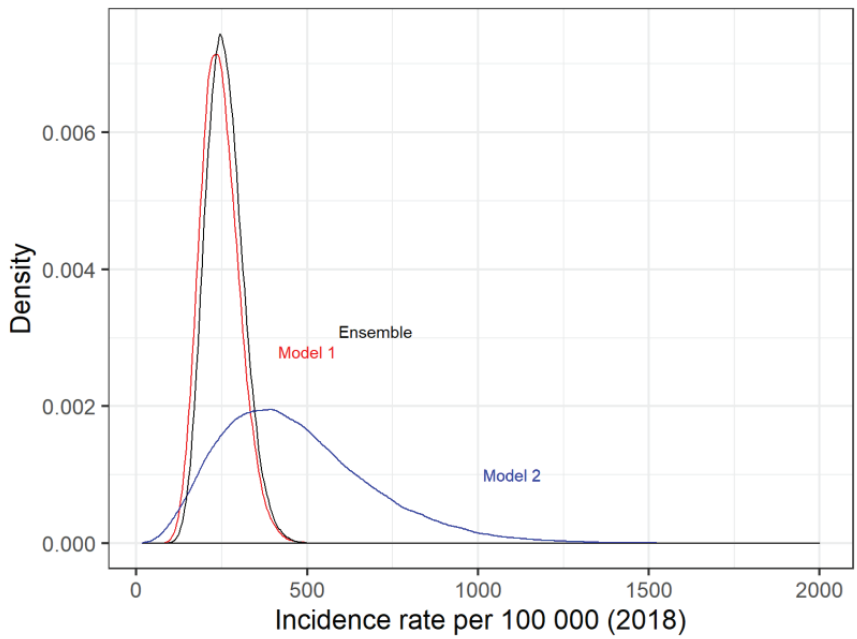
Model 1	245 (135 - 356) / 100 000
Model 2	470 (308 - 910) / 100 000

- The two models were combined in a statistical ensemble, however, Model 2 predictions were found too uninformative due to small numbers and dropped. Model 1 was retained.
- An assumption of a 3% rate of decline in incidence over the period 2000-2018 was used, supported by a steep gradient in prevalence rates over groups of increasing age (from this report finding, Table 32) suggesting a decline in transmission, and an average 8%/year growth in GNI/capita[3].

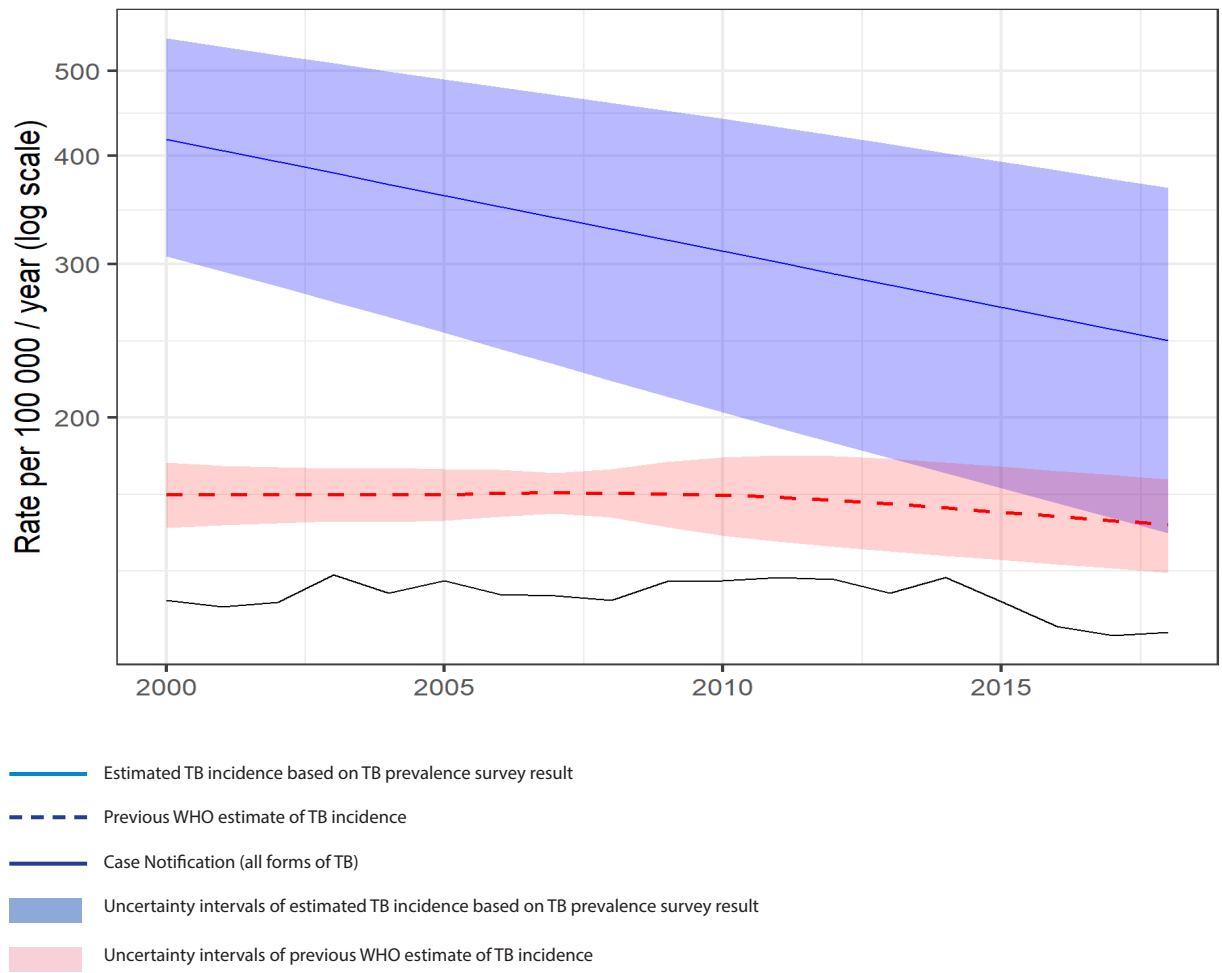
Accounting for Xpert's imperfect sensitivity and a large proportion of extra-pulmonary TB (not measured in the survey), the estimated incidence appears to be higher than previously estimated at a regional workshop, using expert opinion.

Relatively few TB cases were on treatment at the time of the survey (58) and only 3 of the 225 survey cases had been detected before survey investigations, suggesting delays in case detection. The overall average duration of the disease is estimated to be slightly under 2 years.

1 https://www.who.int/tb/publications/global_report/tb19_technical_appendix.pdf?ua=1
2 https://www.who.int/tb/publications/global_report/tb19_technical_appendix.pdf?ua=1
3 https://data.worldbank.org/indicator/NY.GNP.PCAP.CD?locations=NP



There is significant uncertainty about the estimated incidence. Reasons include sampling uncertainty about prevalence compounded by the adjustments made to account for unmeasured prevalence (particularly extra-pulmonary TB), the use of Xpert, which has a lower sensitivity than culture, and the usual assumptions made about unmeasured disease duration of different types of TB cases. The absence of HIV data among prevalent TB cases is not a significant source of uncertainty.



8.3.2: Survey key information sheet (used in social mobilization)

Government of Nepal
Ministry of Health and Population
National Tuberculosis Prevalence Survey 2018-2019
Key information regarding the National TB Prevalence Survey

1. Tuberculosis is a major public health problem globally. In Nepal, nearly half of its population is estimated to be infected with Tuberculosis and at present, 58000 people are suffering from the disease. As per recent estimation, there are 40 to 44 thousand new TB cases are being added each year. It is very difficult to estimate the exact number of TB infected population and their growth each year as there is no national-level TB survey to date. Therefore, to determine the pulmonary TB status in Nepal, the National TB Control Center is conducting the first National TB prevalence survey.
2. This survey will be conducted in 99 randomly selected clusters in 55 districts of Nepal and includes 15year and above age population of respective cluster who has been living for past two or more than two weeks in the cluster.
3. As a primary screening tool to identify the possible TB symptoms among participants, a screening questionnaire will be used and then a chest x-ray will be done in participants.
4. Those who are identified as probable TB cases from primary screening, will be further undertaken for the confirmatory process for which two sputum samples will be taken from participants to conduct Gene X-pert test and smear microscopy. Besides, sputum for culture will be taken from 50% of participants (taking either even only or odd only) in the count.
5. The TB screening results of enrolled participants of the survey will be forwarded to the respective health facility of the cluster through the D/PHO or relevant health office and will be made available to participants. Besides, all identified TB cases will be communicated through the nearest local health facility for treatment enrollment.
6. All personal information collected throughout the survey screening process will be kept confidential and all tests and services provided during the survey will free of cost.
7. The screening tools (survey questionnaire, x-ray, and sputum test) used in this survey do not possess the risk to participants. Instead, participation in the survey may fruitful in terms of:
    - Early detection of pulmonary TB and timely treatment to recover
    - Presence of any other abnormality besides pulmonary TB can be detected in x-ray and appropriate suggestion will be provided by medical doctors for treatment
8. A household visiting survey census team will visit the household and will provide an invitation card with the exact time and date to participate in the survey screening for eligible individuals. It is mandatory to bring invitation card while visiting screening camp to participate in survey screening.
9. The survey screening camp will run in clusters for a fixed duration. Therefore, participants are requested to visit the camp on time and utilize the opportunity.
10. Since the only reliable way to confirming pulmonary TB is sputum test, therefore National TB center kindly request to all those participants who are required to submit sputum; to support in sputum collection and help to eliminate TB.
11. While availing falcon tubes to collect sputum to sputum eligible participants, the tube will be labeled with barcode id, therefore it is requested to participants to use the given tube by the respective person only. If its exchange or used by other participants than identified, then it may mislead the result; a healthy person will appear as TB patient and the actual TB patient will be seen as a healthy individual.
12. For further queries and information kindly contact to National TB Prevalence Survey Secretariat. National TB Centre. Phone number # 016638070

8.3.3: Laboratory awareness IEC used for sputum collection

8.3.4: Patient referral form

HMIS 1.4: Referral / Transfer Slip (translated version)

Government of Nepal
Ministry of Health and Population
Department of Health Services
Health Information Management System
Referral/Transfer Slip

Date.../.../207...

1. Name of Health facility/organization: 2. Contact No.

2. Beneficiary full name: 4. Sex 5. Age

6. Address District... VDC/municipality... Ward No...

7. Services currently taking by beneficiary 8. Date to contact (in D/M/Y)

9. Status

BP	Pulse	Temp.	Respiration	Weight (Kg)	Height (cm)	MUAC (mm)	Edema on both feet
							(+/++/+++)

10. Treatment methods and regimen:

11. Medicines used:

12. Specify if any other test require:

14. Reason for Referral/Transfer:

15. Remarks:

To .....
The above mention patient/service beneficiary visited this facility/treatment center for treatment has been referred/transferred to .....health facility/organization for necessary service and or treatment. Kindly confirm the referral information and send back return form upon patient/beneficiary contact.

Government of Nepal
Ministry of Health and Population
Department of Health Services
Health Information Management System
Referral/Transfer Slip
(Service delivery detail and return information)

Date.../.../207...

Return information sent to .....treatment center/organization

Beneficiary full name:

Sex: Age: Address District...

VDC/municipality...

Patient/beneficiary contact date:

Treatment/Service provided:

Return information sender's Name:

Designation: signature:

Date:.../.../207

Return information sender's Name:

Address	District	VDC/Municipality	Ward No.

This form should use to refer/transfer patient or beneficiary seeking services at their convenient and designated facility/treatment center (amended 2070/71)

8.3.5: Key survey activities and timeline

Key survey Activities	Date
Protocol endorse	January 2017
Pretesting of Survey tools	July 2017
Intrepid Nepal and JANTRA selected as Out Source Agency (OSA) for field implementation through SCI/GF	November 2017
Training to Govt. stakeholder (DTLO/RTLO/RMS/RTC)	December 2017
MOU with three central laboratories (GENETUP, IOM, and NTCC) and Laboratory Set-Up	January 2018
Database server established in NTCC and NITC	January 2018
Training to the entire field implementation team	January 2018
Prevalence survey piloting	February 2018
Post piloting Review Workshop	February 2018
Revision of Protocols and SOPs based on post Pilot recommendation	March 2018
Survey field operation started (by 3 teams simultaneously in 3 clusters)	April 2018
Mid-term Review mission	July 2018
Post-Mid-term review recommendation training/orientation	August 2018
Protocol and SOPs revised based on the final recommendations made by the mid-term review mission	August 2018
Post-mid-term follow up a mission by Global Task Force members	January 2019
Survey field operation/implementation completed	June 2019
Field operation/screening report forwarded to 99 clusters out of 99	August 2019
Entire detected TB cases enrollment follow up completed	September 2019
Data validation completed	October 2019
Data analysis completed	November 2019
The first report writes up workshop conducted (report drafted)	December 2019
Preliminary draft completed	December 2019
Final draft formation and completion	January 2020
Summary Report finalization and dissemination	March 2020
Main Report dissemination	December 2020

