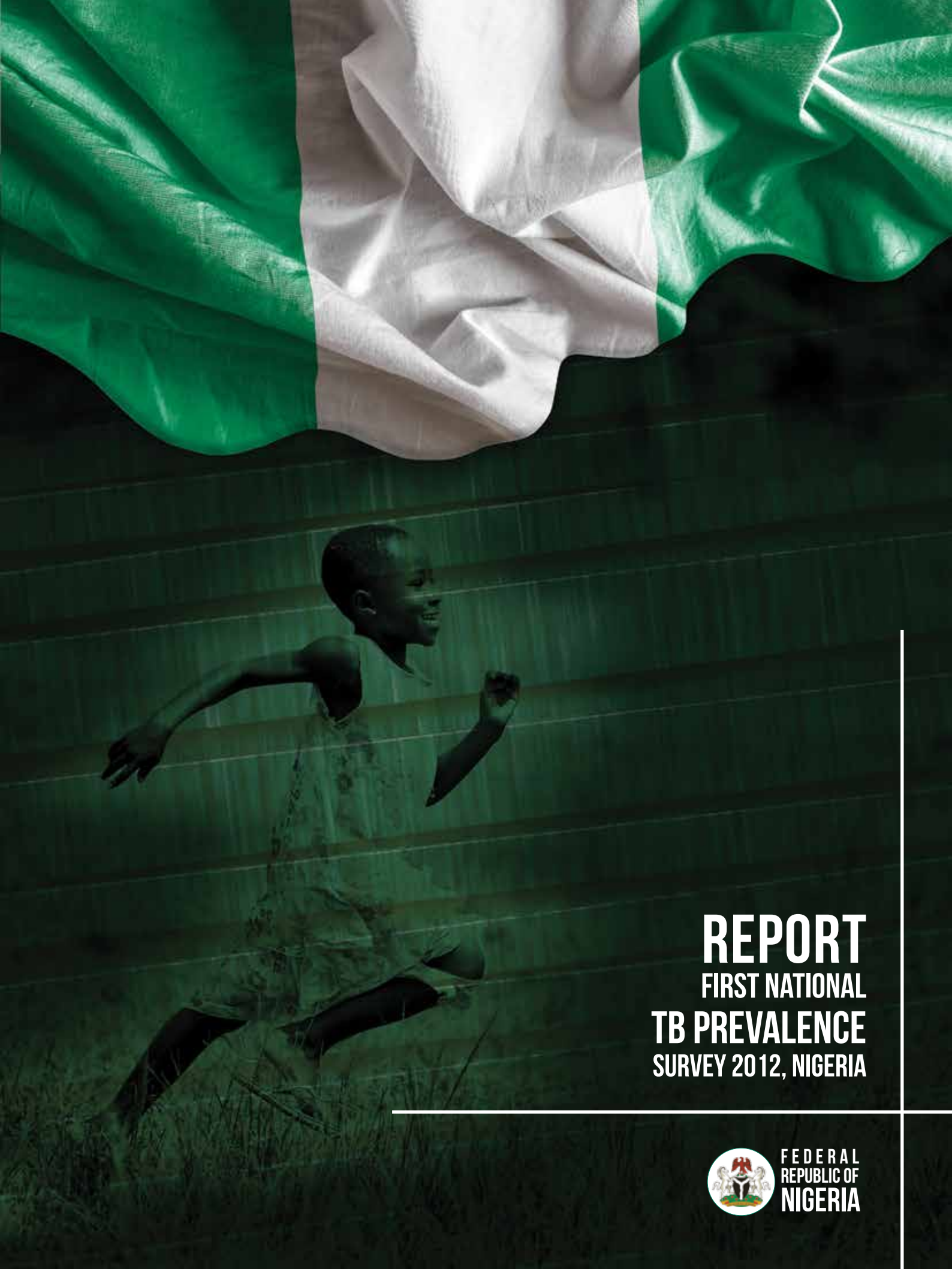

REPORT
FIRST NATIONAL TB PREVALENCE SURVEY 2012, NIGERIA

FEDERAL REPUBLIC OF NIGERIA

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REPUBLIC OF
NIGERIA

Foreword

Prior to 2012, there was no national survey to determine the prevalence of tuberculosis disease (TB) in Nigeria. Estimates of the burden of TB in the country relied on indirect assessment by the World Health Organization (WHO) based on existing TB surveillance data. The accuracy of such estimates largely depends on the quality of the routine surveillance information, which in itself is affected by the completeness of TB notification and instances of TB under-diagnosis. Therefore, it became imperative to conduct a nationwide prevalence survey of TB to obtain a good direct estimate of the burden of TB in the country.

This nationally representative survey was principally aimed at determining the prevalence of bacteriologically-confirmed (sputum smear-positive and/or culture-positive) TB among the general population aged fifteen years and above. It was designed and conducted in line with international recommendations developed by the WHO Global Task Force on TB impact Measurement by a team of seasoned professionals.

The results of the survey highlight the high burden of TB in the country, showing much higher TB prevalence levels than previously estimated based on routine surveillance data. It shows the pattern of the distribution of TB in the general population in relation to age, sex and habitation as well as identifying some key risk factors for TB. In addition, the survey defines the reach of TB services in the general population and the health seeking behavior of persons who have symptoms of TB. The survey also provides information on the possible dynamics of TB transmission in the community as well as challenges to notification of persons that have TB.

To the extent possible, this first national TB prevalence survey in Nigeria has contributed to our knowledge about TB as a disease of major public health importance. It has provided valuable information on the burden and dynamics of TB that will inform strategic interventions to address the challenges of TB control and strengthen routine TB surveillance and provide the benchmark for the monitoring of future progress towards TB control in the country.

Prof. C. O. Onyebuchi Chukwu
Honourable Minister of Health
Federal Republic of Nigeria

Acknowledgements

The TB prevalence survey was conducted by the National Tuberculosis Control programme of the Federal Ministry of Health in close collaboration with the World Health Organization (WHO) and the US Centers for Disease Control and Prevention (CDC). It was coordinated by the Survey Technical Committee made up of Government and several local and international partners.

Bulge of the funding for the survey came from the Global Fund for AIDS, Tuberculosis and Malaria and The Federal Government of Nigeria. Other funders were the USAID, WHO and CDC who provided significant amounts to cover the cost of Technical Assistant and training.

Technical Assistance was provided throughout the entire process by the WHO and CDC under the guidance of the WHO Global Task Force on TB Impact Measurement. Three laboratories were used for processing of sputum specimens namely Nigeria Institute of Medical Research (NMIR) Lagos, National Tuberculosis and Leprosy Training Centre (NTBLTC) Zaria and Zankli Medical Centre Abuja.

Field data collection was carried out amidst very difficult terrain with security challenges by team headed by WHO National Professional Officers comprising of Medical Officers, Radiographers, Data clerks, Laboratory Assistants, interviewers and other support staff.

These findings present, for the first time in the history of TB care and control in Nigeria, a robust nationwide assessment of the actual TB burden in the country for 2012. They also provide invaluable information for the formulation of policies that will need to be put in place to address challenges that have been identified. Finally, the findings provide a baseline level for measuring future progress in the control of TB disease.

Dr. Bridget Okoeguale
HOD, Department of Public Health

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Abbreviations

ACSM	Advocacy, Communication and Social Mobilization
AFB	acid-fast bacilli
AIDS	acquired immuno-deficiency syndrome
CDC	US Centers for Disease Control and Prevention
CI	confidence interval
CR	computerized radiography
CXR	chest x-ray
CIDA	Canadian Internal Development Agency
DOTS	directly observed treatment, short-course
DR-TB	drug-resistant tuberculosis
EA	enumeration areas
FMOH	Federal Ministry of Health (Nigeria)
ILEP	International Federation of Anti-Leprosy Associations
IUATLD	International Union Against Tuberculosis and Lung Disease
GFATM	Global Fund for AIDS, Tuberculosis and Malaria
LJ	Lowenstein Jensen
LGA	local government area
MDG	Millennium Development Goal
MDR-TB	multi-drug resistant tuberculosis
MTB	Mycobacterium Tuberculosis
NMIR	Nigeria Medical Institute Research
NPC	National Population Commission
NTBLCP	National Tuberculosis and Leprosy Control Programme
NTBLTC	National Tuberculosis and Leprosy Training Centre
NTBLCP	National Tuberculosis and Leprosy Control Programme
NTM	Non-Tuberculous Mycobacterium
NTP	National Tuberculosis Programme
NPC	National Population Commission
PHC	primary health care
PPM	public-private mix
PPS	population proportionate sampling
SMC	Survey Management Committee
SLR	supranational reference laboratory
SOP	standard operating procedure
TB	tuberculosis
TBLS	tuberculosis and leprosy supervisor
WHO	World Health Organization
WMA	World Medical Association
USAID	United States Agency for Internal Development
ZN	Ziehl Neelsen

Executive summary

Nigeria's first National Tuberculosis Prevalence survey was concluded in November 2012 by the National TB & Leprosy Control programme. The survey aimed to determine the prevalence of pulmonary tuberculosis (bacteriologically-confirmed; sputum smear and/or culture positive) among the general population aged 15 years and above in Nigeria.

A total of 113,247 persons were considered for inclusion; of these, 77,797 (68.7%) were eligible for the survey in 70 clusters around the country. 44,186 persons (56.8%) participated in the survey, and of these 4,688 (10.6%) submitted sputum for examination. The average number of participants per cluster was 631 (with a range of 279-819). Female participation was higher (26,008 (59%)) compared to male participation (18,178 (41%)).

Survey design and overall methods followed the international recommendations of the WHO Global Task Force on TB Impact Measurement. All survey participants were screened through a symptoms interview and a chest x-ray examination. Participants with any symptom present suggestive of TB or radiological lesion(s) in the lung submitted two sputum specimens (one spot and one early-morning) that were examined by microscopy for acid-fast bacilli (AFB) and culture using solid media in three laboratories – the Nigeria Institute of Medical Research (NMIR), the National Tuberculosis and Leprosy Training Centre (NTBLTC), and the Zankli Medical Centre in Abuja.

Out of the total sputum specimens processed, there were 107 smear-positive cases and 37 culture positive cases making a total of 144 bacteriologically-confirmed pulmonary TB cases. TB prevalence rates per 100,000 population aged 15 years and above were estimated to be 318 (95% CI of 225-412) for smear-positive, and 524 (95% CI of 378-670) for bacteriologically-confirmed. Smear-positive TB prevalence among men was 484 (95% CI of 333-635) per 100,000, higher than that among women estimated to be 198 (95% CI 108-289) per 100,000. The same was observed for bacteriologically-confirmed TB with 751 (CI 538-965) and 359 (CI 213-505) per 100,000 among men and women respectively. An age differential in TB prevalence was also observed, with groups between 24-54 years carrying the highest burden of disease.

Symptomatic participants with cough of any duration numbered 5,152 (11%), while 2,479 (5.6%) had had a cough for two weeks or more. All of these were requested to submit two sputum samples. Among the 107 smear-positive TB cases, 80 (75%) reported TB symptoms during the screening process and 94 (88%) had a positive chest X-ray. Of the 144 bacteriologically-confirmed cases, 92 (64%) reported TB symptoms during the screening process and 128 (89%) had a positive chest X-ray. A total of 2,968 (6.8%) respondents had radiological lesions out of which 38 (1.3%) were smear-positive.

A total of 82 survey participants (0.2%) reported being on TB treatment at the time of

the survey (37 males and 45 females, with 39 residing in urban areas). 552 (1.2%) survey participants reported past history of TB treatment, of whom 281 were males and 271 females, while 303 were from urban, 212 from rural and 37 from semi-urban settings. The majority of those reported taking treatment in general hospitals (48.6%), followed by health centres/PHC (22.4%), teaching hospitals (11.2%), and private hospitals (10.1%). Only one person reported taking treatment at a chemist.

Despite survey limitations in terms of participation rate (56.8%) and the low culture yield, the TB burden in the country is estimated as much higher than previously thought (based on data from the routine surveillance system), with considerable ongoing transmission. These results suggest that TB should be classified as a significant public health problem in Nigeria. Despite the fact that DOTS implementation has been ongoing for the last 10 years, DOTS services appear to have not penetrated the community. Future strategies of the NTLCP need to address decentralization of TB care and control services into the community.

CHAPTER 1

Introduction, methods and procedures

1.1 Background

Tuberculosis is a major public health problem in Nigeria, a country of 169 million inhabitants, with the country currently ranking 10th among the 22 high TB burden countries of the world and fourth highest in Africa (after South Africa, Ethiopia and DR Congo). In the 2012 Global Tuberculosis Report[1], WHO's disease burden estimates, expressed in rates per 100,000 population, were 161 (25-420) for prevalence and 108 (50-186) for incidence. Case detection of all forms stood at 51% (29%-110%). The mortality rate for all forms of TB remains 27 (7-60) per 100,000 population (46,000 deaths per year).

In response to TB as a high priority area of public health concern in Nigeria, the National TB and Leprosy Control Programme (NTBLCP) was launched in 1991 under the Federal Ministry of Health (FMOH). The DOTS Strategy was officially adopted in 1993, but nationwide rollout began only in 2003. The number of DOTS Centres rose to 3,459 by the end of 2009, representing 56% of the targeted 6,261 which will provide a DOTS Centre: population ratio of 1:25,000. There are DOTS Centres in all 36 states and FCT of the country, and 100% of the LGAs have at least two DOTS centres. By the end of 2009 there 1,025 facilities contained laboratories with microscopes and had the capacity to run AFB diagnosis. This represented an AFB lab: population ratio of 1: 149,000, 51% of the targeted 1:80,000[2]. In 2009, 87% of LGAs had AFB laboratories. The population DOTS coverage in 2012 was 85% (program goal is 100% DOTS population coverage).

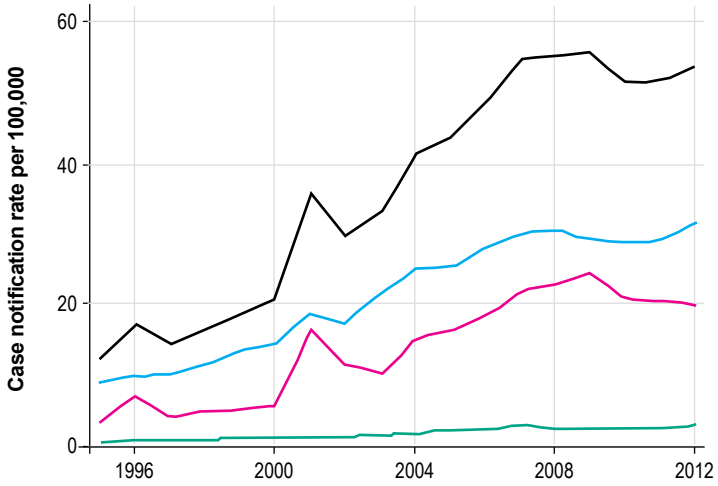
Overall case notifications have consistently increased during DOTS expansion (Figure 1.1) in the country, but these seem to have plateaued since 2008 despite the more intensified approach to PPM activities NTBLCP has taken recently (24% of 2012 notifications directly resulted from PPM). Out of 97,853 notified TB cases in 2012, 52,901 (59%) were confirmed through smear-microscopy, 32,972 (37%) were based on a clinical diagnosis (smear-negative), and only 4,432 (5%) were extra-pulmonary TB. The overwhelming number of TB case notifications in 2012 (93%) were among patients who had not been treated previously.

Some variation was observed in the pattern of TB case notification in the states and the six geo-political zones of the country (Figure 1.2). Case notifications for all forms of TB in the North West zone was 47 per 100,000 population; in the North East Zone, 65 per 100,000 population; in the North Central Zone, 80 per 100,000 population; in the South West Zone, 71 per 100,000 population; in the South South Zone, 52 per 100,000 population; and in the South East Zone, 41 per 100,000 population. The relatively higher notification rates in the three Northern zones may be due to more extensive DOTS expansion activities in those areas, compared with the three Southern zones.

1. Global Tuberculosis Report 2013. Geneva: World Health Organization; 2013 (http://www.who.int/tb/publications/global_report/en/, accessed 5 July 2014).
2. National Tuberculosis and Leprosy Control Programme, Annual Report 2008. Abuja: NTBLCP; 2009 (http://www.ntbltc.org/reports/Annual%20Report%202008%20NTBLCP.pdf, accessed 5 July 2014).

Figure 1.1
Time-series of national TB case notification rates per 100,000 in Nigeria, 1995-2012
Data source: WHO TB database

Panel A. Case notification rates (black: new, all forms; blue: new smear-positive; red: new smear-negative; green: new extra-pulmonary).



Panel B. Case notification rates (black: new, all forms; red: retreated, all forms).

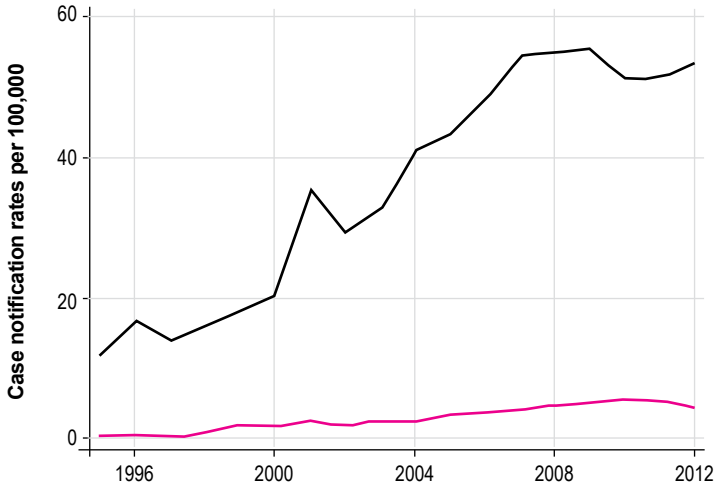
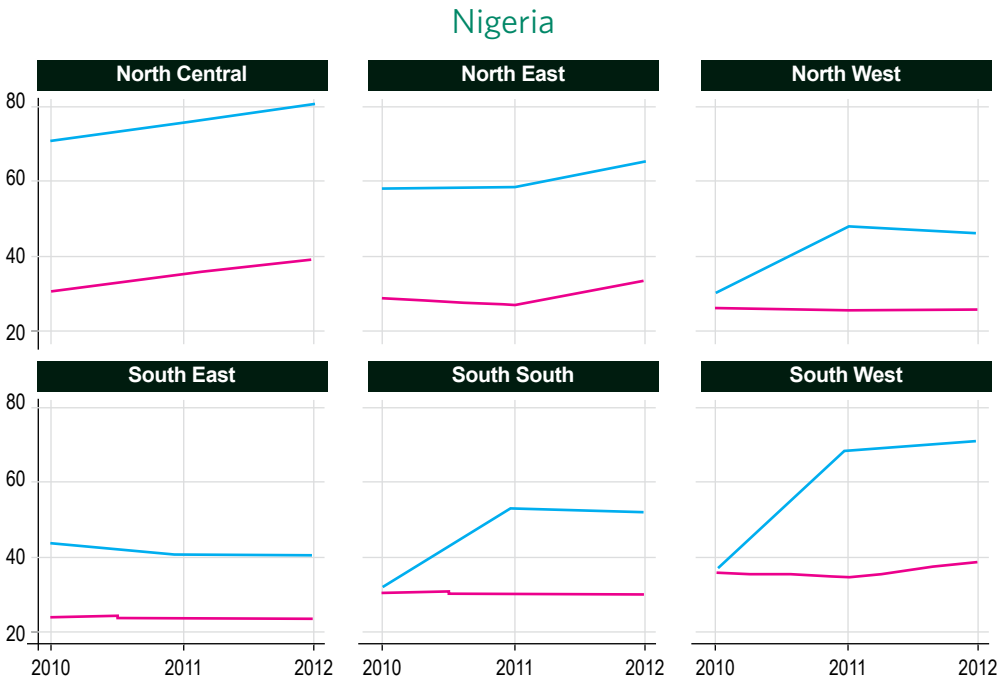


Figure 1.2
Time series of new TB case notification rates per 100,000 (blue: all forms, red: smear-positive), by zone, 2010-2012. Data source: NTBLCP database



Treatment success of notified TB cases in 2011 reached the international target of 85%. It is estimated that the proportion of MDR-TB cases is 2.9% among new cases and 14.3% among previously treated cases[3].

