Epidemiological review of TB disease in Nigeria
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Summary

Background

The Federal Ministry of Health of Nigeria requested the support of the World Health Organization (WHO) to conduct an epidemiological review of TB in the country in preparation for the development of the National Strategic Plan for TB and the Concept Note submission to the Global Fund. This review was based on the thorough and systematic analysis of the national TB surveillance data, including an assessment of the surveillance and vital registration systems using a WHO Global Task Force on TB Impact Measurement checklist of TB surveillance standards and benchmarks.

Objectives

The objectives of the review were to:

- Describe and assess the current national TB surveillance and vital registration systems, with particular attention to their capacity to measure the level of and trends in TB disease burden (incidence and mortality), through the implementation of a checklist of TB surveillance.
- Assess the level of, and trends in, TB disease burden (incidence, prevalence, mortality) using available surveillance, survey, programmatic and other data.
- Define the investments needed to directly measure trends in TB disease burden in the future.

Methods

Nigeria's TB surveillance and vital registration systems were assessed using the checklist of standards and benchmarks developed by the Global Task Force on TB Impact Measurement, in accordance with the standard user guide, in a mission, April 4-15 2013, by Babis Sismanidis (WHO/Geneva) and Julia Ershova (CDC/Atlanta). This involved a desk review of program documents, datasets, and the paper-based surveillance system. Data were collated and analysed, with the exception of sub-national TB case notification and treatment outcome data that were maintained in sub-optimal conditions and required time-consuming data entry and mining. Results of analyses conducted were disseminated at a de-briefing meeting, during which strategies to improve the measurement of TB morbidity and mortality and assess the impact of TB control in Nigeria were discussed. The completion of sub-national analyses was deferred to a second mission once the necessary data entry of the sub-national data was completed.

The second mission was held between February 2-8, 2014 when additional data analyses were conducted of the existing national and sub-national level TB surveillance as well as other health system data. Consultation of findings from these analyses were held with staff from the National Tuberculosis and Leprosy Programme (NTBLCP), as well as other stakeholders involved in the development of the National Strategic Plan for TB.

Main findings

The TB surveillance system in Nigeria has some strengths but also important gaps that need prompt action. Increased investment is required to address the gaps identified by the assessment. Based on the assessment, the greatest strengths of TB surveillance in Nigeria include the external consistency of its data, its adherence to best-practices in recording and reporting as described by WHO guidelines, the ongoing dialogue for the transition from paper to electronic, case-based system, and its monitoring of the level of HIV among TB cases. The primary challenges of the system include the inappropriate storage of aggregated, national and sub-national level TB surveillance data that make any attempts to analysis cumbersome; the weak capacity of available human

resources to maintain large datasets, regularly analyse and critically review surveillance data; knowing that all diagnosed TB cases are reported and that reported cases are accurate; the lack of a national vital registration system with standard coding of causes of death, and the low coverage of the existing system of civil events registration; achieving up-to-date coverage for paediatric TB. Increased investment is required to address these gaps and build a system that can accurately measure TB incidence and mortality.

Overall TB case notifications in the country have been consistently on the rise during DOTS expansion up to 2008 when they seem to have plateaued despite the more intensified approach to PPM; large variability of case notification rates at zonal and state levels could reflect differences in disease burden, but also differences in TB detection and reporting coverage, or errors in reporting; national percentage of successful treatment outcome reached the 85%international target in 2011, but with large zonal and state level variability; relatively low levels of MDR-TB have been measured in a national drug resistance survey; TB prevalence levels are 2-3 times higher than previously thought as measured from a national pulmonary TB prevalence survey among adults (15+ years), with clear sex, age and geographical subgroup differentials; time trends of TB disease burden in Nigeria are not measured directly, but are probably sustained at a still high level.

Key recommendations

Short-term, high impact

- **Strengthen M&E capacity:** Sustain the existing M&E team at national level, and increase their capacity for good data management and analysis practices through for e.g. courses, or on-the-job training.
- **Capture all historical sub-national level data in a single aggregated database.** Transfer all available retrospective surveillance data (LGA and state level) into an appropriate database to facilitate detailed analysis.
- **Promote the analysis and critical review of surveillance data** and improve dissemination of results at all levels (federal, state, LGA).
- **Support the ongoing transition from a paper to an electronic case-based recording and reporting system.**
- **Identify Specific Challenges to TB recording and reporting.**
    - Link up with WHO/GF to conduct the Service Availability and Readiness Assessment (SARA) of the health information system (including the TB data quality assessment component).
    - Draw on results from the prevalence survey to understand characteristics of cases that had gone undiagnosed and untreated by the NTBLCP and assess barriers to health care for TB high risk groups including key affected population. These prevalence survey results, in conjunction with findings from the 2013 mid-term joint review, will form the foundation to address issues related to low case detection and case reporting.

Longer-term, high impact

- **Improve case finding.**
    - Proactively engage with local governments for the decentralisation of TB diagnostic and treatment services as close as possible to the primary health care level.
    - Develop a policy document for making TB notification mandatory (legal requirements) and include recommendations for its successful implementation at all levels (national, state, LGA).

- **Support development of vital registration system:** NTBLCP should proactively engage with the National Population Commission to increase demand and ultimately strengthen the quality and coverage of reporting of causes of death through the national vital registration system, ensuring inclusion of accurate cause of death coding for TB.
- **Conduct studies to improve direct measurement of TB disease:** Conduct a pilot inventory study in FCT state to monitor levels of under-reporting.

List of Abbreviations

BMU	Basic Management Unit
CDC	Centers for Disease Control and Prevention
COD	Cause of death
CoIA	Commission on Information and Accountability for Women's and Children's Health
DHIS	District Health Information System
eRR	Electronic recording and reporting surveillance for TB care and control
HIV/AIDS	Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome
ICD	International Classification of Diseases
IT	Information Technology
MDGs	Millennium Development Goals
MDR-TB	Multi-Drug Resistant TB
M&E	Monitoring and Evaluation
MoH	Federal Ministry of Health
NTBLCP	National Tuberculosis and Leprosy Control Programme
NTRL	National TB Reference Laboratory
PPM	Public-Private Mix
SARA	Service Availability and Readiness Assessment
SOPs	Standard Operating Procedures
TB	Tuberculosis
VA	Verbal Autopsy
VR	Vital Registration
WHO	World Health Organization

1. Introduction

Nigeria is among the 22 high tuberculosis (TB) burden countries worldwide with approximately 100,000 TB cases notified in 2012. In recent years, the National Tuberculosis and Leprosy Control Programme (NTBLCP) has made some advancements in TB control, by increasing the treatment success rate, and expanding PPM activities hence improving case finding.

Despite this progress, up until now estimates of TB disease burden (incidence, prevalence, and mortality) in Nigeria continue to be based on indirect estimation, with significant uncertainty around how accurately they may reflect the true burden of TB disease in the country. To date, the extent to which case notifications and reported deaths reflect Nigeria's true TB incidence and mortality has not been well understood. The completeness and accuracy of routine TB surveillance and vital registration systems in Nigeria have also not been well assessed. This in turn challenges the ability to accurately estimate TB disease burden and objectively measure progress towards global and national targets, such as the Millennium Development Goals (MDGs). An important step in the right direction of improving measurement of TB disease in the country is the finalization of analysis and soon-to-be-released results from the first National TB Prevalence Survey, the first nationwide direct measurement of TB burden among adults (≥15) in Nigeria.

The NTBLCP needs accurate epidemiological information about the burden of TB in Nigeria to effectively plan, monitor, and assess the impact of interventions and progress towards targets. As a result, a review of the systems in place in Nigeria to collect and generate data on TB cases and deaths was planned. To do this review, the Federal Ministry of Health of Nigeria requested the support of the World Health Organization (WHO) to examine the national and sub-national TB surveillance data. The assessment of the TB surveillance and vital registration systems was conducted using a standardized WHO checklist of TB surveillance standards and benchmarks. The expectation was that the results could be used to develop a monitoring and evaluation (M&E) investment plan designed to strengthen TB surveillance and vital registration systems to better measure trends in TB disease burden. The NTBLCP, with the support of the Global Fund and other partners, can use the findings and recommendations of the TB surveillance system assessment to inform targeted M&E investments in Nigeria to strengthen underlying data systems and systematically assess trends in disease burden and program impact.

2. Purpose

2.1. Objectives

- Describe and assess the current national TB surveillance and vital registration systems, with particular attention to their capacity to measure the level of and trends in TB disease burden (incidence and mortality), through the implementation of a checklist of TB surveillance.
- Assess the level of, and trends in, TB disease burden (incidence, prevalence, mortality) using available surveillance, survey, programmatic and other data.
- Define the investments needed to directly measure trends in TB disease burden in the future.

2.2. Proposed outcomes

- A formal performance assessment of TB surveillance based on WHO standards and benchmarks, with strengths and weaknesses (including data gaps and data quality problems) identified, and any unmet monitoring and evaluation needs described.

- A formal assessment of the level of, and trends in, TB disease burden.
- An M&E investment plan with specific recommendations for investment of funds for the improvement of measurement of TB trends in Nigeria.

3. Methods

TB surveillance checklist implementation: This was completed during a first mission, 4-15 April 2013 by WHO/Geneva (Babis Sismanidis) and CDC/Atlanta (Julia Ershova) staff in collaboration with the national M&E team of the NTBLCP. The checklist of TB surveillance standards and benchmarks, the associated user guide and the methods to be used were shared with the Nigerian NTBLCP prior to the checklist implementation visit. During the visit discussions were held with staff from the NTBLCP to review and update the checklist based on what was learned about national surveillance, vital registration systems and previous surveys that collected TB morbidity and mortality data (see Appendix 1 for list of all people met). Various methods were used to collate and analyze the data, including a desk review of documents, datasets, and electronic surveillance systems. A complete list of the documentation, methods and analysis used for the assessment are provided in Appendix 2. On April 8 a de-briefing presentation was held with the NTBLCP staff and WHO's National Professional Officer for Tuberculosis Control during which the results of the mission were shared including immediate and medium priority recommendations on how to improve the data quality and measurement of TB morbidity and mortality in Nigeria. The completed checklist and presentation slides are available in Appendix 3 and Appendix 4 of this report, respectively. The analysis of historical (from 2006 onwards) sub-national (state and LGA level) TB surveillance data was not completed during that mission, due to the inappropriate storage of data in a non-relational format and hundreds of separate Excel worksheets. Aggregated Epi Info databases (one for state, the other for LGA level) were prepared and left with the national M&E team of the NTBLCP for data capture of all available historical data.

Epidemiological review of TB disease in Nigeria: During a second mission, 2-8 February 2014, the collation and analysis of additional TB surveillance and more general health system data was done. During this mission published estimates of TB morbidity and mortality that are already available were compiled and reviewed to assess the level of, and trends in, TB disease burden (both nationally and when data available sub-nationally). Further analysis of TB notification data was also done, specifically at the sub-national (state) level. A de-briefing presentation of preliminary analyses from this mission was given during the NTBLCP's National Strategic Plan development workshop for consultation with national TB stakeholders and opportunity for feedback. Subsequently, some changes were made to the original recommendations after the implementation of the surveillance checklist in April 2013, to allow for a number of developments, such as the decision to include a TB component to the District Health Information System (DHIS). [1] Finally, an interpretation of all available data was provided as to what the plausible levels of, and trends in, TB disease are.

[1] http://www.dhis2.org

4. Assessment of surveillance of TB cases and deaths in Nigeria

4.1. Checklist of TB surveillance standards and benchmarks – Rationale

Surveillance of TB disease and deaths is essential for effective TB prevention and control. Timely, accurate, and complete recording and reporting of TB cases along with analyzing trends in the number and distribution of TB cases is a necessity to monitor and evaluate TB prevention and control programs. It follows that a reliable TB surveillance system is therefore needed to guide policy decisions and develop national strategies and plans to track and report on progress in control efforts, including progress towards national or global targets.

In addition, a robust vital registration system, which includes causes of death, is needed to understand and monitor trends in mortality due to TB, identify health inequalities and priorities, and evaluate the impact and effectiveness of health programs, including TB control and prevention programs. Vital statistics are also needed in TB control to understand emerging health challenges (e.g. HIV/AIDS), and accurately measure progress towards global targets (e.g. the Millennium Development Goals).

The best methods for measuring TB incidence and mortality are through routine surveillance and vital registration systems that capture reliable and comprehensive data about new cases of TB and TB deaths. Having robust systems in place means TB notifications can be considered a direct measure (or a very close proxy) of TB incidence and mortality.

To assess a national TB program's ability to measure TB incidence and mortality, TB experts from the WHO Global Task Force on TB Impact Measurement[2] developed a checklist in 2012 following a two-year development and field testing phase ("The Standards and Benchmarks for TB Surveillance and Vital Registration Systems"[3]). This checklist is designed to be uniformly implemented in all countries to assess strengths and weaknesses of national TB surveillance systems and provide guidance to improve these systems so that TB notifications can more closely measure actual TB incidence and mortality. The checklist consists of 13 standards and their associated benchmarks, with nine standards related to measurement of TB cases and one related to measurement of TB deaths. The final three standards are supplementary standards that can be used to assess whether a country's TB surveillance system provides a direct measure of the number of MDR-TB cases, the number of HIV-positive TB cases, and the burden of pediatric TB. Note that the Checklist only assesses the surveillance system's ability to provide a direct measure of TB incidence and mortality. It does not assess the system's ability to fulfill programmatic requirements. The benchmarks are therefore different from those used in defining programmatic targets. Based on the assessment, gaps and unmet M&E needs in national surveillance systems can be identified and strategies then be developed to address these needs.

4.2. Characteristics of the TB surveillance and vital registration systems

The Nigerian NTBLCP oversees a traditional, aggregate paper-based system. The paper-based system relies on state TB coordinators to review LGA registers, to create and send quarterly reports to the M&E team at the NTBLCP central level in Abuja after a review for accuracy. Staff at central level collect the aggregate data in numerous Excel spreadsheets. The paper-based surveillance system is well established. All service delivery points

[2] http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/en/

[3] http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/resources_documents/en/index.html

systematically use standardized TB collection forms and tools to ensure uniformity. Although there are no written goals for the surveillance system, national guidelines for recording and reporting TB cases exist in manuals and training materials. Data are reliably transmitted on a quarterly basis from the first sub-national administrative level (the state) to the national level, and it is checked along the way by the state coordinators and national-level staff. A certain year's data is usually ready for analysis by May of the following year; annual reports are produced, mainly reporting last year's data. There are increasingly more case notifications reported to the NTBLCP from the private sector, as well as prisons, but due to the way the data are maintained in multiple spreadsheets it is difficult to disaggregate notifications and understand what is the contribution of public-public and public-private mix (PPM) activities to case notifications overall. A Working Group has been formed for the transition from a paper- to a case-based electronic recording and reporting TB system, and is currently investigating the possibility of integrating TB surveillance into the current roll-out of the DHIS 2 in Nigeria.

There is currently no national vital registration system with standard coding of causes of death (COD) in Nigeria, but the National Population Commission the agency tasked with registering civil events currently maintains a civil registration system for deaths and births.[4] This system has very low coverage of overall deaths in the country and produces data of poor quality, but it is in place and could improve with appropriate funding allocation. Standardized coding (e.g. ICD-9 or ICD-10 COD codes) is not utilized, and deaths can be registered at health facilities or district offices, which adds additional variability to cause of death coding. In April 2013 as part of a Commission on Information and Accountability for Women's and Children's Health (CoIA) meeting, a roadmap was developed for the strengthening of the civil and vital registration system in Nigeria.[5]

4.3. Checklist of TB surveillance standards and benchmarks – Summary results

The TB surveillance system in Nigeria has some strengths but also important gaps that need prompt action. Of all the standards for TB surveillance, 5 were met, 7 were not met, and 1 was not applicable (see Table 1). Increased investment is required to address the gaps identified by the assessment. Based on the assessment, the greatest strengths of TB surveillance in Nigeria include the external consistency of its data, its adherence to best-practices in recording and reporting as described by WHO guidelines with a plan to introduce the 2013 revisions[6] to the definitions and reporting framework, the ongoing dialogue for the transition from paper to electronic, case-based system, and its monitoring of the level of HIV among TB cases. The primary challenges of the system include the inappropriate storage of aggregated, national and sub-national level TB surveillance data that make any attempts to analysis cumbersome; the weak capacity of available human resources to maintain large datasets, regularly analyse and critically review surveillance data; knowing that all diagnosed TB cases are reported and that reported cases are accurate; achieving up-to-date coverage for pediatric TB, and TB mortality surveillance. Increased investment is required to address these gaps and build a system that can accurately measure TB incidence and mortality.

[4] http://www.gtsnigeria.com

[5] http://www.who.int/woman_child_accountability/countries/NGA_roadmap_final_web.pdf

[6] Definitions and reporting framework for tuberculosis – 2013 revision (WHO/HTM/TB/2013.2). Geneva, World Health Organization; 2013. Available from: www.who.int/iris/bitstream/10665/79199/1/9789241505345_eng.pdf

Table 1. A summary of the surveillance checklist results, listed by whether standards were met, not met, or were not applicable. The completed checklist can be viewed in Appendix 3

Met	Not Met	Not applicable
B1.1 – Case definitions consistent with WHO guidelines B1.2 (Paper) – TB surveillance system is designed to capture a minimum set of variables for reported TB cases B1.6 – TB surveillance data are externally consistent B2.1 – Surveillance data provide a direct measure of drug resistant TB in new cases B2.2 – Surveillance data provide a direct measure of the prevalence of HIV infection in TB cases	B1.3 (Paper) – All scheduled periodic data submissions (e.g. electronic data files or quarterly paper reports) have been received and processed at the national level B1.4 (Paper) – Data in quarterly reports (or equivalent) are accurate, complete, and internally consistent B1.7 – Number of reported TB cases is internally consistent (within country) B1.8 – All diagnosed cases of TB reported B1.9 – Population has good access to healthcare B1.10 – Vital registration system has high national coverage and quality B2.3 – Surveillance data for children reported with TB are reliable and accurate *OR* all diagnosed childhood TB cases are reported	B1.5 (Electronic) – Data in national database are accurate, complete, internally consistent, and free of duplicates

4.4. Recommendations

These recommendations were originally put together after the implementation of the TB surveillance checklist during the mission in April 2013, and were later adapted during the second mission in February 2014 to allow for relevant developments in TB surveillance in the country (such as the DHIS 2 roll-out) during the period between the two missions.