8.3.6: PS cluster-ID and sample size

Cluster number	District	Municipality	Hill/Mountain/Terai/ Kathmandu Valley	Strata	Sample Size
1	Dhankuta	Dhankuta municipality	H	U	600
2	Ilam	Ilam Municipality	H	U	600
3	Jhapa	Mechinagar municipality	T	U	600
4	Jhapa	Arjundhara Mjun	T	U	600
5	Jhapa	Jhapa Rm	T	R	600
6	Morang	Biratnagar sub-metropolitan city	T	U	600
7	Morang	Jahada RM	T	R	600
8	Morang	Sundarharaicha Mun	T	U	600
9	Morang	Gramthan RM	T	R	600
10	Morang	Kerabari Rm	T	R	530
11	Panchthar	Kumayakh RM	H	R	600
12	Saptari	Mahadecva RM	T	R	600
13	Saptari	Belhi Chapena RM	T	R	600
14	Sankhuwasabha	Khanbari Munucipality	M	U	550
15	Siraha	Mirchaiya M	T	U	600
16	Siraha	Siraha Mun	T	U	600
17	Solukhumbu	Solududhkund M	M	U	500
18	Sunsari	Dharam municipality	T	U	600
19	Sunsari	Itahari Upm	T	U	600
20	Sunsari	Itahari Upm	T	U	600
21	Terhathum	Phetap Rm	H	R	500
22	Udayapur	Katari Mun	H	U	600
23	Bara	Prasauni RM	T	R	600
24	Bara	Pheta RM	T	R	600
25	Bhaktapur	Suryavinayak Mun	K	U	600
26	Bhaktapur	Bhaktapur Municipality, 1 (Chyamashing)	K	U	600
27	Chitawan	Madhi Mun	T	U	600
28	Chitawan	Bharatapur Minicipality, 9	T	U	600
29	Chitawan	Madhi Mun	T	U	600
30	Dhading	Jwalamukhi RM	M	R	550
31	Dhading	Gangajamuna Rm	M	R	550
32	Dhanusha	Ganeshman Ch Mun	T	U	600
33	Dhanusha	Dhanusadhamm Mum	T	U	600
34	Kathmandu	Metropolitan City, 8 (Gaurighat)	K	U	600
35	Kathmandu	Metropolitan City, 4 (Dhumbarahi)	K	U	600
36	Kathmandu	Metropolitan City, 7 (Siphal)	K	U	600
37	Kathmandu	Metropolitan City,13 (Kalimati)	K	U	600
38	Kathmandu	Tarakeswor Mun	K	U	600
39	Kathmandu	Nagarjun Mun	K	U	600
40	Kavre	Chaurideurali Rm	H	R	500
41	Kavre	Namobuddha Mun	H	U	600
42	Lalitpur	Bagmati RM	K	R	600
43	Lalitpur	Lalitpur sub-metropolitan city,13	K	U	600
44	Mahottari	Jaleswor Mun	T	U	600
45	Mahottari	Balawa Mun	T	U	600
46	Mahottari	Bardibas Mun	T	U	600
47	Mahottari	Jaleswor Mun	T	U	530
48	Makwanpur	Kailash Rm	H	R	600
49	Nuwakot	Meghang RM	H	R	600

50	Parsa	Pokhariya Mun	T	U	600
51	Ramechhap	Ramechhap Mun	H	U	500
52	Rautahat	Durga Bhagwati RM	T	U	600
53	Rautahat	Gaur Municipality	T	U	600
54	Rautahat	Rajpur Mun	T	U	600
55	Sarlahi	Haripur Mun	T	U	600
56	Sarlahi	Lalbandhi Mun	T	U	600
57	Sindhupalchok	Balefi Rm	M	R	550
58	Arghakhanchi	Sitganga Mun	H	U	600
59	Baglung	Badhigadh Rm	H	R	600
60	Gulmi	Kalaigandi RM	H	R	500
61	Gulmi	ChandraKot RM	H	R	500
62	Gulmi	Resunga Mun	H	U	600
63	Gorkha	Palungtar Mun	M	U	550
64	Kaski	Annunapiurna RM	H	R	500
65	Kaski	Pokhara Submetropolitancity	H	U	600
66	Kapilbastu	Shivraj Mun	T	U	600
67	Kapilbastu	Yasodhar aRM	T	R	600
68	Myagdi	Raghuganga Rm	H	R	500
69	Nawalparasi	Devchuli Mun	T	U	600
70	Nawalparasi	Pratappur Rm	T	R	600
71	Palpa	Rambha RM	H	R	500
72	Rupandehi	Tilottama Mun	T	U	600
73	Rupandehi	Butawal Municipality	T	U	600
74	Rupandehi	Devdaha Mun	T	U	600
75	Rupandehi	Kotihamai RM	T	R	600
76	Syanja	Waling municipality	H	U	600
77	Tanahun	Myagdi RM	H	R	600
78	Baitadi	Shivnath Rm	H	R	600
79	Baitadi	Patan Mun	H	U	500
80	Baitadi	Dogdakedar RM	H	R	500
81	Bajhang	Jayaprithivi Mun	M	U	550
82	Banke	Janaki RM	T	R	600
83	Bardiya	Basgadhi mun	T	U	600
84	Bardiya	Barbardiya mun	T	U	600
85	Dadeldhura	Parsuram Mun	H	U	600
86	Dailekh	Thatikhandh RM	H	R	600
87	Dang	Tulshipur Mun	H	U	600
88	Dang	Shantinagar Rm	H	R	600
89	Doti	Dipayal Silgadhi municipality	H	U	600
90	Humla	Adanchuli Rm	M	R	500
91	Jajarkot	Junichadh RM	H	R	600
92	Kaiali	Dhangadi municipality	T	U	600
93	Kailali	Janaki RM	T	R	600
94	Kailali	Ghodaghodi Mun	T	U	600
95	Kalikot	Khanda Chakra Mun	M	U	550
96	Kanchanpur	Krishnapir Mun	T	U	600
97	Salyan	Kalimati Rm	H	R	600
98	Surkhet	Lekhbesi mun	H	U	600
99	Surkhet	Ghurvakot mun	H	U	500

8.3.7: Prevalence Survey Secretariat (PSS) and units under PSS

Prevalence Survey Secretariat (PSS)

PS Secretariat was an office established and stationed at NTCC throughout PS, and overall responsibility for the daily administration and operation of the PS. Under PSS, there were the following technical units, namely:

- Central Radiology Unit
- Central Laboratory Unit
- Central Database Management Unit
- Central Logistic Management Unit
- Central Training and Documentation Unit
- Central Liaison and Quality Assurance Unit
- Central Clinical Panel
- Central Panel for PS

Major Roles and Responsibilities:

This Secretariat was overall responsible to carry out the daily/regular activities for PS, especially at the central level. The major role of PPS was to oversee; support and quality assure the field activity being carried out by the outsourced agency. This Secretariat communicates with the working committee about any issues to be discussed and decided upon.

8.3.8: Different committees in the prevalence survey

Steering Committee (SC)

Chairperson:	Secretary, MoHP
Vice-Chair:	Director-General, DoHS
Member:	Chief Specialists, MoHP
Member:	Chairperson, NHRC
Member:	Director-General, CBS
Member:	Director, National Public Health Laboratory (NPHL)
Member:	Policy, Planning & Monitoring Division Chief, MoHP
Member:	Quality Measurement and Regulation Division Chief, MoHP
Member:	Health Coordination Division Chief, MoHP
Member:	Population Management Division Chief, MoHP
Member:	Administration Division Chief, MoHP
Member:	Director, SAARC TB & HIV/AIDS Centre (STAC)
Member:	Joint Secretary of Budget Division, MoF
Member:	WHO Representative to Nepal
Member:	Chief of Party, Save the Children, Global Fund Programs
Member:	Representative from National Planning Commission.
Member:	JICA Chief Representative to Nepal
Member:	Chairperson, NATA Central
Member Secretary:	Director, NTCC (Principal Investigator)

Key responsibility:

This steering committee was formed to give the highest level of direction and stewardship for the survey. Steering Committee was the epitome body for the survey and was responsible to oversee and guide the overall implementation of the prevalence survey in Nepal. All the key documents and processes were presented to this committee and were endorsed by the committee including the budget for the survey. Any key changes in the protocol and budget during the implementation process were also discussed, endorsed, and only brought into implementation.

Technical Advisory Committee (TAC)

Chairperson:	Director, NTCC
Members:	Representative from the National Public Health Laboratory (NPHL)
Members:	Former NTCC Directors-4
Members:	Research Section Chief- (IOM, NAMS, TU-Centre of Research and Development, KU, PAHS, BPKIHS) -1
Members:	RIT, Japan-3 (Epidemiology expert -1, Radiology expert- 1, Laboratory expert- 1)
Members:	Representative from WHO
Members:	Representative from JICA
Members:	Epidemiologist, SAARC TB HIV
Members:	Technical Representative -Save the Children
Members:	Representative from NHRC
Members:	Chief of Population Section, CBS-1
Members:	Representative from DTLO/A-1
Members:	Representative from Damien Foundation
Members:	Representative from Chest Physician's Association
Members:	Representative from Thoracic Society of Nepal
Members:	National Experts in Tuberculosis nominated by TAC
Members:	TWG members - TB
Members:	Representative form sub-recipients of GF TB Grant
Member Secretary:	Survey Coordinator (SC)

Key responsibility:

The committee was primarily responsible to support Working Committee for any technical issues related to the survey. Different experts from the committee were consulted rigorously while developing the protocol, especially sample design and methods to develop the best representative sample design for Nepal.

Working Committee (WC)

Chairperson:	Survey Coordinator (SC)
Member:	Chief, Administration Section, NTCC
Member:	Chief, Financial Administration Section, NTCC
Member:	Senior Consultant Chest Physician, NTCC
Member:	Consultant Chest Physician, NTCC
Member:	Chief, Lab Section of NTCC
Member:	Chief, Radiology Unit, NTCC
Member:	Section officer, Procurement Unit, NTCC
Member:	DR TB Medical Officer, NTCC
Member:	Technical Specialist, TB Program, Save The Children
Member:	TB Manager, Save The Children
Member:	Senior Finance Coordinator, Save The Children
Member:	M&E Specialist, TB Program, Save The Children
Member:	Liaison and Quality Assurance Coordinator, PSS
Member:	Training and Documentation Coordinator, PSS
Member:	PS Central Microbiologist, PSS
Member:	Database Management and IT Officer, PSS
Member:	National Consultant, TB Program, WHO
Member:	Radiographer, NTCC
Member:	Public Health Nurse Officer, NTCC
Member Secretary:	Statistical Officer, NTCC

Key responsibility:

This committee was responsible to develop all necessary (protocol and other supporting documents) for PS and carry out the overall implementation of the survey activity. The committee was also responsible for the supervision of the field and central level implementation of the survey.

Provincial/regional Coordination Committee*

Members:	
Chairperson:	Provincial /Regional Health Directorate
Member:	Regional/Zonal Hospital Medical Superintendent
Member:	Representative from provincial/Regional Administration Office
Member:	Public Health officer.
Member:	Statistical Officer of RHD
Member:	Provincial/Regional TB Partners (Maximum 5 organizations)
Member:	Provincial/Regional QC in charge
Member:	P/RTB Coordinators
Member:	Regional/Zonal Hospital Radiologist- 1
Member Secretary:	Regional TB/Leprosy Officer (RTLO)

Key responsibility:

The committee was mainly responsible for facilitation and coordination with local government authorities and to take ownership of the survey at the province level.

District/Municipal Coordination Committee*

Chairperson:	DHO/DPHO or Municipality Chief
Member:	Representative from District Administration Office
Member:	DEO or Representative
Member:	Rep. District Development Committee/Municipality
Member:	Chief of Branch statistical office
Member:	Rep. from District Police Office
Member:	Medical superintendent
Member:	Statistical officer/assistant
Members:	NATA representative
Members:	Red Cross representative
Member:	District TB Partners (minimum 2 organizations, 1 from each organization)
Member Secretary:	DTLO/Municipal Health Coordinator
Invitee Member:	Ward Chief – Elected Chief of wards or respective cluster
Invitee Member:	Health Facility Incharge – of the respective cluster

Key responsibility:

The committee was responsible to support in all activities, in planning Supervision, coordination, and facilitation among DCC/MCC members, HFOMC members, central working committees, and Outsourced agencies for their roles to implement and supervise the survey field operation.

Health Facility Operation Management Committee (HFOMC)

Chairperson:	Chief, HFOMC
Member:	HFOMC Chairperson if HF from different ward than the selected cluster
Member:	Representative from Local School situated in cluster ward
Member:	Representative from Local Police station
Member:	Representative from NGO's working in the cluster site (if any)
Member:	FCHVs
Member:	Other invitee members (maximum 3 persons) as per requirement
Member Secretary:	HF In-charge

Key responsibility:

The committee was responsible to support field-level planning, arrangement, facilitation, assuring protection, encouraging participation, and local support to the survey implementation at the community level.