TB burden in Nigeria is further compounded by the high prevalence of HIV/AIDS of 4.1% among the general population[4]. In 2012, 86% of registered TB patients were tested for HIV; of these, 23% were found to be HIV-positive (co-infected).

1.2 Justification for the National TB Prevalence survey, Nigeria 2012

The targets of the national TB programme as set out in 2008[5] are: (1) to detect at least 70% of the estimated smear-positive TB cases; (2) to achieve at least an 85% cure rate of the smear-positives; (3) to halve by 2015 the prevalence and mortality due to TB relative to 1990 levels; and (4) to eliminate TB as a public health problem by 2050.

TB still constitutes a serious public health problem in Nigeria, despite the implementation

3. Nigeria National DR-TB Survey Results, 2012.
4. Nigerian National HIV Sero-Prevalence Survey, 2010.
5. National tuberculosis and leprosy control programme (NTBLCP) : workers manual (5th edition) Abuja: Federal Ministry of Health Nigeria, 2008.

of the DOTS strategy since 1993 and subsequent adoption of the WHO Stop TB strategy in 2006. Despite the availability of DOTS in all the 774 Local Government Areas (LGAs) in the country and increasing resources from the Government of Nigeria and international partner agencies (GFATM, USAID, CIDA, IUATLD, WHO and ILEP), targets for case detection and treatment outcome have yet to be met.

To date, information about the TB disease burden in Nigeria has been based upon indirect WHO estimates based on existing surveillance data; there were no nationally representative, robust surveys to inform the process. Due to an unknown amount of under-reported cases from the private sector, under-diagnosed cases not reaching health services, and other data quality issues (such as incomplete reporting from all states), the routine surveillance data are unable to provide an accurate measure of the disease burden. Trends over time cannot be monitored in the absence of a reliable baseline.

Accordingly, it was deemed necessary to conduct a prevalence survey in order to obtain a good estimate of the prevalence of TB in the country; to help strengthen routine disease surveillance; to guide national policies and guidelines for the control of TB in Nigeria; and to measure progress towards achievement of global targets for TB control including the Millennium Development Goals (MDGs).

1.3 Objectives

The main objective of the survey was to determine the prevalence of pulmonary tuberculosis (bacteriologically-confirmed; sputum smear and/or culture positive) among the general population aged 15 years and above in Nigeria

Secondary objectives of the survey were as follows:

- To assess the prevalence of symptoms suggestive of pulmonary TB among the eligible population;
- To determine the prevalence of smear-positive pulmonary TB;
- To determine the prevalence and the patterns of chest X-ray abnormalities among the eligible population;
- To assess the prevalence of culture-positive pulmonary TB;
- To assess the health-seeking behaviour of individuals with symptoms suggestive of TB; and
- To identify some risk factors for prevalent TB, including age, sex, education, smoking, and urban-rural residence.

1.4 Survey methods

The survey protocol was developed with technical support from and followed international recommendations developed by the WHO Global Task Force on TB Impact Measure-

ment[6] based on the experience from surveys conducted in Asian countries[7]. This was the first population-based survey to be conducted in Nigeria.

1.4.1 Survey design

This is a cross-sectional population-based survey carried out between March and November 2012 in Nigeria.

1.4.2 Survey population

The survey population was nationally-representative and comprised of all persons (males and females) aged 15 years of age and older residing in Nigeria. Only members of the household (permanent residents defined as those having slept in the household for 14 days or more) were invited to participate in survey operations. A household in this case referred to a domestic unit consisting of members of a family who live together. The household may include relatives or domestic staff.

Inclusion criteria for survey participants were as follows:

- All those who are permanent residents (slept in the household for 14 days or more) in the household;
- Non-permanent residents (visitors) who had spent at-least two weeks in the household by the survey day;
- Aged 15 years and above; and
- Have provided informed consent.

In terms of exclusion criteria, individuals were excluded from the survey if they were aged less than 15 years of age, institutionalized populations (e.g., prisoners), lived in hard-to-reach areas or conflict zones, or were unable to provide informed consent or refuse to participate.

At the time of protocol development, there no geographical zone or state was excluded from the survey. However, during the field data collection, the two states of Borno and Yobe with three clusters were not accessible by the survey team due to security challenges. The clusters were replaced with three clusters of similar characteristics (socio-cultural, occupation and religion) from neighbouring States of Bauchi (two) and Adamawa (one).

1.4.3 Screening method

This survey adopted the recommended WHO screening strategy[8]. This method had the advantage of limiting the number of individuals who were asked to submit sputum for examination and culture. All eligible survey participants were taken through the following

6. See http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/en/
7. WHO. Tuberculosis Prevalence Surveys: a handbook. Geneva: World Health Organization; 2011.
8. WHO. Tuberculosis Prevalence Surveys: a handbook. Geneva: World Health Organization; 2011.

three levels of screening for active TB disease:

Symptomatic Screening:
All eligible persons were interviewed using a standardized questionnaire (See Annex 6) to identify the presence of symptoms suggestive of pulmonary TB.

Radiological Screening:
Chest x-ray examination was performed on all eligible individuals to identify presence or absence of radiographic abnormalities. A direct x-ray with computed radiography (CR) was used, with x-ray images were read on-site by a trained medical officer. Pregnant women were informed about the risk of radiation carried by a single chest X-ray exposure, and those who agreed to be x-rayed received proper shielding by protective devices. Any participants, including pregnant women, who declined an X-ray examination were exempted from CXR but were asked to submit sputum whether symptomatic or not.

Bacteriological Screening:
Two sputum samples (one spot and one morning) were obtained from persons reporting a cough greater than or equal to two weeks in duration or a chest x-ray examination that showed any radiographic abnormalities suggestive of TB. The two sputum samples were sent to one of three reference laboratories assigned to a survey cluster and stained for AFB microscopy using ZN stain and both specimens were processed and cultured for mycobacterium tuberculosis. Persons who had no cough ≥ 2 weeks or no radiological abnormality did not submit sputum for either AFB microscopy or culture and were assumed to be free of active TB disease.

All those who declined or were exempted from X-ray examinations were classified as "TB suspects" and asked to submit sputum samples when they had any symptom related to TB, regardless of the symptom's duration. This included, for example, a pregnant woman declining CXR examination who had a cough for one week, or an elderly handicapped man who could not afford to come to the CXR site for three days.

1.4.4 Sample size determination

The survey was designed in 2010. In the absence of previous surveys to inform the sample size determination, authors used TB burden estimates available from WHO's Global TB report 2009, and population estimates from the 2006 Nigeria census.

The estimated 2007 prevalence for smear-positive TB in Nigeria from the 2009 WHO Global TB Report was 226/100,000. The 2006 Nigeria population census results estimated that 57.8% of the population in Nigeria is aged 15 or above. There was an assumption that the estimated prevalence of TB is expected to decline as a result of ongoing control programme interventions. Accordingly, authors assumed and applied a 4% reduction a year according to the consensus (taken from expert committee opinion). By 2010, the estimated prevalence for smear-positive TB was assumed to be 200/100,000 among the

total population and 200/0.578=346/100,000 among those aged 15 or more.

The survey was designed to estimate TB prevalence with 20% precision within a 95% confidence interval. Therefore, the calculation to determine the sample size N for the survey used the formulae presented below (for an individually-sampled survey).

$N = z^2 / \mu\varepsilon^2 = 1.96^2 / \mu\varepsilon^2$

Where smear-positive TB prevalence (expressed as a proportion) was estimated μ =0.00346, its precision was chosen at 20% ε = 0.2, and the type I error of 5% translating into a z = 1.96.

$N = 1.96^2 / 0.00346 * (0.2)^2 = 27{,}757$

Authors therefore accounted for the cluster-sampling approach adopted for this survey, as well as experience from other national surveys such as the National HIV/AIDS and Reproductive Health Survey, the Behavioural Surveillance Survey and the integrated biological and behavioural survey. Authors assumed a design effect of 1.5 and a response rate of 85%, bringing the sample size to 48,983 (= (27,757*1.5)/0.85). This was rounded up to **49,000** individuals.

1.4.4.1 Sampling approach

The survey was designed to be nationally-representative including all States in the six geopolitical zones of Nigeria. The 2006 national population census estimates the total population as 140 million in 37 states, 774 local government areas, 4,464 districts, and about 89,280 village areas. On average, a state had a population of 3.8 million, an LGA about 188,000, 31,262 in a district, and about 1,568 persons in a village.

The Nigerian Population Commission had divided each Local Government Area into Enumeration Areas (EAs), each containing approximately equal numbers of people (600). EAs constituted the building blocks of the survey clusters.

As described earlier, the eligible population for this survey is persons aged 15 and above, representing about 57.8% of the population. The eligible population within each EA was approximately 0.578 * 600 = 350 persons. It was agreed in this survey that the sampling unit would be the Enumeration Areas and two EAs will constitute a cluster. Each cluster consisted of a total of 700 eligible (49,000/70) individuals. A total of 70 clusters from across the country were required to reach the target sample size (49,000/700).

In order to ensure that all parts of the country were involved in the survey, a multi-stage sampling method was used:

- Step 1. The first stage stratified the country into six geopolitical zones, all of which

were included.

- Step 2. The 70 clusters were divided among the six geopolitical zones proportional to the size of the population. This resulted in 18 clusters in the North West Zone; 10 in the North Central Zone; nine in the North East Zone; 11 in the South-South Zone; eight in the South East Zone; and 14 I the South West Zone (See Annex 5).
- Step 3. Direct population proportionate sampling (PPS) of LGAs in each zone was carried out to ensure nationwide participation, support and at least one cluster in each state, assuming that the TB situation within a zone is homogenous. The RANDOM command in Excel was used to generate the list of selected LGAs as seen in Annex 5.
- Step 4. In each LGA selected, the two serially adjoining EAs (e.g. 001 and 002; 003 and 004 etc.) were joined together to make one cluster. As the EA sizes are similar, simple random sampling was applied to select the cluster EAs using the RANDOM command in Excel.
- Step 5. The method was then applied at the enumeration area (EA) level.

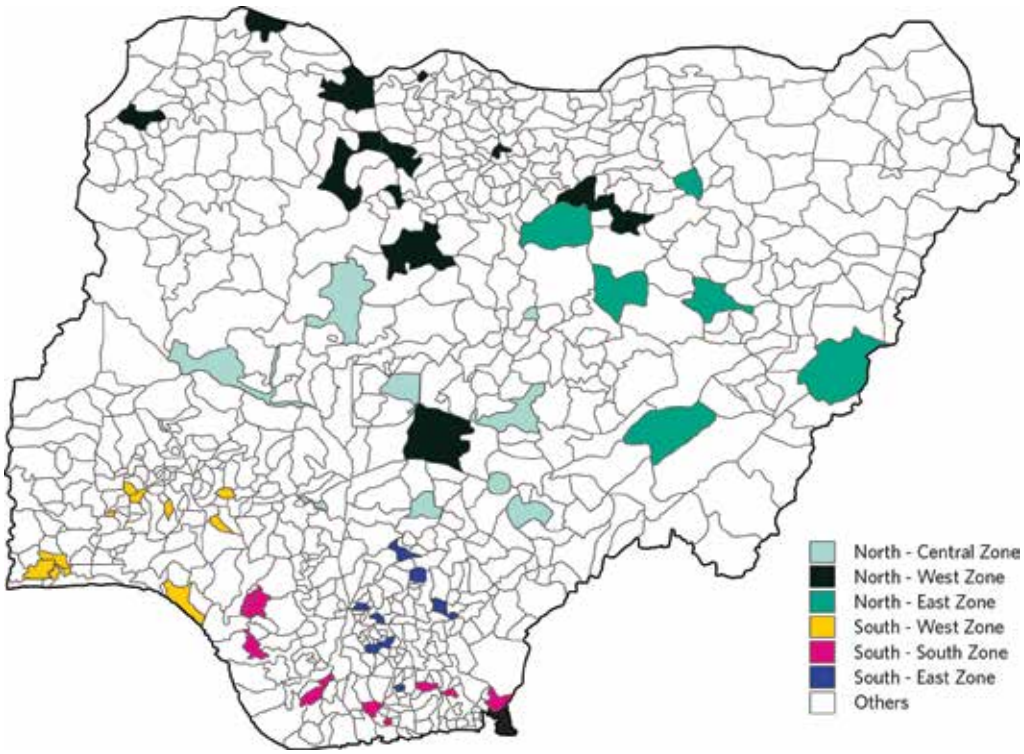
In each selected EA, all eligible respondents were included in the survey. In a situation where the population of eligible respondents was less than 650, a part of the next adjoining EA was included in the survey. In some areas, up to eight EAs constituted one cluster. There was no situation where the population of eligible population exceeded 750.

Due to an unstable security situation, field operations could not take place in the two States of Borno and Yobe. The two EAs in Borno were replaced by two additional EAs in Adamawa and Gombe States that share similar characteristics with Borno, while the only EA in Yobe was replace by adding one EA in Bauchi State with similar characteristics.

1.4.5 Basic survey elements

Data collection took place in the community. In advance of the visit by the survey teams, the team, in conjunction with the authorities in the community and the local government, identified areas where the team would work. Preference was given to health facilities; where this was not available, community halls, school or other buildings provided by the community were used.

Figure 1.3
Sampled clusters for Nigeria TB prevalence survey



1.4.6 Case definitions

For the purpose of the prevalence survey, a person was defined as a pulmonary TB case if he or she was:

- Enrolled in the survey;
- Identified as having symptoms suggestive of TB and/or an abnormal chest x-ray; and
- Bacteriologically- confirmed (smear-positive and/or culture positive) as having *Mycobacterium tuberculosis*.

Persons who were identified as undergoing TB treatment, but were not identified following the algorithm of selection for this survey (do not have cough ≥ 2 weeks OR have a normal chest x-ray) were not considered TB cases in this survey.

Identified TB cases were further classified according to the NTP definitions as follows:

- New case: patient has never had TB treatment or has taken anti-TB medications for < 1 month.
- Case on treatment: patient is presently undergoing treatment with anti-TB drugs.

- Relapse case: patient who was previously declared cured or who completed treatment but who had a new episode of bacteriologically-confirmed TB.
- Default case: patient who interrupted treatment of ≥ 2 months after ≥ 1 month of treatment.
- Failure case: patient who was bacteriologically-positive after ≥ 5 months of treatment.
- Undetected (unknown) case: patient who was diagnosed as TB by the survey for the first time.

The case definitions above are not mutually exclusive. For example, an undetected case could be a new case or a relapse case.

1.5 Survey organization

The survey included several organizational units: the survey management committee, the technical committee (which includes five workgroups), the survey coordinator, and the central and field operations centres. These latter two each consist of the laboratory, chest x-ray, data management, and logistics/administrative sub-units. Each field unit (zone) has one team headed by a team leader.

1.5.1 Survey Management Committee

The Survey Management Committee (SMC) had the primary role of coordination and management of the survey. It was chaired by the Director of Public Health in the Federal Ministry of Health, and consisted of FMOH, WHO, USAID, CDC and partners. It facilitated government political support; created the enabling environment for stakeholder support; coordinated all resources required for effective implementation of the survey at all levels; and ensured effective monitoring and evaluation of the survey.

1.5.2 Technical Committee

The Technical Committee reported to the SMC and had overall responsibility for the technical component of the survey. This included the development of the protocol; provision of technical support for field implementation; formulation of standard operating procedures, trainings, pilot-testing, logistics, ACSM; report preparation; and the dissemination of survey findings through international conferences and scientific manuscripts.

1.5.3 Principal Investigator

The National Co-ordinator NTBLCP was the Principal Investigator, responsible for the management and leadership of the survey process and also for leading advocacy visits to state governments and other local stakeholders to secure political support and additional support for the survey.

1.5.4 Survey Coordinator

The Survey Coordinator was responsible for facilitating the technical component of the survey through the technical committee whose activities he reports directly to the SMC.

In addition, he was responsible for contributing to the preparation of SOPs and the field manual; arranging training and pilot testing; planning of fieldwork; supervising data management; preparing monitoring reports; ensuring proper budgetary allocation to all survey activities; and for reporting any problems with the survey to the SMC. The Survey Coordinator operated as the key liaison person between the operating units (central and field) and the SMC throughout the survey, and was responsible for the day-to-day running of the survey process.

1.5.5 Central unit

All components of the central unit reported directly to the Survey Coordinator. The components were responsible for monitoring field activities through routine visits to the field.

1.5.6 Central laboratory

Three central laboratories (Lagos NMIR, Zaria NTBLTC and Zankli Medical centre) were responsible for processing and performing smear microscopy and culture on all specimens collected. The central laboratories were also responsible for maintaining internal quality controls (quality and quantity of specimen, labelling, storage, processing, reading and grading of results) and external quality assurance was provided by a supranational reference laboratory (SRL) based in Milan.

1.5.7 Central chest x-ray unit

The central chest x-ray unit was responsible for detailed interpretation of all X-ray images and classification of abnormalities as mentioned in the SOPs. It was also responsible for assessing quality assurance, on-site training, retrospective interpretation and for conducting field supervision to ensure adherence to SOPs.

1.5.8 Central data management unit

The Central Data Management Unit, based in the survey secretariat in the national TB programme office, served as the central warehouse for all data collected from the survey. The central data manager was responsible for preparing information systems to capture the data; for the validation of double-entered data files; and for the routine checking of validated data files for systematic errors (cleaning).

1.5.9 Field teams

The components of the central unit described above were also reflected in the field unit, responsible for implementation of field activities as stipulated in the survey protocol. There were six teams trained for field data collection.

The composition of the field teams was (see Table 1.1 and Table 1.2):

Table 1.1
Fixed field team members

Designation	Number	Role
Team Leader	1	Overall supervision
Medical Officer	1	Reading of x-ray
Data Manager	1	Field data management
Interviewers	3	Interviewing respondents
Radiographers	2	X-raying respondents
Receptionist	1	Documentation and maintaining order
Laboratory Assistant	1	Sputum sample management
Total	**10**	

Table 1.2
Co-opted local members

Designation	Number	Role
State TBL Control Officer	1	Advocacy, mobilization, etc.
LGA TBLS	1	Mobilization, registration and follow-up of suspect TB cases, etc.
Local translators	1	Interpretation and translation
Security men	2	Security of equipment and maintaining order
Representatives of local authorities	2	Mobilization
Receptionist	1	Documentation and maintaining order
Laboratory Assistant	1	Sputum sample management
Total	**9**	

1.6 Training requirements

All the central team members were trained prior to commencement of the field data collection. The following trainings were carried out:

- A five day training of all survey teams covered protocol and SOP issues, including introduction and testing of the survey instruments;
- A five day training and field testing of the radiology sub-group (Radiographers and Medical Officers) on the use of digital x-ray and reading; two days were dedicated to field testing in two communities;
- Three trainings of five days each in order to acquaint data managers with the survey instruments, database and recording and reporting procedures;
- Two trainings organized for the laboratory staff on sputum handling, recording and reporting and processing of sputum samples; and
- As a result of the delay in the start of the survey, refresher training was organized for each of the groups one month prior to the commencement of the field data collection.

1.7 Pilot testing

After finalization of the survey protocol, the SOPs and the training plan for field staff, a piloting of the entire survey process was carried out in two clusters - one urban, one rural. One of these was in central Nigeria in a village in Kontagora LGA of Niger State (rural) and the other in Ondo-South town of Ondo South LGA (urban). The main aim was to check the clarity of the entire set of tools for data collection; to assess the feasibility of time allocated for collection of data from each cluster; and to test the logistic arrangements in the field especially sputum transportation. This experience informed certain adjustments in the tools and logistic plan.

1.8 Survey procedures

1.8.1 Procedures before field survey

The survey management committee selected 70 clusters for the survey according to the protocol. One or two weeks prior to the survey in a particular cluster, the Survey Team Leader together with the State TB and Leprosy Control Officer (STBLCO), the designated National Population Commission (NPC) Technical Officer and the Local Government TB and Leprosy Supervisor (TBLS) visited the LGA where the cluster is located.