4.4.1. Short-term, high impact

Strengthening capacity of central M&E team

- Sustain the existing M&E team at national level, and enhance their capacity for good data management and analysis practices through relevant courses and on-the-job training.

Capture all historical national and sub-national level data in a single aggregated database

- Transfer all available (at least from 2006 onwards) historical surveillance national and sub-national (LGA and state level) data into an appropriately designed relational database to facilitate detailed time series analyses. So far, only the 2010-2012 data have been captured.

Promote the analysis and critical review of surveillance data

- Conduct analyses of surveillance data regularly, critically review findings, and use the dissemination of results as an opportunity to improve NTBLCP activities.

Support the ongoing transition to an electronic case-based recording and reporting system

- Cost training activities and equipment necessary for the case-based TB component to the current roll-out of the DHIS 2 system in Nigeria.

Identify Specific Challenges to TB Recording and Reporting

- **National data quality audit**: Conduct a national-level data quality audit to systematically assess data quality and identify sources of under reporting (if any). This would preferably be done as a TB component of a Service Availability and Readiness Assessment (SARA).[7]
- **High-risk groups:** Draw on results from the prevalence survey to understand characteristics of prevalence cases in the country overall, but also specifically target those that had gone undiagnosed and untreated by the NTBLCP and assess barriers to health care for TB high risk groups. This will form the foundation to address issues related to low case detection and case reporting.

4.4.2. Longer-term, high impact

Improve case finding

- Proactively engage with local governments for the decentralisation of TB diagnostic and treatment services as close as possible to the primary health care level.
- Develop a policy document for making TB notification mandatory (legal requirements) and include recommendations for its successful implementation at all levels (national, state, LGA).

Support development of vital registration system

- Dedicate one NTBLCP staff to collaborate with the National Population Commission to support development of the vital registration system, ensuring inclusion of accurate cause of death coding for TB.
- Proactively engage with the National Population Commission to liaise with other MoH representatives (e.g. HIV and Malaria programmes), Global Fund and other CoIA[8] partners to promote the development of a high-quality with national coverage vital registration system.

Conduct studies to improve direct measurement of burden of TB disease

- Conduct a sub-national inventory study in FCT state to monitor levels of under-reporting over time.[9] Inventory studies can help facilitate linkage with and expansion of Public-Private Mix (PPM) activities (since mapping of health providers is required for an inventory study), quantify initial defaulters, and measure levels of under-reporting of TB in children.

[7] http://www.who.int/healthinfo/systems/sara_introduction/
[8] Keeping promises, measuring results, Every Woman Every Child. Commission on Information and Accountability for Women's and Children's Health
[9] http://www.who.int/tb/publications/inventory_studies/

5. TB epidemiology

5.1. TB case notifications

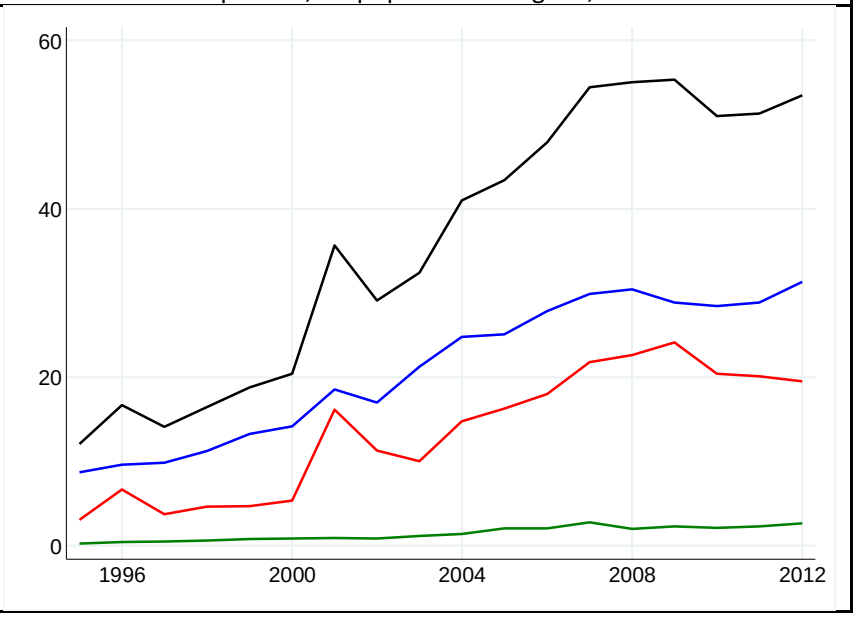
The first point of reference in any investigation to understand TB disease burden in the country is its case notification system. The trends of time series of case notifications, especially in countries where the surveillance system is expanding coverage and intensifying case finding activities, do not necessarily reflect trends in true disease burden, but provide an extremely useful insight during any epidemiological assessment of TB disease in the country. It is then only through further investigation of notification data at national and sub-national levels, including a detailed analysis of the recording and reporting system, the analysis of mortality data, as well as a study of changes in determinants of TB over time, that one acquires a more comprehensive understanding of TB epidemiology and the shortcomings of routine TB surveillance in a country.

5.1.1. Time trends, national level

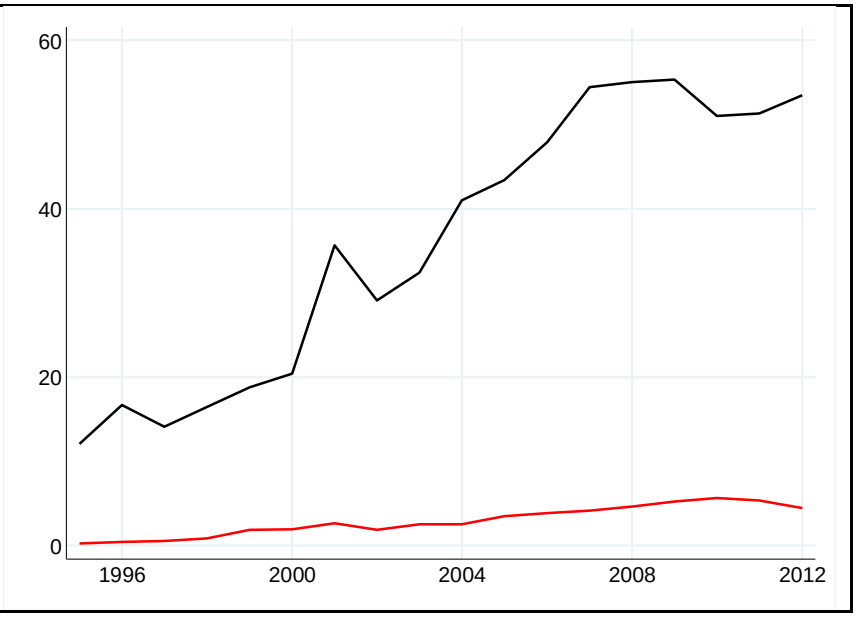
Figure 1 and Figure 2 present national time trends in TB case notification rates in Nigeria, 1995-2012. Overall case notifications have been consistently on the rise during DOTS expansion in the country, but seem to have plateaued since about 2008 despite the more intensified approach to PPM activities NTBLCP has taken recently (24% of 2012 notifications was a direct result of PPM). Out of all notified TB cases in 2012, 59% were confirmed through smear-microscopy, 37% were based on a clinical diagnosis, and finally only 5% were extra-pulmonary TB. The overwhelming amount of notifications in 2012 were among patient who had not been treated previously, with only about 7% of all notifications having a history of previous anti-TB treatment.

Figure 1. Time-series of national TB case notification rates per 100,000 population in Nigeria, 1995-2012

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



Panel B. Case notification rates (**black**: new, all forms; **red**: retreated, all forms). *Data source: WHO TB database*



The interpretation of time series of case notification rates requires careful consideration of reasons why rapid changes are observed. For instance, the spike in notifications of all forms TB in 2001 is likely not due to a sudden increase in TB disease burden because TB incidence rarely changes faster than 10%/year. More likely, the increase was related to a data entry error or a change in reporting coverage.

A number of ratios of different groups of TB case notifications are presented in Table 2. The ratio of new TB cases with pulmonary compared to extrapulmonary disease between 2008-2012 reveals a slow, consistent decrease in pulmonary disease being notified in Nigeria. The trend of national male to female ratio, 2008-2012, is consistent overall, with only slight changes year-to-year, showing more male compared to female TB cases being notified. Examining the numbers of new and retreatment TB cases in Nigeria, 2008-2012, reveals a steady decrease in retreatment cases up until 2011, which could be attributed to retreatment cases being notified as drug-resistant TB and entered into the separate register being maintained for such cases.

Table 2. Ratios of: (i) new pulmonary to extra-pulmonary, (ii) new male to female, and (iii) new to retreated TB case notifications, 2008-2012. *Data source: WHO TB database*

Year	P:EP[1]	Male:Female[2]	New:Retreated[3]
2008	26.5	1.46	11.8
2009	23.1	1.48	10.5
2010	22.8	1.54	9.1
2011	21.2	1.58	9.6
2012	19.4	1.57	11.9

[1]Ratio of new pulmonary (smear-positive and smear-negative) to extra-pulmonary notified cases; [2]Ratio is calculated only among new smear-positive, since age and sex disaggregated data are not provided for smear-negative and extra-pulmonary; [3]Ratio includes TB all forms. *Data source: WHO TB database*

5.1.2. Time trends, sub-national level

Quarterly aggregated reports at the LGA level are sent to the state and from there national level. Investigating time series of sub-national data allow the analyst to review a different dimension to the surveillance data and identify issues with data reporting or quality at sub-national level that would otherwise be masked at national aggregations.

5.1.2.1 Time-trends, zonal-level

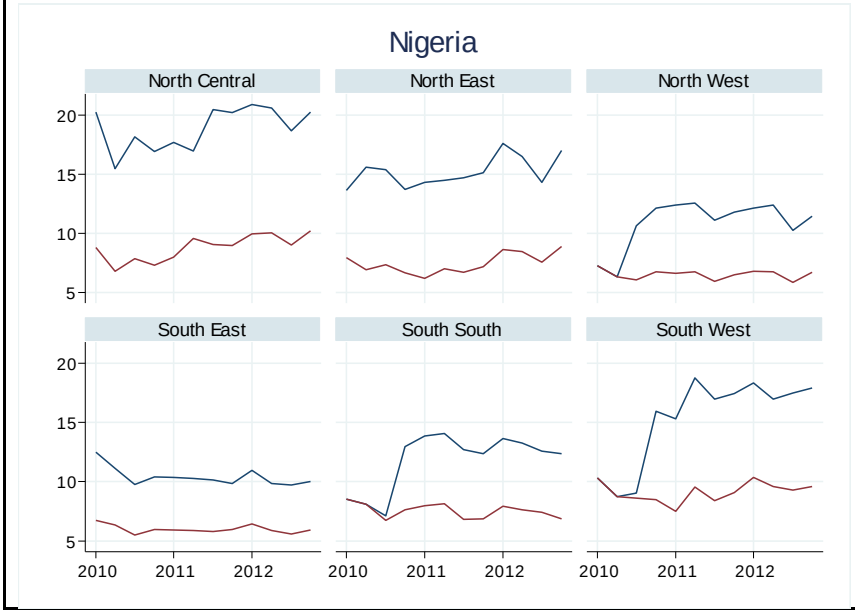
In this section we are presenting TB surveillance data aggregated at the zonal level. For each of the six zones in Nigeria annual data for 2010-2012 are presented in Table 3. Some data entry errors are evident (e.g. South West for 2010 all forms should be at least the same level as smear-positive rate), but also the possibility to assess case finding activities at the zonal level.

Table 3. Time series of new TB case notification rates per 100,000 (all forms and smear-positive), by zone and year, 2010-2012. *Data source: NTBLCP database*

Zone	2010		2011		2012	
	Smear-positive	All forms	Smear-positive	All forms	Smear-positive	All forms
North Central	31	71	36	75	39	80
North East	29	58	27	58	34	65
North West	26	31	26	48	26	46
South East	25	44	24	41	24	41
South South	31	27	30	53	30	52
South West	36	25	35	68	39	71

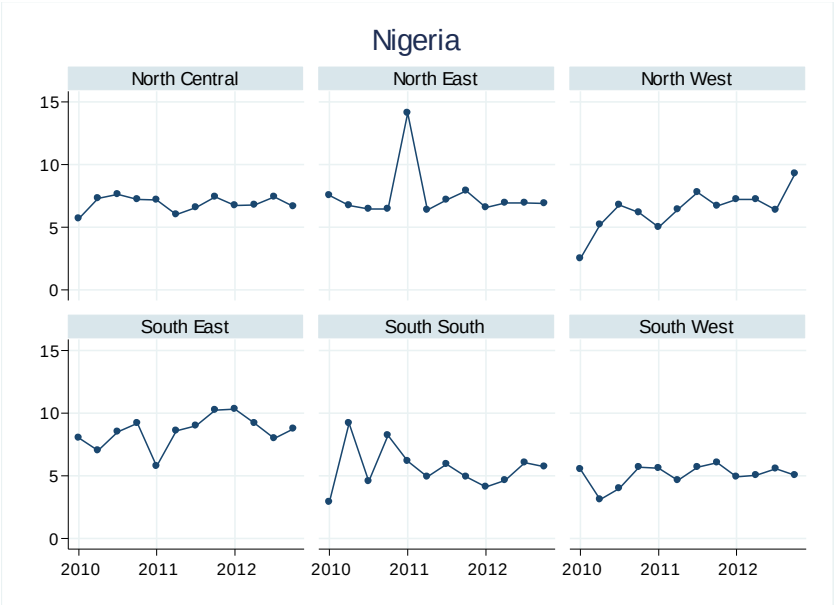
Further disaggregation is also presented in the form of quarterly (as opposed to only annual) data for 2010-2012. In Figure 2 time series of new case notifications are shown for all forms and smear-positive TB. Evidence of incomplete reporting or errors in data entry is clear, for example the increase from Q2 to Q3 in 2010 from South West region of the all forms TB case notification rate. While for other regions, for example South East, smoother time series mean more consistent, but certainly lower compared to other settings, reporting and hence possibly case finding activities.

Figure 2. Time series of new TB case notification rates per 100,000 (blue: all forms, red: smear-positive), by zone and quarter, 2010-2012.
Data source: NTBLCP database



Another useful indicator to assess the performance of TB surveillance is the ratio of the number of individuals with presumptive TB that are being investigated by smear microscopy over the number of smear-positive cases being notified. Figure 3 shows time series of this indicator at the zonal level, per quarter for 2010-2012.

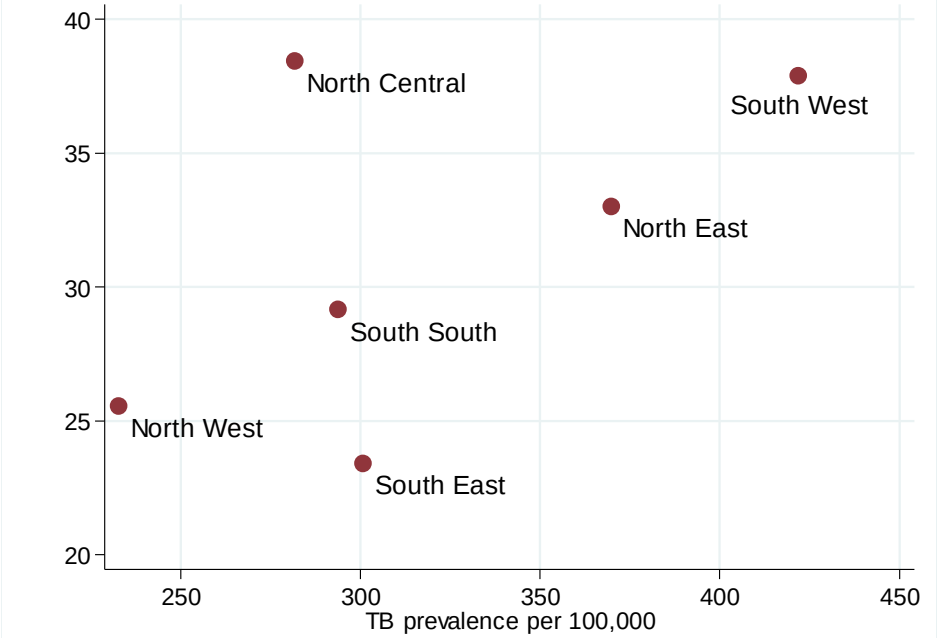
Figure 3. Time series of the ratio of presumptive TB investigated for every smear-positive TB case found, by zone, per quarter for 2010-2012.
Data source: NTBLCP database



The following scatterplot (Figure 4) shows adult (≥15) smear-positive TB case notification rate per 100,000 against smear-positive TB prevalence rates measured in 6 zones in 2012 (based on findings from the national prevalence survey analyzed using the recommended analytical approach of multiple imputation and inverse probability weighting). Of note is the significant uncertainty of TB prevalence estimates at the zonal level since the national TB prevalence survey was only designed to give a precise enough national prevalence estimate.

Keeping the imprecision of the zonal level TB prevalence estimates in mind, it 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.

Figure 4. Scatterplot of smear-positive case notification rates (≥15) against prevalence rates (≥15) by zone. *Data source: NTBLCP database and 1st National TB Prevalence Survey, Nigeria*



5.1.2.2 Time-tends, state-level

This section presents further disaggregated surveillance data at the state level.

The 2012 annual national case notification rate (CNR) was 57 per 100,000. In FCT, the CNR was 127 remaining stable over time with 126 in 2010 and 124 in 2010 and 2011. In the 37 states, the annual CNR in 2011 varied between a minimum of less than 25 and a maximum of 132 per 100,000 (median 56 per 100,000 and inter-quartile range 39 to 65 per 100,000). See Figure 5 for a map of case notification rates per 100,000 population by state in Nigeria for 2011.