- *Provincial and municipal coordination committees are formed after federal administrative structure declared by GON, and the coordination for PS implementation was channelized through these committees.*

8.3.9: Survey Team Training

S.N.	Training /Orientation	Number of days conducted	Number of events	Number of participants per event	Date	Total participants
	Training/orientation to government stakeholder					
1	DTLO/RTLO/RMS/RTC Training by central PS team	3	2	46	16th -21st Dec, 2017	92
2	District coordination committee orientation by DTLOs	1	45	10	January – May 2018	450
3	Municipal level orientation in pre-visit by central PS team and field team	1	99	10	Throughout the survey field implementation period (April 2018 to June 2019)	990
4	Health Facility Operation Management Committee orientation	1	99	5	Throughout the survey field implementation period (April 2018 to June 2019)	495
5	Regional Director orientation	1	1	7	28th Dec 2018	7
	Training to central PS team and field implementation team					
1	Central radiology unit	4	1	2	24th – 27th October 2017	2
2	Central radiology unit with medical officers and radiographer (MO-10, Radiographer-1, Radiologist-2)	5	1	13	25th to 29th December 2017	13
3	Central and radiographer (1) and training field radiographers training (6)	1	1	7	4th to 6th April 2018	7
4	Central laboratory training	2	3	3	31st January to 7th February 2018	9
5	Field team training (for the outsourced team)	4	1	60	4th January to 7th January 2018	60
6	Local staff orientation in field (5SM and 5 volunteer)	1	99	10	Throughout the survey field implementation period (April 2018 to June 2019)	990
					TOTAL	3115
	Second round training orientation (post pilot)					
7	Field team re-orientation/post pilot	1	1	60	24th February 2018.	
8	Medical officer's (x-ray reading training), post pilot	4	2	5	25th – 28th Feb 2018 2nd – 5th March 2018	
	Third round refresher training/ orientation (after mid-term review)					
9	Field team orientation/training	2	1	60	7th to 8th August 2018	

8.3.10: Prevalence survey human resources

	Number	Time contribution for PS	Organizations and Involvement	Duration
Principal Investigator	1	60%	NTCC, Director	From Inception to Final Report Dissemination
Survey Coordinator	1	Full time	NTCC	
Prevalence Survey Officer	1	Full time	NTCC	
Senior Lab Technologist	1	25 % - 30 %	NTCC	
National Consultant-TB	1	80%	WHO	
DR TB Medical Officer	1	30%	NTCC/ Damian Foundation	
TB Technical Specialist	1	20 %	Save The Children	
M&E Specialist		20%	at NTCC (recruited from Save The Children	
Finance Manager	1	20%	at NTCC (recruited from Save The Children)	
Radiographer	1	25 % - 30 %	NTCC	Till completion of all field operation
Liaison and Quality Assurance Coordinator	1	Full time	at NTCC (recruited from Save The Children)	Till Dissemination of final Report
Training and Documentation Coordinator	1	Full time	at NTCC (recruited from Save The Children)	
Microbiologist	1	Full time	at NTCC (recruited from Save The Children)	
Radiologist	1	Full time	at NTCC (recruited from Save The Children)	
Database management and IT Officer	1	Full time	at NTCC (recruited from Save The Children)	
Secretary	1	Full time	at NTCC (recruited from Save The Children)	
Driver	1	Full time	at NTCC (recruited from Save The Children)	
Supporting Staff	1	Full time	at NTCC (recruited from Save The Children)	
Logistic Officer	1	Full time	at NTCC (recruited from Save The Children)	Till Hand over of all logistic of PS by OSA and other central labs. (estimated 2 months after lab handover)
Finance Assistant	1	Full time	at NTCC (recruited from Save The Children)	
Liaison and Quality Assurance Officers	3	Full time	at NTCC (recruited from Save The Children)	Till 2 months after completion of field operation
Total	23			

8.3.11 At NTCC (responsible for overall PS)

At Outsource agency (INTREPID / JANTRA) (responsible for carrying field data collection activity)

Central staff of outsource agency	Number	Time contribution for PS	Duration (In Months)
Survey Manager	1	Full time	Till completion of field cluster operation and complete handover
Survey Manager Co-lead	1	Full time	
Field Survey Coordinator	1	Full time	
Central IT/Data Officer	1	Full time	20
Central Logistical Officer	1	Full time	21
Central Finance Officer	1	Full time	23
Survey Officer	1	Full time	23
Secretary/communication Assistant	1	Full time	23
Supporting staff	2	Full time	23
Total Staff (central level outsource agency)	10		

Field staffs of outsource agency	Number per team	Total Number	Time contribution for PS	Duration (In Months)
Field Survey Manager	1	3	Full Time	20
Medical Officer (Primary x-ray reader)	1	3	Full Time	20
Medical Officer for final interpretation and QC	1	3	Full Time	20
Health staff (HA/Nurse)	3	9	Full Time	20
Lab Technicians	2	6	Full Time	20
Radiographer	2	6	Full Time	20
Field IT officer	2	6	Full Time	20
Mop up officer	1	3	Full Time	20
Security guard	2	6	Full Time	20
Logistics Management officer	1	3	Full Time	20
Maintenance Assistant	1	3	Full Time	20
Receptionist	1	3	Full Time	20
Supporting staff	2	6	Full Time	20
Total (Fixed Staff)	20	60	Full Time	20
Local field staff	13	39	Full Time	20
Total Staff	33	99		

8.3.12: List of contributors

Central committee members name list				
			Central Radiology Unit	
Steering Committee (SC)			Dr. Ishwar Prajapati	Radiologist, PMU-NTCC/SCI
Mr. Khaga Raj Baral	Secretary, MoHP		Mr. Mukesh Kumar Micklum	Radiography Inspector, NTCC
Dr. Roshan Pokharel	Director General, DoHS, MoHP,			
Dr. Anjani Kumar Jha	Chairperson, NHRC		**Central Laboratories**	
Mr. Nebin Lal Shrestha	Director-General, CBS		**NTCC Lab**	
Dr. Runa Jha	Director, National Public Health Laboratory (NPHL)		Mr. Gokarna Raj Ghimire	Senior Medical Lab Technologist, NTCC
Dr. Bikash Devkota	Policy, Planning & Monitoring Division Chief, MoHP		Ms. Meera Hada	Medical Lab Technologist, NTCC
Dr. Dipendra Raman Singh	Quality Measurement and Regulation Division Chief, MoHP		Mr. Ram Babu Shrestha	Laboratory Technicians, NTCC
Mr. Mahendra Prasad Shrestha	Health Coordination Division Chief, MoHP		Mr. Krishna Adhikari	Laboratory Technicians, NTCC
Mr. Nebin Lal Shrestha	Director-General, Central Bureau of Statistics		Mr. Shanta Ram Rajaura	Laboratory Assistant, NTCC
Mr. Shiva Ram Neupane	Administration Division Chief, MoHP		Mr. Bikash Lama	Laboratory Attendant, NTCC
Dr. Ramesh Kumar Kharel	Director, SAARC TB & HIV/AIDS Centre (STAC)		Ayesha Ansari	Microbiologist
Representative	Joint Secretary of Budget Division, MoF		Birendra Kumar Yadav	Laboratory Technologist
Dr. Jos Vandelar	WHO Representative to Nepal		Rakesh Yadav	Microbiologist
Ms. Tara Chettry	Chief of Party, Save the Children, Global Fund Programs		Kanchan Gautam	Medical Technologist
Representative	Representative from National Planning Commission		Sujana Neupane	Medical Technologist
Mr. Devendra Pradhan	Chairperson, NATA Central		Bimala Shrestha	Laboratory Technician
Dr. Sagar Kumar Rajbhandari	Director, NTCC, Member Secretary SC		Samjhana Phunyal	Laboratory Technician
			Nirmala Fainju	Lab boy
			Gautam Deula	Cleaner
Technical Advisory Committee (TAC)			Ram Saran Dhital	Support staff
Dr Sagar Kumar Rajbhandari	Director, NTCC (Chairperson)		Pushpa Singh	Laboratory Assistant
Dr. Runa Jha	Representative from National Public Health Laboratory (NPHL)			
Dr. Rajendra Panta	Former NTCC Director			
Dr. Bikash Lamichhane	Former NTCC Director		**GENETUP/NATA**	
Dr Bhim Singh Tinkari	Former NTCC Director		Bhagwan Maharjan	Microbiologist
Dr. Kedar Narshing K.C	Former NTCC Director		Bijendra Bhakta Raya	Medical Technologist
Dr. Sharat Chandra Barma	Former NTCC Director		Meera Shrestha	Lab Technician
Dr. Norio Yamada	Technical Advisor for NTPS, RIT/JATA,		Shova Maharjan	Lab Technician
Dr. K Ito	Radiology expert RIT/JATA		Priya Khadka	Lab Technician
Ms. Hiroko Matsumoto	Laboratory expert RIT/JATA			
Dr. Lungten Z. Wangchuk	Representative from WHO		**International Organization for Migration (Damak Lab)**	
Members	Epidemiologist, SAARC TB HIV		Mr. Ram Datt Bhatt	Laboratory Services Coordinator
Dr Suvesh Kumar Shrestha	Technical Representative -Save the Children		Mr. Subodh Kumar Lal Das	Laboratory Technologist
Dr. Anjani Kumar Jha	Representative from NHRC		Mr. Ram Lal Mahartara	Laboratory Technician
Mr. Nebin Lal Shrestha	Chief of Population Section, CBS		Mr. Rajendra Pokharel	Senior. Lab Assistant
Mr. Chitrajung Shahi	Representative from DTLO		Mr. Dipak Niroula	Laboratory Assistant
Dr Pramod Raj Bhattarai	Representative from Damien Foundation		Mr. Shanta Dahal	Laboratory Assistant
Dr. Pushpa Malla	Representative from Chest Physician's Association		Mr. Santosh Dahal	Lab Admin Assistant
Mr. Ram Sharan Gopali	Representative form sub-recipients of GF TB Grant			
Dr Shard Kumar Sharma	Survey Coordinator (SC) (Member Secretary)			

Working Committee (WC)			**Central Database Management Unit**	
Dr. Sharad Kumar Sharma	Survey Coordinator (SC) (Chairperson)		Mr. Avay Raj Shrestha	Data Management and IT Officer, PMU-NTCC/SCI
Dr. Naveen Prakash Shah	Senior Consultant Chest Physician, NTCC		**Central Logistic Management Unit**	
Mr. Bhanu Bhakta Neupane	Chief, Administration and Finance Section, NTCC		Mr. Badri Koirala	Administration and Finance Section, NTCC
Mr. Abdhesh Shah	Account Officer, Administration, and Finance Section, NTCC		Ms. Sushma Thapa	Logistic Officer, NTCC/PMU-NTCC/SCI
Mr. Gokarna Raj Ghimire	Laboratory Unit, Medical Lab Technologist, NTCC			
Mr. Mukesh Kumar Micklum	Radiography Inspector, Radiological Unit, NTCC		**Central Training and Documentation Unit**	
Mr. Dev Raj Bhandari	Section officer, NTCC		Mr. Rameshwor Adhikari	Training and Document Coordinators, PMU-NTCC/SCI
Dr. Pramod Raj Bhattrai	DR TB Medical Officer, NTCC			
Dr. Suvesh Kumar Shrestha	Senior Technical Specialist, TB Program, Save The Children		**Central Liaison and Quality Assurance Unit (LQAS unit)**	
Mr. Rajendra Basnet	TB Manager, PMU-NTCC/SCI		Mr. Som Kumar Shrestha	LQAS Coordinator, PMU-NTCC/SCI
Mr. Rajesh Pokhrel	Senior Finance Coordinator, PMU-NTCC/SCI		Mr. Sanjay Shrestha	LQAS Officer, PMU-NTCC/SCI
Mr. Ratna Bahadur Bhattrai	M&E Specialist, TB Program, PMU-NTCC/SCI		Ms.Saraswoti Giri	LQAS Officer, PMU-NTCC/SCI
Mr. Rameswor Adhikari	Training and Documentation Coordinator, PMU-NTCC/SCI		Ms. Khusbu Jha	LQAS Officer, PMU-NTCC/SCI
Mr. Som Kumar Shrestha	Liaison and Quality Assurance Coordinator, PMU-NTCC/SCI		Ms. Pritika Khatri	LQAS Officer, PMU-NTCC/SCI
Ms. Priya Jha	PS Central Microbiologist, PMU-NTCC/SCI		Ms. Sandhya Shrestha	Intern LQAS unit, PMU-NTCC/SCI
Mr. Avay Raj Shrestha	Database Management and IT Officer, PMU-NTCC/SCI		**Central Clinical and Case Management Unit**	
Dr. Ashish Shrestha	National Professional Officer-TB, CDS Unit, WHO CO Nepal		Dr. Naveen Prakash Shah	Senior Consultant Chest Physician, NTCC
Dr. Ishwar Prajapati	Radiologist, PMU-NTCC/SCI		Dr. Ishwar Prajapati	Radiologist, Save The Children
Mr. Gokul Mishra	Focal Person to Nepal, LHLI		Dr Pramod Raj Bhattarai	DR TB Medical Officer, Damien Foundation
Mr. Pushpa Raj Joshi	Statistical Officer, NTCC Central Training and Documentation Unit (member secretary)		Mr. Mukesh Kumar Micklum	Chief Radiology unit, NTCC
			Central Laboratory Unit	
International Experts in Prevalence Survey			Ms. Pirya Jha	Microbiologist, PMU-NTCC/SCI
Dr. Norio Yamada	PS technical advisor/ Epidemiologist, RIT/ JATA			
Dr. K Ito	Radiologist, RIT / JATA		**PMU-NTCC/SCI office and support staff**	
Dr. Hiroko Matsumoto	Laboratory expert RIT/JATA		Ms. Janaki Chhetri	Office Secretary
Dr. T. Yoshiyama	Chest Physician RIT/JATA		Mr. Megh Raj Shrestha	Support staff
Dr. Yohhei Hamada	RIT/JATA		Mr. Niranjan Shrestha	Driver
Y. Hoshino	RIT/JATA			
Fasil Kasa Tsegaye	SCI/Global Fund			
PS Mid Term Review Team				
Dr. Bintari Dwihardiani	PS program expert, WHO consultant			
Dr. Peou Satha	PS Radiology expert, WHO consultant			
Dr. Julia Ershova	Data Management expert, US CDC			