Local government officials, local community authorities and religious leaders were approached to facilitate their support and cooperation in the execution of the survey. With their input, the eligible areas for the survey were confirmed based upon the population size of the selected cluster area and operational feasibility, including security situations. The community and local government level advocacy kits were given to the appropriate persons.

In a few instances, clusters with security challenges or difficult terrains were replaced, usually with a new cluster in the same LGA. The decision to replace the cluster was usually communicated to the survey coordinator before the replacement was done.

Enumeration of the cluster area was carried out by three NPC staff with assistance from the local government TBLS and four community volunteers. The enumeration process took one week and was carried out one or two weeks prior to the actual survey in the cluster.

The enumeration team pasted the building number of houses on the gate or wall of the building. Household numbers were pasted on the doors of individual households.

The survey team leader revisited the enumeration team midway into the enumeration exercise to ascertain that enumeration is going on smoothly and according to the survey protocol.

1.8.2 Field survey procedures

Field operations in a cluster were completed in one week (see Table 1.3). The field operations in some clusters lasted well into the night to allow farmers and workers to participate in the survey. In some urban clusters, screening of participants was carried out on Saturdays to enable civil servants to participate.

Table 1.3
Field Operation Schedule

Day	
1st Sun	Arrival and setting up with local collaborators, census taking and distribution of invitation letter.
2nd Mon	Screening 1 and distribution of invitation.
3rd Tue	Screening 2, distribution of invitation and mop-up of non-attendees
4th Wed	Screening 3, distribution of invitation, mop-up of non-attendees and **shipment of sputum samples 1.**
5th Thu	Screening 4, distribution of invitation and mop-up of non-attendees
6th Fri	Screening 5, distribution of invitation and mop-up of non-attendees
7th Sat	**Shipment of sputum samples 2, and movement to next cluster**

1.8.2.1 Census-taking

Upon arrival in the survey cluster, the enumeration team handed over the household register, interim list of eligible participants and relevant cluster map to the survey team leader. The enumeration team also conducted the survey team leader round the enumerated areas.

The survey team members then entered the survey number (e.g. XX-###-OO signifies: cluster number-house hold number-individual number) into the survey number column of the household register. Every household member, irrespective of the age, was allocated a survey number.

Invitation letters were written for each eligible participant and given personally to them. The letters contained the survey number, day, venue and time that participants are to attend the survey. If an eligible participant was absent, the survey team repeated a visit to the particular household to deliver the invitation letter. In special circumstances, the survey team allowed household members to receive an invitation letter by proxy for other family members. Eligible participants were educated about the survey as they were given the invitation letters.

During the distribution of invitation letters, newcomers staying more than two weeks were added to the household register. Household members who were omitted during the enumeration exercise were also added to the household register. Household members who would not be available for the survey or who had died were omitted. The survey team then calculated the total eligible population, omitting those persons less than 15 years (defined as non-eligible).

1.8.2.2 Interview at survey examination site

Eligible individuals, with their invitation letters, were welcomed to the survey venue by the receptionist. The receptionist collected the invitation letters from the participants and confirmed their eligibility by checking with the cluster household register. If the participant's name was found in the register, the name in the register was ticked and appropriate sections of the registers completed. Written consent for participation was read and explained to the participant in the language that she/he understands or prefers. The participant signed the consent form if she/he agrees to participate in the survey. Those who cannot sign were provided with an inkpad to make a thumbprint on the form. After the consent form had been signed, a member of the survey team took the participant to any of the available interviewers for interview.

An interviewer then opened an Individual Survey Card for the participant and completed the card in line with the protocol. Information recorded in the card included: participant's survey number, name of participant, date of interview, sex, age, occupation, level of education, religion, marital status, past history of TB, TB symptoms, health-seeking behaviour regarding symptoms of TB, TB treatment history and tobacco smoking history. The interviewer also recorded the height and body weight of the participant. After the interviewer had finished collecting the required information from the participant, a member of the survey team takes the participant, along with the survey card, for CXR examination. All interviewed participants, except those exempted or who refused to participate, undergo CXR examinations. The findings of the CXR were recorded on the card by the Medical Officer who reads the CXR. Those identified as TB suspects from the interview and/or CXR were referred for sputum examination.

Follow-up visits were conducted for eligible subjects who failed to come to the survey site. They were asked again to attend the screening exercise. The follow-up visits continued until the end of the survey in the cluster. Those who refused to participate in the survey were noted in the household register and were not visited again. For the elderly and physically challenged, transportation was provided to facilitate their participation. When participants presenting with symptoms could not afford to travel from home, interview and sputum collection were conducted with their consent inside their homes.

1.8.2.3 Chest x-ray (CXR) examination

Chest x-rays were carried out using portable mobile x-ray units (MinXray) provided to each team. This is a computed radiography system (CR) equipped for digital images. Power supply was assured by the provision of one mobile power generating set for each team.

After verifying documentation and receiving consent for the procedure, the x-ray technicians on the team conducted and processed all x-rays using the mobile x-ray unit. The technicians transferred the processed image on a cartridge to a scanner which is connected to a computer. The scanner scanned the image and projected it to a computer. The X-ray image on the computer screen is immediately read by a medical officer trained

on radiographic interpretation prior to the commencement of the survey, in order to determine the presence or absence of any abnormalities. All x-rays were backed up onto CD-ROMs daily.

A CXR shadow eligible for sputum collection was defined as any abnormal shadow in the lung field and mediastinum, or pleural effusion except pleural thickness or small single calcification. Those with serious disease were advised by the team leader to visit an appropriate medical facility for further follow-up in collaboration with the local health authority.

All x-ray images (saved on CD ROMs) and documentation were transferred to the central x-ray unit for validation (presence/absence of abnormalities), detailed interpretation and storage. During the survey, regular field level supervision of the radiographic team was made by the central x-ray team to ensure compliance with the SOPs as mentioned in a separate document (radiology reference guide). Retrospective analysis in cases of bacteriological-radiological discrepancy was carried out by the radiologist and the chest physician. In case of non-consensus, a third opinion from a neutral expert was sought.

1.8.2.4 Sputum collection, storage and shipment

Two sputum specimens (spot and early morning) were collected from each subject eligible for sputum based on either symptoms or CXR screening, or from those exempted from CXR examination irrespective of their symptoms. Submitted specimens were immediately placed in a cooler, where they were kept until they reached the designated processing centre. The identification number of the specimen and other necessary information were recorded in the sputum smear examination forms (Form 08a).

A survey team member and a community volunteer made home visits to trace participants who submitted a spot sputum specimen but failed to submit a morning sputum specimen.

The sputum specimens and sputum smear examination forms were shipped to the designated culture centre on Wednesday and Saturday of each week. The specimens were shipped by either road or air depending on the distance from the survey site to the culture centre. A courier company was contracted to ship the specimens.

1.9 Security during field operations

Security during field operations was ensured through the involvement of local government and community authorities in the enumeration and screening processes. Community members were also co-opted as community volunteers during the processes. In a few instances, the police were informed of the survey activity in an area and their support solicited. Although at the planning stage of the prevalence survey there was no state where health service and disease control activities were suspended, security challenges in Borno

and Yobe States were high resulting in the cancellation of survey activities in these States. However, the Survey Management Committee agreed that the survey be carried out in LGAs in neighbouring States bordering these States.

1.10 Ethical considerations

This survey adhered to the general conduct of ethical biomedical studies as defined by the World Medical Association (WMA) Declaration of Helsinki 2000 and revised in 2007.

Ethical clearance was obtained from the Nigerian National Research Ethical Review Committee of the Nigerian Federal Government. To ensure that the survey met all ethical standards, WHO and CDC were involved in all steps of protocol development and survey implementation.

During the enrolment of respondents, information was provided to respondents about the survey's purpose; implementation strategy; possible side effects (if any); confidentiality; opportunity of the respondent to ask questions; benefits to the respondent; the community and the nation; as well as assurance that the respondent participation was voluntary and that refusal would not affect any potential benefit accrued to the respondent.

Only respondents who gave informed written consent based on the above information were enrolled for the survey. For those who were not literate, the content of the consent form was translated verbally to them in their local dialect. If/and when consent was given, a thumb print was obtained from the respondent in the presence of a witness.

As the data collected are of a sensitive nature and linked to patients, all data were kept in a secured and confidential manner. Training related to patient and data confidentiality was given to all staff during pre-survey training and mid-term review. During aggregated analysis, patient identifiers (i.e. name) were removed.

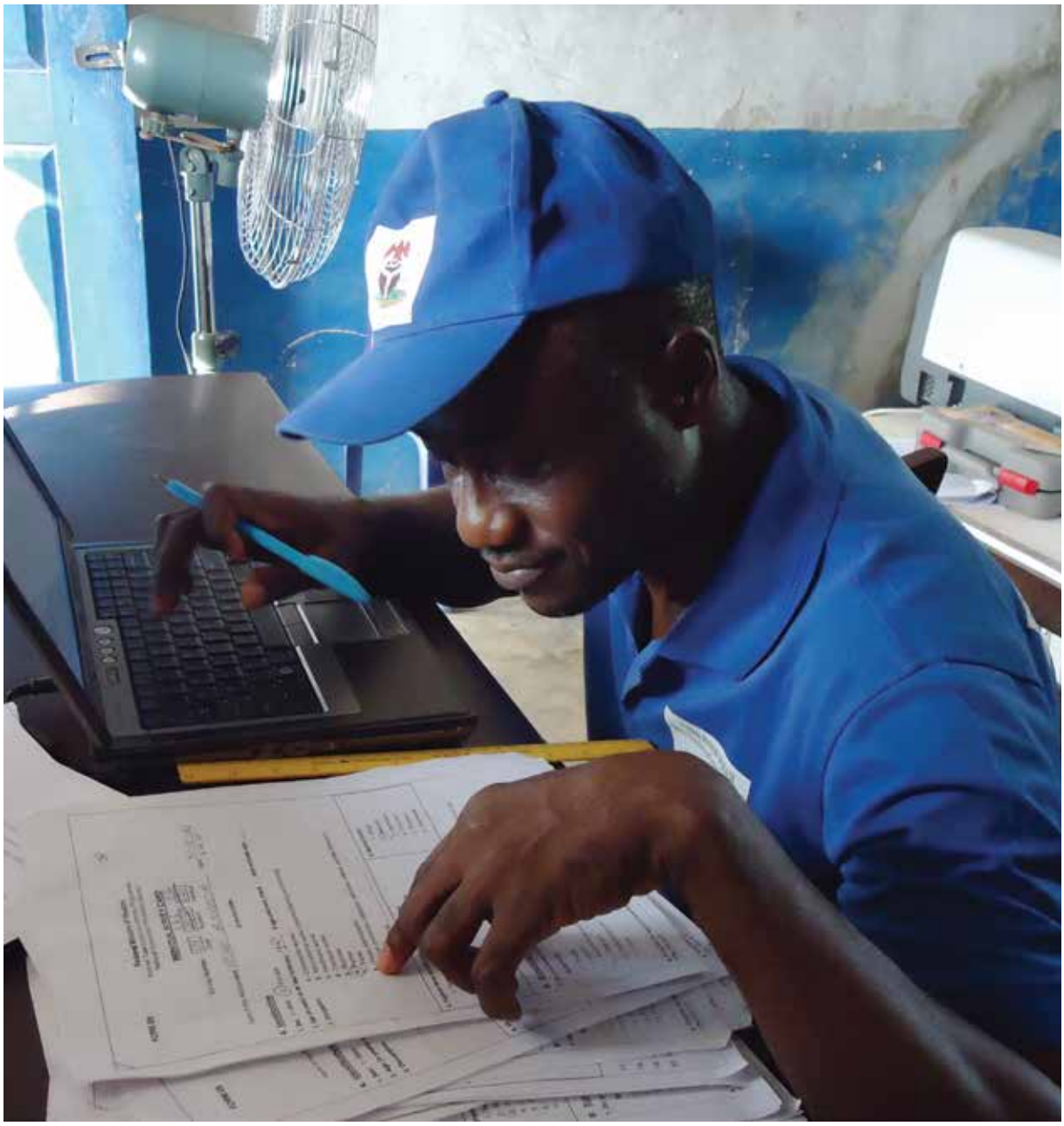
Paper records were kept in a secured room in the survey secretariat. Electronic records were stored in a password-protected database.

During the course of the survey, any person identified as having TB was immediately enrolled in the national TB programme for treatment as per national guidelines.

If during the course of the survey respondents showed symptoms of extra-pulmonary TB or other pulmonary conditions, they were referred to the national TB programme for appropriate services for diagnosis and management. In addition, respondents with an urgent medical need (e.g., pneumothorax) were immediately referred for emergency medical care.

CHAPTER 2

Description of the survey data



2.1 Summary of survey data flow

The field operations for the Nigeria TB prevalence survey ran from February to November 2012, covering 70 clusters. A total of 113,247 persons were enumerated out of which 77,797 (68.7%) persons were eligible to participate in the survey; 44,186 (56.8%) were screened. Of the 44,186 screened, 43,198 (97.8%) were interviewed and had chest x-rays taken, while 987 (2.2%) had interviews only. Of the two screening methods, a total of 4,688 (10.6%) individuals were eligible for sputum examinations.

The remaining 33,511 individuals did not participate. Of these, 32,617 were not present; 1,528 consented but were not interviewed; and 12 persons had no consent forms. Non-participants were recorded.

Note: 35,450 (34,947 children and 503 adult non-residents) were ineligible for inclusion in the survey (see the consort diagram Figure 2.1).

2.2 Age-sex distribution of enumerated, eligible and ineligible populations

The enumerated from survey census, eligible, and ineligible populations overall and broken down by sex, age group and geopolitical zone are presented in Table 2.1. Looking at the table, there were more females (51.9%) enumerated than males (48.1%). 70% of females were eligible, compared to 66.5% of men. The percentages of non-eligible who are age 15 years or less are 30.9% of those enumerated. This is lower than expected when compared to the national figure (45% of the general population being less than 15 years as reported in the 2006 National Population figures). Among those enumerated who are above 15 years of age, only 0.4% were ineligible for the survey.

In terms of zonal distribution, the North-West zone had the highest number of enumerated individuals eligible for the survey, while the South-East zone had a lowest. This appears to reflect the population distribution of the country as indicated in the 2006 census.

Figure 2.1
Consort diagram of the National TB prevalence survey, Nigeria 2012

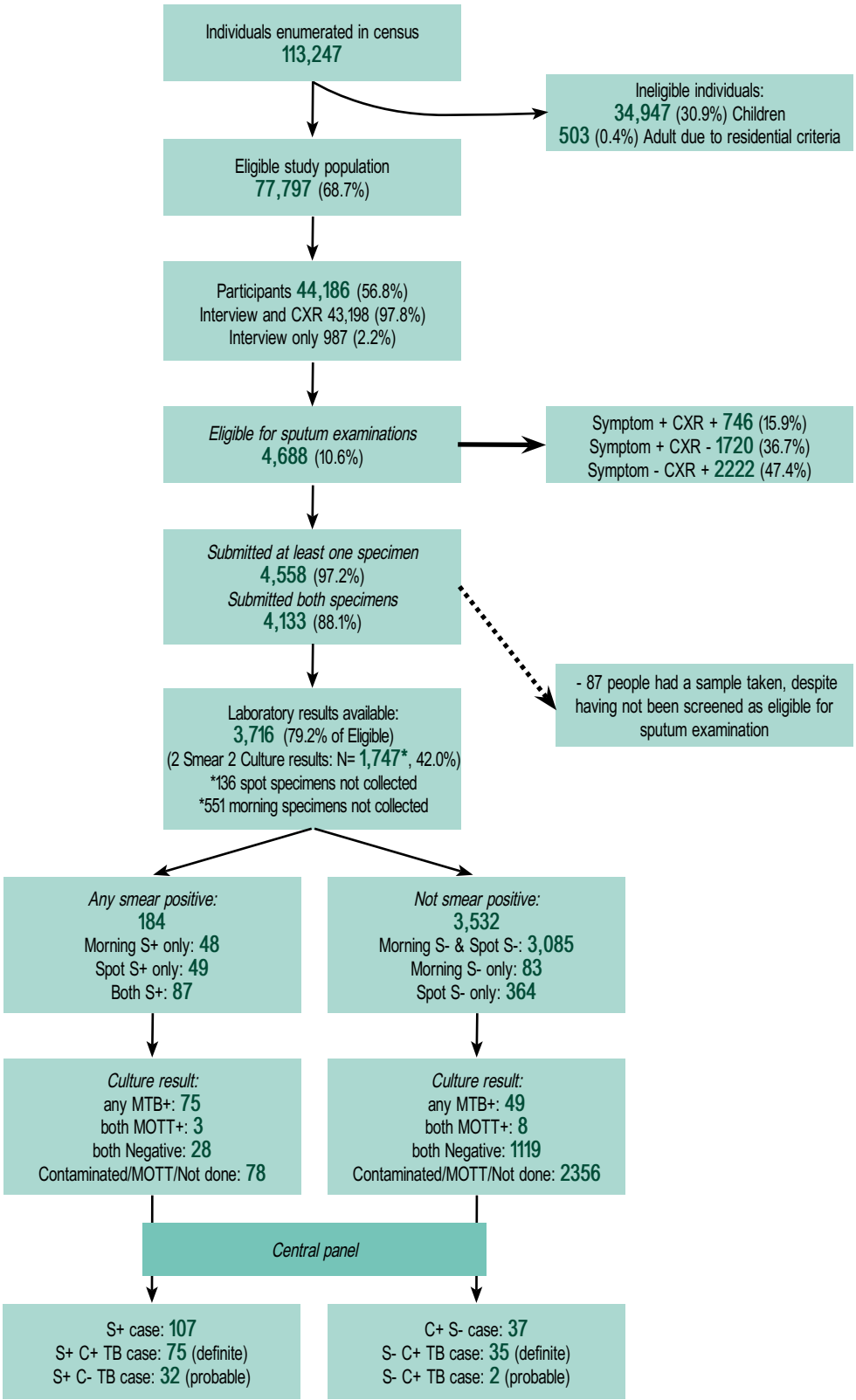
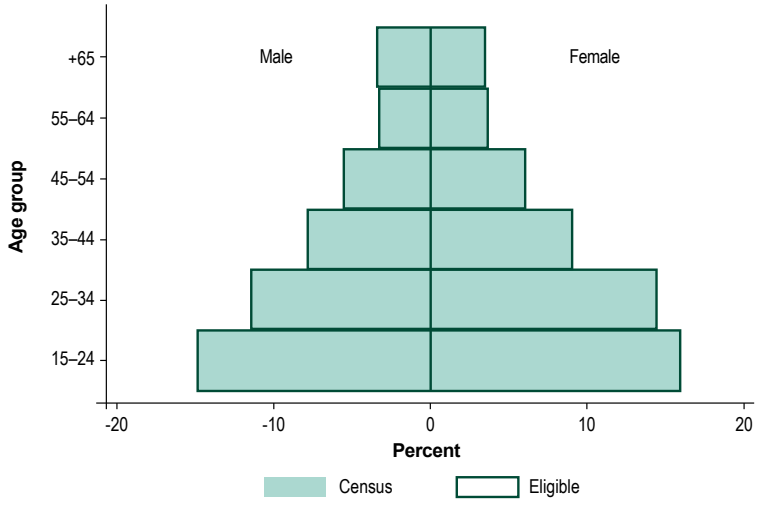


Table 2.1
Enumerated, eligible and non-eligible population: overall, and broken down by sex, age group and geopolitical zone

		Eligible	*%*	*Non-eligible aged >= 15*	*%*	*Non-eligible aged < 15*	*%*	*All enumerated*
Total	**77,797**	68.7%	**503**	0.4%	**34,947**	30.9%	**113,247**	
Sex	*Male*	36,176	66.5%	292	0.5%	17,934	33.0%	54,402
	Female	41,621	70.7%	211	0.4%	17,013	28.9%	58,845
Age (years)	*Unknown (<15)*					0		
	0-4					12,740	100.0%	12,740
	5-9					12,774	100.0%	12,774
	10-14					9,433	100.0%	9,433
	15-24	23,978	99.2%	184	0.8%			24,162
	25-34	20,335	99.4%	132	0.6%			20,467
	35-44	13,324	99.5%	68	0.5%			13,392
	45-54	9,176	99.5%	49	0.5%			9,225
	55-64	5,548	99.3%	40	0.7%			5,588
	65+	5,436	99.5%	30	0.5%			5,466
	Unknown (>=15)	0						0
Zones	*North Central*	10,681	65.3%	14	0.1%	5,660	34.6%	16,355
	North East	8,699	58.7%	327	2.2%	5,794	39.1%	14,820
	North West	21,198	63.3%	38	0.1%	12,232	36.5%	33,468
	South East	7,418	73.2%	34	0.3%	2,679	26.4%	10,131
	South South	12,559	79.6%	31	0.2%	3,179	20.2%	15,769
	South West	17,242	75.9%	59	0.3%	5,403	23.8%	22,704

The age and sex distribution of the population from survey census and eligible survey individuals are very similar (Figure 2.2), suggesting that no sampling bias has been introduced during this step of identifying the eligible survey population.