Figure 5. Map of state level, all forms, annual TB case notification rates in Nigeria, 2011.
Data source: NTBLCP annual report 2011

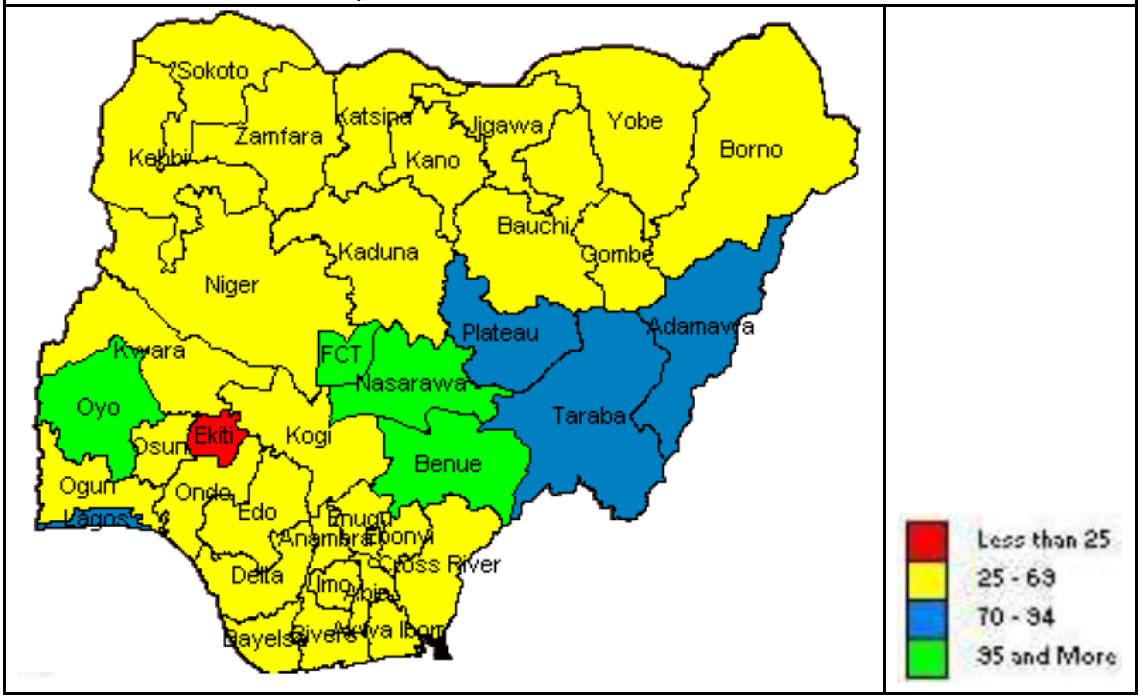
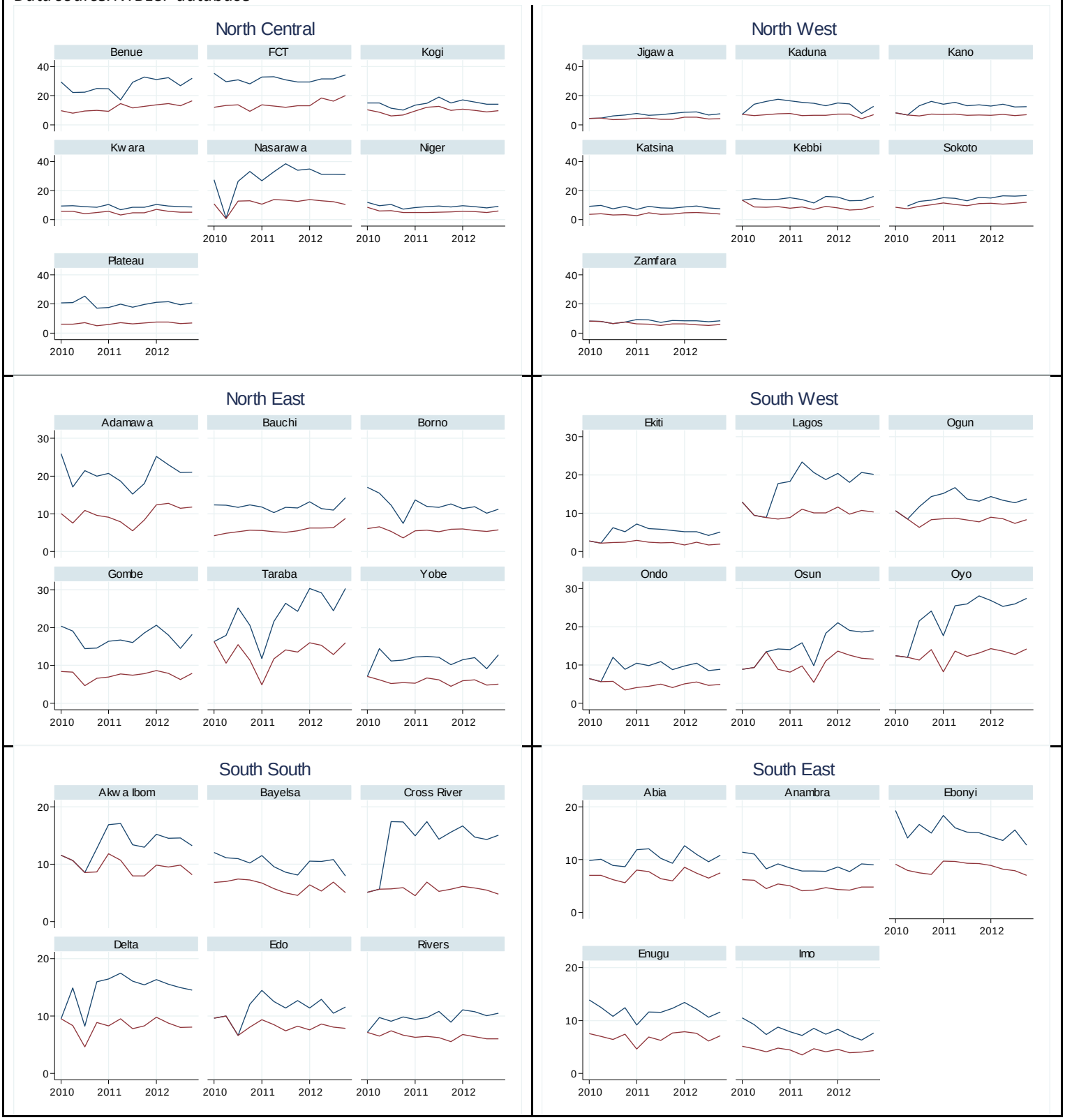


Figure 6 presents further disaggregated time trends in TB case notification rates (all forms, and smear-positive TB) by state and quarter. The figure shows series that are not very consistent (trends going in opposite directions between states or even within states at different time points).

Figure 6. Time series of case notification rates per 100,000 (blue: all forms, red: smear-positive), by state, per quarter for 2010-2012.
Data source: NTBLCP database



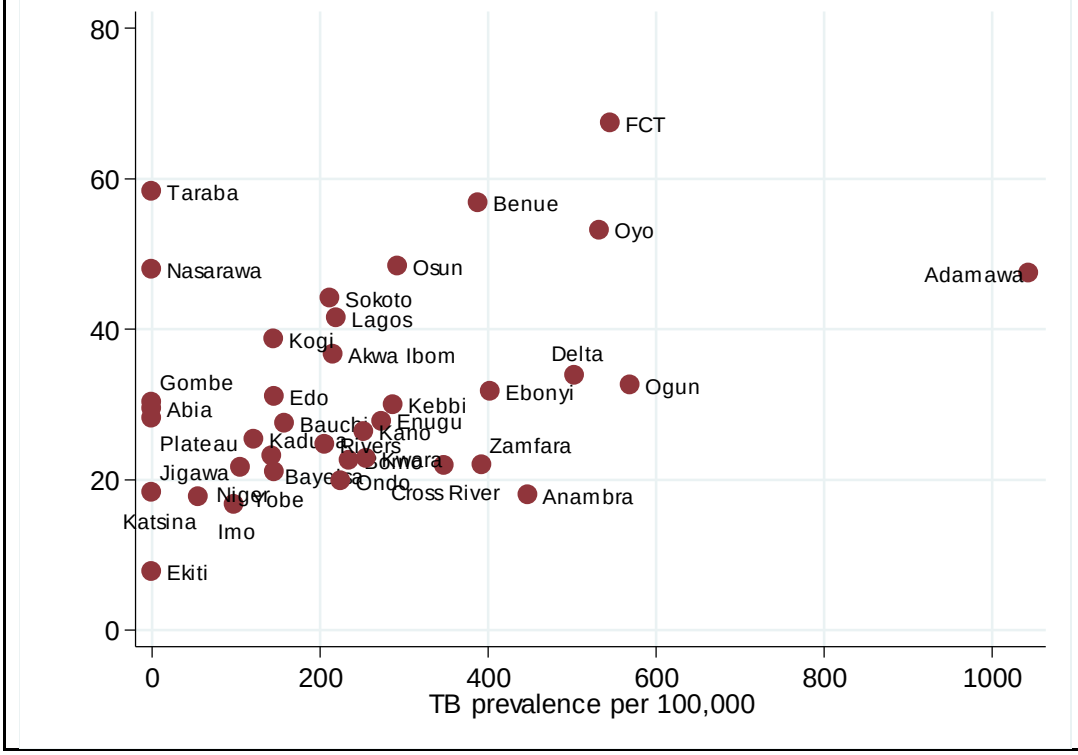
State level quarterly case rates per 100,000 of individuals with presumptive TB that have been investigated through smear microscope are shown in Figure 7.

Figure 7. Time series of presumptive TB rates per 100,000 by state, per quarter for 2010-2012. *Data source: NTBLCP database*

It remains to be investigated whether the important variability between CNRs at state level reflects differences in disease burden, differences in TB detection and reporting coverage, or both. Errors in reporting cannot be ruled out.

Finally, the distribution of the ratios of smear-positive TB prevalence rates measured in 2012 (based on findings from the national prevalence survey analyzed using the recommended analytical approach of multiple imputation and inverse probability weighting) to case notifications for 2012, by state, is shown in Figure 8 indicating wide variability.

Figure 8. Distribution of states by ratio of prevalence/notification rates.
Data source: NTBLCP database and 1st National TB Prevalence Survey, Nigeria



It should be noted that the prevalence survey was not powered to estimate state-level prevalence rates which are even more imprecise than the estimates presented in Figure 4, but still a useful exercise in hypothesis building and further investigations at state level.

5.1.3. Childhood TB

Despite the fact that children under the age of 15 make up 44% of the national population in Nigeria, the data available to properly estimate TB disease burden in this sub-group are extremely sparse, as is the case in most countries where TB is highly endemic. The only available data are those of TB case notifications, shown in Table 4, with the percentage of childhood TB over total notifications being within the expected range for a lower-middle income country (5-15% of the total number of TB cases are expected to be in children – see checklist in Appendix 3).

Table 4. Paediatric TB case notifications, by case type and overall, 2011-2012. *Data source: WHO TB database*

	Paediatric				Adult
Year	SP	SN	EP	All forms (%[1])	All forms
2011	1,107	4,084	645	5,836 (6.3%)	93,050
2012	1,187	3,935	739	5,861 (6.0%)	97,587

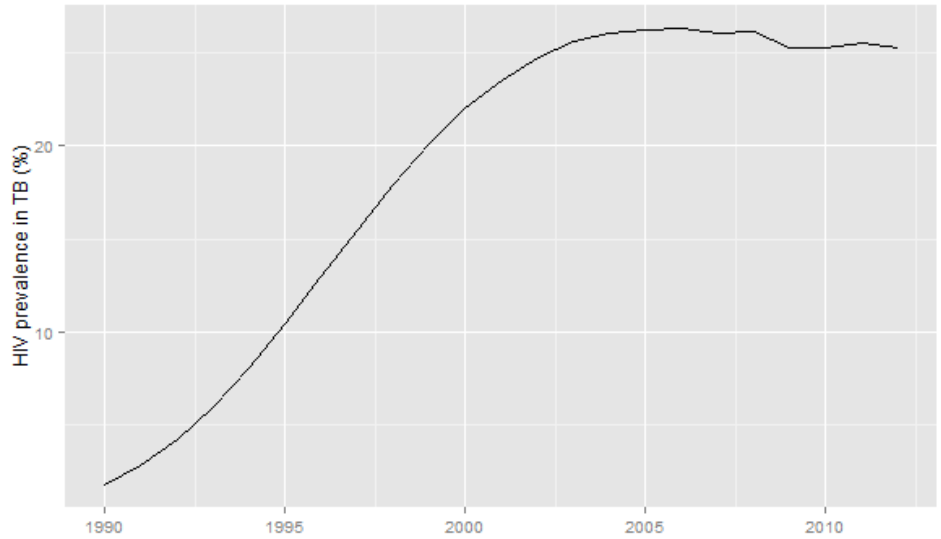
[1]Percentage over adult notifications all forms;
SP=Smear-positive; SN=Smear-negative; EP=Extra-pulmonary

More robust national level data are important to better understand and address childhood TB. It is hypothesized, based on experience from other countries with similar TB epidemiology and health system structure, that under-diagnosis (children sick with TB that never reach health services) and to a lesser extend under-reporting of diagnosed childhood TB cases are the main problems that need to be addressed through contact tracing activities and engagement of paediatricians as part of PPM activities.

5.1.4. HIV-associated TB

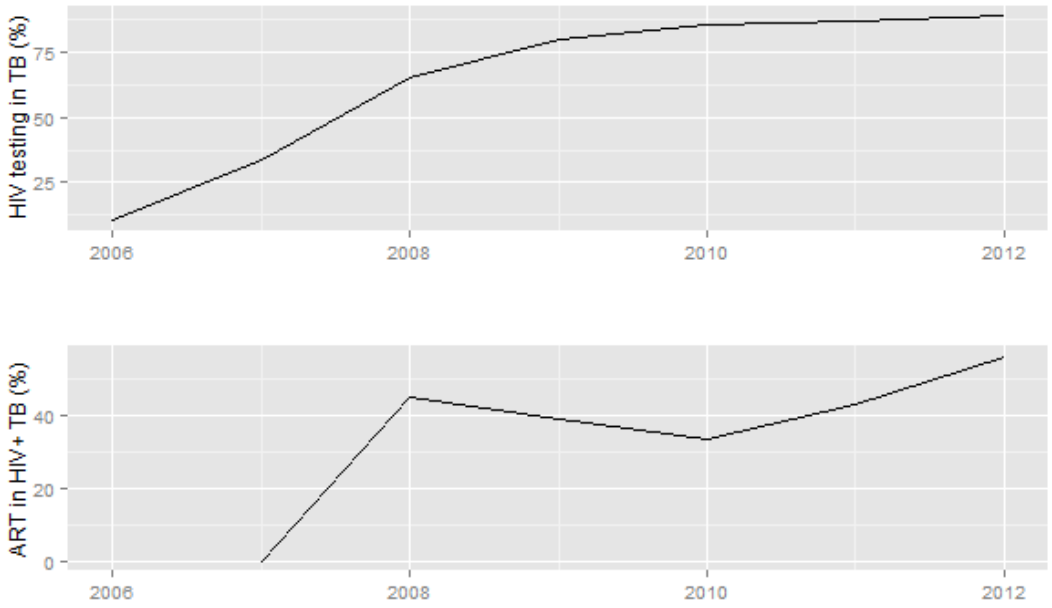
Figure 9 shows the prevalence of HIV infection among newly detected TB patients with a documented HIV test result, which currently stands at about 25%, from routine HIV-testing in TB patients. The peak in HIV in TB occurred around 2005, about 3 years later than the peak in HIV prevalence in adults. HIV prevalence in TB patients has remained approximately stable during the last 5-7 years.

Figure 9. Trends in HIV prevalence among TB cases. *Data source: WHO TB database*



Important complementary information is shown in Figure 10 with time trends in HIV testing coverage (top) and in ART coverage (bottom) among newly detected HIV-positive TB patients. This figure demonstrates clear progress in HIV testing with the proportion of TB patients with a documented test result higher than 75%, while ART coverage of HIV-positive TB cases is also improving but still at only about 45%.

Figure 10. Time series of HIV testing coverage in TB (top) and ART coverage in HIV-positive TB cases identified (bottom), over 2006-2012. *Data source: WHO TB database*



5.1.5. Anti-TB drug resistance

The prevalence of MDR-TB among notified TB cases estimated from the first national drug resistance survey conducted in 2012 is shown in Table 5:

Table 5. Prevalence (expressed as a proportion) of MDR-TB among previously untreated (new) and retreated cases in 2012, and estimated MDR-TB number among notified pulmonary TB, from nationwide drug resistance survey. *Data source: WHO TB database*

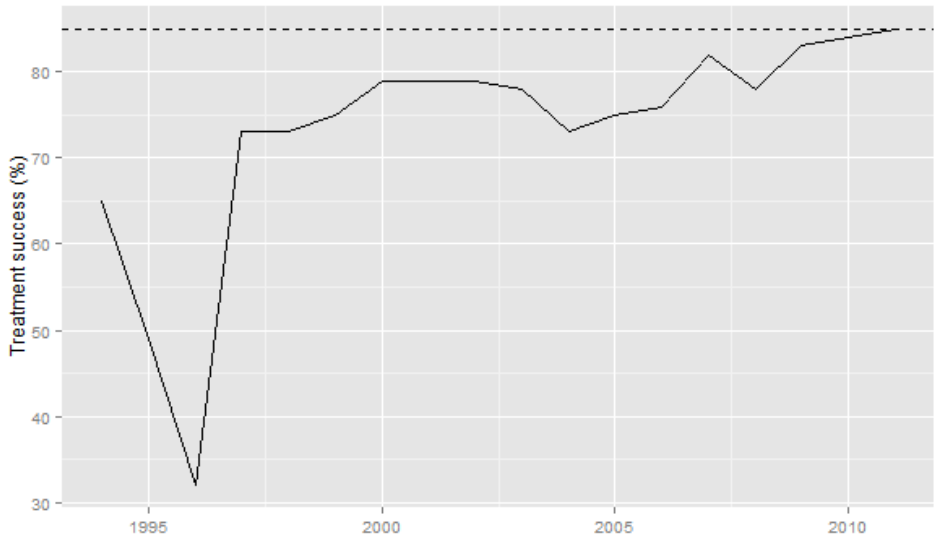
	New	Retreated
Prevalence	0.029 (0.021-0.04)	0.14 (0.1-0.19)
Number among notified PTB	2,500 (1,800-3,400)	1,100 (770-1,500)

MDR-TB=multi-drug resistant TB; PTB=pulmonary TB

5.1.6. Treatment outcomes

The overall treatment success percentage over time is shown in Figure 11. The dashed line represents the global 85% treatment success target, met for the first time in 2011.