PS Post Mid Term Follow Up Review Mission by Global Task Force		Past Contributors	
Dr. Ikushi Onozaki	Global Expert of prevalence survey, WHO Myanmar country office	Mr. Santa Bahadur Shrestha	Past Secretary, MoHP
Dr. Marina Tadolini	WHO HQ	Dr. Sinendra Raj Upreti,	Past Secretary, MoHP
		Dr. Kiran Regmi, Past Secretary	Past Secretary, MoHP
Data Validation Mission		Dr. Pushpa Chaudhari	Past Secretary, MoHP
Dr. Sayori Kobayashi	WHO HQ	Dr. Sushil Nath Pyakhurel,	Past Acting Secretary, MoHP
		Dr. Rajendra Pant	Past NTCC Director
Prevalence Survey Report Writing Team		Dr. Bikhash Lamichhane,	Past NTCC Director
Dr. Anuj Bhattachan	Principal Investigator and Director of NTCC	Dr. Sharat Chandra Verma	Past NTCC Director
Dr. Sharad Kumar Sharma	Survey Coordinator, NTCC	Dr. Kedar Narsing K.C	Past NTCC Director
Dr. Naveen Prakash Shah	Senior Consultant Chest Physician, NTCC	Dr. Bhim Singh Tinkari	Past NTCC Director
Mr. Anil Thapa	Under Secretary- Statistics (Former Survey Coordinator)	Dr. Sagar Rajbhandari	Past NTCC Director
Mr. Pushpa Raj Joshi	Statistics Officer, NTCC	Mr. Sagar Ghimire	Past Survey Coordinator for PS
Mrs. Basundhara Sharma	Senior Public Health Officer	Mr. Anil Thapa	Past Survey Coordinator for PS
Mr.Gokarna Ghimire	Senior Medical Lab Technologist, NTCC		
Ms. Meera Hada	Medical Lab Technologist, NTCC	Dr. Mohan Kumar Prasai	Former Senior Consultant Chest Physician
Mr. Mukesh Kumar Micklum	Radiography Inspector, NTCC	Mr. Badri Nath Janawali	Former PME chief, NTCC
Dr. Lungten Z. Wangchuk	Team Lead – CDS Unit, WHO CO Nepal	Mr. Arun Gautam	Former PME chief, NTCC
Dr. Ashish Shrestha	National Professional Officer-TB, CDS Unit, WHO CO Nepal	Mr. Bimal Yadav	Former Stat officer, NTCC
Dr. Martina Bintari, Dwihardiani,	WHO Consultant	Dr. Ashish Shrestha	Past Assistant Survey Coordinator for PS
Dr. Norio Yamada	PS Technical Advisor, Epidemiologist, RIT/JATA	Ms. Pushpa Chettri	Former Public Health Nurse, NTCC
Dr. Ishwar Prajapati	Radiologist, PMU-NTCC/SCI	Mr. Ram Chandra Khanal	Past LQAS Coordinator, PMU-NTCC/SCI
Mr. Rajendra Basnet	Senior Programme Manager-TB, PMU-NTCC/SCI	Late Mr. Rishi Ram Parajuli	Past Training Coordinator, PMU-NTCC/SCI
Dr. Suvesh Kumar Shrestha	Senior Technical Specialist-TB, SCI		
Mr. Ratna Bahadur Bhattarai	M& E Specialist, PMU-NTCC/SCI		
Mr. Rajesh Pokhrel	Finance Manager, PMU-NTCC/SCI		
Mr. Rameshwor Adhikari	Training And Documentation Coordinator, PMU-NTCC/SCI		
Ms. Priya Jha	Medical Microbiologist, PMU-NTCC/SCI		
Mr. Avay Raj Shrestha	Data Management and IT Officer, PMU-NTCC/SCI		
Mr. Gokul Mishra	Liaison Officer at NTCC, Liverpool School Of Tropical Medicine		
Dr. Pramod Raj Bhattarai	DRTB Medical Officer, Damien Foundation Nepal		
Mr. Ram Sharan Gopali	Survey Manager- Intrepid Nepal / JANTRA		
Mr. Rajesh Man Rajbhandari	Assistant Survey Manager- Intrepid Nepal / JANTRA		

Members from the out-sourced agency (INTREPID Nepal and JANTRA) for field operation		**Field Teams (Continue)**	
I. Central Team		Anupa Dhakal	Staff Nurse
Ram Sharan Gopali	Survey Manager	Enjila Rai	Staff Nurse
Rajesh Man Rajbhandari	Assist. Survey Manager	Akritee Rai	Staff Nurse
Bishow Parakram Shrestha	Field Coordinator	Jina Thapa	Staff Nurse
Dhirendra Shahi	Field Manager	Pratikshya Poudel	Staff Nurse
Nisha Shrestha	Documentation Officer	Nabina Lamichhane	Staff Nurse
Pranita Maharjan	Finance Officer	Binod Basnet	Lab Tech
Shruti Dhungana	Logistic Officer	Karishma Sapkota	Lab Tech
Bhubesh Shahi	Admin Assistant	Renuka Magar	Lab Tech
Durga Tamang	Admin Assistant	Sujan deshmaru	Lab Tech
Durga Karki	Support Staff	Sunita Dhaubanjar	Lab Tech
		Kishowre Kharel	Lab Tech
II. Field Team		Meena Chand	Receptionist
Dr.Bigyan KC	Medical Officer	Anita Bhatta	Receptionist
Dr.Bikash Rauniyar	Medical Officer	Hema puri	Receptionist
Dr.Dharti Joshi	Medical Officer	Sibila Subedi	Receptionist
Dr.Menu Aacharya	Medical Officer	Swikrity Subedi	Receptionist
Dr.Parishit Bikram Singh	Medical Officer	Sanjay Naupane	Electrician
Dr.Rajendera Bikram Kahadka	Medical Officer	Mahesh Satyal Chhetri	Electrician
Dr.Samita Adhikari	Medical Officer	Arun Kumar Chaudhary	Electrician
Dr.Samjana Phuyal	Medical Officer	Purushottam Chaudhary	Electrician
Dr.Santosh Sah	Medical Officer	Rahul Kumar Uranw	IT Officer
Dr.Satish Kumar Ray	Medical Officer	Ashutosh Dhoj Joshi	IT Officer
Kamal Timsina	Field Manager	Bipin Maharjan	IT Officer
Kul Prasad Rai	Field Manager	Sajendra Maharjan	IT Officer
Ganga Dutta Paneru	Field Manager	Pranish Maharjan	IT Officer
Govinda Marasani	Assist FM/Logistic	Nikesh Maharjan	IT Officer
Keshav Pandey	Assist FM/Logistic	Sagar Nakarmai	IT Officer
Navraj Bhatta	Logistic Officer	Bhes Raj Pandey	Support staff
Lokendra Khatri	Logistic Officer	Bhirka Bdr Mijar	Support staff
Manoj Kathet	Assist FM/Logistic	Pratik Lamsal	Support staff
Bhawani Dutta Bhatta	Logistic Officer	Keshav Pant	Support staff
Mukesh Yadav	Radiographer	Yadav Aacharya	Support staff
Satish Bhattarai	Radiographer	Rakesh Saud	Support staff
Srijana Suwal	Radiographer	Bishnu Thapa	Support staff
Tara Magar	Radiographer	Anish Kulung	Support Staff
Amrit Karki	Radiographer	Santosh Rai	Security Guard
Kabita Lama	Radiographer	Bishworaj Lamsal	Security Guard
Anjan Bogati	Health Assistant	Shree Bdr Khatri	Security Guard
Krishna Dev Mehta	Health Assistant	Ram Chandra Raut	Security Guard
Rupak Wagle	Health Assistant	Binod Shahi	Security Guard
Sudeep Poudel	Health Assistant	Mahendra Thapa Magar	Security Guard
Ismita Karki	Staff Nurse	Sujan Majhi	Driver
Lekha Pandey	Staff Nurse	Ramesh Pradhan	Driver

8.3.13: PS Case Book

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
1	1	2	0	2.2.2	Active	1	0	1	1
2	NA	2	1	2.2.2	Active	0	0	0	1
3	NA	2	0	2.2.3	Active	0	0	0	1
4	NA	1	0	2.2.2	Active	0	0	0	1
5	1	2	0	2.2.1	Active	0	0	0	1
6	1	2	0	2.2.3	Active	1	0	1	1
7	NA	2	0	2.2.2	Active	0	0	0	1
8	NA	1	0	2.2.2	Active	0	0	0	1
9	0	1	0	2.2.2	Active	0	0	0	1
10	NA	2	0	2.2.1	Active	0	0	0	1
11	NA	2	0	2.2.1	Active	0	0	0	1
12	1	1	1	2.2.1	Active	0	0	0	1
13	1	1	0	2.2.2	Active	0	0	0	1
14	0	2	1	2.2.3	Active	0	0	0	1
15	NA	2	0	2.2.2	Active	0	0	0	1
16	1	1	0	4.2	Healed	0	0	0	1
17	0	1	0	2.2.2	Active	0	0	0	1
18	0	1	0	2.2.1	Active	0	0	0	1
19	NA	2	0	2.2.2	Active	0	0	0	1
20	0	2	0	2.2.2	Active	0	0	0	1
21	NA	2	0	2.2.2	Active	0	0	0	1
22	0	2	0	2.2.2	Active	1	0	1	1
23	1	2	0	2.1	Active	0	0	0	1
24	0	2	0	mixed	mixed	0	0	0	1
25	0	2	0	2.2.3	Active	0	0	0	1
26	NA	1	1	2.2.2	Active	0	0	0	1
27	NA	1	0	2.2.2	Active	0	0	0	1
28	1	2	0	2.1	Active	0	0	0	1
29	NA	1	0	2.2.2	Active	0	0	0	1
30	1	2	0	2.2.3	Active	0	0	0	1
31	NA	1	0	2.2.1	Active	0	0	0	1
32	0	1	0	2.2.2	Active	1	0	1	1
33	1	2	1	2.1	Active	0	0	0	1
34	NA	1	0	mixed	mixed	0	0	0	1
35	NA	2	0	2.2.3	Active	0	0	0	1
36	NA	2	0	2.1	Active	0	0	0	1
37	0	2	1	2.2.2	Active	0	0	0	1
38	1	2	0	2.2.1	Active	0	0	0	1

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
39	NA	1	0	2.2.1	Active	0	0	0	1
40	NA	1	1	2.2.2	Active	0	0	0	1
41	1	2	0	2.2.2	Active	0	0	0	1
42	1	1	0	2.1	Active	0	0	0	1
43	NA	2	0	2.2.2	Active	1	0	1	1
44	NA	1	1	2.2.2	Active	0	0	0	1
45	1	2	0	2.2.2	Active	0	0	0	1
46	1	2	1	2.2.2	Active	1	0	1	1
47	1	1	1	2.2.2	Active	0	0	0	1
48	0	2	0	2.2.2	Active	0	0	0	1
49	NA	2	0	2.2.2	Active	0	0	0	1
50	NA	1	0	2.2.2	Active	1	0	1	1
51	NA	2	1	2.2.2	Active	0	0	0	1
52	1	1	0	2.2.2	Active	1	0	1	1
53	0	1	0	2.2.2	Active	0	0	0	1
54	0	2	1	2.2.1	Active	0	0	0	1
55	NA	2	0	2.2.2	Active	0	0	0	1
56	NA	2	1	2.2.3	Active	0	0	0	1
57	NA	1	0	mixed	mixed	0	0	0	1
58	NA	1	0	mixed	mixed	0	0	0	1
59	1	2	0	2.1	Active	0	0	0	1
60	NA	1	0	mixed	mixed	0	0	0	1
61	0	1	0	2.2.2	Active	1	0	1	1
62	0	1	0	2.2.3	Active	1	0	1	1
63	0	1	0	2.2.2	Active	0	0	0	1
64	1	2	0	2.1	Active	1	1	0	1
65	1	2	0	mixed	mixed	0	0	0	1
66	NA	2	0	2.2.1	Active	0	0	0	1
67	0	2	1	2.1	Active	0	0	0	1
68	0	2	0	2.2.1	Active	0	0	0	1
69	NA	1	1	2.2.2	Active	0	0	0	1
70	0	1	0	3.2	Active	0	0	0	1
71	NA	2	0	mixed	mixed	0	0	0	1
72	NA	2	1	2.2.2	Active	0	0	0	1
73	1	1	0	4.2	Healed	0	0	0	1
74	NA	2	0	2.2.1	Active	0	0	0	1
75	0	2	1	mixed	mixed	0	0	0	1
76	1	2	0	mixed	mixed	0	0	0	1
77	0	1	0	2.2.2	Active	1	0	1	1

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
78	0	2	1	2.2.2	Active	1	0	1	1
79	0	1	1	2.2.2	Active	0	0	0	1
80	0	1	0	2.2.2	Active	0	0	0	1
81	1	2	1	mixed	mixed	1	0	1	1
82	0	2	0	2.2.3	Active	0	0	0	1
83	NA	2	0	mixed	mixed	0	0	0	1
84	NA	2	0	2.2.2	Active	0	0	0	1
85	0	1	0	mixed	mixed	0	0	0	1
86	1	1	0	4.2	Healed	0	0	0	1
87	1	1	0	2.1	Active	0	0	0	1
88	NA	2	1	2.1	Active	0	0	0	1
89	NA	2	0	2.2.3	Active	0	0	0	1
90	NA	2	0	2.2.3	Active	0	0	0	1
91	1	2	1	Exempted	Exempted	1	1	0	1
92	NA	2	0	2.2.2	Active	0	0	0	1
93	0	1	0	2.2.2	Active	0	0	0	1
94	1	1	0	2.2.1	Active	0	0	0	1
95	NA	2	1	2.1	Active	0	0	0	1
96	NA	1	0	2.2.1	Active	0	0	0	1
97	0	1	1	2.2.1	Active	0	0	0	1
98	0	2	0	2.2.2	Active	0	0	0	1
99	1	1	0	2.2.1	Active	0	0	0	1
100	0	1	1	2.2.2	Active	0	0	0	1
101	0	1	0	2.2.2	Active	0	0	0	1
102	0	2	0	2.2.2	Active	0	0	0	1
103	1	2	0	2.2.2	Active	0	0	0	1
104	1	1	0	2.2.2	Active	0	0	0	1
105	1	2	1	2.2.2	Active	0	0	0	1
106	NA	2	1	2.2.3	Active	0	0	0	1
107	1	2	0	2.2.2	Active	0	0	0	1
108	NA	2	0	2.2.2	Active	0	0	0	1
109	0	1	0	2.2.2	Active	1	0	1	1
110	1	1	0	2.2.2	Active	0	0	0	1
111	0	1	0	2.2.1	Active	0	0	0	1
112	NA	2	0	2.2.2	Active	0	0	0	1
113	1	2	0	2.2.2	Active	0	0	0	1
114	NA	1	0	2.2.1	Active	0	0	0	1