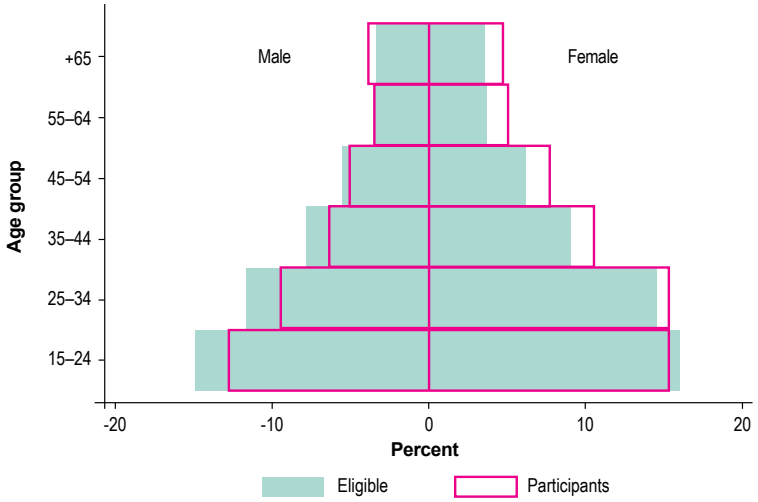
Figure 2.2
Comparison of age and sex distribution of the census and eligible survey populations



2.3 Survey participation

The age and sex distributions of the eligible and survey participant populations show some differences, particularly in the older female and younger male categories (Figure 2.3). This means that the population of those individuals who participated in the survey differs from the targeted eligible population. Weighted analyses were necessary to account for this sampling bias.

Figure 2.3
Comparison of age and sex distribution of the eligible and participant survey populations



2.4 Overall survey participation

Although fewer males than females were eligible across all the age groups, Figure 2.3 above shows lower male participation especially in the age groups of 15-54 (active age group). Participation appears to be narrowing only in the age group 64 and above. This is further illustrated in the graph below.

Details on the age and sex distribution of participants interviewed are presented in Table 2.2.

Table 2.2
Participation by screening tool, evaluable participants that were interviewed

	Eligible	*Participants*	*%*	*Non-Participants*	*%*	*Interviewed*	*%*
Total	**77,797**	**44,186**	**56.8%**	**33,611**	**43.2%**	**43,439**	**98%**
Male							
15-24	11,525	5,607	48.7%	5,918	51.3%	5,385	96%
25-34	8,964	4,182	46.7%	4,782	53.3%	3,997	96%
35-44	6,159	2,828	45.9%	3,331	54.1%	2,703	96%
45-54	4,341	2,273	52.4%	2,068	47.6%	2,169	95%
55-64	2,581	1,565	60.6%	1,016	39.4%	1,489	95%
65+	2,606	1,723	66.1%	883	33.9%	1,677	97%

Table 2.2 - continued

Female							
15-24	12,453	6,747	54.2%	5,706	45.8%	6,779	100%
25-34	11,371	6,802	59.8%	4,569	40.2%	6,794	100%
35-44	7,165	4,685	65.4%	2,480	34.6%	4,677	100%
45-54	4,835	3,434	71.0%	1,401	29.0%	3,426	100%
55-64	2,967	2,246	75.7%	721	24.3%	2,239	100%
65+	2,830	2,094	74.0%	736	26.0%	2,104	100%

Table 2.3 presents the age and sex distribution of 43,199 (97.8%) survey participants that had chest x-ray examinations.

Table 2.3
Age and sex distribution of individuals evaluated by chest x-ray

	Eligible	*Participants*	*%*	*Non-Participants*	*%*	*Interviewed*	*%*
Total	**77,797**	**44,186**	**56.8%**	**33,611**	**43.2%**	**43,199**	**97.8%**
Male							
15-24	11,525	5,607	48.7%	5,918	51.3%	5,516	**98.4%**
25-34	8,964	4,182	46.7%	4,782	53.3%	4,127	**98.7%**
35-44	6,159	2,828	45.9%	3,331	54.1%	2,803	**99.1%**
45-54	4,341	2,273	52.4%	2,068	47.6%	2,257	**99.3%**
55-64	2,581	1,565	60.6%	1,016	39.4%	1,554	**99.3%**
65+	2,606	1,723	66.1%	883	33.9%	1,717	**99.7%**
Female							
15-24	12,453	6,747	54.2%	5,706	45.8%	6,440	**95.4%**
25-34	11,371	6,802	59.8%	4,569	40.2%	6,488	**95.4%**
35-44	7,165	4,685	65.4%	2,480	34.6%	4,569	**97.5%**
45-54	4,835	3,434	71.0%	1,401	29.0%	3,408	**99.2%**
55-64	2,967	2,246	75.7%	721	24.3%	2,237	**99.6%**
65+	2,830	2,094	74.0%	736	26.0%	2,083	**99.5%**

Cluster summary of interview and CXR screening is illustrated in Annex 7.

2.4.1 Occupation

All participants in the survey were interviewed using a structured questionnaire that covered basic demographic data including occupation. The most common occupations of the participants consisted of husband/housewife (17.6%), traders (17.8%) and students 19%). Least frequent among them were the occupations of health worker (0.9%), construction worker (0.7%) and transport worker (1.1%). Details can be seen in Table 2.4.

Table 2.4
Occupation of participants

	Male	%	Female	%	Total	%
Construction worker	287	1.6%	35	0.1%	322	0.7%
Admin worker	1,459	8.0%	960	3.7%	2419	5.5%
Healthcare worker	117	0.6%	279	1.1%	396	0.9%
Transport worker	682	3.8%	32	0.1%	714	1.6%
Business	1,291	7.1%	1,496	5.8%	2787	6.3%
Farmer	4,130	22.7%	2,414	9.3%	6544	14.8%
Trader	1,250	6.9%	6,598	25.4%	7848	17.8%
Housewife/husband	253	1.4%	7,514	28.9%	7767	17.6%
Artisan	2,290	12.6%	1,666	6.4%	3956	9.0%
Student	4,858	26.7%	3,643	14.0%	8501	19.2%
Other	1,561	8.6%	1,371	5.3%	2932	6.6%
Total	**18178**		**26008**		**44186**	

2.4.2 Educational level of survey participants

The participants' questionnaire also asked about the highest level of education attained (Table 2.5). This was to see whether this may have any influence on what participants' responses if they have symptoms suggestive of TB. In this case, 22.9% of participants had no formal education; 13.5% non-formal/Koranic; 20.5% primary education; 19.5% completing senior secondary school; 11.8% junior secondary; and 11.8% post-secondary education. In general, males seemed to have higher levels of education than females.

Table 2.5
Highest education level of survey participants

	Male	%	Female	%	Total	%
None	2,380	13.1%	7,756	29.8%	10136	22.9%
Non-formal/Koranic	2,238	12.3%	3,708	14.3%	5946	13.5%
Primary	3,783	20.8%	5,285	20.3%	9068	20.5%
JSS 3 completed	2,494	13.7%	2,720	10.5%	5214	11.8%
SSS 3 completed	4,227	23.3%	4,386	16.9%	8613	19.5%
Post-secondary	3,053	16.8%	2,151	8.3%	5204	11.8%
Don't know	3	0.0%	2	0.0%	5	0.0%
Total	**18,178**		**26,008**		**44,186**	

2.4.3 History of TB among participants

The majority of the participants reported no history of TB. A total of 82 participants (0.2%) reported to being on TB treatment at the time of survey; out of these, 37 were males and 45 females. Most of them (39) were from urban areas (Table 2.6).

Table 2.6
Participants on treatment for TB at time of survey

	All	%	Male	%	Female	%
Yes	82	0.2%	37	0.2%	45	0.2%
No	44,104	99.8%	18,178	99.8%	25,963	99.8%
Total	44,186		18,215		26,008	
	Rural	%	Semi-urban	%	Urban	%
	34	0.2%	9	0.4%	39	0.2%
	18,894	99.8%	2,452	99.6%	22,758	99.8%
Total	18,928		2,461		22,797	

In terms of treatment for TB (Table 2.7), the majority of those on treatment received treatment in government health facilities such as health centre/PHC (43.2%) and general hospitals (35.1%). Fewer received treatment in private hospitals (5.4%), university teaching hospitals (5.4%), traditional healers (5.4%), mission hospitals 2.7%, or others (2.7%).

Table 2.7
Health-seeking behaviour of participants on TB treatment

	All	%	Male	%	Female	%	Rural	%	Semi-urban	%	Urban	%
Health centre/ PHC	22	26.8%	10	31.3%	12	27.9%	5	16.1%	1	14.3%	16	43.2%
Private hospital	8	9.8%	3	9.4%	5	11.6%	6	19.4%	0	0.0%	2	5.4%
Traditional centre	4	4.9%	3	9.4%	1	2.3%	2	6.5%	0	0.0%	2	5.4%
Chemist	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
General hospital	30	36.6%	12	37.5%	18	41.9%	13	41.9%	4	57.1%	13	35.1%
Teaching hospital	4	4.9%	2	6.3%	2	4.7%	0	0.0%	2	28.6%	2	5.4%
Mission hospital	5	6.1%	2	6.3%	3	7.0%	4	12.9%	0	0.0%	1	2.7%
Other	2	2.4%	0	0.0%	2	4.7%	1	3.2%	0	0.0%	1	2.7%
Missing	7	8.5%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
Total	82		32		43		31		7		37	

552 (1.2%) of the respondents reported having had TB treatment in the past; out of these 281 were male and 271 female. The majority (303) were from urban areas, with 212 from rural and 37 from semi-urban areas.

48.6% of the respondents reported seeking treatment in general hospital; 22.4% in health centres/PHC; 11.2% in teaching hospitals; and 10.1% in private hospitals. Only one individual reported seeking treatment at the chemist.

Table 2.8
Participants' previous TB treatment status

Previous Treatment History												
	All	*%*	*Male*	*%*	*Female*	*%*	*Rural*	*%*	*Semi-urban*	*%*	*Urban*	*%*
Yes	552	1.2%	281	1.5%	271	1.0%	212	1.1%	37	1.5%	303	1.3%
No	43,634	98.8%	17,897	98.5%	25,737	99.0%	18,716	98.9%	2,424	98.5%	22,494	98.7%
Total	**44,186**		**18,178**		**26,008**		**18,928**		**2,461**		**22,797**	

Place of Previous Treatment												
	All	*%*	*Male*	*%*	*Female*	*%*	*Rural*	*%*	*Semi-urban*	*%*	*Urban*	*%*
Health centre/ PHC	93	17.9%	46	17.4%	47	18.4%	21	10.6%	8	22.9%	64	22.4%
Private hospital	58	11.2%	30	11.4%	28	11.0%	28	14.1%	1	2.9%	29	10.1%
Traditional centre	6	1.2%	2	0.8%	4	1.6%	4	2.0%	0	0.0%	2	0.7%
Chemist	4	0.8%	2	0.8%	2	0.8%	3	1.5%	0	0.0%	1	0.3%
General hospital	257	49.5%	122	46.2%	135	52.9%	94	47.5%	24	68.6%	139	48.6%
Teaching hospital	54	10.4%	37	14.0%	17	6.7%	20	10.1%	2	5.7%	32	11.2%
Mission hospital	36	6.9%	17	6.4%	19	7.5%	21	10.6%	0	0.0%	15	5.2%
Other	11	2.1%	8	3.0%	3	1.2%	7	3.5%	0	0.0%	4	1.4%
Total	**519**		**264**		**255**		**198**		**35**		**286**	

2.5 Field screening

2.5.1 TB-related symptoms

All eligible participants were interviewed about TB-related symptoms over the past month (Table 2.9). 11% of respondents reported a cough (cough of 1-13 days 6.1%, 14-30 days 6.1% and >30 days 2.2%). 0.7% of participants had haemoptysis. According to the protocol, only those who had had a cough for two weeks or more (2,479 participants, or 5.6% were eligible to submit a sputum sample.

Table 2.9
Results of screening interview: TB-related symptoms

	N	%
1. Cough	5152	11.7%
1-13 days	2679	6.1%
14-30 days	1492	3.4%
31 + days	981	2.2%
2. Sputum	3551	8.0%
3. Haemoptysis	288	0.7%
4. Chest pain	6813	15.4%
5. Body weight loss	3553	8.0%
6. Fever	8493	19.2%
Any symptom (1-6)	15812	35.8%
Eligible for sputum exam by interview	**2473**	**5.6%**
No symptoms	28374	64.2%
Total	**44186**	

2.5.2 Chest x-ray examinations

A total of 43,186 (98%) of the 43,199 participants had chest x-rays (CXR) examination (see detail in Table 2.10). Those 987 participants who did not take CXR consisted of pregnant women, older people who could not walk to the centres and, in some cases, those who were unable to participate due to faulty CXR machines. Of those who received CXR, 2,968 (6.9%) were eligible for sputum examination due to abnormal findings. Slightly more males (7.5%) than females (6.4%) had abnormal findings on CXR. Additionally, the age groups 55-64 and above 65 showed more abnormalities on CXR than did the younger age groups.

Table 2.10
Chest x-ray field screening results

			(Normal)		*(Abnormal)*	
	CXR not taken	*CXR taken*	*Non-eligible for sputum*	*(%)*	*Eligible for sputum*	*(%)*
Total	**987**	**43,199**	**40,229**	**93.1%**	**2,968**	**6.9%**
Male						
	204	17,974	16,619	92.5%	1,355	7.5%
15-24	91	5,516	5,422	98.3%	94	1.7%
25-34	55	4,127	3,952	95.8%	175	4.2%
35-44	25	2,803	2,605	92.9%	198	7.1%
45-54	16	2,257	1,982	87.8%	275	12.2%
55-64	11	1,554	1,325	85.3%	229	14.7%
65+	6	1,717	1,333	77.6%	384	22.4%

Table 2.10 - continued

Female						
	783	25,225	23,610	93.6%	1,613	6.4%
15-24	307	6,440	6,303	97.9%	135	2.1%
25-34	314	6,488	6,269	96.6%	219	3.4%
35-44	116	4,569	4,328	94.7%	241	5.3%
45-54	26	3,408	3,095	90.8%	313	9.2%
55-64	9	2,237	1,946	87.0%	291	13.0%
65+	11	2,083	1,669	80.1%	414	19.9%
Zone						
North Central	37	5,973	5,355	89.7%	618	10.3%
North East	485	6,002	5,741	95.7%	261	4.3%
North West	334	11,454	10,616	92.7%	838	7.3%
South East	38	3,781	3,644	96.4%	137	3.6%
South South	37	6,678	6,271	93.9%	407	6.1%
South West	56	9,311	8,602	92.4%	707	7.6%

2.6 Field screening summary

As indicated in the table below, a total of 4,688 individuals (10.6%) were eligible for sputum examination by either symptoms or CXR. 746 (15.9%) were eligible by both CXR and interview, while 2222 (47.4%) were eligible by CXR only and 1720 (36.7%) by symptoms only (Table 2.11).

Table 2.11
Summary results of screening: reasons of eligibility for sputum examinations

		INTERVIEW (SYMPTOMS)		
		Eligible	Not Eligible	Total
CXR	Eligible*	746	2,222	**2,968**
	Not Eligible	1,720	39,498	**41,218**
	Total	**2,466**	**41,720**	**44,186**

*eligibility for sputum examination

2.7 Laboratory examinations

In accordance with the survey protocol, the 4,688 participants considered eligible for the sputum examinations were asked to submit two sputum specimens (spot and early morning). 4558 participants (97%) submitted at least one sputum specimen, and 4,133 (88%) submitted both (Table 2.12).

Table 2.12
Summary results of sputum specimen collection from the field

		MORNING		
		Collected	Not collected	Total
SPOT	Collected	4,133	420	4,553
	Not collected	5	130	135
	Total	4,138	550	4,688

2.7.1 Sputum collection and availability of results

The table below summarizes the results for smear microscopy. The protocol established that two samples (spot and early morning) should be collected and examined for each participant. In practice, some participants had only one sputum result due to issues such as failing to submit samples, lost specimens due to spillage, or broken slides. Accordingly, only 3,252 (69.4%) of 4,688 participants eligible for sputum examination had both spot and morning sputum smear results available. With respect to individual specimen smear results, 3,629 (77.4% of eligible) spot results were obtained; of these, 3,493 were negative and 136 smear-positive. For early morning samples, 3,339 (71.2% of eligible) results were obtained; of these, 3,204 were smear-negative and 135 smear-positive. See Tables 2.13 and 2.14 for the relationship between spot and morning sputum smear results, disaggregated by sex and age.

Table 2.13
Relationship between spot and morning sputum smear results

		MORNING						
		Negative	*Scanty*	*1+*	*2+*	*3+*	*NA*	Total
SPOT	*Negative*	3,085	21	16	6	1	364	3,493
	Scanty	23	14	11	2	0	3	53
	1+	11	9	15	2	6	8	51
	2+	1	1	4	4	5	1	16
	3+	1	1	1	0	12	1	16
	NA	83	2	2	0	0	972	1,059
	Total	3,204	48	49	14	24	1,349	4,688

"Not available" category includes specimen not collected, smear not carried out, or smear results not available

Table 2.14
Relationship between CXR, symptom screening and laboratory microscopy results

		Spot Sputum						Morning Sputum					
	Requested	*NA**	*Negative*	*Scanty*	*1+*	*2+*	*3+*	*NA**	*Negative*	*Scanty*	*1+*	*2+*	*3+*
Eligible symptom only	1,720	458	1226	20	14	1	1	585	1099	19	15	1	1
Eligible CXR only	2,222	436	1750	20	13	1	2	573	1611	20	13	3	2
Eligible both	746	165	517	13	24	14	13	191	494	9	21	10	21
Total	**4,688**	**1059**	**3493**	**53**	**51**	**16**	**16**	**1349**	**3204**	**48**	**49**	**14**	**24**
Male													
15-24	264	57	197	3	3	2	2	89	166	3	4	0	2
25-34	316	85	215	5	8	1	2	109	192	1	8	3	3
35-44	304	70	222	2	6	1	3	93	199	4	2	2	4
45-54	389	74	298	6	6	3	2	101	272	4	8	2	2
55-64	298	54	238	0	3	2	1	77	214	0	3	1	3
65+	501	121	368	9	2	0	1	137	353	5	5	0	1
Total	**2072**	**461**	**1538**	**25**	**28**	**9**	**11**	**606**	**1396**	**17**	**30**	**8**	**15**
Female													
15-24	333	77	241	7	5	3	0	105	217	3	6	0	2
25-34	405	77	319	1	5	1	2	110	284	3	4	2	2
35-44	397	94	291	3	7	1	1	114	270	7	1	1	4
45-54	482	95	372	6	5	2	2	110	358	9	2	2	1
55-64	421	107	311	3	0	0	0	137	278	3	3	0	0
65+	578	148	421	8	1	0	0	167	401	6	3	1	0
Total	**2616**	**598**	**1955**	**28**	**23**	**7**	**5**	**743**	**1808**	**31**	**19**	**6**	**9**
Zone													
North Central	863	169	683	4	5	2	0	206	646	2	6	1	2
North East	417	111	268	21	12	4	1	117	268	17	11	2	2
North West	1201	203	974	8	9	4	3	325	853	12	5	3	3
South East	356	64	271	10	7	2	2	92	243	10	8	0	3
South South	867	159	691	6	7	3	1	240	612	1	6	4	4
South West	984	353	606	4	11	1	9	369	582	6	13	4	10

*NA: Results not available

Table 2.15 contains information about the relationship between smear and culture results of spot and early morning individual specimens. Overall, more spot specimens than early morning specimens were examined. Early morning specimens were found to have higher positivity than spot specimens. It should also be noted that 1,349 participants either did not submit early morning specimens, or their specimens were misplaced or failed to be processed.