Figure 11. Treatment success (either cure or treatment completion) percentage among the new smear-positive case notification cohorts, 1996-2011. *Data source: WHO TB database*

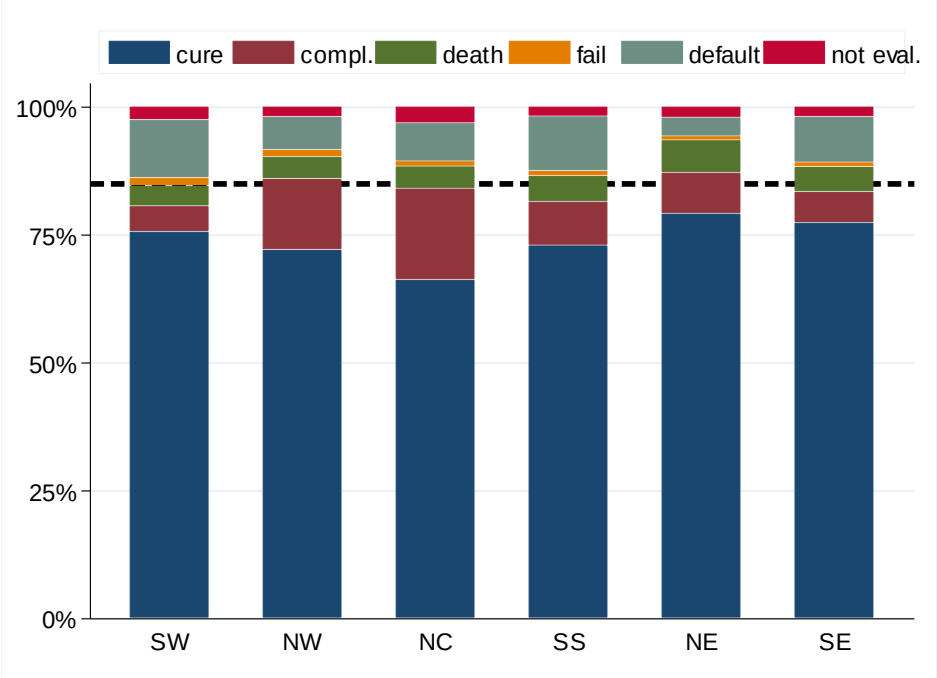


Breaking down the available 2010 data into the sub-national (zonal and state) levels we observe:

- Some variability in treatment cure and completion at the zonal level, for the new smear-positive TB patient cohort (Figure 12), with South-West recording the lowest percentage of successful outcome;
- Less variability in successful treatment outcome is observed among the new, all-forms TB patient cohort (Figure 12), although there are still potentially lessons to be learned for other categories of treatment outcome, such as from North East for recording the lowest default percentage.
- Similar findings can be seen when dissecting the data further at the state level (Figure 13), with opportunities for monitoring progress to take corrective action where required or learning lessons to implement across all states from goo performers.
- Percentages of successful treatment outcomes for HIV-positive TB patient cohorts are generally lower compared to the overall patient cohorts as seen at both zonal (Figure 14) and state (Figure 15) levels.

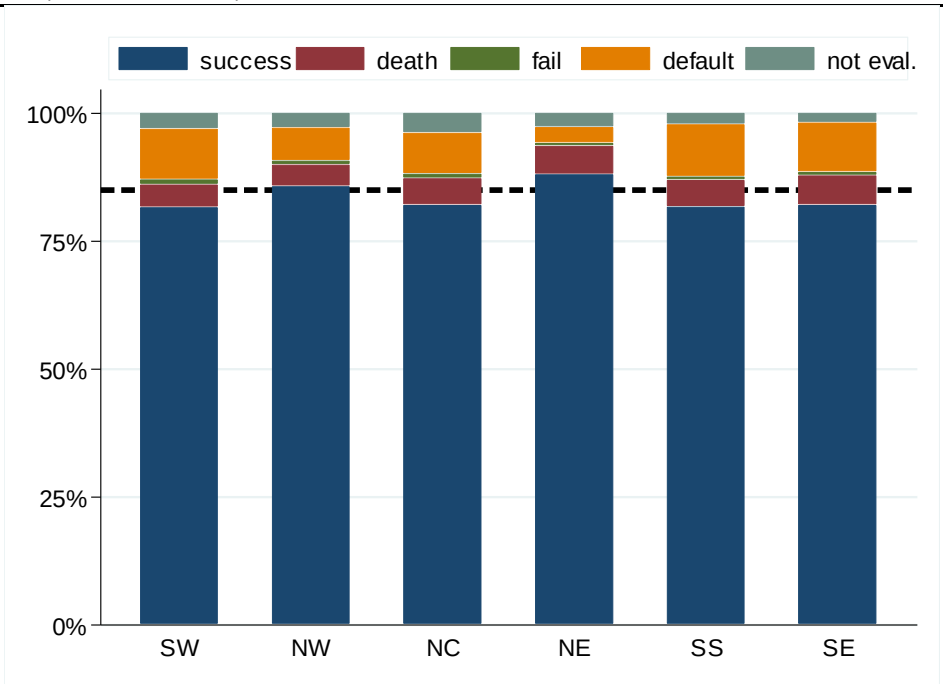
Figure 12. Zonal level treatment outcomes of the new: (i) smear-positive, and (ii) all-forms TB case notification cohorts for 2010. *Data source: NTLCP database*

New smear-positive TB (bars from left to right are presented in descending order of the cohort size, starting with the zone that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; compl.=treatment completed; not eval.=treatment not evaluated or transferred out

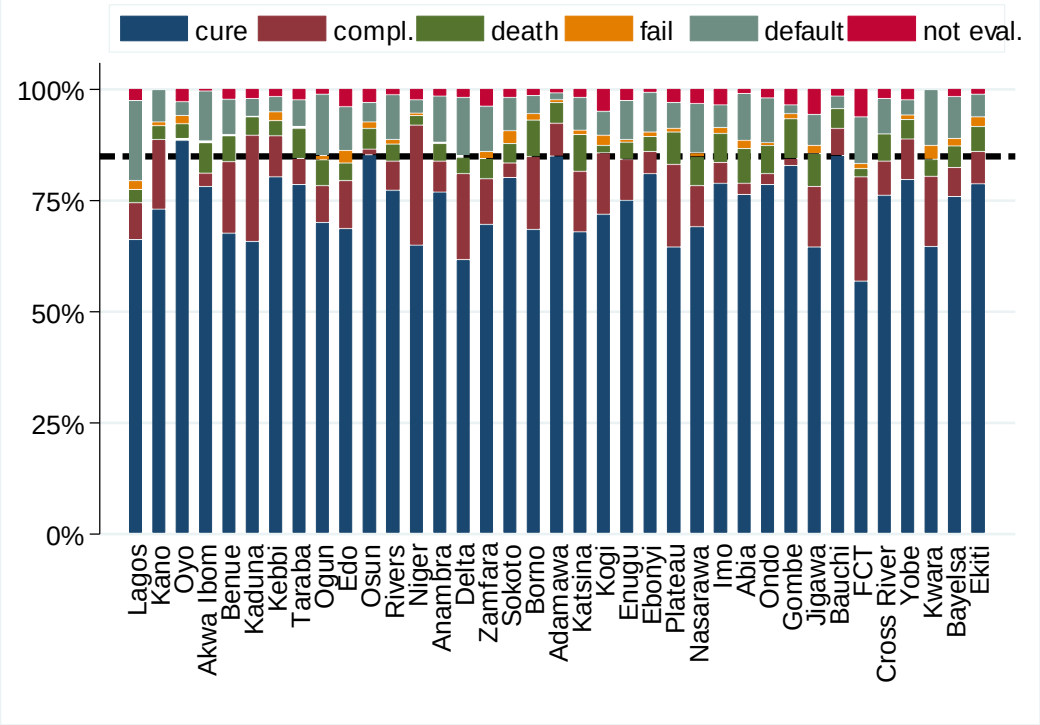
New all-forms TB (bars from left to right are presented in descending order of the cohort size, starting with the zone that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; not eval.=treatment not evaluated or transferred out

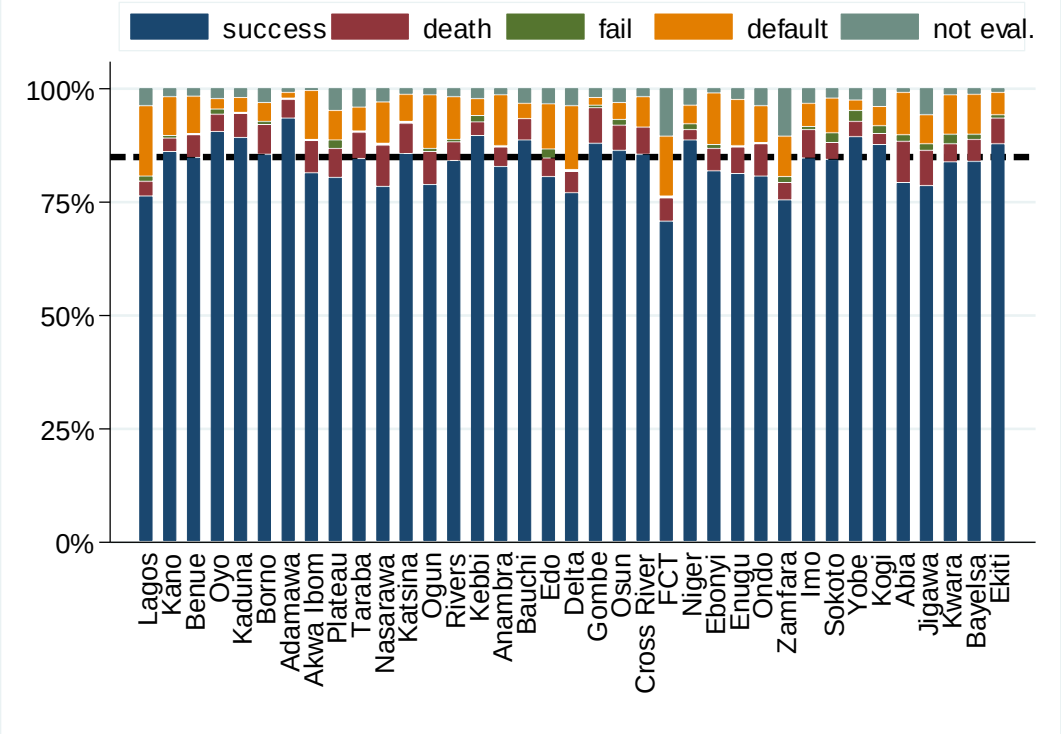
Figure 13. State level treatment outcomes of the new: (i) smear-positive, and (ii) all-forms, TB case notification cohorts for 2010. *Data source: NTLCP database*

New, smear-positive TB (bars from left to right are presented in descending order of the cohort size, starting with the state that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; compl.=treatment completed; not eval.=treatment not evaluated or transferred out

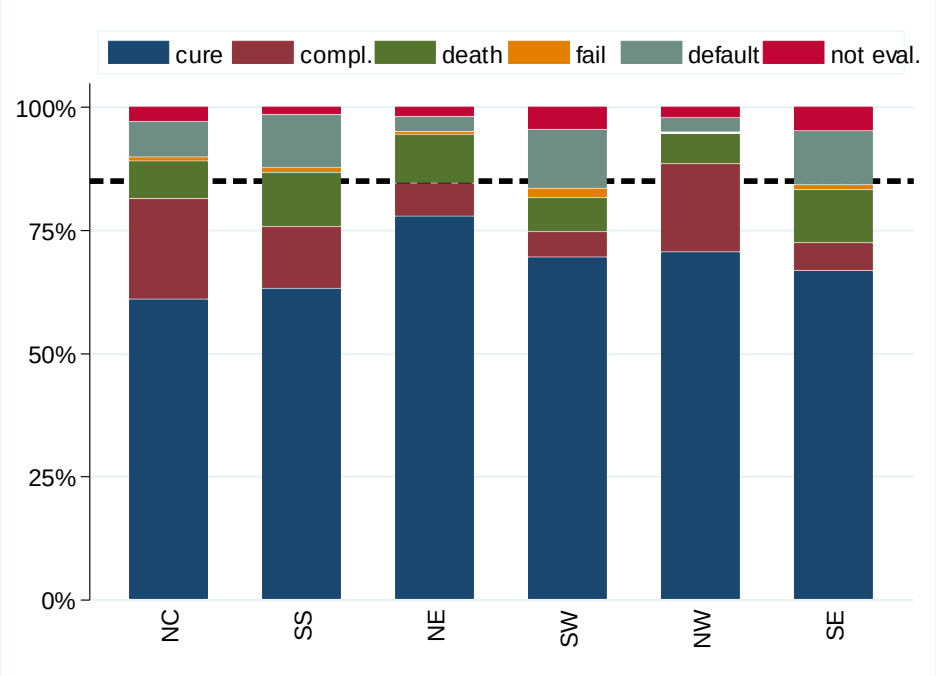
New, all-forms TB (bars from left to right are presented in descending order of the cohort size, starting with the state that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; not eval.=treatment not evaluated or transferred out

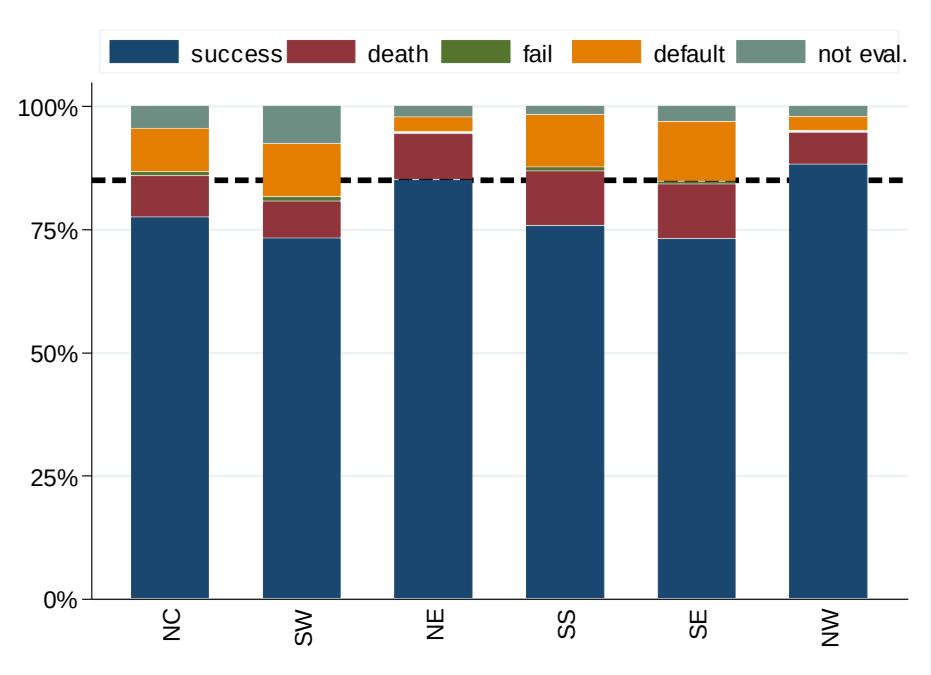
Figure 14. Zonal level treatment outcomes of the new, HIV-positive: (i) smear-positive, and (ii) all-forms TB case notification cohorts for 2010. *Data source: NTLCP database*

New, HIV-positive, smear-positive TB
(bars from left to right are presented in descending order of the cohort size, starting with the zone that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; compl.=treatment completed; not eval.=treatment not evaluated or transferred out

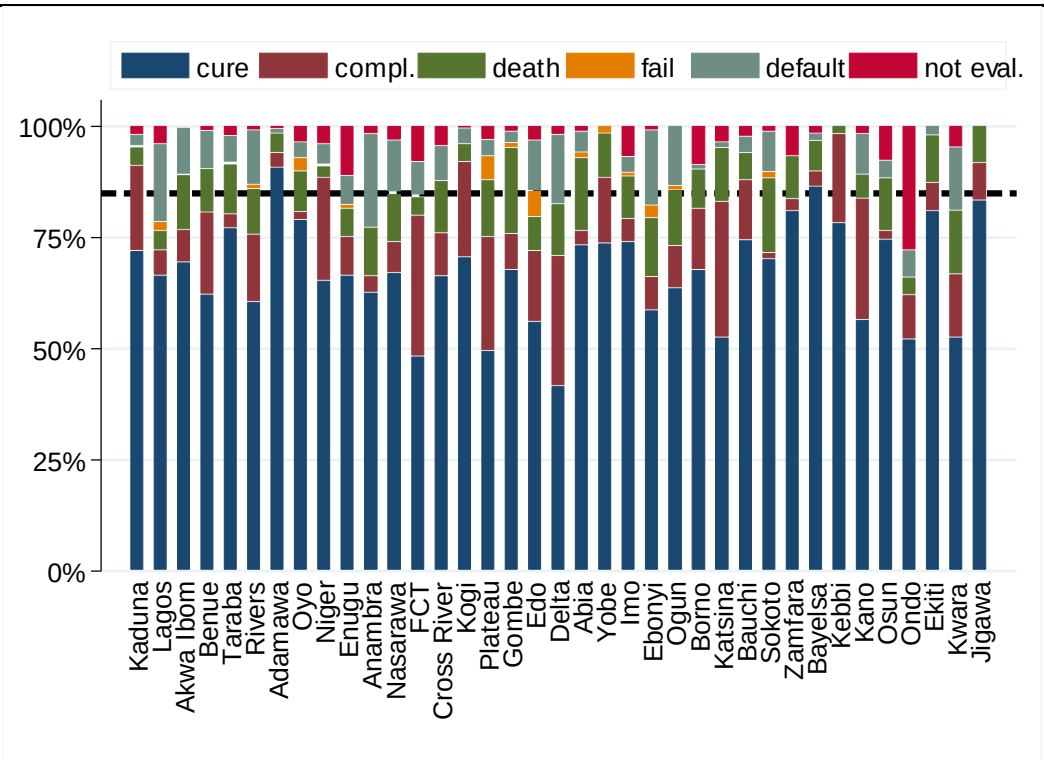
New, HIV-positive, all-forms TB
(bars from left to right are presented in descending order of the cohort size, starting with the zone that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; not eval.=treatment not evaluated or transferred out