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
115	0	2	1	mixed	mixed	0	0	0	1
116	0	1	0	2.2.1	Active	0	0	0	1
117	0	1	0	2.2.1	Active	0	0	0	1
118	0	1	0	2.2.2	Active	0	0	0	1
119	0	1	0	2.2.1	Active	1	0	1	1
120	0	1	0	mixed	mixed	0	0	0	1
121	0	2	0	2.2.2	Active	1	0	1	1
122	1	2	0	2.2.2	Active	0	0	0	1
123	NA	1	0	2.2.2	Active	0	0	0	1
124	1	1	0	2.2.2	Active	0	0	0	1
125	NA	1	0	2.2.2	Active	0	0	0	1
126	1	1	0	2.2.2	Active	1	0	1	1
127	NA	2	1	2.1	Active	0	0	0	1
128	0	1	0	mixed	mixed	0	0	0	1
129	0	2	0	2.1	Active	0	0	0	1
130	1	2	0	2.2.2	Active	0	0	0	1
131	1	1	0	2.2.1	Active	0	0	0	1
132	1	2	0	Exempted	Exempted	1	1	0	1
133	1	2	0	2.2.2	Active	0	0	0	1
134	0	1	1	2.2.2	Active	1	0	1	1
135	1	2	0	mixed	mixed	0	0	0	1
136	1	2	0	4.2	Healed	0	0	0	1
137	1	2	1	2.2.2	Active	0	0	0	1
138	1	2	0	2.2.2	Active	0	0	0	1
139	NA	2	0	2.1	Active	0	0	0	1
140	0	2	0	mixed	mixed	0	0	0	1
141	NA	2	0	2.2.1	Active	0	0	0	1
142	0	1	0	2.2.1	Active	1	0	1	1
143	0	1	0	2.2.2	Active	0	0	0	1
144	0	2	0	2.1	Active	0	0	0	1
145	0	2	1	2.2.1	Active	0	0	0	1
146	NA	1	0	2.2.2	Active	0	0	0	1
147	0	1	1	2.1	Active	0	0	0	1
148	0	2	0	2.2.2	Active	0	0	0	1
149	NA	1	0	2.2.2	Active	0	0	0	1
150	0	2	0	2.2.2	Active	0	0	0	1
151	NA	1	0	2.2.2	Active	0	0	0	1
152	1	2	0	2.2.3	Active	0	0	0	1
153	0	1	0	2.2.2	Active	0	0	0	1

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
154	0	1	0	2.2.2	Active	1	0	1	1
155	1	2	0	2.2.2	Active	0	0	0	1
156	NA	1	0	2.2.2	Active	0	0	0	1
157	NA	2	0	2.2.2	Active	0	0	0	1
158	NA	2	0	2.2.2	Active	0	0	0	1
159	0	2	0	2.2.1	Active	1	0	1	1
160	NA	2	1	2.2.3	Active	0	0	0	1
161	0	2	0	2.2.2	Active	1	0	1	1
162	0	2	1	2.2.2	Active	1	0	1	1
163	1	1	0	2.2.2	Active	0	0	0	1
164	NA	1	0	2.2.1	Active	0	0	0	1
165	1	2	1	2.2.2	Active	0	0	0	1
166	NA	2	0	2.2.2	Active	0	0	0	1
167	NA	1	0	2.2.2	Active	0	0	0	1
168	0	1	0	2.2.2	Active	0	0	0	1
169	1	2	0	2.1	Active	0	0	0	1
170	NA	1	0	mixed	mixed	0	0	0	1
171	0	2	0	2.2.2	Active	0	0	0	1
172	0	1	0	2.2.2	Active	0	0	0	1
173	NA	1	0	mixed	mixed	0	0	0	1
174	NA	2	0	2.2.2	Active	0	0	0	1
175	0	1	0	2.2.2	Active	1	0	1	1
176	1	2	0	5.2	Other Abnormality in the lung	0	0	0	1
177	0	2	0	2.2.2	Active	1	0	1	1
178	0	2	0	2.1	Active	1	0	1	1
179	0	2	1	2.2.2	Active	0	0	0	1
180	NA	2	0	2.2.2	Active	0	0	0	1
181	0	2	0	2.1	Active	0	0	0	1
182	0	2	0	2.1	Active	1	0	1	1
183	NA	1	0	2.1	Active	0	0	0	1
184	1	2	1	5.2	Other Abnormality in the lung	0	0	0	1
185	0	1	0	2.2.1	Active	0	0	0	1
186	0	1	0	2.2.2	Active	0	0	0	1
187	NA	2	0	2.1	Active	0	0	0	1
188	NA	2	0	2.2.2	Active	0	0	0	1
189	NA	2	0	2.2.1	Active	0	0	0	1
190	NA	1	0	mixed	mixed	0	0	0	1

Participant' SN	Culture Result	No. of GeneXpert positive	Cough >=14 days	panel CXR	X-ray reading	TREATMENT HISTORY STATUS	Current treatment status	Past treatment_ status	Case (1= yes, 0- No)
191	1	2	0	mixed	mixed	0	0	0	1
192	1	1	1	4.2	Healed	0	0	0	1
193	0	1	0	2.2.2	Active	1	0	1	1
194	NA	2	0	2.2.2	Active	0	0	0	1
195	0	2	0	2.2.2	Active	0	0	0	1
196	0	2	1	2.2.2	Active	0	0	0	1
197	NA	2	0	2.2.2	Active	0	0	0	1
198	NA	2	1	2.1	Active	0	0	0	1
199	1	1	0	4.2	Healed	0	0	0	1
200	NA	1	0	2.2.2	Active	0	0	0	1
201	0	1	0	2.2.2	Active	0	0	0	1
202	0	2	0	mixed	mixed	0	0	0	1
203	NA	2	0	2.2.2	Active	0	0	0	1
204	1	2	0	4.2	Healed	1	0	1	1
205	0	1	1	2.2.2	Active	0	0	0	1
206	1	2	0	2.1	Active	0	0	0	1
207	1	1	0	5.2	Other Abnormality in the lung	0	0	0	1
208	NA	2	1	2.2.3	Active	0	0	0	1
209	0	2	0	2.2.2	Active	1	0	1	1
210	0	1	0	2.2.2	Active	1	0	1	1
211	1	1	1	5.2	Other Abnormality in the lung	0	0	0	1
212	NA	2	0	2.2.3	Active	0	0	0	1
213	NA	1	0	2.2.1	Active	0	0	0	1
214	0	2	1	2.2.2	Active	0	0	0	1
215	NA	2	0	2.2.1	Active	0	0	0	1
216	NA	1	0	2.2.2	Active	0	0	0	1
217	NA	2	0	2.2.2	Active	0	0	0	1
218	NA	2	0	2.2.1	Active	0	0	0	1
219	NA	2	1	2.1	Active	0	0	0	1
220	0	1	1	2.2.3	Active	0	0	0	1
221	0	1	0	2.1	Active	0	0	0	1
222	1	1	0	mixed	mixed	0	0	0	1
223	0	1	0	2.2.1	Active	0	0	0	1
224	1	2	0	2.2.2	Active	0	0	0	1
225	1	2	0	2.1	Active	0	0	0	1