Table 2.15
Comparison of smear and culture results between spot and morning specimens

SPOT		Culture						
		Negative	*MTB*	*Contaminated*	*NTM*	*ID unknown*	*NA*	Total
Smear	*Negative*	1,812	34	312	47	0	1,288	3,493
	Scanty	15	9	8	4	1	16	53
	1+	15	20	6	1	0	9	51
	2+	2	11	0	0	0	3	16
	3+	1	12	0	1	0	2	16
	NA	316	0	52	0	0	691	1,059
	Total	2,161	86	378	53	1	2,009	4,688

MORNING		Culture						
		Negative	*MTB*	*Contaminated*	*NTM*	*ID unknown*	*NA*	Total
Smear	*Negative*	1,410	28	372	45	0	1,349	3,204
	Scanty	13	6	7	4	0	18	48
	1+	15	23	4	1	0	6	49
	2+	1	10	1	0	0	2	14
	3+	1	17	2	0	0	4	24
	NA	291	0	73	3	0	982	1,349
	Total	1,731	84	459	53	0	2,361	4,688

2.7.2 Culture examinations

All specimens collected in the filed were sent for culture. Of the 4,553 spot specimens collected, results were obtained for 2,678(59%). Of these, 2,161 were culture negative (80%), 86 MTB, 378 were contaminated (14%) and 53 NTM. Among the 4,138 early morning specimens, 2,327 (56%) results were obtained out of which 1,731 culture negative (74%), 84 MTB, 459 contaminated (19.7%) and 53 NTM.

Table 2.16
Relationship between spot and early morning culture results

		MORNING						
		Negative	*MTB*	*Contaminated*	*NTM*	*ID unknown*	*NA*	Total
SPOT	*Negative*	1,360	25	263	29	0	484	2,161
	MTB	10	46	8	2	0	20	86
	Contaminated	161	2	137	4	0	74	378
	NTM	22	1	9	11	0	10	53
	ID unknown	0	0	1	0	0	1,243	1,244
	NA	178	10	41	7	0	530	766
	Total	1,731	84	459	53	0	2,361	4,688

Table 2.17
Culture examination results

		Spot Sputum						Morning Sputum					
	Requested	*NA*	*Negative*	*MTB*	*Con-tami-nated*	*NTM*	*ID un-known*	*NA*	*Negative*	*MTB*	*Con-tami-nated*	*NTM*	*ID un-known*
Eligible symptom only	1,720	754	812	11	126	17	0	927	606	13	159	15	0
Eligible CXR only	2,222	938	1041	32	189	22	0	1062	874	27	229	30	0
Eligible both	746	317	308	43	63	14	1	372	251	44	71	8	0
Total	**4,688**	**2009**	**2161**	**86**	**378**	**53**	**1**	**2361**	**1731**	**84**	**459**	**53**	**0**
Male													
15-24	264	133	112	3	15	1	0	162	77	5	18	2	0
25-34	316	148	136	10	17	5	0	179	108	10	16	3	0
35-44	304	126	147	9	21	0	1	148	115	13	26	2	0
45-54	389	158	176	12	36	7	0	187	158	6	34	4	0
55-64	298	115	144	8	27	4	0	140	118	6	30	4	0
65+	501	182	254	6	54	5	0	211	205	3	76	6	0
Total	**2072**	**862**	**969**	**48**	**170**	**22**	**1**	**1027**	**781**	**43**	**200**	**21**	**0**
Female													
15-24	333	159	138	8	26	2	0	192	118	9	12	2	0
25-34	405	185	184	9	26	1	0	210	151	12	30	2	0
35-44	397	185	176	7	25	4	0	221	126	6	42	2	0
45-54	482	206	232	5	33	6	0	229	188	5	52	8	0
55-64	421	190	174	6	45	6	0	221	147	4	40	9	0
65+	578	222	288	3	53	12	0	261	220	5	83	9	0
Total	**2616**	**1147**	**1192**	**38**	**208**	**31**	**0**	**1334**	**950**	**41**	**259**	**32**	**0**
Zone													
North Central	863	385	418	3	53	4	0	513	288	5	57	0	0
North East	417	210	149	18	34	6	0	221	142	11	39	4	0
North West	1201	512	603	18	51	17	0	593	508	18	62	20	0
South East	356	100	176	6	73	1	0	129	137	5	84	1	0
South South	867	557	263	12	30	5	0	624	198	8	32	5	0
South West	984	245	552	29	137	20	1	281	458	37	185	23	0
Total	**4688**	**2009**	**2161**	**86**	**378**	**53**	**1**	**2361**	**1731**	**84**	**459**	**53**	**0**

2.8 Health-seeking behaviour

In the survey, there were 2,466 symptomatic participants experiencing one or more of the following: cough, haemoptysis, chest pain, or weight loss. Of these, 1,079 (44%) were male and 1,387 (56%) were female. Among these, 664 (24%) took no action; 680 (28%) used self-medication; 1142 (46%) consulted health services. Similar patterns of behaviour were observed among males and females, as shown in Table 2.18.

Among the 1,142 respondents that consulted health services, 419 respondents (37%) went to general hospitals, and 319 (28%) consulted chemists. Other health services consulted included health centres/PHC clinics (163 (14%)); private clinics (130 (11%)). 4% of respondents consulted university teaching and mission hospitals, and 2% consulted traditional healers and "other". Similar patterns of health-seeking behaviours are seen in both males and females and across rural and urban areas, as set out in Table 2.19.

Table 2.18
Healthcare-seeking behaviour of symptomatic survey participants by gender and location

What did they do for care?												
	All	*%*	*Male*	*%*	*Female*	*%*	*Rural*	*%*	*Semi-urban*	*%*	*Urban*	*%*
No action taken	604	24%	261	43%	343	57%	297	49%	37	6%	270	45%
Self-treated	680	28%	311	46%	369	54%	247	36%	12	2%	421	62%
Consulted health service	1142	46%	488	43%	654	57%	495	43%	60	5%	587	51%
Unknown	40	2%	19	48%	21	53%	19	48%	3	8%	18	45%
Total	**2466**	**100%**	**1079**	**44%**	**1387**	**56%**	**1058**	**43%**	**112**	**5%**	**1296**	**53%**
	15-24	*%*	*25-34*	*%*	*35-44*	*%*	*45-54*	*%*	*55-64*	*%*	*65+*	*%*
No action taken	123	20%	119	20%	86	14%	105	17%	74	12%	97	16%
Self-treated	126	19%	125	18%	93	14%	95	14%	93	14%	148	22%
Consulted health service	166	15%	187	16%	176	15%	201	18%	146	13%	266	23%
Unknown	8	20%	4	10%	8	20%	3	8%	8	20%	9	23%
Total	**423**	**17%**	**435**	**18%**	**363**	**15%**	**404**	**16%**	**321**	**13%**	**520**	**21%**

Table 2.19
Choice of health service among those who first seek care

Where did those that consulted health services first seek care?												
	All	*%*	*Male*	*%*	*Female*	*%*	*Rural*	*%*	*Semi-urban*	*%*	*Urban*	*%*
Health centre/PHC	163	14%	61	37%	102	63%	81	50%	8	5%	74	45%
Private hospital	130	11%	56	43%	74	57%	63	48%	4	3%	63	48%
Traditional centre	11	1%	8	73%	3	27%	6	55%	0	0%	5	45%
Chemist	319	28%	146	46%	173	54%	138	43%	5	2%	176	55%
General hospital	419	37%	171	41%	248	59%	158	38%	40	10%	221	53%
Teaching hospital	46	4%	23	50%	23	50%	15	33%	0	0%	31	67%
Mission hospital	42	4%	19	45%	23	55%	30	71%	2	5%	10	24%
Other	9	1%	3	33%	6	67%	2	22%	1	11%	6	67%
Missing	3	0%	1	33%	2	67%	2	67%	0	0%	1	33%
Total	**1142**	**100%**	**488**	**43%**	**654**	**57%**	**495**	**43%**	**60**	**5%**	**587**	**51%**
	15-24	*%*	*25-34*	*%*	*35-44*	*%*	*45-54*	*%*	*55-64*	*%*	*65+*	*%*
Health centre/PHC	22	13%	28	17%	19	12%	37	23%	13	8%	44	27%
Private hospital	16	12%	25	19%	18	14%	23	18%	18	14%	30	23%
Traditional centre	2	18%	2	18%	0	0%	3	27%	0	0%	4	36%
Chemist	66	21%	55	17%	50	16%	40	13%	38	12%	70	22%
General hospital	50	12%	65	16%	75	18%	74	18%	67	16%	88	21%
Teaching hospital	5	11%	6	13%	8	17%	10	22%	5	11%	12	26%
Mission hospital	3	7%	6	14%	4	10%	11	26%	4	10%	14	33%
Other	1	11%	0	0%	2	22%	2	22%	1	11%	3	33%
Missing	1	33%	0	0%	0	0%	1	33%	0	0%	1	33%
Total	**166**	**15%**	**187**	**16%**	**176**	**15%**	**201**	**18%**	**146**	**13%**	**266**	**23%**

CHAPTER 3

TB prevalence: analytical methods and key results

3.1 Crude TB prevalence rates

Of the 41,820 evaluable participants, 107 smear-positive cases were found: the crude prevalence rate was 256/100,000 population. This finding is based on the assumption that those who did not submit specimens or did not have decisive laboratory results were negative.

In addition, out of the 107 smear-positive survey cases, 80 (75%) presented with symptoms which satisfy the TB screening criteria for sputum examination (cough for two weeks or more) as stated in the protocol, while 94 (88%) of the cases had typical radiological findings that were consistent with active TB disease. See Figure 2.1 above.

3.2 Number of TB survey cases broken down by laboratory

A total of 148 bacteriologically-confirmed cases out of 41,363 participants evaluated gave a crude prevalence of 348/100,000 (not accounting for cluster sampling design and missing data), as shown in Table 3.1. With the bacteriologically-confirmed survey cases, 92 cases (64%) presented with symptoms which satisfied the case definition, and 128 cases (89%) had typical radiological findings consistent with TB.

Table 3.1
Number of TB survey cases broken down by laboratory

	S+C+	S+CXR+	S-C+	Total
NIMR Lagos	21	9	14	44
Zankli Abuja	14	16	11	41
NTBLTC Zaria	40	7	16	63
Total	75	32	41	148

Among smear-negative subjects, MTB was isolated from 37 subjects. The risk of cross-contamination was reviewed with clinical and laboratory data, and all of those 37 were categorized as culture-confirmed survey cases. Accordingly, there were 148 bacteriologically-positive cases in this survey. There were 37 smear-negative culture positive cases, with a crude prevalence rate of 89/100,000.

The majority of smear-positive and bacteriologically-confirmed cases (28% and 31%, respectively) are from the South West zone, followed by the North West zone with 19% and 20% respectively.

As seen in Table 3.2, the majority of the prevalent smear-positive cases were within the age ranges 25-54 (42%) in males and 15-44 (33%) in females. Among the bacteriologically-positive, the age group 25-54 accounted for 39% of cases in males, and the age group 15-44 accounted for 31% of cases in females. As seen in Figure 2.3, ages 15-54 accounted for the majority of the cases.

Table 3.2
Numbers of TB prevalent survey cases and evaluable participants, and crude rates per 100,000 by detailed symptoms

	Smear-positive			*Smear-negative culture-positive*			*Bacteriologically-confirmed*		
	Number of cases	*Number of evaluable participants*	*Crude rate per 100,000*	*Number of cases*	*Number of evaluable participants*	*Crude rate per 100,000*	*Number of cases*	*Number of evaluable participants*	*Crude rate per 100,000*
Total	107	41820	256	37	41363	89	144	41363	348
Symptom									
Eligible	80	1662	4813	12	1464	820	92	1464	6284
Non-Eligible	27	40158	67	25	39899	63	52	39899	130
1. Cough									
No	23	37586	61	22	37361	59	45	37361	120
1-13 days	4	2571	156	3	2537	118	7	2537	276
14-30 days	33	977	3378	7	888	788	40	888	4505
31 + days	47	686	6851	5	577	867	52	577	9012
2. Sputum									
Yes	72	2871	2508	14	2678	523	86	2678	3211
No	35	38949	90	23	38685	59	58	38685	150
3. Haemoptysis									
Yes	10	223	4484	5	187	2674	15	187	8021
No	97	41597	233	32	41176	78	129	41176	313
4. Chest pain									
Yes	49	6235	786	11	6020	183	60	6020	997
No	58	35585	163	26	35343	74	84	35343	238
5. Body weight loss									
Yes	45	3240	1389	8	3177	252	53	3177	1668
No	62	38580	161	29	38186	76	91	38186	238
6. Fever									
Yes	42	7861	534	15	7644	196	57	7644	746
No	65	33959	191	22	33719	65	87	33719	258
Any symptom (1-6)	89	14520	613	22	14197	155	111	14197	782
No symptom	18	27300	66	15	27166	55	33	27166	121

Table 3.3
Numbers of TB prevalent survey cases broken down by categories

	Smear-positive		Bacteriologically-confirmed	
	Number	*Percent*	*Number*	*Percent*
Total	107	100%	148	100%
Symptom				
Eligible	80	75%	92	64%
Non-Eligible	27	25%	52	36%
Field CXR				
Eligible	94	88%	128	89%
Non-Eligible	13	12%	16	11%
Male				
15-24	6	6%	8	6%
25-34	15	14%	19	13%
35-44	12	11%	17	12%
45-54	18	17%	20	14%
55-64	8	7%	10	7%
65+	7	7%	12	8%
Female				
15-24	10	11%	11	9%
25-34	10	11%	16	13%
35-44	10	11%	13	10%
45-54	7	7%	9	7%
55-64	2	2%	5	4%
65+	2	2%	4	3%
Zone				
North Central	11	10%	13	9%
North East	19	18%	24	17%
North West	20	19%	29	20%
South East	10	9%	10	7%
South South	17	16%	22	15%
South West	30	28%	44	31%
Previously Treated				
Yes	19	18%	21	15%
No	88	82%	123	85%
Currently on treatment				
Yes	12	11%	12	8%
No	95	89%	132	92%

3.3 Statistical analysis for the estimation of TB prevalence rates

All analyses described below were conducted separately for each of the two binary survey outcomes ("yes" or "no") as described in the survey protocol of smear-positive pulmonary TB and bacteriologically-confirmed pulmonary TB.

In terms of cluster level analysis, the survey prevalence estimate serves as a summary measure of all cluster-level prevalence estimates. The average of the cluster-level prevalence estimates is the point estimate of survey prevalence among all survey participants, and the standard error was calculated by dividing the standard deviation of the cluster-level prevalence estimates by the square root of the number of clusters.

3.3.1 Individual level analysis

Individual-level analyses of pulmonary TB prevalence were performed using logistic regression, in which the log odds, i.e. $\mathbf{log}\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)$ is modelled where π_{ij} is the probability of individual ***i*** in cluster ***j*** being a prevalent pulmonary TB case. The simplest model that can be fitted is $\boldsymbol{\alpha} = \mathbf{log}\left(\frac{\pi_{ij}}{1-\pi_{ij}}\right)$, in which case the overall prevalence of pulmonary TB is then estimated as: $\mathbf{p} = \frac{\exp(a)}{1+\exp(a)}$, where **p** is the observed overall proportion of survey participants with pulmonary TB. Logistic regression was used because the outcome is binary: for each individual there is a probability of having pulmonary TB at the time of the cross-sectional survey (in the generalized linear models framework, the logistic link function is the "natural link function"). The most crucial characteristic of such analyses is that they take into account the clustering of individuals. If this is not done, the calculated 95% confidence interval (CI) for true pulmonary TB prevalence will have less than the nominal 95% coverage due to underestimation of the standard error of the prevalence estimate. The recommended logistic regression was used for these types of surveys, with robust standard errors calculated from the observed between-cluster variability. In total, three recommended models of analysis were used: one does not account for missing data, while two attempt to correct for bias.

Model one: robust standard errors on complete case dataset

This model does not account for variation in the number of individuals per cluster or correlation among individuals in the same cluster when estimating the point prevalence of pulmonary TB (logit command with the robust option in Stata). Equal weight is given to each individual in the sample. However, the model does correct for clustering (by using the observed between-cluster variation) when estimating the 95% confidence interval, and can control for the strata that were part of the survey design. This model exactly corresponds to the classical analysis of surveys (svy commands with Stata) when one does not need to adjust for sampling weights. This is the case in the self-weighting survey design for nationwide TB prevalence surveys. This model is restricted to survey participants.

Model two: robust standard errors with multiple imputations for missing value

This model uses multiple missing value imputation for individuals: a) without a field CXR result and/or symptom screening, and b) for individuals with a positive CXR result or TB symptoms but without smear and/or culture results This approach was taken in order to include all individuals who were eligible for the survey in the analysis. This model (logit command with the robust option in Stata) allows for both the clustering in the survey design and the uncertainty introduced by imputation of missing values when estimating the 95% confidence interval for the prevalence of pulmonary TB.

Model three: robust standard errors with missing value imputations and inverse probability weighting

Missing value imputation is used for individuals eligible for sputum examination (defined as having a field CXR reading that was abnormal and/or TB symptoms) for whom data from one or more of the central CXR reading, symptom questions, and smear and/or culture results was not available. Survey participants were defined for this analysis as individuals who had a CXR that was technically adequate and also participated in the symptom screening survey. Inverse probability weighting (IPW) was then used to correct for differentials in the participation of individuals by age, sex, and cluster. Through the combination of imputation of missing data and the use of weights, the analysis (using the logit command with the robust option in Stata) aimed to represent the whole of the survey eligible population, but the weights are applied only to individuals who were screened by both CXR and symptoms. This is the recommended analytical approach for reporting final results.

3.3.2 Handling of missing data

Describing missing data can apply to data missing from the outcome or the exposure variables:

Missing data in the outcome variables:

- Participants categorized as eligible for sputum examination by symptom (including cough with unknown duration) but having no or only one bacteriological result of sputum examination;
- articipants eligible for sputum examination by field CXR reading regardless of types of shadows, but having no or only one bacteriological result of sputum examination; or
- Participants having abnormal shadow detected by central CXR reading but having no or only one bacteriological result of sputum examination.

Missing data in the exposure variables:

- The results of field and/or CXR reading are not available (CXR not taken, quality unreadable); or
- Cough with unknown duration.

3.3.3 Imputation models

All imputation models were run in STATA 12 using the mi group of command for the imputation of data and calculation of pooled estimates combining all imputed datasets.

Outcomes of smear-positive TB and having a smear-positive result: All variables associated with being a smear-positive case and missing data were investigated for inclusion in the imputation model. These include stratum, age group, sex, field CXR result, cough for more than two weeks, weight loss, fever, blood in sputa, chest pain, and having a history of TB treatment. The final imputation model included: age group, sex, stratum, cough for more than two weeks, weight loss, and treatment history. 30 datasets were imputed, after 10 cycles for each saved one. These were combined for the final estimates (the percentage of missing outcome data was about 30%).The same imputation model was used for imputation of values among survey participants (Model 2) and eligible for sputum examination (Model 3).

Outcome of bacteriologically-confirmed TB: All variables which associated with being a bacteriologically-confirmed case and missing data were investigated for inclusion in the imputation model. These were stratum, age group, sex, field CXR result, cough for more than two weeks, weight loss, fever, blood in sputa, chest pain, and having history of TB treatment. The final imputation model included: age group, sex, stratum, cough for more than two weeks, blood in sputa, weight loss, and treatment history. 50 datasets were imputed, after 10 cycles for each saved one, and combined for the final estimates (the percentage of missing outcome data was about 40%). The same imputation model was used for imputation of values among survey participants (Model 2) and eligible for sputum examination (Model 3).