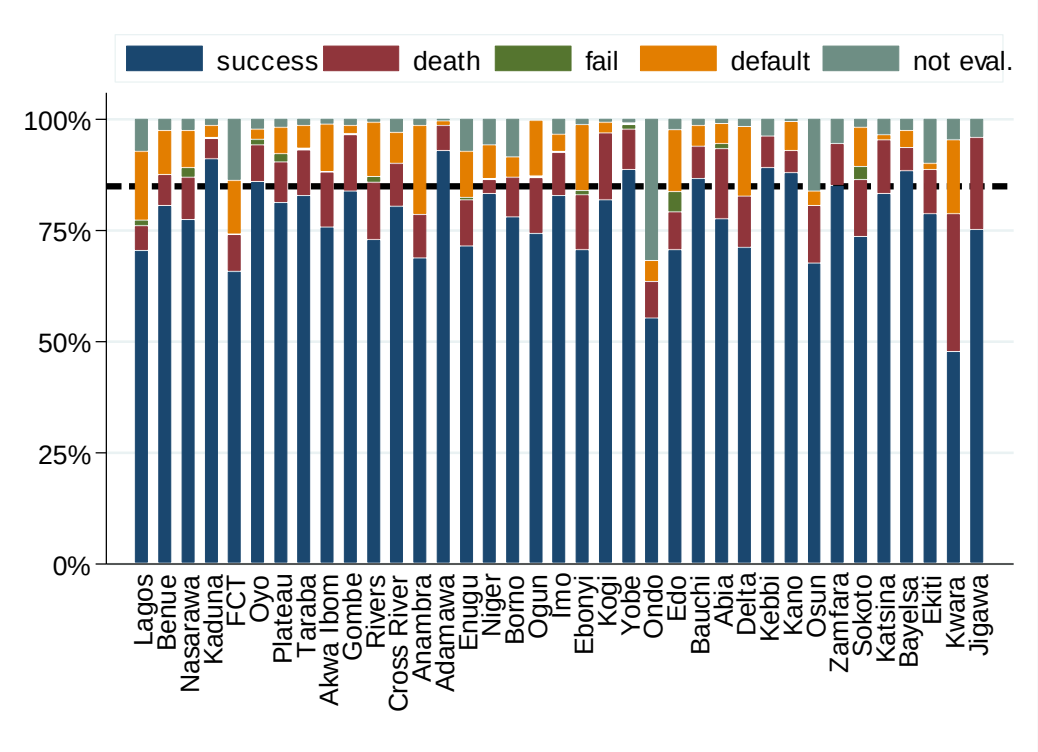
Figure 15. State level treatment outcomes of the new, HIV-positive: (i) smear-positive, and (ii) all-forms TB case notification cohorts for 2010. *Data source: NTLCP database*

New, HIV-positive, smear-positive TB (bars from left to right are presented in descending order of the cohort size, starting with the state that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; compl.=treatment completed; not eval.=treatment not evaluated or transferred out

New, HIV-positive, all-forms TB (bars from left to right are presented in descending order of the cohort size, starting with the state that had the largest cohort in 2010)



NC=North Central; NE=North East; NW=North West; SE=South East; SS=South South; SW=South West; not eval.=treatment not evaluated or transferred out

5.1.7. At risk populations

No studies conducted in Nigeria have been identified looking specifically at TB disease burden in the traditional higher at risk populations (excluding HIV-associated TB that has already been addressed in section 5.1.4), such as for example prisoners, health workers, etc. Data gaps are evident with a clear need for more work on the quantification of burden, but also understanding better the TB epidemic in Nigeria. An opportunity to do this is through the results from the national TB prevalence survey (also see section 5.2), by studying characteristics of prevalent cases in the country overall, but also specifically target those that had gone undiagnosed and untreated by the NTBLCP and assess barriers to health care for TB high risk groups.

5.2. TB prevalence

Key results from the first national TB prevalence survey in Nigeria are presented in this section. A complete set of results in a comprehensive report will be disseminated sometime during the first quarter of 2014 and will be the basis for updating all estimates of TB disease prevalence.

Overall TB prevalence (Table 6) is much higher than previously thought when indirect estimation, as opposed to direct measurement, was used.

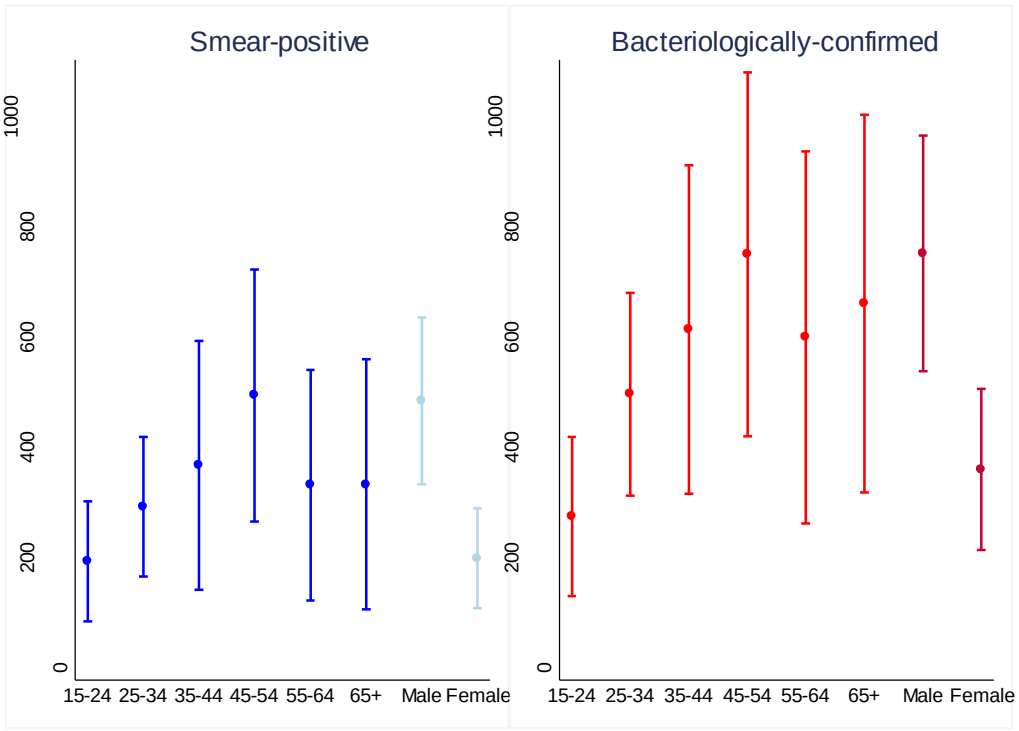
Table 6. Estimated adult TB prevalence rates per 100,000 based on findings from the national prevalence survey analyzed using the recommended analytical approach of multiple imputation and inverse probability weighting. *Data source: 1st National TB Prevalence Survey, Nigeria*

	Best estimate	95% confidence interval
Smear-positive TB	318	(225-412)
Bacteriologically-confirmed TB	524	(378-670)

When disaggregating the TB prevalence rates by age and sex (Figure 16) it becomes clear that both age and sex differentials exist in TB disease burden among adults in the country. There are more prevalent TB cases among males and adults of productive age between 35-54. This younger age pattern (compared to the typically older age-pattern found in Asian countries) is similar to the one found in the first national Ethiopian TB prevalence survey[10] and is consistent with ongoing TB transmission in the community.

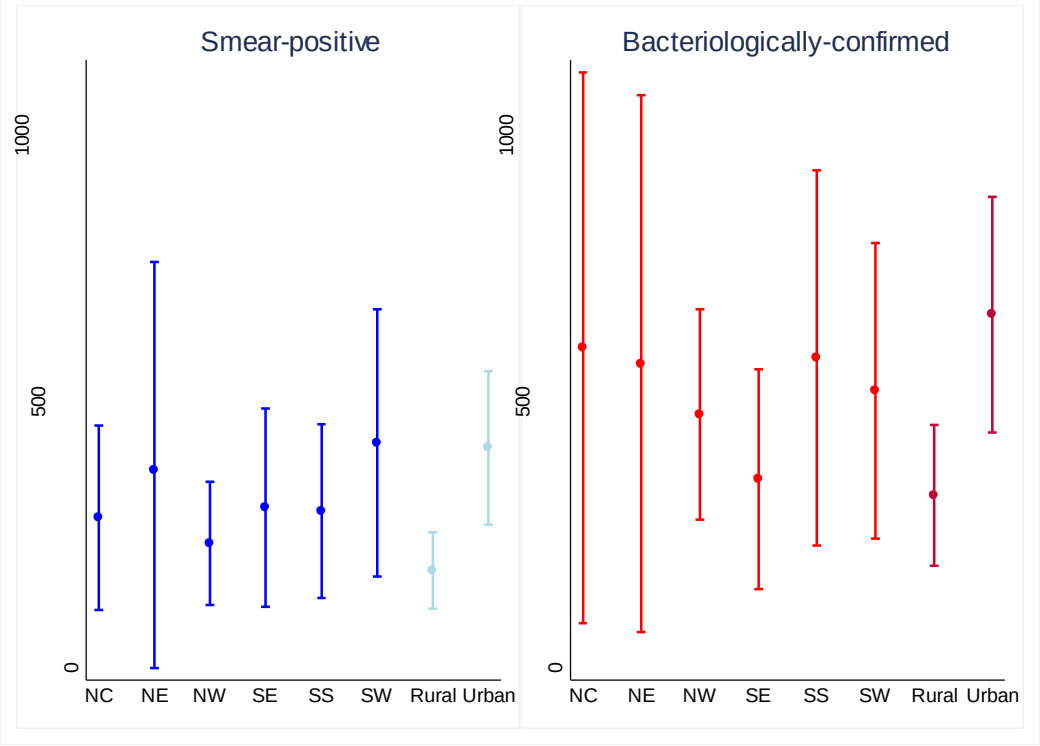
[10] The first population-based national tuberculosis prevalence survey in Ethiopia (2010/2011). Habtemichael, A et al. IJTLD (*in press*)

Figure 16. 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 (Figure 17) of disease burden presents an obviously higher level of disease in urban compared to rural settings, making urban slum areas an obvious target population for NTBLCP case finding activities. Zonal differences also seem to exist, although it is important to keep in mind the large imprecision of these estimates.

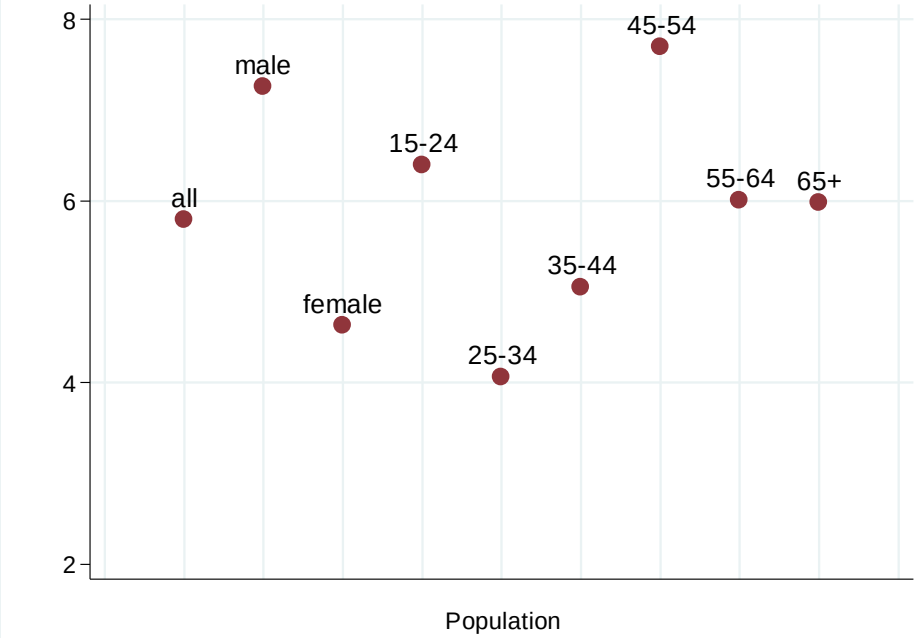
Figure 17. Zonal and urban/rural-specific TB prevalence rates (smear-positive and bacteriologically-confirmed) per 100,000. *Data source: 1st National TB Prevalence Survey, Nigeria*



NC=North Central; NE=North East; NW=North West; South East; South-South; 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 (Figure 18). This can be used to identify and target for action groups of TB patients where disease burden in relation to case finding is the highest. Males and those between the ages of 45 to 54 are the ones with the highest ratios in Nigeria.

Figure 18. Smear-positive TB prevalence rate per 100,000 to annual (2012) smear-positive TB case notification rate per 100,000 ratios; overall and broken down by age and sex. *Data source: 1st National TB Prevalence Survey, Nigeria*



5.3. TB mortality

There is no well-functioning vital registration systems of deaths with standard COD in Nigeria. This means direct measurement of TB mortality among those HIV-negative is not currently possible. Therefore, an indirect estimation of the levels of and trends in TB mortality needs to be employed.

Figure 19. Trends in TB mortality, excluding HIV (blue line). The blue ribbon denotes the uncertainty around TB mortality estimates. *Data source: WHO TB database*
(To be updated with analyses for Global TB Report 2014)

5.4. TB incidence

The following figure shows the time trend of the estimated incidence rate in Nigeria.

Figure 20. Trends in estimated TB incidence (blue). The blue ribbon shows the uncertainty range. The black line shows case notification rates (all forms).
Data source: WHO TB database
(To be updated with analyses for Global TB Report 2014)

5.5. Determinants of TB

Key determinants of TB examined in this section include time changes in the size of the economy (GDP per capita) as well as wealth distribution (GINI index), in the performance of health systems (under-5 mortality rate)

in relation to the economy and to health system reforms, HIV burden (HIV prevalence in the adult population) and plausible impact of TB control (treatment outcomes, drug resistance, TB-associated AIDS deaths over time in relation to ART coverage).

A recent study of the population attributable fraction (PAF) of different risk factors for TB has quantified the relative contributions of well-known determinants of TB on its disease burden in Nigeria (Table 7). This could provide a more rational approach at prioritizing public health action to mitigate the effects of these determinants on TB burden. In the case of Nigeria, the top four PAFs of TB determinants were HIV, alcohol abuse, indoor air pollution and under-nutrition.

TABLE 7. Prevalence & population attributable fractions (PAF) of selected TB risk factors, Nigeria[11]

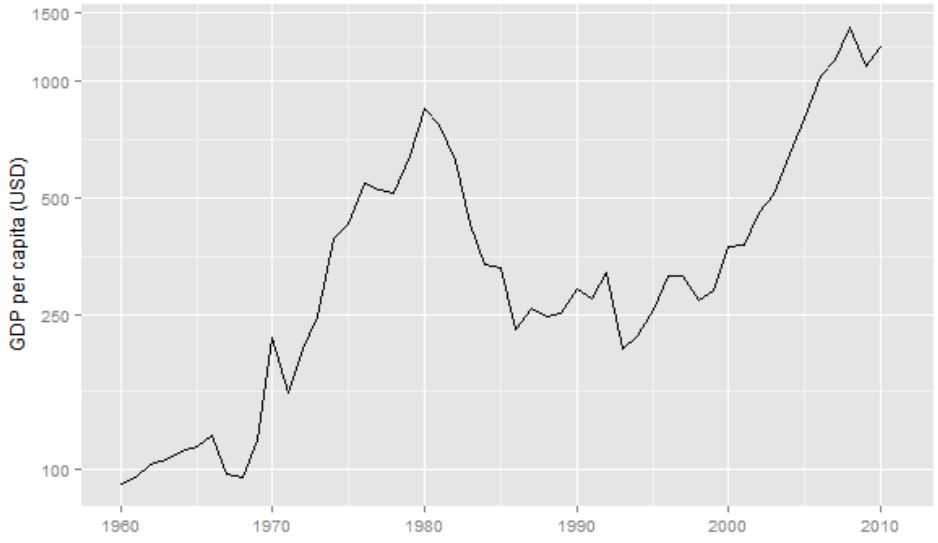
Risk factor	Prevalence in total population	PAF total population
HIV	3.9%[1]	25.6%
Under-nutrition	9.0%	16.5%
Diabetes	3.5%[1]	4.0%
Alcohol misuse	26.1%[1]	21.7%
Smoking	7.0%	3.8%
Indoor Air Pollution	67.0%	21.1%

[1] Among those aged 15 years or above

5.5.1. *Size of the economy and distribution of wealth*

The following figure (Figure 21) shows time changes in national GDP per capita in Nigeria, 1960-2010.

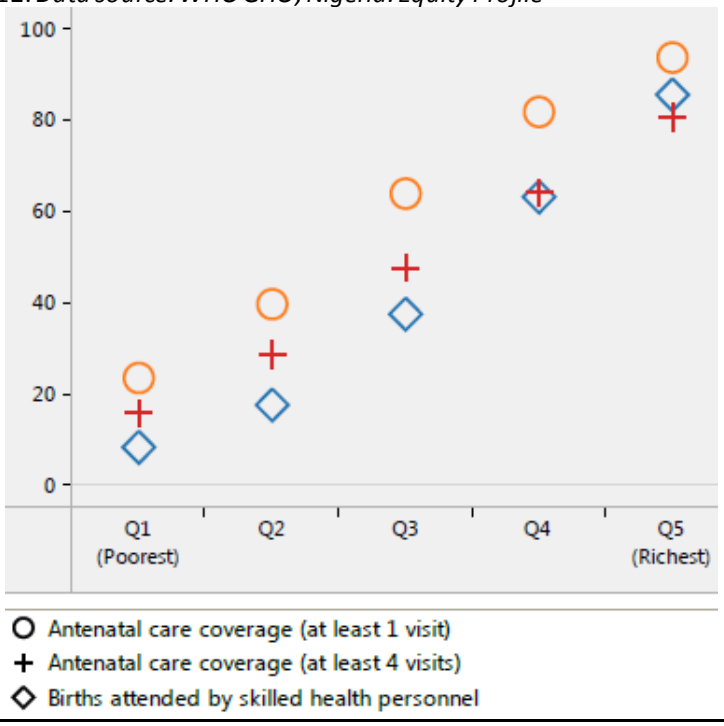
Figure 21. Trends in GDP per capita in Nigeria, 1960-2010. *Data source: World Bank*



[11] Lönnroth K, Castro KG, Chakaya JM, Chauhan LS, Floyd K, Glaziou P, et al. Tuberculosis control and elimination 2010-50: cure, care, and social development. Lancet. 2010;375(9728):1814–29

After an exponential decrease from the beginning to the mid-1980's, and a stable state throughout the 1990's, the economy has been growing exponentially since the start of 2000's until today. The impact of this economic growth on health could be beneficial although it most probably does not reach its full potential due to wealth distribution inequalities – as evidenced by the GINI index at 48% in 2010 – and little investments in health insurance for the general population, and especially those in the lower wealth quintiles (Figure 22).

