Comparison of Survey Results to Evaluate the Availability, Readiness, and Quality of the Uganda Tuberculosis Diagnosis Network

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Abbreviations

BSC	biosafety cabinets
CPHL	Central Public Health Laboratories
DNA	Diagnostic Network Assessment
DR-TB	drug-resistant tuberculosis
DST	drug susceptibility testing
EQA	external quality assurance
HC	health center
HCW	healthcare worker
LF-LAM	lateral flow lipoarabinomannan assay
MDR-TB	multidrug-resistant tuberculosis
MTB	mycobacterium tuberculosis
NGO	nongovernmental organization
NSP	National Strategic Plan
NTLP	National TB and Leprosy Program
NTRL	National TB Reference Laboratory
PFP	private for profit
PNFP	private not for profit
PPE	personal protective equipment
QA	quality assurance
QC	quality control
QTSA	Quality of TB Service Assessment
RRH	regional reference hospital
RR-TB	rifampicin-resistant tuberculosis
SLMTA	Strengthening Laboratory Management Toward Accreditation
SOP	standard operating procedure

TAT	turnaround time
TB	tuberculosis
TPT	TB preventive therapy
USAID	United States Agency for International Development
VHT	Village Health Team
WHO	World Health Organization
WRD	WHO-recommended rapid diagnostic tests

Executive Summary

Diagnostic services are an essential component of TB treatment and prevention in high TB burden countries, and critical for achieving ambitious international goals for reducing TB morbidity and mortality. However, in most high burden settings, TB diagnostic services do not meet the needs of National TB Programs in terms of access, quality, and efficiency.

Strengthening TB diagnosis services is a priority for Nation TB Programs and their stakeholders, and tools and resources have recently become available to help understand how and where diagnosis systems are falling short. The TB Diagnostic Network Assessment (DNA) and the Quality of TB Services Assessment (QTSA) are two such tools. The DNA, developed by the Global Laboratory Initiative, compares the TB diagnostic network in a country with a set of standards based on international best practices for TB diagnosis. For each standard, "core capacities" and "components" are used to define essential features and functions of a national diagnosis network designed to detect, assess, notify, and respond to TB. Areas of the TB diagnostic network that fail to meet the standard would be targeted for strengthening. The QTSA is a health facility survey which measures the quality of TB service delivery, from screening and diagnosis through treatment and follow-up. While there are important methodological differences between the two surveys, the outputs are similar with regard to diagnostic services and the diagnostic network in countries. The similarities suggest that results from the two surveys could be combined to produce information on TB diagnosis system performance and capacity in countries that is synergistic, that is, greater than the either survey alone, or the sum of the two surveys.

This paper compares the DNA and QTSA in terms of the objectives, content, and results for the case of Uganda, a high burden TB country which has recently completed both surveys (2019). The paper attempts to describe the performance (i.e., availability and readiness) and quality of TB diagnosis services at health facilities in Uganda and investigates how data from QTSA surveys can be used to complement the National TB DNA. An in-depth understanding of the performance and quality of TB diagnosis in Uganda (and potentially other countries) will aid in the formulation of priority actions to improve TB diagnosis services.

To understand how the surveys could be used in a synergistic manner, the methods and application of the two surveys were reviewed, including subject matter details, expected outputs, sampling methods, and geographic coverage. The surveys were then mapped to gauge the extent of the alignment of indicators and corroboration of results, organized by DNA core capacities. Indicators pertaining to availability and readiness were identified and aggregate national-level results of matching indicators were compared.

Results of matching indicators were then compared at the facility level for facilities participating in both surveys. Finally, an index of availability and readiness was explored to determine the utility of monitoring these attributes as a method of quality control for TB diagnosis services.