3.4 Estimated TB prevalence rates from survey population

The point estimates along with corresponding confidence intervals (CI) of prevalence rates per 100,000 population using the recommended analytical approach (Model 3) of combining multiple imputation and inverse probability weighting are summarized in Table 3.4. The prevalence rates of smear-positive and bacteriologically positive are 318 (95% CI: 225-412) and 524 (95% CI: 378-670) per 100,000 population of those 15 years and above. Prevalence among men is higher (484 (95% CI: 333-635)) than in females (198 (95% CI: 108-289)). A similar situation was found in the bacteriologically positive cases: these were 751 per 100,000(95% CI: 538-965)) in males and 359 per 100,000(95% CI: 213-505]) per 100,000 in females. An age differential in TB prevalence rates is also apparent, with highest rates being estimated among the 35-54 age group. Finally, TB prevalence is much higher in urban than in rural settings.

Table 3.4
Estimated TB prevalence rates per 100,000 using the recommended analysis combining multiple imputation and inverse probability weighting

	Smear-positive			Bacteriologically-confirmed		
	Best point estimate	*Lower limit*	*Upper limit*	*Best point estimate*	*Lower limit*	*Upper limit*
Total	**318**	**225**	**412**	**524**	**378**	**670**
Sex						
Male	484	333	635	751	538	965
Female	198	108	289	359	213	505
Age group						
15-24	193	84	302	274	130	419
25-34	291	165	418	496	312	680
35-44	367	141	593	613	316	911
45-54	494	265	722	750	420	1079
55-64	331	122	540	599	262	936
65+	332	106	559	660	318	1003
Setting						
Rural	182	111	254	323	191	456
Urban	413	269	556	663	441	884

3.5 Extrapolating nationwide from survey prevalence

The prevalence estimates drawn from the survey population are for pulmonary TB among adults of 15 and above. Adjustments were needed in order to estimate prevalence for extra-pulmonary TB and TB among children (0-14 years), and also to estimate prevalence for all ages.

Step 1 - Estimating all cases of pulmonary TB

The percentage of children over total population for 2012 in Nigeria was 44%. The calculated smear-positive TB case notification rate per 100,000 for children, and its standard deviation (SD) over the last few years(2007-2012) was p_{child} = 39 per 100,000, SD=9. Authors assumed that the child to adult ratio among TB case notification rates was the same as that for TB prevalence. Accordingly, the authors extrapolated this to pulmonary TB in all ages as a weighted average of pulmonary TB in children and pulmonary TB in adults:

$$p_{total}=p_{child} * c + p_{adult} * (1-c)$$

where p_{child} is the prevalence among children, p_{adult} the bacteriologically-confirmed prevalence among adults drawn from the survey and c the percentage of children in the country.

Step 2 – Estimating all forms of TB

The assumed EP prevalence rate was constant across all ages. Authors calculated the proportion of EP over total TB case notifications, and its standard deviation over the last few years (2007-2012) at p_{eo} = 5 per 100,000, SD=0.2. They then inflated the estimate for pulmonary TB prevalence of all ages by the amount that extra-pulmonary TB contributes to total TB case notifications. Following the steps described above, the all-forms, all-ages TB prevalence level in Nigeria for 2012 is estimated at 323 (95% CI :239-406) per 100,000.

3.6 Summary results from the first national TB prevalence survey in Nigeria

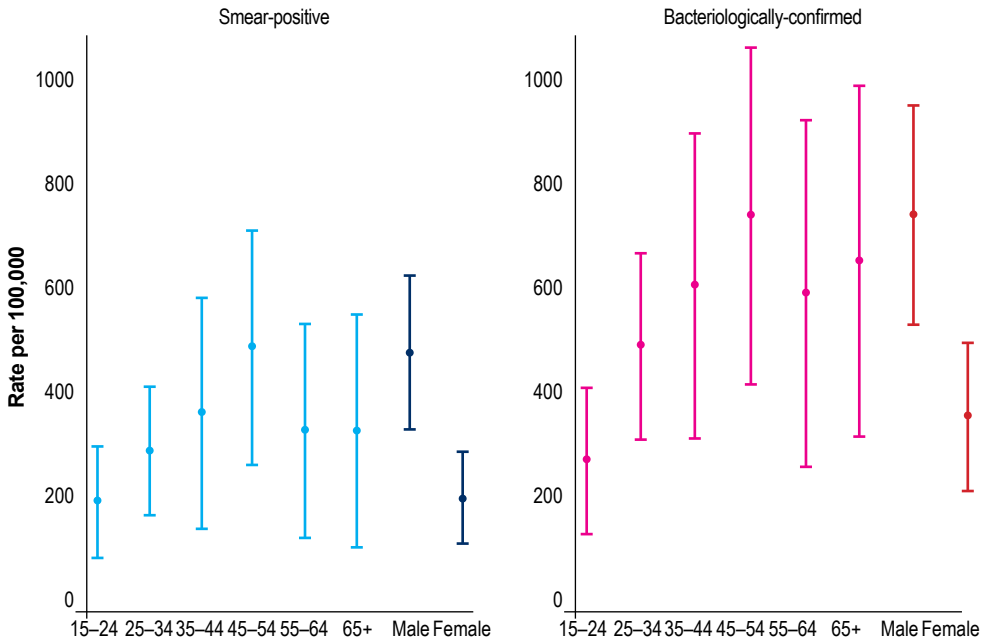
Findings from the TB prevalence survey in Nigeria show much higher TB prevalence levels than previously estimated based on the routine surveillance data that were available in the country (Table 3.5).

Table 3.5
Estimated adult TB prevalence rates per 100,000 based on findings from the national prevalence survey analysed using the recommended analytical approach of multiple imputation and inverse probability weighting

	Best estimate	*95% confidence interval*
Smear-positive TB	318	[225-412]
Bacteriologically-confirmed TB	524	[378-670]

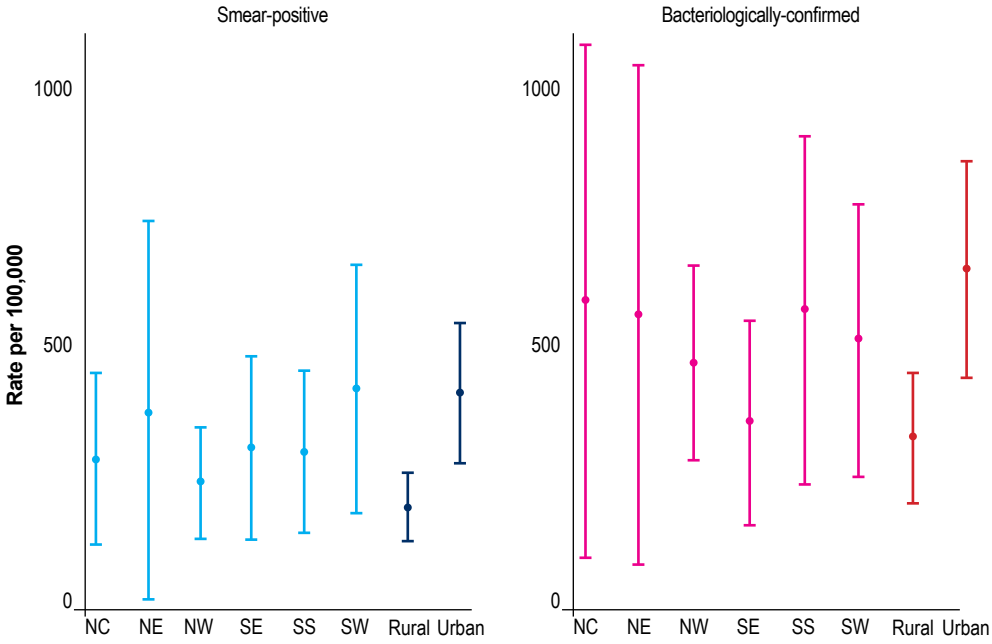
When disaggregating age and sex, disparities exist in TB disease burden among adults in Nigeria. The highest prevalence of TB cases appears among males and adults ages 35-54 (Figure 3.1).

Figure 3.1
Age and sex-specific TB prevalence rates (smear-positive and bacteriologically-confirmed) per 100,000. Data source: 1st National TB Prevalence Survey, Nigeria



The geographical disaggregation of disease burden presents higher levels of disease in urban than rural settings (Figure 3.2).

Figure 3.2
Zonal and urban/rural-specific TB prevalence rates (smear-positive and bacteriologically-confirmed) per 100,000. Data source: 1st National TB Prevalence Survey, Nigeria



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West

Another important investigation combining data from the TB prevalence survey with the 2012 annual smear-positive TB case notification data is the ratio of prevalence to notification, shown in Table 3.6. This can be used to identify and target those groups of TB patients whose disease burden is highest in relation to case finding. Males and those aged 45-54 represent the groups with the highest ratios in Nigeria.

Table 3.6
Prevalence to case notification ratio, Nigeria 2012

	Number of smear-positive survey cases	*Smear-positive survey prevalence rate per 100,000*	*Smear-positive case notification rate per 100,000 (15+)*	*P:N rate ratio*
Total	**107**	**318**	**55**	**5.78**
Sex				
Male	66	484	67	**7.25**
Female	41	198	43	**4.63**
Age group				
15-24	16	193	30	**6.39**
25-34	25	291	72	**4.06**
35-44	22	367	73	**5.05**
45-54	25	494	64	**7.69**
55-64	10	331	55	**6.01**
65+	9	332	55	**5.98**

CHAPTER 4

Discussion

4.1 Prevalence rate of TB

The point estimates of TB prevalence rates and of associated confidence intervals (CI) of smear-positive and bacteriologically-confirmed cases are 318 (95% CI: 225-412) and 524 (95% CI: 378-670) per 100,000 population (15 years and above) respectively. The prevalence of smear-positive TB among men is higher (484, 95% CI: 333-635) than in females (198, 95% CI: 108-289). A similar situation was found in the bacteriologically-positive cases, with 751 (95% CI: 538-965) and 359 (95% CI: 213-505) per 100,000 males and females respectively.

A comparison of the smear-positive prevalence of 318 per 100,000 with the NTP's notification rate of 55 per 100,000 in 2012 produces a ratio of 5.78. This is higher than the numbers suggested by the Ethiopian national survey in 2011, which produced a ratio of about 1:1 (smear-positive prevalence of 61 per 100,000).

Results from this survey show a burden of TB in the Nigeria which is over double the WHO estimated burden for 2012.

Among the participants, 107 cases of smear-positive pulmonary TB were detected. Of these, 73% were new, 14% had been treated for TB in the past and 11% were on treatment at the time of the survey. This shows that 89% of the detected confirmed smear-positive TB patients were not on anti-TB treatment during the survey. This may be a result of the under-coverage of DOTS treatment and microscopy centres, and may also be attributable to low community awareness about TB services.

37 smear-negative culture-positive pulmonary cases were found, compared with 107 smear-positive pulmonary cases. This finding differs from those of recent surveys; for instance, smear-negative culture-positive cases accounted for over half of all detected cases in the Cambodian 2012 survey. This difference may be due to:

- high contamination rate from some clusters; or
- lack of performance of ID test when only a few colonies were growing on agar slants.

Additional efforts to confirm diagnosis by molecular technologies were made in the case of any observed discrepancy between the smear and the culture results where an aliquot of the decontaminated sample was still available and frozen in the laboratory. However, additional efforts to confirm diagnosis by molecular technologies could not be carried out in the survey despite requests to the medical panel.

The highest prevalence was found among the age group 24-54 years, despite the fact that this group had the lowest participation rate. This suggests that the reported point estimate of the survey may have been underestimated. This low participation has been

accounted for, as much as possible, through multiple imputations. This age group constitutes the most productive and mobile individuals in the society, and the TB control programme will need to increase measures to address TB among this group in order to reduce transmission in the community.

Health-seeking behaviour

Approximately one-third (35.8%) of the eligible population had at least one of the six symptoms (cough, sputum, chest pain, haemoptysis, body weight loss and fever). The majority of symptomatic respondents (52%) took inappropriate action (either self-medication or no action) which could be responsible for the continued transmission of TB in the community and may explain the low TB case notification in the country.

Among those that sought any form of care, the majority consulted the general hospital (37%) and chemist (28%), while only 14% sought care from the PHC system which is supposedly the entry point into the health care system in Nigeria. This is in line with several studies that have shown the weakness of the PHC system in Nigeria and the fact that the chemist shop is the first point of contact for many Nigerians seeking health care services. The inherent weakness in the PHC system has led to people seeking care at higher levels. These results emphasize the urgent need for the government to strengthen the PHC system and to optimize TB services at all levels.

Most of those identified as "on treatment" during the survey were receiving this treatment in the general hospitals and PHC clinics. DOTS services are primarily available in these two categories of health facilities. A relatively low percentage of TB patients take treatment in private facilities because in Nigeria private practitioners will generally charge for services or immediately refer suspected TB cases to the government-run health institutions. Of interest is the very low number of those who first consulted the traditional healers (1%). This may be due to the fact that private chemists and PHC facilities are available or that individuals have less confidence in traditional healer on issues relating to chest infections.

Of the 43,199 chest x-rays taken in the field, 2,968 (6.9%) were abnormal. Majority of these abnormal chest x-rays (22.4% males and 19.9% females) were in the age group 65 years and above. Of the 1,786 respondents who had abnormal chest x-ray results and had laboratory results, 36 (2%) were sputum-positive.

Although the design of the survey was not primarily to demonstrate regional/zonal or urban/rural variation, results show a higher prevalence of bacteriologically-confirmed cases in the urban (663 (95% CI: 441-884)) and compared to rural areas (323 (95% CI: 191-456)) as seen in Table 3.4. Keeping the imprecision of the zonal level TB prevalence estimates in mind, this is useful for the purposes of hypothesizing and investigating further differences between zones in terms of the relationship between true TB disease burden and TB case finding. For example, South West has approximately the same level of case

notification rate as North Central but a much higher burden of TB prevalence. Lastly, a wide variation was observed in the TB prevalence among the clusters ranging from 0 to 1,757 per 100 000 population.

In recent years NTP has had an increase in the coverage of the DOTS programme in terms of facilities expansion, TB/HIV collaborative activities and collaboration with private and tertiary providers. Although the number of notified cases has increased, the notification rate still remains low. There are still a lot of TB cases in the communities undiagnosed. The programme will have to focus on increasing access to basic DOTS especially diagnostic services, and also identify and focus more on hotspots like urban slums in order to improve notification rates.

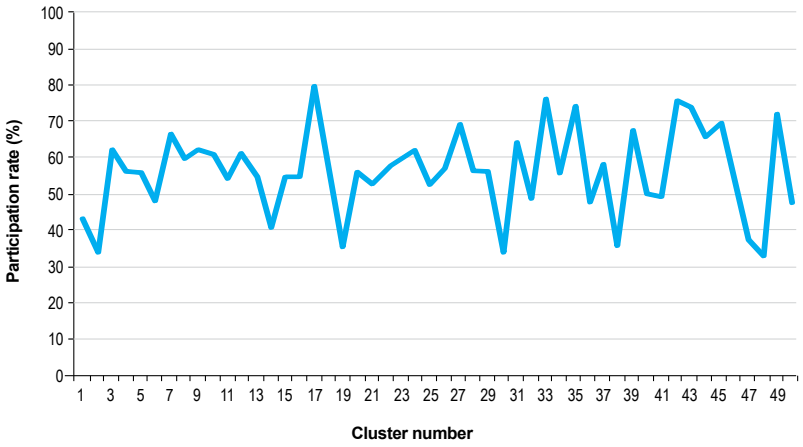
4.2 Considering eligibility criteria

In the survey, all adults 15 years and above who stayed in selected households for 14 days or more at the time of the census were eligible for the survey. By chance, none of the selected clusters felt areas where exclusion was being considered such as the military barracks, hospitals, diplomatic compounds or hotels. Although there were challenges in determining eligibility during the census because of some who are only stay during weekends and return to their place of work during the week, the survey census was generally considered to be successful. Although registered as eligible, some individuals were only available during the weekends. Some were also only at home in the evening after spending days either at farms or business areas.

4.3 Survey participation

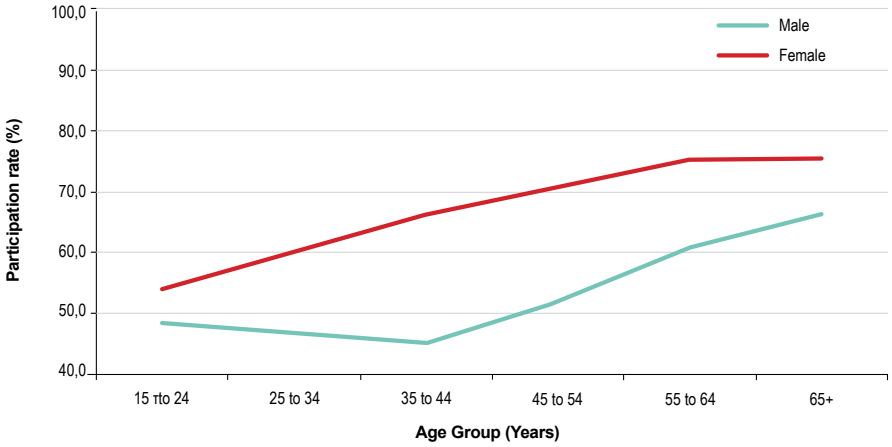
Although the National Population Commission was involved in the census and enumeration, the overall participation was 56.8%. This was a relatively low rate in relation to the 85% which had been planned. This may be due to the fact that the initial community mobilization and planned pre-survey visits to the communities were not strictly adhered to. In addition, some of the cluster fell into urban areas where there is general apathy towards what is considered as government programmes or survey. Houses in such urban areas usually have perimeter fences with gates and sometimes guards who hindered surveyed staff from entering. The rainy season also resulted in the involvement of community leaders and extension by one additional day in some clusters, but did not drastically alter participation (Figure 4.1). All possible sensitivity analyses were conducted to investigate whether lower levels of participation rate biased the results of the survey with reassuring findings. Final reported estimates of TB prevalence have accounted for missing data due to non-participation.

Figure 4.1
Participation rate (%) by cluster (chronological order)



Younger males were the most difficult to recruit in the survey, a finding consistent with all recently completed similar surveys in other countries in Africa and Asia (Figure 4.2).

Figure 4.2
Participation rate (%) by age group and sex



4.4 Characteristics of participants

4.4.1 TB-related symptoms

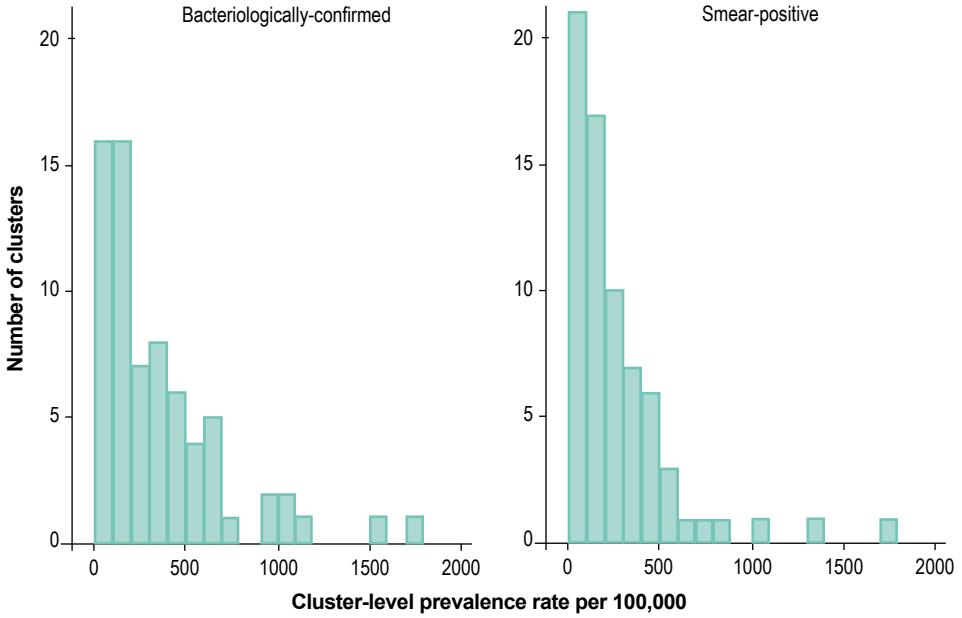
During the survey, all eligible participants were interviewed about TB-related symptoms within the past one month. 11% of participants had had a cough of some duration (cough of 1-13 days 6.1%, 14-30 days 6.1% and >30 days 2.2%); 8% had sputum; 15.4% had experienced chest pain; 0.7% had haemoptysis; and 19% had had fever. 35.8% of the participants had at least one of the six symptoms, while 64.2% had no symptoms. This relatively low number of participants who have symptoms compared to other surveys (such as that in Cambodia) may be due to the fact that in some communities, coughing especially among smokers, old persons and kola eaters is assumed to be normal so may

not have presented as a complaint. However, eligibility rates for sputum examination by interview and CXR were about 11% which seems to correspond to those with symptoms.