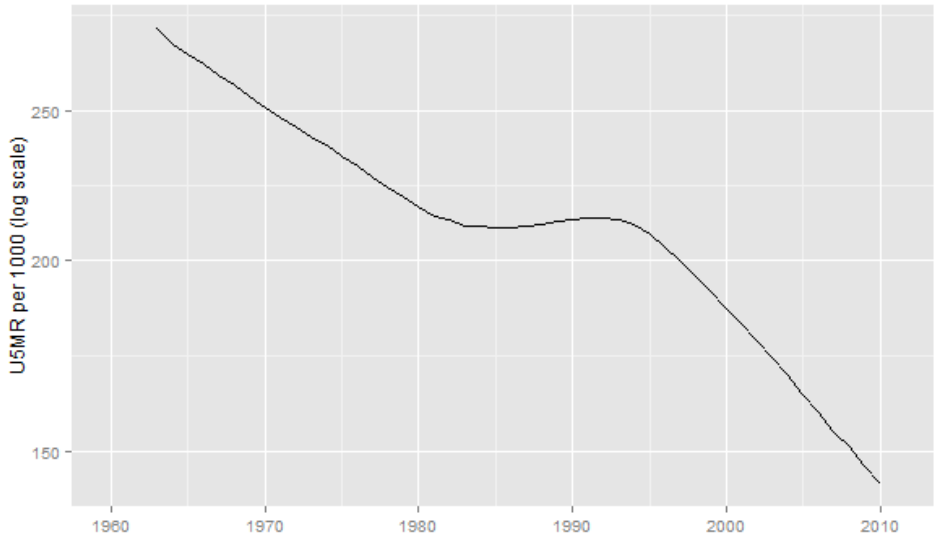
Figure 22. Maternal health service coverage by wealth quintile in Nigeria, 2012. *Data source: WHO GHO, Nigeria: Equity Profile*



5.5.2. Under-5 mortality

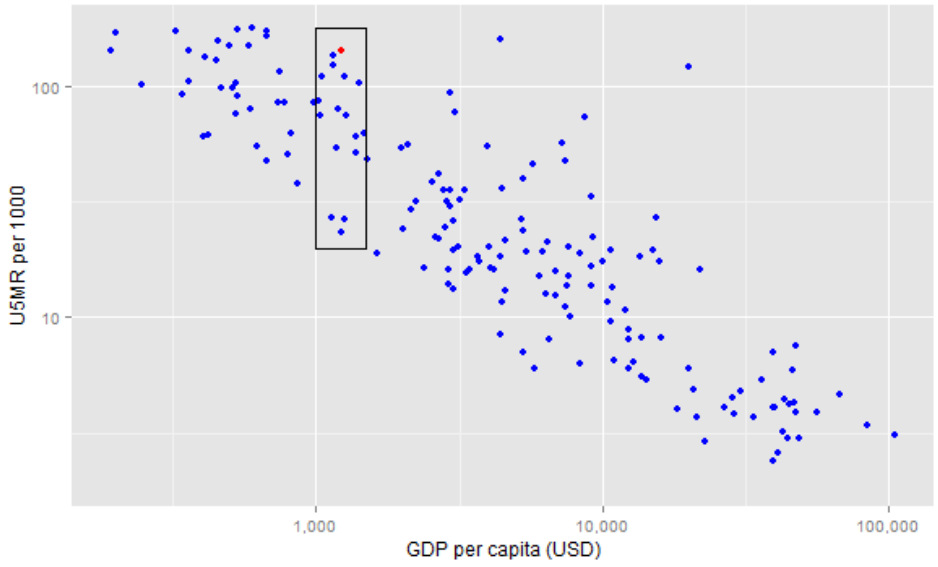
We use the under-5 mortality rate per 1,000 live births as an indicator of overall performance of health systems. Figure 23 shows time series of this indicator since 1960. The decline in U5MR is nearly linear (on a log scale), with stagnating levels only between 1985-1993 coinciding with a stagnating size of the economy. Last available levels (2010) are still very high at about 143 per 1,000 live births.

Figure 23. Trends in under-5 mortality Nigeria, 1960-2010. *Data source: World Bank*



Of note, the U5MR in Nigeria was the highest in 2010 among other countries with similar size of the economy expressed as GDP per capita as can be seen in Figure 24. Each blue dot represents a pair of country data points, Nigeria is shown in red. This suggests a lower level of performance of the health system (as measured through the U5MR indicator) in Nigeria than could be expected relative to the size of the economy. The black rectangle includes countries with a GDP per capita between 1,000 and 1,500 USD per capita. In this group of lower-middle-income countries, U5MR in 2010 the best-performer was Viet Nam with 23.3 per 1,000. Other examples from the same group of countries include India with 62.7, Ghana with 74.4, and Pakistan with 86.5 per 1,000 live births.

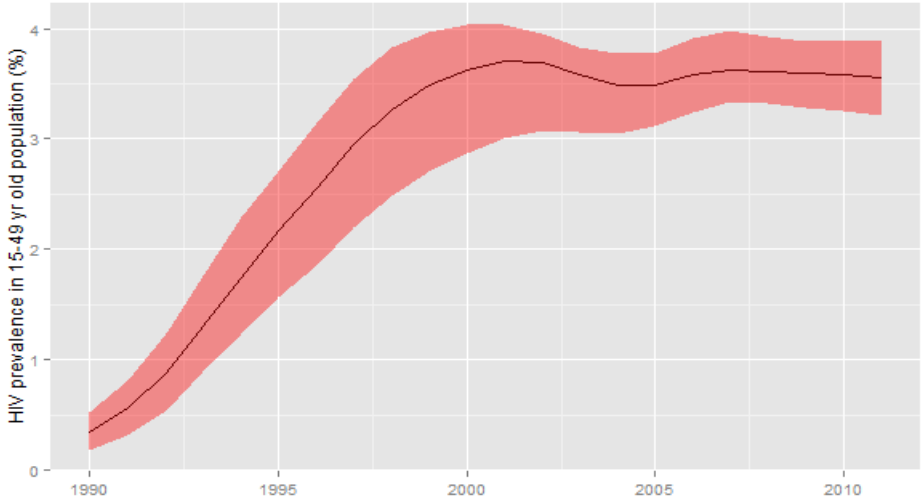
Figure 24. Scatterplot of under-5 mortality rate per 1,000 live births against GDP per capita (2010). Each blue dot represents a country pair of data points. Nigeria is shown in red. The rectangle encloses countries with GDP between 1,000 and 1,500 USD per capita. *Data source: World Bank*



5.5.3. HIV burden

In Figure 25 we present time changes of the estimated HIV prevalence in adults (15-49 years). HIV prevalence peaked around 2003 and has remained stable thereafter at a level in excess of 3.5% among the 15-49 year old population.

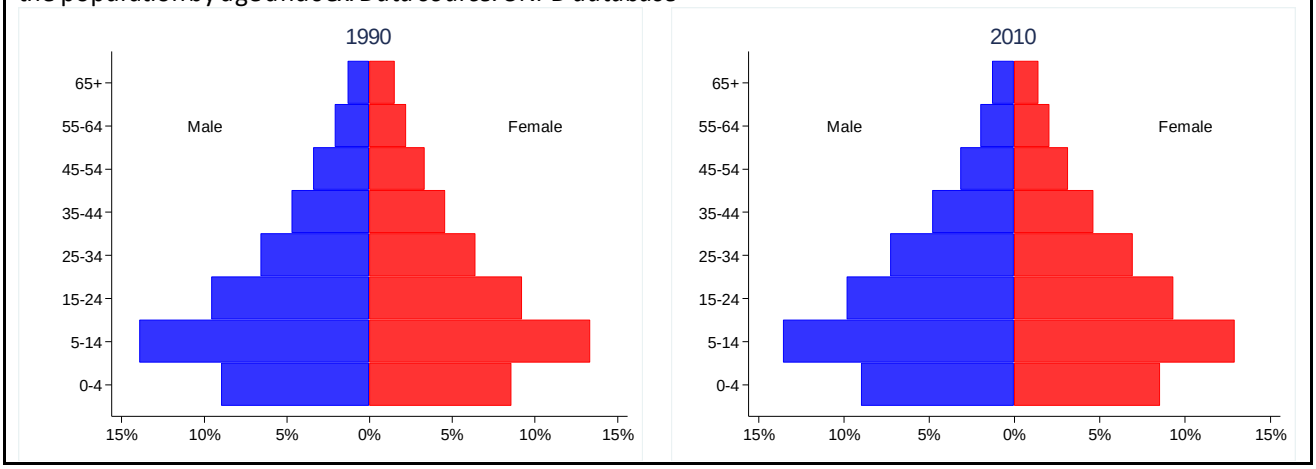
Figure 25. Trends in HIV prevalence in 15-49 year old population. *Data source: AIDSinfo database*



5.5.4. Demographic characteristics of general population

The following figure (Figure 26) shows age and sex population pyramids for Nigeria in 1990, and 2010. These indicate a stable state of demographic characteristics of the general population, with about 44% of the population being less than 15, and only about 3% being more than 65 years in 2010.

Figure 26. 1990 and 2010 population pyramids of the general population in Nigeria representing the distribution of the population by age and sex. *Data source: UNPD database*



We are complementing this information with time series of age-specific TB rates of TB patient cohorts notified to the NTBLCP (Figure 27 and Figure 28). Rates among younger adults aged between 25-54 are consistently higher than those older than 55 years. This age pattern is consistent with findings from the TB prevalence survey that showed higher disease burden in younger adults, strengthening further the hypothesis that there is ongoing transmission of tuberculous infection in the community. Therefore, the young population structure in Nigeria does not contribute to the decline in TB burden.

Figure 27. Time trends in age-specific new, all case type notification rate per 100,000 in Nigeria.
Data source: WHO TB database

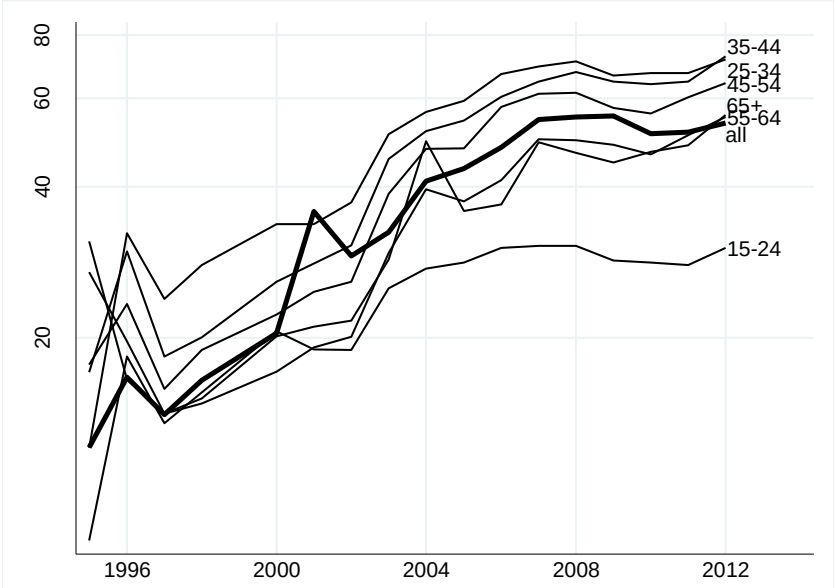
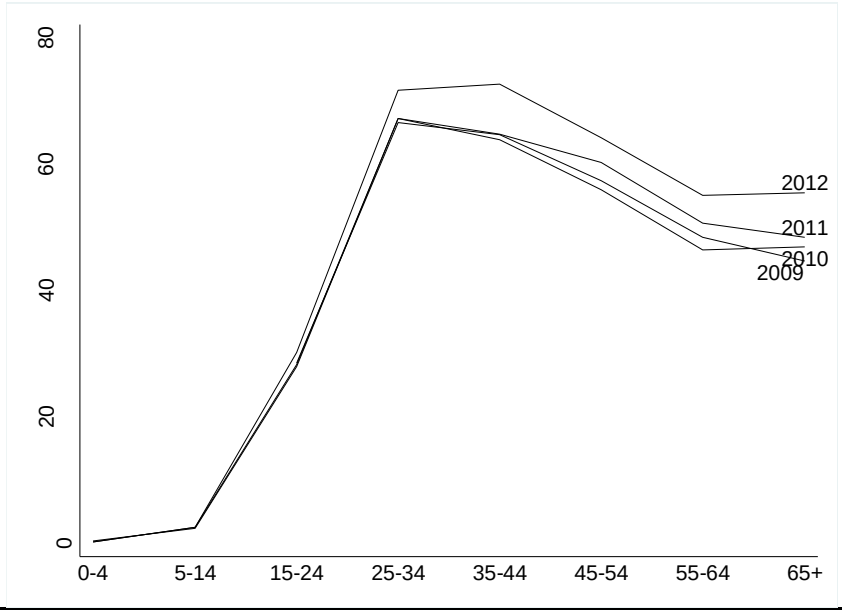


Figure 28. Age-specific, new, smear positive case notification rate per 100,000 in Nigeria for each of the 2009-2012 cohorts of TB patients.
Data source: WHO TB database



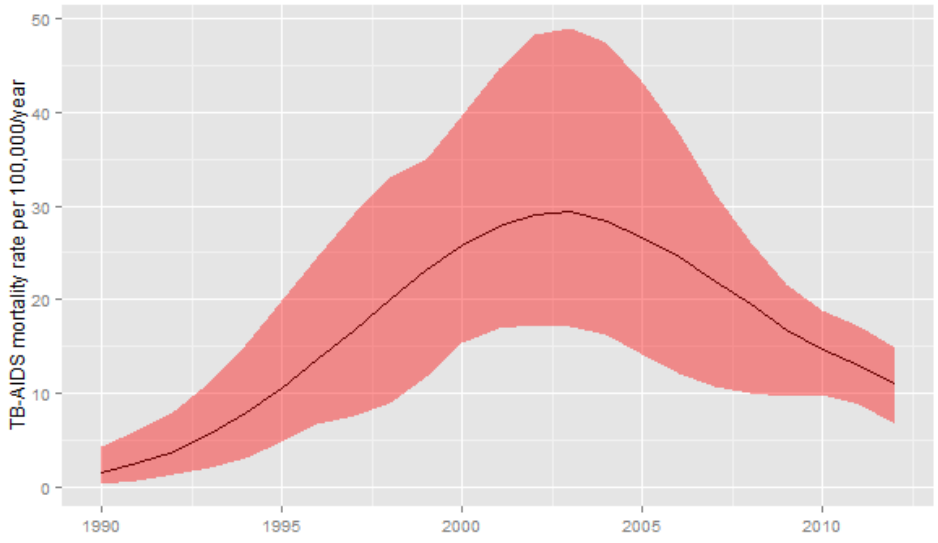
5.5.5. Impact of TB control on disease burden

It is very difficult, based on routine surveillance data and observational studies and in the absence of controlled community trial results, to estimate the impact of TB control interventions on time trends in estimated TB incidence or mortality, due to the multifactorial nature of drivers of TB incidence. For instance, TB incidence and mortality sharply fell in Western Europe during the first half of the 20th century, well before effective chemotherapy became available, in great part due to improvements in living conditions, nutrition and hygiene. Therefore, we focus this section on the measurable impact of TB control.

Prevalence of MDR-TB in 2012 was measured at 2.9% (section 5.1.5) among newly detected TB patients with no history of prior TB treatment (or a history of treatment of less than one month), and 14% among retreated from a national drug resistance survey. Therefore, drug resistance transmission is ongoing. This finding is consistent with the relatively slow reach of the target on treatment success in 2011 as shown in section 5.1.6. This means a significant proportion of newly detected TB patients could acquire MDR-TB as a result of an unsuccessful treatment outcome, also contributing in turn MDR-TB transmission and primary MDR-TB incidence.

Early initiation of ART among new, HIV-infected TB patients is the single most important predictor of survival. The following figure (Figure 29) shows time trends in TB-associated AIDS mortality rates. Improvements in ART coverage contributed to the decline of TB-AIDS mortality, which dropped from 29.4 per 100,000 in 2003 to 11 per 100,000 in 2012, an 63% decline in TB-AIDS mortality over a period of 10 years. The UNAIDS target of halving TB/HIV mortality since 2004 was reached in 2011, well in advance of the target year 2015.

Figure 29. Trends in HIV-associated TB mortality rate per 100,000.
Data source: AIDSinfo and WHO TB databases



6. Summary of findings and recommendations to strengthen TB surveillance and improve direct measurement of TB disease burden

The three tier system (federal, state, LGA) of administration in Nigeria is also observed in the administration of all health programmes, including that of TB control. This makes for a complicated system to oversee, implement change, but also mobilise and allocate resources. The national TB surveillance system, the responsibility of Nigeria's federal government, is a traditional aggregated paper-based system although an important initiative is currently underway to transition to a case-based electronic solution. Case notification of TB has improved over time through higher coverage of the surveillance system – mostly through PPM activities, whose potential in case finding is still not fully realised. In recent years, numbers appear to have stagnated, and remain at low levels when compared against prevalence survey results, mainly due to barriers to accessing health care (under-diagnosis of TB cases) and a limited network of TB diagnostic services (under-reporting of TB cases). The first national survey of TB prevalence has just been completed, and is the first of its kind that allows direct measurement of TB disease burden in Nigeria. This makes the estimation of the level of TB prevalence possible, but still leaves much to be desired for a meaningful assessment of time trends. A repeat TB prevalence survey in 7-10 years' time (depending on the rate of decrease of TB burden) to provide a robust assessment of trend should remain a priority for the country, but in the meantime indirect estimation is the only other alternative, especially since the current vital registration system is of poor quality, coverage and does not capture information on standard coding of COD.