Significant overlap between the two surveys was only found for four out of the nine DNA core capacities (Diagnostic algorithm, Biosafety, Quality of the diagnostic network, and TB/HIV). For the diagnosis algorithm, QTSA largely corroborated the findings of the DNA that WHO recommended diagnostics (i.e. GeneXpert) were widely available (QTSA found that 92% of facilities surveyed had access to GeneXpert on site or by referral). For drug-resistant TB diagnosis, QTSA also corroborated the DNA finding of the availability of drug-susceptibility testing (DST) for rifampicin, though results were more disparate for DST of second-line drugs. For DST of second-line drugs, the DNA found that 83 percent of facilities have access, whereas the QTSA found only 31 percent of facilities that use offsite labs have DST for second-line drugs available from the offsite lab. For Biosafety, the DNA found that TB screening was available to staff in 43 percent of facilities while QTSA found 47 percent. DNA found that 95 percent of facilities had personal protective equipment (PPE) available while QTSA found somewhat less (N-95 respirators [63%]; eye protection [27%]; gowns, scrubs, or clinical coats [88%]). For Quality of the diagnosis network, DNA and QTSA agreed that supervision is regularly conducted at health facilities (DNA=82%, QTSA=81%) although

they differed on the extent to which supervisors left written feedback of their findings (DNA=56%, QTSA=81%). For TB/HIV, both surveys reported finding HIV testing widely available (DNA=100%, QTSA=99%).

Mapping of indicators across the two surveys found 26 sufficiently similar for comparison, though for many of these there are minor differences in scope or emphasis. Comparisons for national level results found an average absolute percentage difference of 24 percent (median = 18%) for all comparisons between the DNA and QTSA. The averages for indicators pertaining to availability and those pertaining to readiness were 23 percent and 24 percent, respectively. Nearly half (46%) of the comparable indicators differed by more than 20 percent. DNA estimates were 9 percent higher than comparable QTSA estimates, on average.

At the health facility level results for matching indicators agreed for 73 percent of facilities (n=11). Indicators for availability of services were more likely to agree (80%) than those for readiness to provide the service (69%). The performance index (measuring availability and readiness of diagnosis services) found 81 percent agreement on average of indicator values within facilities. The average percentage difference in the index value (difference between index calculated for DNA indicators, and for QTSA indicators) across facilities was 17 percent (n=11). These results indicate that an index of availability and readiness could be constructed from some, or all, of the 22 indicators to identify facilities in need of support. Such an index could potentially be informed by routine supervision such that TB program planners need not wait until the next health facility survey to collect data on these specific parameters.

The results of the analysis indicate that, though the surveys do not align entirely on performance indicators for TB diagnosis services, it is nonetheless useful to compare the results for the following purposes. First, for indicators with the same or very similar indicator definitions, results from QTSA can be used to validate, or ground-truth, results from the DNA. Second, the QTSA results can be used to inform the self-assessment of the DNA. The DNA methodology calls for a self-assessment by the NTLP, which is then validated in the field by an external team conducting the DNA. If recent QTSA values are available, they should be used to inform the self-assessment, given the methodological rigor of the QTSA. Lastly, indicators from the QTSA can be used to inform program monitoring, evaluation, and planning in the periods between DNAs and QTSAs. If information on availability, readiness, and quality can be obtained through routine supervision at health facilities, these parameters can be monitored regularly, and interventions formulated to improve performance as the needs arise.

Although the index of availability and readiness modeled here may not be the ideal tool for gauging availability, readiness, and performance, such a tool can be easily developed with the indicators available in a given TB program. Adaption to country programs would nevertheless be necessary to make the tool responsive to the needs of specific countries. This effort shows that such a tool is possible and adds value for evaluating the performance of the TB diagnosis network.