4.4.2 Geographical variation of TB prevalence

Using the routine surveillance data, at the time of when protocol was developed, it was assumed that TB burden was equally distributed all over the country. However, the result shows that in the 70 cluster selected, TB cases are not equally distributed. This is demonstrated in Figure 4.3.

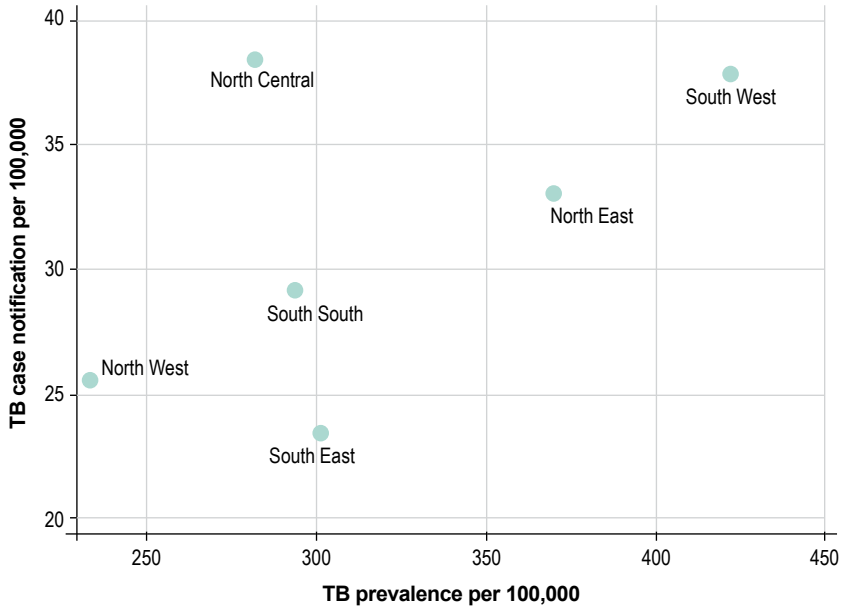
Figure 4.3
Cluster variation in the number of TB cases



The y axis shows the number of clusters among 70, and the x axis shows smear-positive prevalence per 100,000. Around 50% of cluster had 0 or only 1 S+ TB case as expected, while extremely high prevalence clusters exist (hot spots). Though the mathematical average was 255 (prevalence of smear-positive)/ 100,000, the median was 168. While strengthening TB control efforts in general is essential, it is important to discover such "hot spots" so as to focus special efforts upon them.

Keeping the imprecision of the zonal level TB prevalence estimates in mind, these remain useful for the purposes of hypothesizing and investigating further differences between zones in terms of the relationship between true TB disease burden and TB case finding. For example, the South West has approximately the same level of case notification rate as North Central but a much higher burden of TB prevalence (Figure 4.4).

Figure 4.4
Scatterplot of smear-positive case notification rates (U15) against prevalence rates (U15) by zone. Data source: NTBLCP database and 1st National TB Prevalence Survey, Nigeria



4.5 Comparison of routine TB surveillance data with survey report

Table 3.6 demonstrates the prevalence to notification ratio in 2012 among smear-positive TB cases (programme notifies smear-positive cases). While the smear-positive prevalence is 318/100,000, the notification is 55/100,000. This gives a ratio of 5.78, the highest observed among countries recently completing similar surveys in Africa and Asia. This ratio is seen to be higher in males as compared to females, and highest in the age group 45-54.

In recent years, NTP has increased in the coverage of the DOTS programme in terms of facilities expansion, TB/HIV collaborative activities, and involving private and tertiary providers. Although the programme has demonstrated an increase in the number of notified cases, the notification rate remains low. There are a significant number of undiagnosed TB cases in the communities. The programme will have to focus on increasing access to basic DOTS, especially diagnostic services, and identify and focus more on hotspots especially urban slums in order to improve notification rates.

4.6 Strengths and Limitations of the Survey

4.6.1 Strengths

The survey was designed and implemented in accordance with the National Protocol

which was based on the recommendations of the Global Task Force on TB Prevalence Survey. All three recommended screening methods were used (symptom screening, chest x-ray radiography and sputum examinations (microscopy and culture)) in all planned 70 clusters.

The survey was successfully led by a coordinating committee, receiving continuous support from an active technical committee and implemented by a survey coordinator and field teams. This led to capacity-building with respect to the planning, coordination and execution of surveys in the country.

Sustained technical support from WHO, CDC, the supra-national reference laboratory in Milan and the Global Task Force (from the design, pre-testing, field data collection, analysis and report writing) contributed not only to the quality of the exercise but also to capacity-building of personnel in Nigeria.

A wide range of participation from partners (local and international), government at all levels (federal, state and local) and communities ensured country ownership of the exercise. Funding provided from Nigerian Government, the Global Fund, WHO, CDC (Nigeria and Atlanta) and USAID ensured effective implementation of the survey.

4.6.2 Limitations

In the design

The exclusion of children and extra-pulmonary TB cases from the survey might have led, respectively, to a slight overestimation and underestimation of the TB burden. However, this limitation was accounted for during statistical analysis. The inclusion of HIV testing was initially considered by the survey management committee but was dropped due to concern that participation would be low, thereby affecting the primary objective of the survey.

Field cluster operation

Generally, the participation rate was low due to several reasons that differ from one part of the country to the other. These include security concerns, stigma, perception of being tested for HIV, inability to fully implement community mobilization activities, rainfall and difficult terrain. Furthermore, in some urban communities, there was generally apathy towards government programmes and many residents could not attend due to obligations of urban life. In rural areas, some communities were scattered from each other, the exercise clashed with the farming season and several under-aged children were enumerated as eligible.

There were some technical hitches with the mobile x-ray machines in some clusters which resulted in delays or inabilities to have chest x-rays performed on all eligible respondents. Secondly, some chest x-ray films were lost due to poor storage techniques. Thirdly, the central reading of the CXR was done long after field operations were over, making correc-

tive actions difficult during implementation.

There were some challenges with the logistics of sputum transportation and processing during the survey which resulted in many samples being rejected and high culture contamination rate as compared with similar surveys in Africa (less than 2% Ethiopia 2012) and Asia (less than 1% Cambodia 2012).

In addition, there were delays in transmitting the laboratory results to the central data manager due to administrative and workload challenges in the laboratories.

How could missing data have influenced the analysis?

Missing data from low participation: Authors employed an inverse probability weighting approach to account for missing data due to the differences between the targeted eligible and participant populations. This approach in essence forces the survey participant population to be more similar to the targeted eligible population and uses observed data weighed accordingly to account for the lower participation in survey population strata defined by sex, age and urban/rural setting.

Missing data from sputum specimens not collected or not being examined in the laboratory (smear and culture), or unavailable laboratory results: To address this, authors have employed multiple imputation of missing data to identify potential bias being introduced in survey results due to these missing data, as well as inflated the uncertainty of final prevalence estimates accordingly to account for these unintended gaps in data. This is the internationally recommended analytical approach used in the analyses of similar surveys in Africa and Asia.

Lastly, in spite of the above mentioned limitations, the stakeholders consider that the exercise was a success. Lessons learned will serve as benchmarks for improvement in subsequent surveys.

CHAPTER 5

Programmatic implications and recommendations

5.1 High tuberculosis prevalence to case notification ratio indicates low case detection

Recommendations to address low case detection include:

1. Ensure universal access to treatment and microscopic services;
2. Deployment and expansion of new technologies such as GeneXpert;
3. Active case detection targeting high burden areas and high risk groups;
4. Engage all care providers in TB control; and
5. Strengthen routine surveillance to include all points of contacts between patients and health care services,

5.2 Inappropriate action by symptomatic respondents

A large percentage of symptomatic respondents took inappropriate action, either taking no action or self-medicating. Recommendations to address this situation include:

1. Massive awareness campaign to create demand at all levels;
2. Community mobilization for participation, ownership and sustainability;
3. Advocacy at all levels of government and community for increased political commitment and resources; and
4. All states and LGAs to buy into the existing national strategic plan, tailoring it to local situations.

5.3 Laboratory capacity

The survey has identified the following challenges relating to the performance of the TB reference laboratory services: transportation, storage, sputum processing and data management. Recommendations to address these challenges include:

1. Strengthen transportation system from peripheral to reference laboratories;
2. Strengthen infrastructural and human capacity of the reference laboratories; and
3. Strengthen the laboratory data management system.

CHAPTER 6

Conclusion

For the first time in the history of the country, this survey has provided a nationwide population-based estimate of the TB burden for Nigeria, unveiling a much higher than previously thought level of TB prevalence. The exercise also revealed a wide variation in the burden of TB among the clusters surveyed; this information will be valuable for informing decisions about resource allocation; for targeting interventions; and for identification of programme areas that require strengthening. Furthermore, the survey created national capacity for the planning and implementation of population-based surveys at all levels of the health programmes and institutions that were involved. The survey's limitations have been investigated and accounted for at the analysis stage to the extend possible. Finally, results and lessons learned from this survey can and should be used in follow-up surveys that will allow the country to monitor impact of its activities to address the TB epidemic.

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Annex 1.
Survey funding and cost breakdown

Funding Source	*Amount in US$*	*Description*
Ministry of Health (MDG)	1,226,871	Field operations, procurement of equipment, logistics of sputum and communication
Global Fund	1,465,283.39	Equipment, Field Activities, etc.
World Health Organization	375,650	Technical Assistance, training including Human Resources.
Total	**3,067,804**	

Cost breakdown

Item	*Cost in US$*	*Percentage of total Cost*
Technical assistance	173,139.39	6%
Capital costs (x-ray equipment, laboratory supplies, etc.)	1,296,709.22	42%
Training	293,686.01	10%
Pre-field visit cost	38,431.90	1%
Field Operation cost	906,678.40	30%
Communication and maintenance	69,315.03	2%
Expenses for sputum transportation	176,573.50	6%
Central data management	103,729.37	3%
Stationary	5,403.27	1%
Others	4,138.30	1%
Total	**3,067,804**	100%

Annex 2.
Technical Committee

Name	*Position*	*Organization*
Prof Emmanuel Idigbe	Chairman	Nigeria Institute of Medical Research, Lagos
Dr Obasanya Joshua	Principal Investigator	National TB Programme, Abuja
Dr Patrobas Philip	Member	World Health Organization, Nigeria
Dr Lovett Lawson	Member	Zankli Medical Center, Abuja
Prof Ekanem Ekanem	Member	Lagos University Teaching Hospital
Dr Chukwueme Nkemdilim	Survey Coordinator 2	World Health Organization, Nigeria
Dr Temitayo Odusote	Member	USAID
Dr Ayodele Awe	Member	World Health Organization, Nigeria
Prof Bandele	Member	Lagos University Teaching Hospital
Dr Banwat Edmond	Member	Jos University Teaching Hospital
Dr Babalola Akin	Member	University of Abuja Teaching Hospital
Dr Ogiri Samuel	Member	World Health Organization, Nigeria
Dr Adamu Haruna	Member	World Health Organization, Nigeria
Dr Daniel Olusoji James	Member	World Health Organization, Nigeria
Dr Chijioke Osakwe	Member	World Health Organization Nigeria
Mrs Tubi Abiola	Member	Centre for Disease Control, Nigeria
Mr Mohammed Kassim	Member	National Population Commission
Dr Osahon Ogbweiwe	Survey Coordinator 1	

External Technical Consultants

Name	*Position*	*Organization*
Dr Ikushi Onozaki	Medical Officer	WHO Geneva
Dr Charalampos (Babis) Sismanidis	Statistician	WHO Geneva
Dr Eugene McCray	Medical Officer	CDC Atlanta
Dr Narayan Pendse	Radiologist	WHO Geneva
Dr Julia Ershova	Data Specialist	CDC Atlanta
Dr Cirillo Daniella	Lab Consultant	SRRL Milano

Annex 3.
Central Medical Panel

Name	*Organization*
Dr Ikushi Onozaki	WHO
Dr Cirrilo Daniela	SRRL Milano
Dr Obasanya Olusegun	NTP
Dr Babalola Akinola	AUTH
Dr Patrobas Philip	WHO

Annex 4.
Survey team members

Team Leaders

Name	*Organization*
Dr Samuel Ogiri	WHO-NPO North-Central zone
Dr Haruna Adamu	WHO-NPO North-East zone
Dr Moses Onoh	Medical Advisor TLMN
Dr Osakwe Puis Chijioke	WHO-NPO South East zone
Dr Daniel Olusoji James	WHO-NPO South West
Dr Jose Micheal Madu	WHO-NPO South South

Radiology team

Name	
Dr Babalola Akin	Abuja University Teaching Hospital
Dr Roland Ogeh	Medical Officer
Dr Madaki Yohanna	Medical Officer
Dr Ibrahim Umar	Radiographer
Alh Sani Ibrahim	Radiographer
Dr Isaac Mokuro	Medical Officer
Ahmadu Alhaji Ahmadu	Radiographer
Mr Dalington Obinna	Radiographer
Mr Tijanni Ibrahim	Radiographer

Interviewers

Name
Mr John Dadu
Mr Patrick Awuya
Mrs Patience Okpe
Mr Joshua Bobai
Mrs Hadiza Garba
Mr Tijani Mohammed
Mr Shaibu Balanga
Mrs Tanna Mary Usman
Ihedinna Jabor
Clarkson Teknikio

Data team

Name	
Dr Osahon Ogbeiwi	Consultant and Coordinator
Mr Gideon Zaphania	Central Data manager
Mr Danjuma Udoji	North-West data clerk
Mr Peter Ikpe	South-East data clerk
Mr Kamal Bello	North-Central data clerk
Mr Daniel Olusoji	South-West Data clerk
Mr Tijani Usman	North-East data clerk

Annex 5.
List of clusters

Cluster No	*Zone*	*State*	*Selected LGA*	*Clusters replaced due to security concerns*
1	NORTH CENTRAL	BENUE	Gboko	
2	NORTH CENTRAL		Markudi	
3	NORTH CENTRAL	FCT	Municipal Area Council	
4	NORTH CENTRAL	KOGI	Ankpa	
5	NORTH CENTRAL		Okene	
6	NORTH CENTRAL	KWARA	Ilorin West	
7	NORTH CENTRAL	NASARAWA	Lafia	
8	NORTH CENTRAL	NIGER	Mokwa	
9	NORTH CENTRAL		Shiroro	
10	NORTH CENTRAL	PLATEAU	Bassa	
11	NORTH EAST	ADAMAWA	Yola North	
12	NORTH EAST		Fufore	
13	NORTH EAST	BAUCHI	Bauchi	
14	NORTH EAST		Ningi	
15	NORTH EAST	BORNO	Gwoza	Gombi in Adamawa
16	NORTH EAST		Maiduguri	Gombe in Gombe
17	NORTH EAST	GOMBE	Akko	
18	NORTH EAST	TARABA	Gassol	
19	NORTH EAST	YOBE	Fune	Dambam in Bauchi
20	NORTH WEST	JIGAWA	Birnin Kudu	
21	NORTH WEST		Gwaram	

List of clusters - continued

22	NORTH WEST	KADUNA	Igabi	
23	NORTH WEST		Kaduna South	
24	NORTH WEST		Zaria	
25	NORTH WEST	KANO	Dala	
26	NORTH WEST		Gwale	
27	NORTH WEST		Kano Municipal	
28	NORTH WEST		Nasarawa	
29	NORTH WEST		Ungogo	
30	NORTH WEST	KATSINA	Funtua	
31	NORTH WEST		Kankara	
32	NORTH WEST		Katsina	
33	NORTH WEST	KEBBI	Birnin Kebbi	
34	NORTH WEST	SOKOTO	Gada	
35	NORTH WEST		Sokoto North	
36	NORTH WEST	ZAMFARA	Gusau	
37	NORTH WEST		Zurmi	
38	SOUTH EAST	ABIA	Aba South	
39	SOUTH EAST	ANAMBRA	Aguata	
40	SOUTH EAST		Idemili North	
41	SOUTH EAST	EBONYI	Onicha	
42	SOUTH EAST	ENUGU	Enugu East	
43	SOUTH EAST		Nsukka	
44	SOUTH EAST	IMO	Isiala Mbano	
45	SOUTH EAST		Mbatoli	
46	SOUTH SOUTH	AKWA-IBOM	EssienUdim	
47	SOUTH SOUTH		Uyo	
48	SOUTH SOUTH	BAYELSA	Yenegoa	
49	SOUTH SOUTH	CROSS RIVER	Akpabuyo	
50	SOUTH SOUTH	DELTA	Ughelli North	
51	SOUTH SOUTH		Warri South	
52	SOUTH SOUTH	EDO	Ikpoba-Okha	
53	SOUTH SOUTH		Oredo	
54	SOUTH SOUTH	RIVERS	Obio/Akpor	
55	SOUTH SOUTH		Ogo Bolo	
56	SOUTH SOUTH		Port-Harcourt	

List of clusters - continued

57	SOUTH WEST	EKITI	Ado-Ekiti	
58	SOUTH WEST	LAGOS	Kosofe	
59	SOUTH WEST		Mushin	
60	SOUTH WEST		Ajeromi/Ifelodun	
61	SOUTH WEST		Alimosho	
62	SOUTH WEST	OGUN	Ado Odo/Ota	
63	SOUTH WEST		Ifo	
64	SOUTH WEST	ONDO	Akure South	
65	SOUTH WEST		Ilaje	
66	SOUTH WEST	OSUN	Ife East	
67	SOUTH WEST		Iwo	
68	SOUTH WEST	OYO	Ibadan South East	
69	SOUTH WEST		Ibadan North East	
70	SOUTH WEST		Ibadan South West	

Annex 6.
Survey instruments (tools)

FORM 01

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

HOUSEHOLD REGISTER

Household Number: ☐☐☐

Zone: _____ State: _____

Cluster number: _____ Building Number: _____

Household address: _____

_____

Household contact Person: _____ Phone number: _____

Name of interviewer: _____ Date: ___ / ___ /___

No	*Survey №*	*Name* Surname first	*Age*	*Sex* 1-Male, 2-Female	*Occupation**	*Stayed at least 2 weeks?* 1 –Yes, 2 – No	*Eligible?* 1 –Yes, 2 – No	*Remarks* (Reason for Absence)	*Attendance* 1 –Yes, 2 – No	*Consent* 1 –Yes, 2 – No
01	| |									
02	| |									
03	| |									
04	| |									
05	| |									
06	| |									
07	| |									
08	| |									
09	| |									
10	| |									
11	| |									

12	| |									
13	| |									
14	| |									
15	| |									
16										
17										
18										
18										
19										
20										
21										
22										
23										
24										

***Occupation classification:**

1 – Constriction worker **2** – Administrative worker (including banking and financing)

3 – Healthcare worker **4** – Transport worker **5** – Business **6** – Farmer **7** – Trader

8 – Hose wife/husband **9** – Artisan (vulcanizer, electrician, cobbler, plumber, carpenter)

10 – Student **11** – Other

Team leader: _____ Signature: _____ Date: ___ / ___ /___
dd mm yyy

Data manager: _____ Signature: _____ Date: ___ / ___ /___
dd mm yyy

FORM 02

Federal Ministry of Health

NTBLCP/ National Tuberculosis Prevalence Survey

SURVEY HOUSEHOLD NUMBER

Date: ___ / ___ /___ Issued by: _____

FORM 03

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

SURVEY SCREENING INVITATION CARD

Name: _____

Cluster no *household no* *serial no*

You are invited to come to _____ to participate in the on-going National Tuberculosis Prevalence Survey

Appointment day and time: _____

Please come for TB Screening on: _____

FORM 04

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

PARTICIPANT CONSENT FORM

Part I: Information sheet

(1) Introduction:

I am from National TB Programme of the Federal Ministry of Health, Nigeria. We are conducting this survey throughout the country. We would like you to give you information about the survey and invite you to participate in all screening activities. If you have questions about these activities you can ask me.