8.3.14 Survey cluster summary

Cluster number	Strata	Enumerated	Eligibility								Participation								TB Treatment History (Onsite participant)						Symptoms (Among On-site participant)				Chest X-ray screening (Among On-site Participant)				Eligible for Sputum										Sputum Collected						Lab results available				TB Case - Total
			Eligible						Non-eligible		Participant				Non-participant		Participation rate (%)		No treatment history		Under current Treatment		Previously treated		Cough for two weeks or more		Cough <2 week with at-least 1 other TB symptom		Chest X-ray done		Chest X-ray not done		For Xpert				For Culture		Xpert				Culture		At least 1 Xpert		Culture		
			Total		On-site		Off-site				Total		On-site		Off-site																		Onsite						Only 1 Sample (Xpert)		Both Samples (Xpert)		At-least 1 Sample (Xpert)		Sample for culture						
																																	Eligible (By Symptom only)		Eligible (By X-ray only)		Eligible (By Both Symptom and X-ray)		Total Eligible (onsite and offsite)		Total Eligible (onsite and offsite)															
		n	n	%	n	%	n	%	n	%	n		n	%	n	%	%		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
1	hilly urban	832	611	73.4	606	99.2	5	0.8	221	26.6	552	547	90.3	5	100.0	59	9.7	90.3	539	97.6	0	0.0	13	2.4	5	0.9	4	0.7	542	99.1	5	0.9	0	86	9	105	19.0	60	10.9	7	6.7	99	94.3	105	100.0	56	93.3	105	100.0	56	100.0	2
2	hilly urban	786	601	76.5	597	76.0	4	0.7	185	23.5	548	544	91.1	4	100.0	53	8.8	91.2	539	98.4	0	0.0	9	1.6	3	0.6	1	0.2	536	98.5	8	1.5	2	105	2	120	21.9	63	11.5	0	0.0	120	100.0	120	100.0	63	100.0	120	100.0	63	100.0	1
3	terai urban	754	606	80.4	605	80.2	1	0.2	148	19.6	526	525	86.8	1	100.0	80	13.2	86.8	505	96.0	1	0.2	20	3.8	14	2.7	2	0.4	517	98.5	8	1.5	4	95	12	120	22.8	66	12.5	6	5.0	113	94.2	119	99.2	62	93.9	119	100.0	62	100.0	2
4	terai urban	795	602	75.7	599	75.3	3	0.5	193	24.3	528	525	87.6	3	100.0	74	12.3	87.7	508	96.2	0	0.0	20	3.8	8	1.5	0	0.0	518	98.7	7	1.3	1	93	7	111	21.0	59	11.2	2	1.8	108	97.3	110	99.1	57	96.6	110	100.0	57	100.0	1
5	terai rural	899	618	68.7	614	68.3	4	0.6	281	31.3	569	565	92.0	4	100.0	49	7.9	92.1	550	96.7	0	0.0	19	3.3	10	1.8	1	0.2	560	99.1	5	0.9	1	122	10	142	25.0	79	13.9	0	0.0	142	100.0	142	100.0	79	100.0	142	100.0	79	100.0	6
6	terai urban	790	603	76.3	600	75.9	3	0.5	187	23.7	529	526	87.7	3	100.0	74	12.3	87.7	515	97.4	0	0.0	14	2.6	10	1.9	0	0.0	520	98.9	6	1.1	2	94	8	113	21.4	59	11.2	1	0.9	110	97.3	111	98.2	56	94.9	111	100.0	56	100.0	1
7	terai rural	901	621	68.9	620	68.8	1	0.2	280	31.1	545	544	87.7	1	100.0	76	12.2	87.8	531	97.4	1	0.2	13	2.4	17	3.1	0	0.0	533	98.0	11	2.0	1	102	16	131	24.0	72	13.2	3	2.3	127	96.9	130	99.2	71	98.6	130	100.0	71	100.0	0
8	terai urban	874	602	68.9	600	68.6	2	0.3	272	31.1	524	522	87.0	2	100.0	78	13.0	87.0	504	96.2	1	0.2	19	3.6	14	2.7	4	0.8	512	98.1	10	1.9	1	96	17	126	24.0	66	12.6	1	0.8	125	99.2	126	100.0	65	98.5	126	100.0	65	100.0	3
9	terai rural	795	599	75.3	596	75.0	3	0.5	196	24.7	568	565	94.8	3	100.0	31	5.2	94.8	559	98.4	0	0.0	9	1.6	6	1.1	1	0.2	560	99.1	5	0.9	1	105	6	120	21.1	63	11.1	2	1.7	118	98.3	120	100.0	61	96.8	120	100.0	61	100.0	1
10	terai rural	762	525	68.9	523	68.6	2	0.4	237	31.1	473	471	90.1	2	100.0	52	9.9	90.1	461	97.5	0	0.0	12	2.5	16	3.4	1	0.2	459	97.5	12	2.5	4	91	13	122	25.8	66	14.0	3	2.5	118	96.7	121	99.2	65	98.5	121	100.0	65	100.0	3
11	hilly rural	835	607	72.7	603	72.2	4	0.7	228	27.3	550	546	90.5	4	100.0	57	9.4	90.6	539	98.0	0	0.0	11	2.0	10	1.8	2	0.4	531	97.3	15	2.7	3	96	9	127	23.1	69	12.5	2	1.6	125	98.4	127	100.0	68	98.6	127	100.0	68	100.0	3
12	terai rural	951	614	64.6	611	64.2	3	0.5	337	35.4	579	576	94.3	3	100.0	35	5.7	94.3	558	96.4	1	0.2	20	3.5	6	1.0	2	0.3	556	96.5	20	3.5	1	115	7	146	25.2	76	13.1	2	1.4	144	98.6	146	100.0	75	98.7	146	100.0	75	100.0	0
13	terai rural	885	605	68.4	601	67.9	4	0.7	280	31.6	558	554	92.2	4	100.0	47	7.8	92.2	542	97.1	0	0.0	16	2.9	13	2.3	1	0.2	542	97.8	12	2.2	2	135	12	165	29.6	90	16.1	2	1.2	163	98.8	165	100.0	88	97.8	165	100.0	88	100.0	3
14	mountain urban	826	564	68.3	547	66.2	17	3.0	262	31.7	532	515	94.1	17	100.0	32	5.7	94.3	519	97.6	0	0.0	13	2.4	3	0.6	2	0.4	508	98.6	7	1.4	0	94	5	123	23.1	68	12.8	0	0.0	123	100.0	123	100.0	67	98.5	123	100.0	67	100.0	1
15	terai urban	902	604	67.0	602	66.7	2	0.3	298	33.0	552	550	91.4	2	100.0	52	8.6	91.4	537	97.3	1	0.2	14	2.5	2	0.4	0	0.0	542	98.5	8	1.5	0	99	2	111	20.1	59	10.7	10	9.0	94	84.7	104	93.7	53	89.8	104	100.0	53	100.0	0
16	terai urban	816	602	73.8	599	73.4	3	0.5	214	26.2	556	553	92.3	3	100.0	46	7.6	92.4	537	96.6	1	0.2	18	3.2	3	0.5	0	0.0	538	97.3	15	2.7	1	120	2	141	25.4	78	14.0	0	0.0	140	99.3	140	99.3	78	100.0	140	100.0	78	100.0	2
17	mountain urban	935	519	55.5	513	54.9	6	1.2	416	44.5	459	453	88.3	6	100.0	60	11.6	88.4	442	96.3	0	0.0	17	3.7	4	0.9	9	2.0	444	98.0	9	2.0	4	108	9	136	29.6	75	16.3	2	1.5	131	96.3	133	97.8	74	98.7	133	100.0	74	100.0	4
18	terai urban	815	619	76.0	614	75.3	5	0.8	196	24.0	533	528	86.0	5	100.0	86	13.9	86.1	512	96.1	1	0.2	20	3.8	16	3.0	0	0.0	520	98.5	8	1.5	3	63	13	93	17.4	50	9.4	2	2.2	87	93.5	89	95.7	48	96.0	89	100.0	48	100.0	0
19	terai urban	864	604	69.9	598	69.2	6	1.0	260	30.1	539	533	89.1	6	100.0	65	10.8	89.2	525	97.4	0	0.0	14	2.6	1	0.2	1	0.2	525	98.5	8	1.5	1	107	1	122	22.6	65	12.1	4	3.3	115	94.3	119	97.5	61	93.8	119	100.0	61	100.0	1
20	terai urban	810	602	74.3	600	74.1	2	0.3	208	25.7	567	565	94.2	2	100.0	35	5.8	94.2	553	97.5	0	0.0	14	2.5	5	0.9	1	0.2	559	98.9	6	1.1	0	105	6	119	21.0	66	11.6	2	1.7	117	98.3	119	100.0	66	100.0	119	100.0	66	100.0	2
21	hilly rural	700	515	73.6	505	72.1	10	1.9	185	26.4	486	476	94.3	10	100.0	29	5.6	94.4	471	96.9	0	0.0	15	3.1	18	3.8	4	0.8	470	98.7	6	1.3	2	94	20	132	27.2	72	14.8	0	0.0	132	100.0	132	100.0	72	100.0	132	100.0	72	100.0	1
22	hilly urban	940	607	64.6	604	64.3	3	0.5	333	35.4	552	549	90.9	3	100.0	55	9.1	90.9	538	97.5	0	0.0	14	2.5	36	6.6	15	2.7	539	98.2	10	1.8	22	113	29	177	32.1	90	16.3	5	2.8	172	97.2	177	100.0	86	95.6	177	100.0	86	100.0	9
23	terai rural	1,038	588	56.6	587	56.6	1	0.2	450	43.4	532	531	90.5	1	100.0	56	9.5	90.5	513	96.4	0	0.0	19	3.6	11	2.1	29	5.5	513	96.6	18	3.4	24	97	16	153	28.8	83	15.6	9	5.9	144	94.1	153	100.0	76	91.6	153	100.0	76	100.0	1
24	terai rural	1,034	610	59.0	609	58.9	1	0.2	424	41.0	571	570	93.6	1	100.0	39	6.4	93.6	538	94.2	1	0.2	32	5.6	9	1.6	7	1.2	560	98.2	10	1.8	10	137	6	164	28.7	91	15.9	3	1.8	161	98.2	164	100.0	89	97.8	164	100.0	89	100.0	2
25	kathmandu urban	755	603	79.9	597	79.1	6	1.0	152	20.1	522	516	86.4	6	100.0	81	13.4	86.6	501	96.0	0	0.0	21	4.0	0	0.0	1	0.2	507	98.3	9	1.7	1	95	0	111	21.3	64	12.3	6	5.4	105	94.6	111	100.0	60	93.8	111	100.0	60	100.0	0
26	kathmandu urban	791	616	77.9	615	77.7	1	0.2	175	22.1	574	573	93.2	1	100.0	42	6.8	93.2	536	93.4	0	0.0	38	6.6	5	0.9	1	0.2	566	98.8	7	1.2	2	135	4	149	26.0	82	14.3	5	3.4	140	94.0	145	97.3	79	96.3	145	100.0	79	100.0	0
27	terai urban	1,148	615	53.6	610	53.1	5	0.8	533	46.4	581	576	94.4	5	100.0	34	5.5	94.5	558	96.0	1	0.2	22	3.8	20	3.5	25	4.3	560	97.2	16	2.8	21	118	24	183	31.5	95	16.4	8	4.4	172	94.0	180	98.4	86	90.5	180	100.0	86	100.0	5
28	terai urban	994	620	62.4	616	62.0	4	0.6	374	37.6	554	550	89.3	4	100.0	66	10.6	89.4	538	97.1	0	0.0	16	2.9	16	2.9	13	2.4	545	99.1	5	0.9	20	58	9	96	17.3	47	8.5	1	1.0	92	95.8	93	96.9	46	97.9	93	100.0	46	100.0	1
29	terai urban	1,062	577	54.3	571	53.8	6	1.0	485	45.7	561	555	97.2	6	100.0	16	2.8	97.2	548	97.7	0	0.0	13	2.3	18	3.2	17	3.1	538	96.9	17	3.1	16	95	19	152	27.1	77	13.7	4	2.6	145	95.4	149	98.0	75	97.4	149	100.0	75	100.0	0
30	mountain rural	1,202	562	46.8	548	45.6	14	2.5	640	53.2	535	521	95.1	14	100.0	27	4.8	95.2	524	97.9	0	0.0	11	2.1	9	1.7	7	1.3	513	98.5	8	1.5	7	97	9	135	25.2	67	12.5	2	1.5	132	97.8	134	99.3	65	97.0	134	100.0	65	100.0	0
31	mountain rural	878	550	62.6	546	62.2	4	0.7	328	37.4	529	525	96.2	4	100.0	21	3.8	96.2	523	98.9	0	0.0	6	1.1	13	2.5	6	1.1	509	97.0	16	3.0	6	103	13	142	26.8	72	13.6	1	0.7	139	97.9	140	98.6	72	100.0	140	100.0	72	100.0	3
32	terai urban	978	600	61.3	595	60.8	5	0.8	378	38.7	558	553	92.9	5	100.0	42	7.0	93.0	541	97.0	2	0.4	15	2.7	1	0.2	4	0.7	539	97.5	14	2.5	0	120	5	144	25.8	77	13.8	6	4.2	133	92.4	139	96.5	72	93.5	139	100.0	72	100.0	4
33	terai urban	948	603	63.6	603	63.6	0	0.0	345	36.4	565	565	93.7	0		38	6.3	93.7	553	97.9	1	0.2	11	1.9	5	0.9	1	0.2	539	95.4	26	4.6	4	114	2	146	25.8	79	14.0	1	0.7	145	99.3	146	100.0	77	97.5	146	100.0	77	100.0	6
34	kathmandu urban	826	598	72.4	595	72.0	3	0.5	228	27.6	532	529	88.9	3	100.0	66	11.0	89.0	510	95.9	1	0.2	21	3.9	12	2.3	15	2.8	519	98.1	10	1.9	16	97	11	136	25.6	78	14.7	6	4.4	128	94.1	134	98.5	75	96.2	134	100.0	75	100.0	1
35	kathmandu urban	773	602	77.9	593	76.7	9	1.5	171	22.1	532	523	88.2	9	100.0	70	11.6	88.4	519	97.6	1	0.2	12	2.3	11	2.1	18	3.4	516	98.7	7	1.3	17	68	12	113	21.2	62	11.7	0	0.0	111	98.2	111	98.2	61	98.4	111	100.0	61	100.0	0
36	kathmandu urban	764	627	82.1	616	80.6	11	1.8	137	17.9	563	552	89.6	11	100.0	64	10.2	89.8	542	96.3	0	0.0	21	3.7	11	2.0	13	2.4	550	99.6	2	0.4	13	130	11	168	29.8	91	16.2	5	3.0	161	95.8	166	98.8	86	94.5	166	100.0	86	100.0	3
37	kathmandu urban	760	639	84.1	635	83.6	4	0.6	121	15.9	553	549	86.5	4	100.0	86	13.5	86.5	528	95.5	0	0.0	25	4.5	2	0.4	0	0.0	544	99.1	5	0.9	1	102	1	113	20.4	63	11.4	9	8.0	96	85.0	105	92.9	53	84.1	105	100.0	53	100.0	0
38	kathmandu urban	816	601	73.7	592	72.5	9	1.5	215	26.3	544	535	90.4	9	100.0	57	9.5	90.5	531	97.6	1	0.2	12	2.2	14	2.6	11	2.1	528	98.7	7	1.3	16	81	9	122	22.4	64	11.8	0	0.0	120	98.4	120	98.4	64	100.0	120	100.0	64	100.0	4
39	kathmandu urban	875	620	70.9	614	70.2	6	1.0	255	29.1	549	543	88.4	6	100.0	71	11.5	88.5	518	94.4	1	0.2	30	5.5	7	1.3	19	3.5	532	98.0	11	2.0	15	138	11	180	32.8	104	18.9	9	5.0	169	93.9	178	98.9	97	93.3	178	100.0	97	100.0	2
40	hilly rural	952	605	63.6	601	63.1	4	0.7	347	36.4	552	548	91.2	4	100.0	53	8.8	91.2	529	95.8	0	0.0	23	4.2	27	4.9	13	2.4	544	99.3	4	0.7	24	107	16	155	28.1	75	13.6	3	1.9	148	95.5	151	97.4	73	97.3	151	100.0	73	100.0	4
41	hilly urban	844	554	65.6	546	64.7	8	1.4	290	34.4	498	490	89.7	8	100.0	56	10.1	89.9	478	96.0	0	0.0	20	4.0	13	2.7	3	0.6	484	98.8	6	1.2	3	102	13	132	26.5	66	13.3	6	4.5	123	93.2	129	97.7	64	97.0	129	100.0	64	100.0	0
42	kathmandu rural	1,015	606	59.7	593	58.4	13	2.1	409	40.3	531	518	87.4	13	100.0	75	12.4	87.6	515	97.0	0	0.0	16	3.0	15	2.9	13	2.5	508	98.1	10	1.9	12	112	16	163	30.7	89	16.8	4	2.5	157	96.3	161	98.8	87	97.8	161	100.0	87	100.0	4
43	kathmandu urban	743	609	82.0	601	80.9	8	1.3	134	18.0	532	524	87.2	8	100.0	77	12.6	87.4	512	96.2	0	0.0	20	3.8	4	0.8	0	0.0	507	96.8	17	3.2	3	84	1	112	21.1	61	11.5	10	8.9	96	85.7	106	94.6	54	88.5	106	100.0	54	100.0	1
44	terai urban	1,096	622	56.8	620	56.6	2	0.3	474	43.2	587	585	94.4	2	100.0	35	5.6	94.4	562	95.7	2	0.3	23	3.9	33	5.6	12	2.1	557	95.2	28	4.8	19	108	26	181	30.8	90	15.3	18	9.9	152	84.0	170	93.9	76	84.4	170	100.0	76	100.0	4
45	terai urban	1,119	607	54.2	605	54.1	2	0.3	512	45.8	552	550	90.9	2	100.0	55	9.1	90.9	526	95.3	1	0.2	25	4.5	43	7.8	7	1.3	538	97.8	12	2.2	10	102	40	165	29.9	82	14.9	14	8.5	138	83.6	152	92.1	75	91.5	152	100.0	75	100.0	2
46	terai urban	1,233	607	49.2	598	48.5	9	1.5	626	50.8	537	528	88.3	9	100.0	70	11.5	88.5	523	97.4	1	0.2	13	2.4	30	5.7	6	1.1	515	97.5	13	2.5	16	117	20	175	32.6	87	16.2	31	17.7	140	80.0	171	97.7	64	73.6	171	100.0	64	100.0	6
47	terai urban	863	538	62.3	536	62.1	2	0.4	325	37.7	485	483	90.1	2	100.0	53	9.9	90.1	460	94.8	2	0.4	23	4.7	38	7.9	8	1.7	474	98.1	9	1.9	24	100	22	156	32.2	80	16.5	17	10.9	133	85.3	150	96.2	64	80.0	150	100.0	64	100.0	1
48	hilly rural	1,165	615	52.8	601	51.6	14	2.3	550	47.2	567	553	92.0	14	100.0	48	7.8	92.2	546	96.3	2	0.4	19	3.4	17	3.1	12	2.2	542	98.0	11	2.0	6	122	23	176	31.0	96	16.9	1	0.6	173	98.3	174	98.9	94	97.9	174	100.0	94	100.0	5
49	hilly rural	1,007	594	59.0	581	57.7	13	2.2	413	41.0	552	539	92.8	13	100.0	42	7.1	92.9	524	94.9	0	0.0	28	5.1	15	2.8	4	0.7	527	97.8	12	2.2	12	128	7	171	31.0	97	17.6	0	0.0	169	98.8	169	98.8	97	100.0	169	100.0	97	100.0	5
50	terai urban	1,258	622	49.4	621	49.4	1	0.2	636	50.6	581	580	93.4	1	100.0	41	6.6	93.4	551	94.8	2	0.3	28	4.8	17	2.9	20	3.4	564	97.2	16	2.8	23	106	14	158	27.2	92	15.8	5	3.2	153	96.8	158	100.0	90	97.8	158	100.0	90	100.0	2