Table 7 provides an overview of all determinants of TB disease that have been investigated based on available data, and how these might be influencing TB disease burden in order to better understand their dynamics and interactions, and inform subsequent assumptions about time trends.

Table 7. Summary table of determinants of TB disease and how they might be influencing its burden

Driving burden downwards	Driving burden upwards
The scale-up of DOTS with increased coverage of TB reporting. Since the late 2000s, PPM approaches have been progressively implemented: general hospitals, private clinics, detention centres, etc. have been linked with the NTP, helping to improve standards of care. In 2012, PPM contributed 24% of TB notifications (all forms of TB).	Demographic population structure. Despite the fact that the population in Nigeria remains young, the percentage of the population accounted for by children remained stable over the last 20 years at 44%, high transmission of tuberculous infection in the community is ongoing as evidenced from higher burden of TB disease among young adults.
Somewhat improved health system performance, evidenced from the decrease in U5MR which still remains at very high levels, 142 per 1,000 live births.	Very little health insurance coverage, unequally distributed among wealth quintiles.
Sustained economic growth as evidenced by the growth in GDP per capita since the mid-1990's.	Economic inequalities evidenced through the GINI index, 48% in 2010.
	HIV stable among the general population but still at a high level of about 4% that is expected to heavily impact the TB epidemic.
	Limited access in primary health care of TB diagnostic and treatment services.

While efforts have been made in recent years to strengthen TB surveillance and improve measurement of disease burden, these need to be intensified if the country is going to address the serious existing data gaps and shortcomings of the surveillance system. Three priority areas have been identified:

1. **Enhancing capacity on good data management and analytical practices** of the M&E teams primarily at national, but also state and LGA levels. This will allow the utilisation of all historical national and sub-national TB surveillance data, and promote their use to guide policies, but also improve data quality.
2. **Improving case finding**. A number of policies and practices stand in the way of a notification system that captures more comprehensively incident TB, which need to be addressed. These include the limited TB diagnostic and treatment services often only available in secondary and tertiary healthcare levels, absence of mandatory notification of TB, limited active case finding activities, PPM activities that do not yet cover all of the private and public non-NTP sectors, M&E still reliant on paper-based systems.
3. **Supporting the development of a high-quality national vital registration system with standard coding of COD**. The country has no functional vital registration system in place to allow the study of mortality statistics by cause of death, nor conducted any verbal autopsy studies. The momentum created by the CoIA initiative needs to be actively supported by the NTBCLP.

To address these challenges, the following key recommendations are made to the NTBLCP:

Short-term, high impact

- **Strengthen M&E capacity:** Sustain the existing M&E team at national level, and increase their capacity for good data management and analysis practices through for e.g. courses, or on-the-job training.
- **Capture all historical sub-national level data in a single aggregated database.** Transfer all available retrospective surveillance data (LGA and state level) into an appropriate database to facilitate detailed analysis.
- **Promote the analysis and critical review of surveillance data** and improve dissemination of results at all levels (federal, state, LGA).
- **Support the ongoing transition from a paper to an electronic case-based recording and reporting system.**
- **Identify Specific Challenges to TB recording and reporting.**
    - Link up with WHO/GF to conduct the Service Availability and Readiness Assessment (SARA) of the health information system (including the TB data quality assessment component).
    - Draw on results from the prevalence survey to understand characteristics of cases that had gone undiagnosed and untreated by the NTBLCP and assess barriers to health care for TB high risk groups including key affected population. This will form the foundation to address issues related to low case detection and case reporting.

Longer-term, high impact

- **Improve case finding.**
    - **Promote the decentralisation of TB services:** Proactively engage with local governments for the decentralisation of TB diagnostic and treatment services as close as possible to the primary health care level.

  - **Make reporting of TB mandatory:** Develop a policy document for making TB notification mandatory (legal requirements) and include recommendations for its successful implementation at all levels (national, state, LGA).
- **Support development of vital registration system:** NTBLCP should proactively engage with the National Population Commission to increase demand and ultimately strengthen the quality and coverage of reporting of causes of death through the national vital registration system, ensuring inclusion of accurate cause of death coding for TB.
- **Conduct studies to improve direct measurement of TB disease:** Conduct a sub-national inventory study in FCT state to monitor levels of under-reporting.

Table 8 provides an overview of programmatic implications based on key findings from this epidemiological review.

Table 8. What do findings from this epidemiological review mean in terms of activities the NTLCP will need to be looking into implementing in the new National Strategic Plan?

Key finding	Programmatic implication
• High prevalence to notification rate ratios • TB diagnostic and treatment services not available in many primary health care settings • PPM activities not yet reaching their full potential	Improve case finding overall through: • decentralisation of TB services; • continued expansion of PPM and making reporting of TB mandatory.
Zonal and state level variability in: • case notification rates • treatment outcomes	Identify zones and states in order to: • take corrective action where required; • learn lessons from good performers and implement on the rest.
Higher disease burden in certain subgroups: • Men (prevalence survey) • Younger age groups (prevalence survey) • Low case notification rates are observed in children considering the high disease burden of their parents (the young to middle age groups found in the prevalence survey)	Target intensified case finding activities to these subgroups.

7. Investment framework

Table 9 presents the recommended investment plan for strengthening TB surveillance and improving direct measurement of TB disease burden.

Funding for the following activities is requested from the Global Fund's "strategic investment plan in country data systems to systematically prepare countries to measure impact" or through the forthcoming Concept Note:

Table 9. Investment plan for strengthening TB surveillance and improving direct measurement of TB disease burden.

Short-term, high impact	
Training to strengthen data management and analytical capacity *Modular course on Operational Research (3 x 1 week for 12 participants with 1 project per 2-3 participants)*	USD 200,000 (1 time cost)
Capture all historical sub-national surveillance data from at least 2006 *Dedicated M&E person time*	No cost to the NTBLCP if existing M&E staff completes this task.
Support the transition to an eRR solution 1. *Training* 2. *Equipment*	x per y x per y
Conduct a data quality audit as a TB component of a SARA assessment.	USD 100,000 (1 time cost)
Longer-term, high impact	
Make TB notification mandatory 1. *Development of a policy document* 2. *Stakeholders meeting* 3. *Engagement with Departments of Planning, Research and Statistics*	x y z
Support development of vital registration system	No cost to the NTBLCP apart from staff time liaising with key stakeholders.
Pilot (FCT state) inventory study to map all health care providers and assess under-reporting of TB cases	USD 100,000 (1 time cost)
TOTAL	USD X

Appendices

Appendix 1. Persons met

Person(s)	Title	Organization/Affiliation
Joshua Obasanya	NTBLCP Programme Manager	NTBLCP
Nkem Chukwueme	Team leader M&E	NTBLCP
Funmilayo Fashade	Statistician	NTBLCP
Gideon Zephaniah	Data Manager	NTBLCP
Ayodele Awe	TB National Professional Officer	WHO – Nigeria Country Office
Philip Patrobas	TB National Professional Officer	WHO – Nigeria Country Office
Samuel Ogiri	TB National Professional Officer	WHO – Nigeria Country Office
Abiodun Hassan	Chair of Working Group on eRR	ARFH (Association for reproductive and family health)
Jumoke Onazi		KNVC – Nigeria Country Office
D'Arcy Richardson	NSP developer	Freelance consultant

Appendix 2. Wish list of data sources and other information required for the review

Description of the TB surveillance system and data sources

- Data acquisition, data flows, data quality checks, paper-based versus electronic, case-based versus aggregated at the central level, frequency of reporting to the central level
- TB surveys (prevalence surveys, drug resistance surveys, mortality surveys, inventory studies, surveys of HIV in TB) conducted in the past 10 years
- Staffing and budgeting of routine TB surveillance at central level
- Surveillance audits, surveys and data quality assessments
- Vital registration system

TB Programme - National Level

- National TB Programme manual
- TB case definitions
- National guidelines for TB, TB/HIV, MDRTB, and TB in children
- WHO guidelines for treatment of tuberculosis, surveillance of drug resistance in tuberculosis, and HIV surveillance among tuberculosis patients
- Most recent annual report(s) of TB, TB/HIV, MDRTB, and TB in children
- Blank data collection forms for TB, MDRTB, TB/HIV, and TB in children (e.g. treatment card, reports forms, registers)
- Most recent complete years' compiled reports of TB cases (paper and/or electronic)
    - Quarterly reports of TB cases sent to the NTP from BMUs over the period of one year
- Documentation for surveillance system (e.g. SOPs, data dictionary)
- Documentation and/or SOPs for electronic surveillance systems
    - System logs that show which data files were imported for the reporting year and when they were imported
    - List of automated checks run at the time of data entry
    - List of data queries used to check data quality at the national level
    - SOPs for detection and removal of duplicate TB cases at national level
- Any reports or publications on data quality, inventory studies, or surveillance evaluations that have been done in past 5 years
- Surveillance-related training documents
- List of all TB BMUs in country
- Results from a drug resistance survey conducted in last 5 years (including documentation of results of proficiency testing conducted at the Supranational TB Reference Laboratory)
- National surveillance data from the last year for which complete data are available
    - Dataset of minimum set of variables (see B1.2)
    - Records in the national patient- or case-based database for TB, TB/HIV, MDRTB, and TB in children
    - # and rates of reported TB cases at national level, first sub-national levels (and BMUs, if available)
        - Case-rates TB at national and first subnational level, results of investigations conducted to identify reasons for any observed rapid changes
        - Distribution of case notification rates between subnational areas
        - National laboratory register

External to TB Programme

- Country income grouping from World Bank website.
- TB mortality rates (HIV-negative TB) at the national level from vital registration system over past 5 years.
- Classification of the national HIV epidemic (generalized, concentrated or low level)
- Results from a survey of HIV infection among a sample of TB cases conducted (in last 3 years, if possible) or data prevalence of HIV among newly detected TB cases
- Documentation of legal and regulatory frameworks for TB reporting
- Latest country-specific estimates of the under-5 mortality rate from WHO publication World Health Statistics (issued annually) or WHO's Global Health Observatory website
- Proportion of national health expenditures that are out-of-pocket from WHO's national health accounts database or WHO Global Health Expenditure Atlas.
- National vital registration system information (e.g. description, national coverage and quality) from national statistics office or WHO Mortality Database

Analysis and interpretation of the output of TB surveillance

- Time trends in case numbers by reporting state.
- Time trends in change in case numbers by reporting state.
- Time trends in the proportion of pulmonary and extra-pulmonary TB.
- Time trends in the proportion of retreatment cases out of the sum of new and retreatment cases.
- Time trends in the proportion of new pediatric TB cases out of the sum of all new cases.
- Time trends in the proportion of TB cases by sex.
- Time trends in the percentage of TB cases tested for HIV and the percentage of HIV-positive TB cases.

Appendix 3. Checklist of Standards and Benchmark

COUNTRY NAME: Nigeria **DATE OF ASSESSMENT: April 4-15, 2013**

CHECKLIST OF STANDARDS AND BENCHMARKS FOR TB SURVEILLANCE AND VITAL REGISTRATION SYSTEMS

INTRODUCTION

Background

A major goal of tuberculosis (TB) surveillance is to provide an accurate measure of the number of new TB cases and TB deaths that occur each year, and to be able to assess these trends over time. In some countries, TB surveillance already meets the standards necessary to do this, but in others, there are important gaps in the TB surveillance system that does not make this possible. For example, TB cases that are diagnosed in the private sector go unreported in many settings, and in many countries with a high burden of TB, people with TB may not access health care and therefore not be diagnosed at all. Furthermore, many countries lack vital registration systems with the geographical coverage and quality required to accurately measure deaths caused by TB. Therefore, the *checklist of standards and benchmarks for TB surveillance and vital registration systems* (the Checklist) was developed with the following objectives:

- To assess a national surveillance system's ability to accurately measure TB cases and deaths
- To identify gaps in national surveillance systems that need to be addressed in order to improve TB surveillance.

The results of a national assessment by use of the Checklist can be used to identify which countries have surveillance systems that already provide an accurate measure of the number of TB cases and deaths that occur each year, and to define the actions necessary to strengthen surveillance in countries in which gaps are identified. Following the 2012 recommendations of the Global Fund's Technical Evaluation Reference Group (TERG) and a collaborative agreement between the Global Fund and World Health Organization (WHO), there was a new aim to integrate assessments of TB surveillance using the Checklist within Global Fund grant mechanisms. As such, assessments with the Checklist should be timed to coincide with periodic reviews, programme reviews or Global Fund phase II grant renewals, with results used to develop monitoring and evaluation (M&E) investments plans that can be supported through subsequent Global Fund grants. This collaboration has great potential to help strengthen TB surveillance in more than a hundred countries receiving Global Fund grants for TB care and control worldwide.

The Checklist was developed by a team of experts in disease surveillance in conjunction with expert advice from meetings organised by WHO in September 2011 and May 2012. The Checklist underwent two rounds of field-testing in eleven countries, including Brazil, China, Egypt, Estonia, Japan, Kenya, the Netherlands, Nigeria, Uganda, the United Kingdom and the United States of America, and was revised accordingly.

What does the Checklist specifically assess?

The Checklist has two parts: part A is a checklist that provides a general description of the TB surveillance system that is being assessed; part B (section 1) is a checklist for TB surveillance and vital registration systems which includes three sections covering data quality, system coverage, and TB mortality data from vital registration systems. Part B (section 2) includes the supplementary standards for surveillance of TB/HIV cases, drug resistant cases and TB cases in children.

Part A consists of eighteen questions that characterise the national TB surveillance system and sets the background for Part B which consists of thirteen standards and their associated benchmarks. The standards are general statements about the characteristics that define a high-performance TB surveillance system; nine standards are related to the measurement of TB cases and one is related to measurement of TB deaths. There are three supplementary standards that can be used to assess whether a country's TB surveillance system can be certified as providing a direct measure of the number of drug resistant TB cases, HIV-positive TB cases, and child TB cases.

For each of the thirteen standards, benchmarks define (in quantitative terms wherever possible) the level of performance considered sufficient to meet its respective standard. To ensure time for the most complete data to be available for review, the assessment of TB surveillance and vital registration systems is designed to use data for the most recent complete calendar year, unless otherwise stated in the user guide. Depending upon the timeliness of the reporting and finalisation of data validation procedures in the system, the lag time may range from no delay to one year. In some instances, data from additional years are needed to assess trends over time, or data from only a single quarter are required to reduce the burden of data collection. It is anticipated that an assessment of a TB surveillance system using the Checklist would take place every 3 to 5 years.

For part A and B of the Checklist, key actions, if required, should be recorded that will 1) address the identified gaps in the surveillance and vital registration systems that prevent them from accurately measuring TB cases and deaths and 2) help the system improve TB surveillance based on well-established best practices. An estimated budget to support activities that could bridge these gaps will assist in developing an M&E investment plan.

The data, materials and personnel required to assess each standard and associated benchmark(s) are listed below, followed by the user guide. The user guide was developed to provide instructions to implement the associated checklist of standards and benchmarks in an accurate and standardised way. The rationale for each standard and associated benchmark(s), and the methods that should be used to assess the benchmarks, are explained in the user guide. Specifically, the user guide provides a description of how and what data should be collected. For elements that require reviewing a sample of records, the user guide also explains how the sampling should be conducted. Examples are used to illustrate the methods described in the user guide, as well as recommended corrective actions to take if the benchmarks are not met. The user guide also defines key terms used in the Checklist, and further lists the supporting appendices.

It is recognised that the standards and benchmarks related to health system coverage (Standard B1.9) and vital registration (Standard B1.10) are outside the purview of the TB programme. However, to assess the capacity of the surveillance system to accurately estimate TB burden, these two standards and associated benchmarks are deemed necessary.

In a few instances e.g. Standards B1.4 and B1.8, where compilation of the necessary evidence may be difficult or impossible on a regular basis, it is acceptable to use evidence from the literature, reports of special studies or other related health surveys carried out in recent years to demonstrate that a standard is met, provided results from the assessment of other standards show that data quality within the system has not subsequently declined. This is explained in more detail in the user guide.

This Checklist may also be used at the sub-national level, but this is not the primary purpose for which the tool was developed. It should also be noted that the Checklist only assesses one part of a system's capacity and is *not* intended to assess the system's ability to fulfil other programmatic requirements, e.g. patient care, delivery of lab results, or drug stock management (see Box 1). Furthermore, the standards assess the outputs rather than the inputs or processes of the surveillance system which will vary by country. Box 2 below highlights best practices for TB surveillance systems. Using this along with information collected in the Checklist's Table A, countries can identify areas where additional resources can be targeted to effectively strengthen their surveillance systems.

What is a certified TB surveillance system?

For a country's TB surveillance systems to be *certified* as providing a direct measurement of TB cases and TB deaths, all 10 standards and their associated benchmarks (Part B, section 1) should be met. The three supplementary standards in part B (section 2) can be used to assess whether a country's TB surveillance system can be certified as providing a direct measure of the number of drug-resistant TB cases, HIV-positive cases of TB, and TB in children specifically.

Certification provides an objective situational analysis of the current TB surveillance system. It is meant to provide a baseline and a framework which can be used to support improvements (if required) in the system. Subsequent assessments can be used to determine if targets are met based upon the initial assessments. Certification is based on the review of the system from the assessed time period. External peer review and endorsement of the findings by the WHO Global Task Force on TB Impact Measurement will be necessary for a country's system to be certified.

Who can undertake the Checklist?

The Checklist can be used by in-country national TB programme staff for self-assessment. All parts of the checklist should be undertaken by someone with an informed and current knowledge of the system that may include all or some of the following people:

- NTP manager
- NTP programme officer
- NTP monitoring and evaluation office
- NTP statistician/epidemiologist
- NTP data manager
- WHO TB programme officer

What methods are required and how long does it take to complete the Checklist?

The Checklist requires an accurate and a thorough collection of data from available sources. Therefore, a desktop review of all documents related to the Checklist, including datasets and electronic surveillance systems, is necessary, and data audits at selected basic management unit (BMUs) may be required as well. Interviews with the relevant stakeholders and partners may also be necessary to obtain the necessary information. Depending on how this information is stored, i.e. paper-based or electronic-based, it may take several weeks for the appropriate data to be extracted. Electronic-based data generally require less time to complete the Checklist than paper-based systems. Time should also be allocated to summarise the findings of the Checklist before dissemination.