This survey has been reviewed and approved by the National Ethical Review Committee of the Federal Ministry of Health, and the World Health Organisation. The main person and organisations involved in executing the survey are:

Principal Investigator	National Coordinator, National Tuberculosis Control Programme
Name of organization	Federal Ministry of Health, Abuja, Nigeria
Name of organizations funding the survey	Global Fund for TB, Malaria and HIV/AIDS World Health Organisation Federal Government of Nigeria Centre for Disease Control, USA ILEP

(2) Purpose of the survey:

The aims of this survey is to quantify/know the disease burden/magnitude of active pulmonary TB (smear-positive and culture positive TB) among people aged 15 years and above, to know occurrence of TB suggested symptoms, people/patients behaviours against TB symptoms as well as utilization of TB service in public and private sectors. The survey findings will be used to revise the current strategies for TB control and will help to develop a future plan to control TB in Nigeria.

(3) Methods to be used during survey:

To fulfil above aims, community members who have been invited will be screened by;

Individual interview about TB symptoms

Chest X-ray examination, and

If a participant is suspected of having TB using above two methods, sputum will be collected for examination by microscopy and culture.

The entire screening process in the community would take about 30 minutes.

(4) Voluntary participation

Your participation in this survey is entirely voluntary. It is your choice whether to participate or not.

(5) Right to refuse or withdraw

If you choose not to participate in this survey there will be no penalty on you (all the service you receive from the health centre or any health facility will continue and nothing will change). You are free to withdraw and discontinue your participation at any time during the survey without providing any reason.

(6) Procedure

If you decided to participate in this survey, you will be interviewed about your socio demographic information, about TB suggestive symptoms, past or current anti-TB treatment history and health seeking behaviours related to TB suggestive symptoms. The information recorded is confidential (it will not be shared with anybody without permission).

You will be examined for TB by using a Chest X-ray. X-ray machine to be used is a digital one that will enable you also have a view of your own lungs. If you are suspected of having TB (after the interview and chest X-ray), you will be asked to bring two sputum samples for examination. If the result confirms you have active TB, you will be treated according to the NTP guidelines.

(7) Risks and discomforts

There are no psychological, social and physical hazards except the radiation exposure,which has a very negligible risk. There are no risks or possible hazards to you for being included in this survey since the average actual effect of the radiation exposure is 0.05mSv (Sievert). Protection devises will be used and the surrounding will be out of bound within 3 meters radius.

(8) Benefits

This study will be beneficial to the community as well as TB programme for the improvement of programme management and evaluation of programme impact. The findings of the survey would provide valuable information express the programme impact and to develop the appropriate plan and strategies for efficient implementation of the National TB Programme according to the real situation.

(9) Incentives or compensation

No compensation for any risk, but some goods may be provided for participating in this

survey as a compensation of your time spent for the screening process.

(10) Confidentiality

Your participation in this survey is confidential. We will not be sharing information about you to anyone outside of the survey teams or the State TB Programme. The information that we collect from this survey will be kept private.

(11) Publication or sharing the results

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

(12) Who to contact

Any question regarding this survey may be directed to Dr. Joshua O. Obasanya, National Coordinator, National TB Programme, Department of Public Health, FMOH , Abuja , Nigeria. Tel: 07043314737, Email: joobasanya@hotmail.com

Part 2: Consent Sheet

"I have read (or heard it read to me) the information sheet. I fully understand my participation in the screening is of no risk to my health. I also fully understand that I may withdraw from the survey at any stage without giving any reason and my withdrawal will not affect my usual entitlement to care and treatment.

"On these terms, I agree to participate in all screening activities of this survey, including individual interview, chest X-ray and submission of sputum specimens if required to do so,

Or agree as parent or legal guardian of _____ to his / her full participation in the survey."

Signed: _____ Date: ___ / ___ /___

Print name: _____ (State if parent or guardian)

Witnessed by (signed): _____ Date: ___ / ___ /___

Print name of witness: _____ (a community member)

Signature of the Receptionist: _____ (Survey team member)

FORM 05

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

INDIVIDUAL SURVEY CARD

Survey Number: ☐☐☐☐☐☐☐

Name of the Respondent: _____ Date: ___ / ___ /___

A. Identification

1. Sex: 1 - Male 2 - Female

2. Age (in years) as at last birthday: _____

if age unknown, check ☐ and estimate age: _____

3. Occupation:

1. Constriction worker
2. Administrative worker (including banking and financing)
3. Healthcare worker
4. Transport worker
5. Business
6. Farmer
7. Trader
8. House wife/husband
9. Artisan (mechanics, vulcanizer, electrician, cobbler, plumber, carpenter)
10. Student
11. Other. Specify _____

	5. Religion:	6. Marital Status:
	1 - Christianity 2 - Islam 3 - Traditional 4 - Others Specify _____ 9 - Don't know	1 - Single 2 - Married 3 - Separated 4 - Divorced 5 - Widowed 9 - Don't know

B. Symptoms

☐ Participant agreed to symptom screening

7. Do you have any of these symptoms? If Yes, for how long?

Note one week is 7 days, one month is 30 days.

Symptoms			Days
7.1 Cough	1 - Yes	2 - No	

C. Behaviour regarding symptoms (if YES for TB suspect)

9. What did you do about your symptoms?	10. If option 4 is selected in question 9, where did you first seek care?
1 - Not recognized as illness 2 - Ignored 3 - Self-treatment 4 - Consulted Health Service 5 - Other Specify: _____	1 - Single 2 - Married 3 - Separated 4 - Divorced 5 - Widowed 9 - Don't know

D. TB Treatment History

Current TB Treatment	Past History of TB Treatment
11. Are you currently taking any anti-TB drugs?	**14. Have you been treated for TB in the past?**
1 - Yes 2 - No	1 - Yes 2 - No
12. How long?	**15. If yes what was the year of your last episode?**
(In weeks, 1 month=4 weeks) _____	_____
13. Where are you taking the treatment?	**16. Where did you receive the treatment?**
1 - Health Centre/PHC 2 – Private Hospital 3 – Traditional center 4 – Chemist 5 – General Hospital 6 – Teaching Hospital 7 – Mission Hospital 8 - Other Specify: _____	1 - Health Centre/PHC 2 – Private Hospital 3 – Traditional center 4 – Chemist 5 – General Hospital 6 – Teaching Hospital 7 – Mission Hospital 8 - Other Specify: _____

17. Have you ever smoked tobacco?

1 - Yes 2 - No If yes, how long (in years)? _____

18. Do you currently smoke tobacco?

1 - Yes 2 - No If yes, how long (in years)? _____

19. If it is cigarette, how many sticks/day do you usually smoke?

_____ (Cigarettes)

E. Physical Examination

21. Weight: _____ (kg) ☐ Not Available

Interviewer's name: _____

Interviewers Signature: _____ Date: ___ / ___ /___

Reviewer's Name: _____

Reviewers Signature: _____ Date: ___ / ___ /___

Interviewers should direct the respondent to the X-ray Section.

Comments _____

F. Chest X-Ray Findings

23. Chest X-Ray done

1 - Yes 2 - No 3 - Decline

24. If No give reason

_____

G. Sputum Smear Microscopy

26. Sputum examination requested

1 - Yes 2 - No

27. Spot sputum specimen collected from subject

1 - Yes 2 - No If Yes, Date: ___ / ___ /___

Data checked complete and accurate by:

Data Manager's name: _____

Data Manager's signature: _____ **Date: ___ / ___ /___**

FORM 06

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

CHEST X-RAY DATA SHEET

TO BE FILLED BY RADIOLOGIST AT CENTRAL LEVEL

Date: ___ / ___ /___ Survey Number: _____

Zone: _____ State: _____ LGA: _____

X-ray quality Assessment:

☐ Good ☐ Average ☐ Below Average

X-ray Interpretation:

N	*ADNS*	*ADS-NA*	*ADS-NTB*	*ADS-TB*	*ADS-U*

X-ray Second Reading Date: ___ / ___ /___ Read by _____

FORM 06b

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

CHEST X-RAY REGISTER

Zone: _____ State: _____ LGA: _____

Cluster Number: _____ Date: ___ / ___ /___

SN	Survey No.	Name	Age		Result	Remarks	Sputum exam reqd	Read by:
			M	F				
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	
	/ /						Yes No	

FORM 07

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

SPUTUM SAMPLE COLLECTION REGISTER

Zone: _____ State: _____ LGA: _____

Date: ___ / ___ /___

Community: _____ Cluster Number: _____

Lab Serial No.	Code	Name	Age		Sputum Collection date		Remarks
			M	F	Day1 (S)	Day2 (H)	
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						
	/ /						

FORM 07b

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

SPUTUM SAMPLE BATCH DISPATCH REGISTER

Zone: _____ State: _____ LGA: _____

Date of dispatch: ___ / ___ /___

Community: _____ Cluster Number: _____

Batch Number: _____

Lab Serial No.	Survey Code	Name	Sputum Collection date		Date Received at the Lab	Condition when received
			Day1 (S)	Day2 (H)		
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					
	/ /					

Packed by: _____ Date: _____

Delivered by: _____ Date: _____

Received by: _____ Date: _____

FORM 08

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

SPUTUM SMEAR EXAMINATION FORM

Zone: _____ State: _____ LGA: _____

Community: _____ Cluster Number: _____

Lab. Serial Number: _____ Survey Number: _____/_____/_____

Sputum Container: Day 1 Date: ___ / ___ /___ Spot specimen ☐

Day 2 Date: ___ / ___ /___ Home specimen ☐

Signature/Name of sputum Collector

Name: _____ Date of dispatch: ___ / ___ /___

SPUTUM SMEAR EXAMINATION RESULTS

TO BE FILLED AT REFERENCE LABORATORY

Date specimen received by lab: _____/_____/_____

Sputum Smear examination:

Reading Date	*Specimen*	*Appearance*	*Results*					
			Negative	*1-9*	*1+*	*2+*	*3+*	*Not Available*
	Day 1(S)							
	Day 2(H)							

Examined by: _____ Signature: _____

Date: ___ / ___ /___

FORM 08b

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

SPUTUM CULTURE EXAMINATION FORM

Zone: _____ State: _____ LGA: _____

Community: _____ Cluster Number: _____

Lab. Serial Number: _____ Survey Number: _____/_____/_____

Sputum Container: Day 1 Date: ___ / ___ /___ Spot specimen ☐

Day 2 Date: ___ / ___ /___ Home specimen ☐

Signature/Name of sputum Collector

Name: _____ Date of dispatch: ___ / ___ /___

SPUTUM CULTURE EXAMINATION RESULTS

Date specimen received by lab: _____/_____/_____

Sputum culture examination:

Sputum	*Results*						*Inoculation date*	*Reading Date*
	Positive	*Negative*	*Contami-nated*	*Positive Not TB*	*Pos. ID unknown*	*Not Available*		
Day 1(S)								
Day 2(H)								

Examined by: _____ Signature: _____

Date: ___ / ___ /___

FORM 15

Federal Ministry of Health

National Tuberculosis and Leprosy Programme

National Tuberculosis Prevalence Survey

INTERVIEW QUESTIONNAIRE FOR THE TB SMEAR POSITIVE OR CULTURE POSITIVE CASES DIAGNOSED

Cluster no *household no* *serial no*

1. **Survey number:** | | | | | | | |

2. **Name:** _____

3. **Age:** _____ | | |

4. **Sex:** (1. Male 2.Female) |

5. **Address:** _____

6. **Occupation:** _____ income: _____

7. **Marital status:** (1.Married, living together 2.Married, living separately |

   3.Divorced 4.Widowed 5.Never married 6.Other (Specify) _____

8. **How many family members** living together including patient?

9. **Position in a household:**

   1.Head of household 2.Spouse of head 3.Parents of the household head |

   4.Sibling or grandchild of the household head 5. non family member 6.Other

   (Specify) _____

10. **Distance from home** to any TB diagnostic centre under NTP _____ Km

11. Cost for one way transportation to TB diagnostic centre _____ Naira

12. Time spent for one visit to TB clinic _____ hours

13. Are you a native? (1.Yes 2.No) ☐

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

15. Status of bacteriological examination (1.S+ 2.S neg. C+) ☐

16. Type of TB patient (1.New 2.Relapse 3.Treatment after default 4.Failure) ☐

17. Treatment Category put on (1.Cat I 2. Cat II) ☐

18. Did you know you had TB before the Survey (during interview)?
(1.Yes 2.No) ☐

19. If yes, for how long have you known you had TB? _____ (Months)

20. If yes, why did you delay treatment? State reason: _____

Annex 7.
Cluster summary of participation according to screening methods

Cluster	Setting	*Census, eligible, participant populations*					*Treatment history*		*Interview screening*		*CXR screening*		Positive by either	*Specimens collected*	
		Enumer-ated	Eligible	Non-resident adults	Children	Partici-pants	Ever	Current	Positive	No symptoms	Positive	Done		Spot	Morning
1	Rural	1461	922	9	530	686	8	7	57	392	19	671	61	61	60
2	Urban	1375	925	2	448	639	13	1	35	446	68	638	83	82	76
3	Urban	1276	1050	1	225	376	4	2	26	221	29	375	48	48	47
4	Rural	1621	955	0	666	720	19	2	33	436	13	718	39	38	34
5	Urban	1494	1062	0	432	738	8	1	39	209	20	738	49	44	43
6	Urban	1820	1082	3	737	407	4	2	11	310	8	406	17	16	13
7	Rural	1941	1078	0	863	711	6	0	34	310	94	696	116	115	97
8	Semi-Urban	1378	949	5	428	325	5	2	27	181	80	324	90	87	60
9	Rural	2035	1354	1	681	663	8	1	57	317	175	663	204	203	199
10	Rural	1954	1304	0	650	745	19	0	78	323	112	744	156	155	143
11	Semi-Urban	1884	1133	6	751	761	18	2	30	560	44	709	60	60	49
12	Rural	1603	834	66	705	599	4	0	16	492	21	555	30	30	21
13	Rural	1584	964	70	618	621	9	1	26	426	61	562	80	72	65
14	Rural	1837	1032	20	803	819	2	0	42	589	35	721	71	69	64
15	Semi-Urban	1559	916	126	522	737	12	4	39	621	37	719	61	60	59
16	Urban	1567	983	2	582	604	1	0	9	549	7	576	15	15	13
17	Rural	1776	884	137	757	779	2	2	13	648	14	735	24	24	18
18	Rural	1405	1078	0	327	802	6	0	23	575	26	708	44	44	43
19	Rural	1605	875	3	729	765	11	1	24	624	16	717	32	32	29
20	Rural	1536	953	19	582	809	1	0	24	639	17	704	37	37	37
21	Rural	1512	896	3	616	766	10	1	31	598	26	703	47	47	45
22	Semi-Urban	1907	1132	7	769	638	2	1	16	344	74	635	85	85	81
23	Rural	1895	1093	0	802	713	4	1	57	269	181	712	205	205	205
24	Urban	1384	1035	6	347	363	1	0	11	259	2	331	13	13	13
25	Urban	1538	1461	0	77	727	8	2	18	493	60	713	73	61	60
26	Urban	1918	1457	0	461	710	14	1	32	456	35	657	55	52	50
27	Urban	1864	1298	1	566	661	13	1	36	444	105	661	120	120	109
28	Urban	1788	1215	0	573	531	13	1	34	260	59	525	76	76	70
29	Rural	1811	1246	1	565	713	12	1	32	379	68	708	92	85	78
30	Urban	2104	1249	4	854	731	4	0	23	473	18	730	36	34	21
31	Rural	2011	975	12	1028	729	0	0	25	479	53	726	67	67	66
32	Urban	2549	1441	0	1108	447	1	0	21	350	16	430	32	30	29
33	Urban	1777	951	54	826	721	2	0	46	402	25	718	63	58	52
34	Rural	1897	1087	14	796	731	4	2	27	582	13	714	34	34	24
35	Urban	2143	1525	3	617	731	0	0	79	540	23	723	83	83	72

Cluster summary of participation - continued

Cluster	Setting	*Census, eligible, participant populations*					*Treatment history*		*Interview screening*		*CXR screening*		Positive by either	*Specimens collected*	
		Enumer-ated	Eligible	Non-resident adults	Children	Partici-pants	Ever	Current	Positive	No symptoms	Positive	Done		Spot	Morning
36	Urban	1799	1072	4	725	356	0	1	27	231	22	354	36	34	28
37	Rural	2035	1112	5	920	711	4	1	17	534	41	710	47	38	36
38	Urban	1295	930	0	365	334	5	0	32	218	8	329	34	32	31
39	Rural	1423	1046	6	372	553	8	0	41	382	5	553	44	43	39
40	Urban	1602	1083	4	515	573	4	0	18	388	2	573	19	19	19
41	Rural	1247	849	2	396	532	5	2	40	290	45	524	73	65	53
42	Urban	987	820	6	165	279	7	1	15	201	10	277	22	16	15
43	Urban	1183	845	1	337	475	11	1	33	333	34	473	54	48	44
44	Rural	1120	868	2	251	535	1	1	31	374	15	521	42	39	35
45	Rural	1274	977	19	278	538	7	0	56	236	18	531	68	65	50
46	Rural	1304	968	7	335	526	9	3	45	327	59	522	86	83	66
47	Urban	1527	1142	10	382	464	5	1	24	285	42	463	61	60	60
48	Urban	1510	1271	13	238	726	9	2	23	375	18	711	40	38	25
49	Rural	1685	1085	9	598	615	7	2	64	266	29	611	83	83	64
50	Urban	1527	1229	9	296	706	9	5	111	280	29	702	122	120	107
51	Rural	1380	1277	5	103	723	4	3	48	374	14	720	52	51	46
52	Urban	1534	1358	3	174	672	2	0	56	378	10	672	63	61	52
53	Urban	1326	1274	4	50	741	10	1	77	413	15	739	84	83	65
54	Urban	1112	860	2	252	484	3	0	32	310	59	484	82	78	74
55	Rural	1076	865	6	209	529	12	1	61	232	70	526	109	104	99
56	Urban	1788	1230	56	542	529	4	2	34	316	62	528	85	81	69
57	Urban	1412	1213	7	193	662	7	1	17	495	19	662	32	32	29
58	Urban	1586	1115	0	471	515	6	0	13	306	6	504	18	18	17
59	Urban	1698	1237	1	460	637	12	0	30	343	14	632	39	39	37
60	Urban	1921	1395	2	524	665	23	4	58	375	34	660	69	69	68
61	Urban	1705	1158	4	547	580	4	0	15	381	5	572	19	19	19
62	Rural	1715	1164	30	526	653	11	1	27	423	20	644	39	39	39
63	Urban	1662	1074	5	587	605	13	1	23	458	24	594	37	37	37
64	Urban	1758	1263	5	490	754	11	0	32	514	39	753	62	62	55
65	Rural	1388	1029	9	352	642	19	1	29	414	33	638	50	48	45
66	Urban	1505	1311	1	193	718	8	0	31	518	35	718	58	58	56
67	Urban	1715	1349	2	364	742	21	5	51	506	49	741	78	78	76
68	Urban	1348	1054	3	291	662	13	2	48	515	233	662	248	243	217
69	Urban	1940	1533	6	401	733	13	1	26	632	85	733	95	94	91
70	Urban	1351	1347	0	4	799	17	0	50	555	111	798	140	134	130
TOTAL		**113247**	**77797**	**823**	**34947**	**44186**	**552**	**82**	**2466**	**28374**	**2968**	**43199**	**4688**	**4553**	**4138**

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