Cluster number	Strata	Enumerated	Eligibility								Participation								TB Treatment History (Onsite participant)						Symptoms (Among On-site participant)				Chest X-ray screening (Among On-site Participant)				Eligible for Sputum								Sputum Collected								Lab results available				TB Case - Total
			Eligible						Non-eligible		Participant				Non-participant		Participation rate (%)		No treatment history		Under current Treatment		Previously treated		Cough for two weeks or more		Cough <2 week with at-least 1 other TB symptom		Chest X-ray done		Chest X-ray not done		For Xpert				For Culture		Xpert				Culture		At least 1 Xpert		Culture		
			Total		On-site		Off-site				Total		On-site		Off-site																		Onsite																	
																																	Eligible (By Symptom only)	Eligible (By X-ray only)	Eligible (By Both Symptom and X-ray)	Total Eligible (onsite and offsite)		Total Eligible (onsite and offsite)		Only 1 Sample (Xpert)		Both Samples (Xpert)		At-least 1 Sample (Xpert)		Sample for culture						
		n	n	%	n	%	n	%	n	%	n	n	%	n	%	n	%	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	n	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n
51	hilly urban	865	553	63.9	544	62.9	9	1.6	312	36.1	476	467	85.8	9	100.0	77	13.9	86.1	459	96.4	0	0.0	17	3.6	15	3.2	14	3.0	458	98.1	9	1.9	15	57	14	104	21.8	51	10.7	3	2.9	99	95.2	102	98.1	50	98.0	102	100.0	50	100.0	1
52	terai urban	1,269	618	48.7	616	48.5	2	0.3	651	51.3	570	568	92.2	2	100.0	48	7.8	92.2	539	94.6	0	0.0	31	5.4	29	5.1	17	3.0	553	97.4	15	2.6	26	110	20	170	29.8	99	17.4	0	0.0	170	100.0	170	100.0	99	100.0	170	100.0	99	100.0	2
53	terai urban	1,135	600	52.9	598	52.7	2	0.3	535	47.1	557	555	92.8	2	100.0	43	7.2	92.8	533	95.7	0	0.0	24	4.3	11	2.0	12	2.2	537	96.8	18	3.2	12	125	11	165	29.6	90	16.2	1	0.6	164	99.4	165	100.0	90	100.0	165	100.0	90	100.0	2
54	terai urban	1,460	601	41.2	597	40.9	4	0.7	859	58.8	543	539	90.3	4	100.0	58	9.7	90.3	502	92.4	1	0.2	40	7.4	23	4.3	21	3.9	498	92.4	41	7.6	20	99	24	185	34.1	110	20.3	3	1.6	181	97.8	184	99.5	107	97.3	184	100.0	107	100.0	0
55	terai urban	1,106	611	55.2	611	55.2	0	0.0	495	44.8	555	555	90.8	0		56	9.2	90.8	529	95.3	1	0.2	25	4.5	23	4.1	23	4.1	529	95.3	26	4.7	26	87	20	156	28.1	89	16.0	6	3.8	148	94.9	154	98.7	86	96.6	154	100.0	86	100.0	5
56	terai urban	987	610	61.8	606	61.4	4	0.7	377	38.2	568	564	93.1	4	100.0	42	6.9	93.1	528	93.0	1	0.2	39	6.9	7	1.2	7	1.2	556	98.6	8	1.4	8	130	6	155	27.3	96	16.9	2	1.3	150	96.8	152	98.1	91	94.8	152	100.0	91	100.0	6
57	mountain rural	955	607	63.6	600	62.8	7	1.2	348	36.4	540	533	88.8	7	100.0	67	11.0	89.0	530	98.1	0	0.0	10	1.9	11	2.1	10	1.9	525	98.5	8	1.5	8	118	13	154	28.5	74	13.7	7	4.5	137	89.0	144	93.5	68	91.9	144	100.0	68	100.0	2
58	hilly urban	861	606	70.4	598	69.5	8	1.3	255	29.6	561	553	92.5	8	100.0	45	7.4	92.6	533	95.0	1	0.2	27	4.8	32	5.8	21	3.8	542	98.0	11	2.0	26	109	27	181	32.3	101	18.0	6	3.3	172	95.0	178	98.3	97	96.0	178	100.0	97	100.0	2
59	hilly rural	1,131	618	54.6	614	54.3	4	0.6	513	45.4	581	577	94.0	4	100.0	37	6.0	94.0	569	97.9	0	0.0	12	2.1	19	3.3	8	1.4	567	98.3	10	1.7	10	124	17	165	28.4	89	15.3	2	1.2	163	98.8	165	100.0	86	96.6	165	100.0	86	100.0	5
60	hilly rural	670	502	74.9	491	73.3	11	2.2	168	25.1	459	448	91.2	11	100.0	43	8.6	91.4	450	98.0	0	0.0	9	2.0	24	5.4	18	4.0	443	98.9	5	1.1	22	78	20	136	29.6	69	15.0	1	0.7	132	97.1	133	97.8	66	95.7	133	100.0	66	100.0	1
61	hilly rural	746	502	67.3	486	65.1	16	3.2	244	32.7	471	455	93.6	16	100.0	31	6.2	93.8	457	97.0	0	0.0	14	3.0	35	7.7	30	6.6	446	98.0	9	2.0	32	81	33	171	36.3	89	18.9	4	2.3	166	97.1	170	99.4	85	95.5	170	100.0	85	100.0	1
62	hilly urban	932	607	65.1	597	64.1	10	1.6	325	34.9	544	534	89.4	10	100.0	63	10.4	89.6	529	97.2	1	0.2	14	2.6	38	7.1	46	8.6	524	98.1	10	1.9	41	90	43	192	35.3	101	18.6	2	1.0	189	98.4	191	99.5	98	97.0	191	100.0	98	100.0	4
63	mountain urban	994	602	60.6	596	60.0	6	1.0	392	39.4	550	544	91.3	6	100.0	52	8.6	91.4	533	96.9	2	0.4	15	2.7	5	0.9	5	0.9	535	98.3	9	1.7	6	70	4	95	17.3	47	8.5	3	3.2	90	94.7	93	97.9	45	95.7	93	100.0	45	100.0	1
64	hilly rural	1,003	619	61.7	605	60.3	14	2.3	384	38.3	566	552	91.2	14	100.0	53	8.6	91.4	561	99.1	1	0.2	4	0.7	11	2.0	18	3.3	539	97.6	13	2.4	20	58	9	114	20.1	57	10.1	9	7.9	104	91.2	113	99.1	51	89.5	113	100.0	51	100.0	0
65	hilly urban	902	616	68.3	613	68.0	3	0.5	286	31.7	534	531	86.6	3	100.0	82	13.3	86.7	523	97.9	0	0.0	11	2.1	6	1.1	5	0.9	524	98.7	7	1.3	8	53	3	73	13.7	37	6.9	2	2.7	72	98.6	74	101.4	35	94.6	74	100.0	35	100.0	0
66	terai urban	851	622	73.1	616	72.4	6	1.0	229	26.9	544	538	87.3	6	100.0	78	12.5	87.5	516	94.9	0	0.0	28	5.1	34	6.3	41	7.6	524	97.4	14	2.6	50	84	25	176	32.4	98	18.0	12	6.8	164	93.2	176	100.0	90	91.8	176	100.0	90	100.0	1
67	terai rural	894	605	67.7	595	66.6	10	1.7	289	32.3	582	572	96.1	10	100.0	23	3.8	96.2	570	97.9	1	0.2	11	1.9	44	7.7	22	3.8	553	96.7	19	3.3	31	133	35	224	38.5	118	20.3	20	8.9	204	91.1	224	100.0	114	96.6	224	100.0	114	100.0	2
68	hilly rural	796	510	64.1	503	63.2	7	1.4	286	35.9	481	474	94.2	7	100.0	29	5.7	94.3	474	98.5	0	0.0	7	1.5	13	2.7	17	3.6	469	98.9	5	1.1	14	102	16	144	29.9	75	15.6	0	0.0	143	99.3	143	99.3	75	100.0	143	100.0	75	100.0	2
69	terai urban	1,080	622	57.6	617	57.1	5	0.8	458	42.4	557	552	89.5	5	100.0	65	10.5	89.5	532	95.5	1	0.2	24	4.3	8	1.4	4	0.7	539	97.6	13	2.4	4	124	8	154	27.6	87	15.6	0	0.0	152	98.7	152	98.7	87	100.0	152	100.0	87	100.0	12
70	terai rural	889	587	66.0	585	65.8	2	0.3	302	34.0	555	553	94.5	2	100.0	32	5.5	94.5	544	98.0	0	0.0	11	2.0	11	2.0	5	0.9	545	98.6	8	1.4	9	107	7	133	24.0	70	12.6	0	0.0	132	99.2	132	99.2	69	98.6	132	100.0	69	100.0	3
71	hilly rural	808	488	60.4	475	58.8	13	2.7	320	39.6	451	438	92.2	13	100.0	37	7.6	92.4	445	98.7	0	0.0	6	1.3	6	1.4	5	1.1	427	97.5	11	2.5	6	63	5	97	21.5	49	10.9	1	1.0	94	96.9	95	97.9	47	95.9	95	100.0	47	100.0	2
72	terai urban	822	630	76.6	626	76.2	4	0.6	192	23.4	589	585	93.5	4	100.0	41	6.5	93.5	557	94.6	0	0.0	32	5.4	15	2.6	3	0.5	575	98.3	10	1.7	12	113	6	145	24.6	85	14.4	2	1.4	143	98.6	145	100.0	80	94.1	145	100.0	80	100.0	3
73	terai urban	844	635	75.2	634	75.1	1	0.2	209	24.8	556	555	87.5	1	100.0	79	12.4	87.6	530	95.3	1	0.2	25	4.5	10	1.8	4	0.7	550	99.1	5	0.9	9	83	5	103	18.5	56	10.1	9	8.7	91	88.3	100	97.1	50	89.3	100	100.0	50	100.0	0
74	terai urban	883	620	70.2	610	69.1	10	1.6	263	29.8	560	550	90.2	10	100.0	60	9.7	90.3	529	94.5	0	0.0	31	5.5	11	2.0	13	2.4	543	98.7	7	1.3	11	105	13	146	26.1	89	15.9	11	7.5	135	92.5	146	100.0	77	86.5	146	100.0	77	100.0	1
75	terai rural	925	602	65.1	593	64.1	9	1.5	323	34.9	571	562	94.8	9	100.0	31	5.1	94.9	554	97.0	1	0.2	16	2.8	30	5.3	10	1.8	550	97.9	12	2.1	19	108	21	169	29.6	90	15.8	6	3.6	163	96.4	169	100.0	85	94.4	169	100.0	85	100.0	4
76	hilly urban	914	600	65.6	594	65.0	6	1.0	314	34.4	550	544	91.6	6	100.0	50	8.3	91.7	524	95.3	0	0.0	26	4.7	7	1.3	7	1.3	534	98.2	10	1.8	6	123	8	153	27.8	89	16.2	1	0.7	152	99.3	153	100.0	88	98.9	153	100.0	88	100.0	5
77	hilly rural	845	562	66.5	555	65.7	7	1.2	283	33.5	516	509	91.7	7	100.0	46	8.2	91.8	506	98.1	0	0.0	10	1.9	7	1.4	2	0.4	496	97.4	13	2.6	4	62	5	91	17.6	45	8.7	5	5.5	86	94.5	91	100.0	40	88.9	91	100.0	40	100.0	2
78	hilly rural	1,114	560	50.3	538	48.3	22	3.9	554	49.7	536	514	95.5	22	100.0	24	4.3	95.7	513	95.7	0	0.0	23	4.3	30	5.8	16	3.1	500	97.3	14	2.7	13	207	33	289	53.9	144	26.9	20	6.9	267	92.4	287	99.3	132	91.7	287	100.0	132	100.0	3
79	hilly urban	953	561	58.9	554	58.1	7	1.2	392	41.1	550	543	98.0	7	100.0	11	2.0	98.0	528	96.0	0	0.0	22	4.0	28	5.2	11	2.0	533	98.2	10	1.8	8	149	31	203	36.9	101	18.4	10	4.9	191	94.1	201	99.0	96	95.0	201	100.0	96	100.0	3
80	hilly rural	954	573	60.1	557	58.4	16	2.8	381	39.9	528	512	91.9	16	100.0	45	7.9	92.1	514	97.3	0	0.0	14	2.7	46	9.0	18	3.5	499	97.5	13	2.5	20	146	44	238	45.1	119	22.5	17	7.1	220	92.4	237	99.6	109	91.6	237	100.0	109	100.0	1
81	mountain urban	961	568	59.1	559	58.2	9	1.6	393	40.9	522	513	91.8	9	100.0	46	8.1	91.9	511	97.9	1	0.2	10	1.9	23	4.5	10	1.9	505	98.4	8	1.6	8	136	25	184	35.2	94	18.0	4	2.2	180	97.8	184	100.0	85	90.4	184	100.0	85	100.0	1
82	terai rural	924	640	69.3	636	68.8	4	0.6	284	30.7	598	594	93.4	4	100.0	42	6.6	93.4	583	97.5	0	0.0	15	2.5	24	4.0	14	2.4	579	97.5	15	2.5	20	142	18	198	33.1	102	17.1	8	4.0	188	94.9	196	99.0	98	96.1	196	100.0	98	100.0	2
83	terai urban	1,037	629	60.7	623	60.1	6	1.0	408	39.3	600	594	95.3	6	100.0	29	4.6	95.4	555	92.5	0	0.0	45	7.5	37	6.2	18	3.0	580	97.6	14	2.4	17	160	38	234	39.0	129	21.5	9	3.8	225	96.2	234	100.0	117	90.7	234	100.0	117	100.0	2
84	terai urban	920	621	67.5	618	67.2	3	0.5	299	32.5	610	607	98.2	3	100.0	11	1.8	98.2	599	98.2	0	0.0	11	1.8	16	2.6	8	1.3	597	98.4	10	1.6	2	155	22	192	31.5	101	16.6	2	1.0	190	99.0	192	100.0	98	97.0	192	100.0	98	100.0	2
85	hilly urban	922	607	65.8	597	64.8	10	1.6	315	34.2	557	547	91.6	10	100.0	50	8.2	91.8	541	97.1	1	0.2	15	2.7	35	6.4	26	4.8	530	96.9	17	3.1	36	84	25	171	30.7	89	16.0	6	3.5	164	95.9	170	99.4	81	91.0	170	100.0	81	100.0	5
86	hilly rural	895	603	67.4	598	66.8	5	0.8	292	32.6	581	576	96.3	5	100.0	22	3.6	96.4	574	98.8	0	0.0	7	1.2	62	10.8	52	9.0	561	97.4	15	2.6	75	87	39	219	37.7	111	19.1	0	0.0	219	100.0	219	100.0	110	99.1	219	100.0	110	100.0	0
87	hilly urban	1,218	627	51.5	620	50.9	7	1.1	591	48.5	561	554	89.4	7	100.0	66	10.5	89.5	536	95.5	0	0.0	25	4.5	26	4.7	12	2.2	540	97.5	14	2.5	16	120	22	179	31.9	92	16.4	7	3.9	171	95.5	178	99.4	74	80.4	178	100.0	74	100.0	1
88	hilly rural	1,110	567	51.1	564	50.8	3	0.5	543	48.9	553	550	97.5	3	100.0	14	2.5	97.5	535	96.7	1	0.2	17	3.1	41	7.5	14	2.5	534	97.1	16	2.9	17	171	38	245	44.3	124	22.4	14	5.7	229	93.5	243	99.2	109	87.9	243	100.0	109	100.0	3
89	hilly urban	1,211	644	53.2	634	52.4	10	1.6	567	46.8	593	583	92.0	10	100.0	51	7.9	92.1	581	98.0	1	0.2	11	1.9	40	6.9	15	2.6	571	97.9	12	2.1	22	119	33	195	32.9	100	16.9	8	4.1	180	92.3	188	96.4	90	90.0	188	100.0	90	100.0	1
90	mountain rural	991	516	52.1	515	52.0	1	0.2	475	47.9	508	507	98.4	1	100.0	8	1.6	98.4	502	98.8	2	0.4	4	0.8	55	10.8	4	0.8	489	96.4	18	3.6	5	86	54	164	32.3	84	16.5	0	0.0	164	100.0	164	100.0	84	100.0	164	100.0	84	100.0	0
91	hilly rural	1,045	616	58.9	614	58.8	2	0.3	429	41.1	593	591	96.3	2	100.0	23	3.7	96.3	587	99.0	0	0.0	6	1.0	36	6.1	17	2.9	573	97.0	18	3.0	27	80	26	151	25.5	76	12.8	2	1.3	147	97.4	149	98.7	73	96.1	149	100.0	73	100.0	0
92	terai urban	884	612	69.2	607	68.7	5	0.8	272	30.8	542	537	88.5	5	100.0	70	11.4	88.6	528	97.4	0	0.0	14	2.6	11	2.0	4	0.7	526	98.0	11	2.0	7	108	8	139	25.6	73	13.5	22	15.8	114	82.0	136	97.8	60	82.2	135	99.3	60	100.0	0
93	terai rural	999	631	63.2	627	62.8	4	0.6	368	36.8	602	598	95.4	4	100.0	29	4.6	95.4	582	96.7	0	0.0	20	3.3	30	5.0	9	1.5	587	98.2	11	1.8	14	190	25	243	40.4	129	21.4	3	1.2	236	97.1	239	98.4	125	96.9	239	100.0	125	100.0	3
94	terai urban	1,035	625	60.4	619	59.8	6	1.0	410	39.6	591	585	94.5	6	100.0	34	5.4	94.6	574	97.1	0	0.0	17	2.9	10	1.7	9	1.5	575	98.3	10	1.7	8	108	11	142	24.0	81	13.7	2	1.4	139	97.9	141	99.3	78	96.3	141	100.0	78	100.0	0
95	mountain urban	807	567	70.3	565	70.0	2	0.4	240	29.7	538	536	94.9	2	100.0	29	5.1	94.9	519	96.5	1	0.2	18	3.3	91	17.0	53	9.9	508	94.8	28	5.2	75	71	69	240	44.6	123	22.9	2	0.8	235	97.9	237	98.8	120	97.6	237	100.0	120	100.0	4
96	terai urban	1,017	606	59.6	601	59.1	5	0.8	411	40.4	587	582	96.8	5	100.0	19	3.1	96.9	558	95.1	0	0.0	29	4.9	26	4.5	5	0.9	572	98.3	10	1.7	14	138	17	183	31.2	99	16.9	2	1.1	180	98.4	182	99.5	89	89.9	182	100.0	89	100.0	2
97	hilly rural	907	607	66.9	603	66.5	4	0.7	300	33.1	589	585	97.0	4	100.0	18	3.0	97.0	573	97.3	0	0.0	16	2.7	25	4.3	15	2.6	566	96.8	19	3.2	25	106	15	169	28.7	92	15.6	0	0.0	169	100.0	169	100.0	89	96.7	169	100.0	89	100.0	6
98	hilly urban	1,072	609	56.8	603	56.3	6	1.0	463	43.2	588	582	96.5	6	100.0	21	3.4	96.6	580	98.6	0	0.0	8	1.4	18	3.1	5	0.9	565	97.1	17	2.9	10	102	13	148	25.2	74	12.6	4	2.7	140	94.6	144	97.3	69	93.2	144	100.0	69	100.0	1
99	hilly urban	1,138	552	48.5	549	48.2	3	0.5	586	51.5	532	529	96.4	3	100.0	20	3.6	96.4	518	97.4	0	0.0	14	2.6	22	4.2	3	0.6	519	98.1	10	1.9	5	131	20	169	31.8	86	16.2	4	2.4	165	97.6	169	100.0	78	90.7	169	100.0	78	100.0	4
	Total	47,681	29096	61.0	28776	62.7	320	1.1	18585	39.0	54200	26726	92.9	320	100.0	2050	7.0	93.0	26147	48.2	19	0.0	880	1.6	1217	4.6	726	2.7	26090	97.6	636	2.4	899	5392	1044	8246	15.2	4373	8.1	264	3.2	7909	95.9	8173	99.1	4120	94.2	8172	100.0	4120	100.0	113