NOTE: ASPECTS OF A SURVEILLANCE SYSTEM NOT ADDRESSED BY THE CHECKLIST

Published surveillance evaluation guidelines have provided criteria against which surveillance systems can be assessed[1]. These include:

— Acceptability
— Data quality
— Flexibility
— Positive predictive value
— Representativeness
— Sensitivity
— Simplicity
— Stability
— Timeliness
— Usefulness

While these are important criteria to evaluate the performance of TB surveillance systems, some of these are not covered by and are outside the scope of the objectives of this checklist. For example, this checklist is not intended to assess the ability of a surveillance system to detect outbreaks in a timely manner, or its simplicity, flexibility, acceptability or positive predictive value, since these aspects do not directly measure a systems ability to provide an accurate measure of the number of TB cases and deaths that occur each year.

[1] Centers for Disease Control and Prevention. Updated guidelines for evaluating public health surveillance systems: recommendations from the guidelines working group. MMWR 2001;50(No. RR-13):1–35.

PART A: CHARACTERISTICS OF THE TB SURVEILLANCE SYSTEM

Before completing the checklist, it is important to characterise the national TB surveillance system. Please provide answers to the following questions.

COUNTRY NAME: Nigeria **DATE OF ASSESSMENT: 4 April – 15 April**

QUESTIONS	OUTCOMES (Best practises are in bold)	KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
A1. How are data recorded for individual TB cases at the service delivery level (e.g. in TB diagnostic units, health centres, clinics)? *(Tick all that apply)*	☐ **Data are recorded electronically on a national internet-based system** ☐ Data are recorded electronically on a state/provincial/regional internet-based system ☐ Data are recorded electronically on a local system ☒ Data are recorded on paper only (*facility level and aggregated electronically at the LGA level*) ☐ Data are not recorded	Move towards a case-based electronic recording and reporting system at facility level (there is currently a specific objective for this in their 2010-2015 M&E National Plan, but little progress has been made so far).	
A2. Do all service delivery points systematically use standardised TB data collection forms and tools?	☒ **Yes, completely** ☐ Mostly ☐ Partially ☐ No, not at all	No action is required	
A3. Which TB cases are included in the national TB surveillance data?	☐ **All TB cases from all parts of the country** ☒ Some TB cases are systematically excluded (*Tick all that apply*): ☒Some part(s) of the country are excluded due to safety ☐Some case types are excluded ☒Some care providers, e.g. non-NTP providers, prisons, private practitioners, are	• Enforce and expand PPM activities in the country. • Produce an exhaustive mapping of all health care providers who diagnose TB.	

QUESTIONS	OUTCOMES (Best practises are in bold)	KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
	excluded. Describe: North states (safety reasons) and non-NTP providers. All 232 prisons are engaged. ☐ Others: _____		
A4. What types of TB data are available at the national level? *(Tick all that apply)*	☐ **Patient level data that allow multiple episodes of TB in the same person to be identified are available** ☐ Case level data are available ☒ Only aggregated data are available, i.e. summaries for groups of cases	• State-level (n=37) aggregated data are available (but stored in across multiple Excel spreadsheets) per quarter and year since 2003 • LGA-level (n=774) aggregated data are available (but stored in across multiple Excel spreadsheets) per quarter and year since 2012 • Develop relational databases (Epi-Info) to capture all available aggregated retrospective data at LGA and state levels (per quarter and year) • Once all data are captured in appropriate database, perform time series analyses at state and LGA level and add in National Report.	
A5. What is the expected frequency of data transmission from the first sub-national administrative level to the national level? *(Tick all that apply)*	☐ **Real-time** ☐ More often than monthly ☐ Monthly ☒ Quarterly ☐ Less often than quarterly	Advocate for the transition towards an electronic recording and reporting system	

QUESTIONS	OUTCOMES (Best practises are in bold)	KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
A6. At what levels of the system are TB data systematically verified for accuracy, timeliness and completeness? *(Tick all that apply)*	☒ **From the service unit upwards (supervisory visits and quarterly meetings)** ☐ From the 1st administrative level upwards ☐ From the 2nd administrative level upwards ☐ Only at the national level ☐ Not at any level	No action is required	
A7. What types of quality assurance procedures are systematically undertaken for TB data? *(Tick all that apply)*	☐ **Quality controls are in place for the electronic surveillance system (automated checks at data entry and batch checking, plus SOPs)** ☒ Data are reviewed during supervisory monitoring visits to service units and sub-national levels (How often? *Quarterly*) ☒ Data are reviewed during meetings with TB staff (How often? *Quarterly*) ☐ Other (specify:_____)	No action is required	
A8. Is feedback on TB data quality systematically provided to all lower reporting levels?	☐ **Yes, completely** ☒ Mostly (feedback is provided during quarterly meetings) ☐ Partially ☐ No, not at all	Ensure the NTP website is functional (www.ntblcp.gov.ng) and national reports are posted on it.	
A9. When are national TB case data for a given calendar year considered ready for national analyses and reporting?	☐ Before April the following calendar year ☒ Before May the following calendar year ☐ Before June the following calendar year ☐ On or after beginning of June the following calendar year	No action is required	
A10. Are there national guidelines for recording	☐ **Yes. They are posted on the internet.**	Post available manual and other	

QUESTIONS	OUTCOMES (Best practises are in bold)	KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
and reporting of TB data e.g. documentation or instructions? *(Tick all that apply)*	☒ **Yes. They are available in a manual or other reference document, e.g. training materials** ☐ No	relevant material on the NTP website	
A11. Does the national TB programme have a training plan which includes staff involved in data collection and reporting at all levels of the reporting process?	☒ **Yes** • At facility level, all new staff (also on an ad hoc basis according to availability of funding) are trained - one-week training course with existing curriculum • At LGA and state levels all TB coordinators are trained in Zaria (8 week-long programme management, that includes an M&E component) ☐ No	No action is required	
A12. How often do TB programme staff receive training specifically on TB surveillance (i.e. recoding and reporting of TB data)? *(Tick all that apply)*	☐ **Training is routinely received at national and sub-national levels** (How often?_____) ☒ Training is received on an ad hoc basis ☒ Staff receive training when they are hired ☐ No routine training is received	Strengthen M&E training schedule for staff handling data	
A13. How many staff work on TB surveillance at the national level? *(Tick all that apply)* • 2 medical officers (Kuye Joseph, Nkem) • 2 statisticians (Funmi	☐ **Epidemiologist, full-time** (#) ☐ Epidemiologist, part-time (#_____) ☒ **Statistician, full-time / data manager** (# 2) ☐ Statistician, part-time (#_____) ☐ **Data manager, full-time** (#_____) ☐ Data manager, part-time (#_____)	Enhancing capacity of M&E team in good data management and analysis practices	

QUESTIONS	OUTCOMES (Best practises are in bold)	KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
& Segun) • 1 resident field epidemiology (Aisha) • 1 scientific officer (Peters)	☐ **Data quality officers, full-time** (#_____) ☐ Data quality officers, part-time (#_____) ☒ Other (specify: 2 medical officers, 1 field epidemiologist in training, 1 scientific officer)		
A14. Is a national TB surveillance report routinely produced and disseminated on an annual basis?	☒ **Yes** (last available is from 2012) ☐ No	Post all available reports on the NTP website	
A15. Are there written goals of the surveillance system?	☒ **Yes** (as part of the national 2010-2015 M&E plan) ☐ No	No action is required	
A16. Policies and procedures are in place to protect the confidentiality of all surveillance data e.g. records, registers.	☐ **Yes, completely** ☒ Mostly (names only appear on TB registers/treatment cards/lab registers at facility level) ☐ Partially ☐ No, not at all	Produce written policies for the protection of confidentiality and integrate in the NTP guidelines	
A17. Is there a long term financial plan and budget in place to support TB surveillance activities?	☒ **Yes** (partial funding is available from the Global Fund, detailed budget is available, linking specific activities with each of the objectives of the National M&E Plan) ☐ No	Monitor progress in terms of each of the activities described in the detailed budget of the National M&E Plan	
A18. When was the last time the TB surveillance system was evaluated?	☐ **Within the last year** ☐ **Within the last 1-5 years** ☐ Within the last 5-10 years ☒ Never (in a systematic and standardised way, but as part of programme reviews)	Institutionalise the periodic implementation of the systematic assessment of TB surveillance	

PART B (Section 1): CHECKLIST FOR TB SURVEILLANCE AND VITAL REGISTRATION SYSTEMS

For each standard, please assess whether the system is able to satisfy the associated benchmark(s), using the methods recommended in the user guide. Indicate 'Met', 'Partially met', "Not met" or 'Not applicable' in the results column. Describe the key results and any action recommended to improve the quality of the system in the last two columns.

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
TB SURVEILLANCE SYSTEM DATA QUALITY				
B1.1 Case definitions are consistent with WHO guidelines	All three benchmarks should be satisfied to meet this standard: • Laboratory-confirmed cases[i] are distinguished from clinically diagnosed cases • New cases are distinguished from previously treated cases • Pulmonary cases are distinguished from extrapulmonary cases	☒Met ☐Partially met ☐Not met	The definition of smear-negative is not explicitly presented in the National Guidelines (Workers Manual, 5th ed.)	Planning to introduce the 2013 revisions to the definitions and reporting framework
B1.2 TB surveillance system is designed to capture a minimum set of variables for reported TB cases	Data are routinely collected for at least each of the following variables: • Age or age group • Sex • Year of registration • Bacteriological results [i] • History of previous treatment • Anatomical site of disease • For case-based systems, a patient identifier (e.g. numeric ID)	☒Met ☐Partially met ☐Not met	Patient identifier is assigned by the LGA supervisor at the facility level (guidelines on the generation of these are provided in the national guidelines).	
B1.3 All scheduled	• *For paper-based systems:* 100% of	☐Met	• Facility level maintains a paper-based collection system (N=4,642	

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
periodic data submissions (e.g. electronic data files or quarterly paper reports) have been received and processed at the national level	expected reports from each TB basic management unit have been received and data aggregated at national level • *For national patient-based or case-based electronic systems that import data files from sub-national (e.g. provincial or regional) electronic systems:* 100% of expected data files have been imported	☒Not met ☐Not applicable	DOTS centres) • LGA (and all other higher administrative) levels maintain an aggregated excel-based collection system • Quarterly data are submitted from each LGA during the quarterly data quality checking meetings. LGAs with 0 cases for a quarter are expected to submit a form. • It has not been possible to assess completeness of reporting at LGA level for 2012, due to the failure of data extraction from the multiple excel spreadsheets in an analysable format • eTB manager for MDR-TB patients is in place (since July 2012). Data entry takes place at the state level. There are 8 MDR-TB treatment centres around the country.	
B1.4 Data in quarterly reports (or equivalent) are accurate, complete, and internally consistent *(For paper-based systems only)*	All benchmarks should be satisfied to meet this standard: • Sub-totals of the number of TB cases by age group, sex, and case type equals the total number of reported TB cases in ≥95% of quarterly reports (or equivalent) from basic management units. • The number of TB cases in ≥95% of quarterly reports (or equivalent) matches the number of cases	☐Met ☐Partially met ☒Not met ☐Not applicable	• Link up with WHO HQ for the SARA evaluation, from a nationally representative sample of health facilities • To be assessed during the field visits of the 2013 Programme Review based on standardised tools that are provided by the NTP	

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
	recorded in TB basic management unit registers and source documents (patient treatment cards and laboratory register) • Data for a minimum set of variables are available for ≥95% of the total number of reported TB cases in quarterly reports			
B1.5 Data in national database are accurate, complete, internally consistent, and free of duplicates *(For electronic case-based or patient-based systems only)*	All benchmarks should be met to reach this standard: • Data validation checks are in place at national level to identify and correct invalid, inconsistent, and missing data in the minimum set (B1.2) • For each variable in the minimum set (standard B1.2), > 90% of case records are complete, valid and internally consistent for the year being assessed. • <1% of case records in the national dataset for the year being assessed are unresolved potential duplicates	☐Met ☐Partially met ☐Not met ☒Not applicable	Advocate for the development and implementation of an eRR system A specific objective for the development of an eRR system is already listed in the National M&E Plan (2013), but little progress has been made so far on this. Efforts need to be intensified	

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
B1.6 TB surveillance data are externally consistent	• Among new TB cases, the percentage of children is between 5-15% in low- and middle-income and <10% in high-income countries	☒Met ☐Partially met ☐Not met	Percentage of new, all forms, childhood (0-14) over total TB notifications in 2012 is 6%	
B1.7 Number of reported TB cases is internally consistent (within country)	• Year to year change in the national number of reported TB cases is consistent with year to year change in national TB mortality (HIV-negative, from national vital registration) i.e. trajectories with the same direction	☐Met ☐Partially met ☒Not met	No direct measurement of TB mortality, PPM contribution only available from 2012 onwards State level time series analyses of quarterly aggregated case notification data, 2010-2012, show inconsistencies	
TB SURVEILLANCE SYSTEM COVERAGE				
B1.8 All diagnosed cases of TB are reported	Both benchmarks should be satisfied to meet this standard: • TB reporting is a legal requirement • ≥90% of TB cases are reported to national health authorities, as determined by a national-level investigation (e.g. inventory study) conducted in last 10 years	☐Met ☐Partially met ☒Not met	• TB reporting is not a legal requirement • There are non-NTP private providers that diagnose TB in the country, but the level of under-reporting has not been measured with a dedicated study (e.g. inventory study) • Free TB drugs are offered from the NTP. However, INH and RIF can be bought from private pharmacies	
B1.9 Population has good access to health care	Both benchmarks should be satisfied to meet this standard: • Under-5 mortality rate (probability of dying by age 5 per	☐Met ☐Partially met ☒Not met	• Under-5 mortality is 124 per 1,000 live births • 60% out of pocket expenditure	

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
	1000 live births) is <10 • <25% total health expenditure is out-of-pocket			
QUALITY AND COVERAGE OF VITAL REGISTRATION SYSTEM				
B1.10 Vital registration system has high national coverage and quality	Both benchmarks should be satisfied to meet this standard: • Cause of death documented in ≥90% of total deaths recorded in a a) national vital registration system OR b) sample vital registration system • <10% of deaths have ICD codes for ill-defined causes (defined as ICD-9 780-799 and ICD-10 R00-R99)	☐Met ☐Partially met ☒Not met	• National Population Commission is responsible for collecting vital registration data, including cause of death (http://www.population.gov.ng/) • However, although hospitals are reporting and some verbal autopsies are done in communities, data collected are not ICD-compliant, coverage is not good, needs a lot of strengthening	

PART B (Section 2): SUPPLEMENTARY CHECKLIST FOR TB SURVEILLANCE

For each standard, please assess whether the system is able to satisfy the associated benchmark(s), using the methods recommended in the user guide. Indicate 'Met', 'Partially met', "Not met" or 'Not applicable' in the results column. Describe the key results and any action recommended to improve the quality of the system in the last two columns .

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
SURVEILLANCE OF DRUG RESISTANT TB				
B2.1 Surveillance data provide a direct measure of	One of the two benchmarks should be satisfied to meet this standard: • Rifampicin susceptibility status	☒Met ☐Partially met ☐Not met	• National guidelines for MDR-TB exist • 1st national DRS is completed MDR among new – 2.9% (95%CI: 2.1-4.0)	

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
drug resistant TB in new cases	(positive/negative) documented for ≥75% of new pulmonary TB cases • Rifampicin susceptibility status (positive/negative) documented for a nationally representative drug resistance survey of new pulmonary TB cases		MDR among retreated - 14% (95% CI: 10-19)	
SURVEILLANCE OF TB/HIV				
B2.2 Surveillance data provide a direct measure of the prevalence of HIV infection in TB cases	One of the two benchmarks should be satisfied to meet this standard: • HIV status (Positive/Negative) documented for ≥80% of all TB cases notified in all settings with a generalised epidemic state[ii] or concentrated epidemic state[iii] and in settings with a low level epidemic state,[iv] where feasible • HIV status is available from a representative sample from all TB cases notified in settings with a low-level epidemic state where it is not feasible to implement routine surveillance	☒Met ☐Partially met ☐Not met	• 87% of notified TB patients were tested for HIV in 2011	
SURVEILLANCE OF CHILD TB				

STANDARD	BENCHMARK(S)	RESULTS	RESULTS (DESCRIPTION) INCLUDING KEY ACTION(S) REQUIRED TO ADDRESS THE GAPS	ESTIMATED BUDGET REQUIREMENTS TO ADDRESS KEY ACTION(S)
B2.3 Surveillance data for children reported with TB (defined as ages 0-14 years) are reliable and accurate or all diagnosed childhood TB cases are reported	Both of the benchmarks should be satisfied to meet this standard: • Ratio of age groups 0-4 to 5-14 years is in the range 1.5-3.0 • ≥90% of childhood TB cases are reported to national health authorities, as determined by a national-level investigation (e.g. inventory study) conducted in last 10 years	☐Met ☐Partially met ☒Not met	• Data reported in the 0-4 and 5-14 age group categories since 2010 • Only smear-positive is disaggregated • Ratio of all forms TB notification rates of age groups 0-4 Vs. 5-14 is 0.83 for 2012 • The level of under-reporting has not been measured with a dedicated study (e.g. inventory study)	

CHECKLIST SUMMARY – Nigeria, April 2013				
STANDARD	**MET**	**PARTIALLY MET**	**NOT MET**	**NOT APPLICABLE**
B1.1	**X**			
B1.2	**X**			
B1.3			**X (paper-based)**	
B1.4			**X**	
B1.5				**X**
B1.6	**X**			
B1.7			**X**	
B1.8			**X**	
B1.9			**X**	
B1.10			**X**	
B2.1	**X**			
B2.2	**X**			
B2.3			**X**	

Appendix 4. Debriefing Presentation, 8 April 2013

The following presentation was given to NTBLCP staff on April 8, 2013.

Double click on the icon below to open.

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[i] i.e. by smear, culture or WHO-endorsed molecular test (e.g. Xpert MTB/RIF)
[ii] Generalised epidemic state: HIV prevalence consistently >1% in pregnant women.
[iii] Concentrated epidemic state: HIV prevalence is consistently >5% in at least one defined subpopulation and is <1% in pregnant women in urban areas.
[iv] Low-level epidemic state: HIV prevalence has not consistently exceeded 5% in any defined subpopulation.