8.3.15 PS cases as per case definition in details (before and after imputation)

	History	Xpert Results	Panel CXR Decision	Before Imputation							After imputation (average results from 50 Mis, rounded to integer)				
				Total	Culture Status			Case determination			MTB Culture Status			Case determination	
					Negative	Positive	Missing	Not Case	CASE	Undetermined	Negative	Positive	Total	Not Case	CASE
A. Participants without any history of treatement															
A.1	No History	Negative	Not Applicable	11,320	5,246	16	6,058	11,320	0		11251	69	11320	11320	0
A.1	No History	Positive	Normal	5	2	0	3	2	0	3	5	0	5	5	0
A.1	No History	Positive	Active	159	44	37	78	0	159	0	89	70	159	0	159
A.1	No History	Positive	Mixed	22	8	5	9	0	22	0	15	8	22	0	22
A.1	No History	Positive	Healed	50	15	6	29	15	6	29	40	10	50	40	10
A.1	No History	Positive	Other Abnormality in the Lung	38	15	4	19	15	4	19	31	7	38	31	7
A.1	No History	Positive	Other Abnormality	1	0	0	1	0	0	1	1	0	1	1	0
A.1	No History	Positive	Exempted(*)	2	0	0	2	0	0	2	1	1	2	1	1
A.2	No History	Undetermined	Not Applicable	603	70	0	533	0	0	603	0	0	0	0	0
		Positive	Not Applicable								6	1	7	6	1
		Negative	Not Applicable								592	4	597	597	0
A . Total (A1 + A2)				**277**		**52**			**191**			**96**			**200**
B. Participants with past history of treatment															
B.1	Past History	Negative	Not Applicable	1,288	1,100	3	185	1,288	0	0	1284	4	1288	1288	0
B.1	Past History	Positive	Active	29	20	5	4	0	29	0	23	6	29	0	29
B.1	Past History	Positive	Mixed	6	4	1	1	4	1	1	5	1	6	5	1
B.1	Past History	Positive	Healed	8	5	1	2	5	1	2	7	1	8	7	1
B.1	Total			43	29	7	7	9	31	3	34	9	43	12	31
B.2	Past History	Undetermined	Not Applicable	40	9	0	31	0	0	40	0	0	0	0	0
		Positive	Not Applicable								0	0	1	0	0
		Negative	Not Applicable								39	0	40	40	0
B. Total (B1 + B2)				**43**		**7**			**31**			**9**			**31**
C. Participants with current treatment															
C.1	Current	Negative	Not Applicable	28	17	0	11	28	0	0	28	0	28	28	0
C.1	Current	Positive	Active	22	16	1	5	16	1	5	20	2	22	20	2
C.1	Current	Positive	Mixed	1	0	0	1	0	0	1	1	0	1	1	0
C.1	Current	Positive	Healed	1	0	0	1	0	0	1	1	0	1	1	0
C.1	Current	Positive	Exempted	2	1	1	0	1	1	0	1	1	2	1	1
C.1	Total			26	17	2	7	17	2	7	23	3	26	23	3
C.2	Current	Undetermined	Not Applicable	0	0	0	0	0	0	0	0	0	0	0	0
C.2	Current	Positive	Not Applicable								0	0	0	0	0
C.2	Current	Negative	Not Applicable								0	0	0	0	0
C. Total				**26**		**2**			**2**			**3**			**3**
I. Total Cases among with participants for imputation (A+B+C)				**346**		**61**			**224**			**108**			**234**
II. Participants with Xpert positive among participants not for imputation (**)															
	Any	Positive	Not aplicable	6	1	1	4	5	1	0		1			1
Total PS cases (I + II)				**352**		**62**			**225**			**109**			**235**

Remarks

*: Xpert positive without CXR is categorized as TB case if culture (observed or imputed) positive

**: no imputation. Only cases with observed culture positive are categorized as TB case

The number of cases by combination of Xpert, history, MTB culture and Panel CXR

8.3.16 STATA Do-files for analysis of data of the survey.

The Do-files will be published in the National TB Control Center's official website at https://nepalntp.gov.np/

8.3.17 Rationale for use of estimated prevalence of smear positive PTB for sample size calculation

This survey used estimated prevalence of smear positive PTB to determine the sample size, though the primary outcome is the bacteriologoically confirmed (Xpert MTB/RIF Positive) PTB cases. Relative precision is the key determinant of the sample design in this Prevalence Survey. Because primary indicator is Xpert positive TB cases in this survey and population new projection is available, precision of the above sample size is examined for expected prevalence of Xpert positive TB cases with population. Based on previous surveys, it is assumed that prevalence of bacteriologically confirmed TB is twice as high as that of smear positive TB cases. It is also that Xpert sensitivity to bacteriologically confirmed TB cases is 75%. With projection population for 2016 and case notification for 2015, recent case notification rate is 148/100000 population.

For different combinations of P/N ratio (ranging between 1 and 2) and *kappa* (0.6 and 0.8), precisions are examined under the sample size calculated above (Table 4.2).

Having used the same sample size of 582, and applying the estimated prevalence of Xpert MTB/RIF positive PTB, Relative precision in different scenarios (Table 4.2) seems acceptable (mostly <0.30). For this prior guess of prevalence, relative precision of about 24% can be obtained. Even for an extreme assumption with PN ratio of 1 and *kappa* of 0.8, relative precision is expected to about 32%. Given that the country doesn't yet have credible reporting on Xpert MTB/RIF cases, it is justified to use estimation of prevalence of Smear Positive PTB as the basis of sample size calculation.

Cluster size	Coefficient of between-cluster variation	Prevalence per 100,000 among 15+ years old	Design effect	Relative precision
m	*k*	*p*	*DEFF*	*d*
Scenario-2(*kappa* = 0.6, prevalence X = notification_2015 x 2 x 0.75)				
582	0.6	222	1.47	0.226
Scenario-2b(*kappa* = 0.6, prevalence X = notification_2015 x 1.72 x 0.75)				
582	0.6	191	1.40	0.239
Scenario-2b(*kappa* = 0.6, prevalence X = notification_2015 x 1.5 x 0.75)				
582	0.6	167	1.35	0.251
Scenario-2b(*kappa* = 0.8, prevalence X = notification_2015 x 1 x 0.75)				
582	0.6	111	1.23	0.295
Scenario-2(*kappa* = 0.8, prevalence X = notification_2015 x 2 x 0.75)				
582	0.8	222	1.83	0.254
Scenario-2b(*kappa* = 0.8, prevalence X = notification_2015 x 1.72 x 0.75)				
582	0.8	191	1.71	0.265
Scenario-2b(*kappa* = 0.8, prevalence X = notification_2015 x 1.5 x 0.75)				
582	0.8	167	1.62	0.276
Scenario-2b(*kappa* = 0.8, prevalence X = notification_2015 x 1 x 0.75)				
582	0.8	111	1.41	0.316