Introduction

The World Health Organization's (WHO) End TB Strategy aims to end the global tuberculosis (TB) epidemic, with targets to reduce TB deaths by 95 percent and to cut new cases by 90 percent between 2015 and 2035.1 The United Nations General Assembly High-Level Meeting Political Declaration on TB contained several global targets endorsed by Heads of States, including targets to treat 40 million people with TB between 2018 and 2022, 3.5 million children with TB, 1.5 million people with drug-resistant TB (DR-TB), and at least 30 million put on TB preventive treatment.2 Because the confirmation of TB diagnosis is imperative for effective TB control, TB laboratories play a critical role. The End TB Strategy also calls for universal access to early diagnosis of TB and drug susceptibility testing (DST) for all bacteriologically confirmed cases, at least for rifampicin. Those with rifampicin-resistant TB (RR-TB) should receive DST for fluoroquinolones and second-line injectable drugs. WHO recommends that national TB programs develop networks with modern diagnosis methods, have efficient referral systems, use standard operating procedures (SOPs), and have quality control/quality assurance (QC/QA), with adequate staffing and good infection control.

To assess progress toward the End TB Strategy goals and objectives and to improve the quality of TB diagnosis networks, a TB Diagnostic Network Assessment (DNA) Tool was developed by the United States Agency for International Development (USAID) with support from the Global Laboratory Initiative and other partners. The DNA compares the TB diagnosis network in a country with a set of standards based on international best practices for TB diagnosis. For each standard, "core capacities" and "components" are used to define essential features and functions of a national diagnosis network designed to detect, assess, notify, and respond to TB.

Uganda is one of 20 countries with the highest burden of HIV-associated TB in the world.[3] TB incidence in Uganda was 200/100,000 in 2018; 40 percent of these people were estimated to be coinfected with HIV. Of the estimated 86,000 incident cases, 57,756 (67%) were notified to the national TB program and only 56 percent of the notified cases were bacteriologically confirmed. WHO estimates that there are 1500 multidrug-resistant and rifampicin-resistant TB (MDR/RRTB) cases per year in Uganda. In 2018 there were 516 laboratory confirmed cases of MDR/RR TB. Uganda has made progress improving TB diagnosis and treatment (e.g., rapid scale-up of molecular testing for TB and first-line drug resistance with GeneXpert; 80% treatment success rate); however, there is much room for improvement to meet global standards.[4]

In addition to TB diagnosis, the overall quality of TB service delivery is a cause for concern globally and in Uganda. As access to health services has improved, a renewed emphasis on quality has emerged. Tools to assess quality of care and elements of quality, such as the availability of services and the readiness of health facilities to deliver them, have been developed. The Quality of TB Service Assessment (QTSA) was developed by MEASURE Evaluation, which is funded by USAID, to assess quality of care specific to the TB cascade, including prevention, diagnosis, and treatment. The QTSA includes aspects of service availability and readiness for TB; a provider knowledge, attitudes, and practices survey; patient satisfaction survey; and a review of key TB outcomes through a TB register review. The QTSA has been implemented in several countries, including Uganda, during the period 2017 to 2020.

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[1] World Health Organization (WHO). (2020). *WHO end TB strategy*. Retrieved from https://www.who.int/tb/post2015_strategy/en/.

[2] United Nations General Assembly. (2018). *Political declaration of the high-level meeting of the General Assembly on the fight against tuberculosis*. Retrieved from http://www.stoptb.org/webadmin/cms/docs/Political-Declaraion-on-the-Fight-against-Tuberculosis.pdf.

[3] WHO. (2019). *Global tuberculosis report 2019*. Geneva: Switzerland: WHO. Retrieved from https://www.who.int/teams/global-tuberculosis-programme/global-report-2019.

[4] *Joint Assessment of the Tuberculosis Diagnostic Network of Uganda*, August 25 – September 6, 2019

At the time this report was written and published in 2020/21, Uganda was the only country to have undertaken both a DNA and nationally representative QTSA. The availability of results from these two surveys provides a unique opportunity to explore the challenges and opportunities facing TB diagnostic networks in Uganda. Can comparing and leveraging the results of these two surveys, which each gauge TB program capacity in different ways, shed new light on gaps and weaknesses or methods to assess quality in TB programming?

With such questions in mind, the current study attempts to describe the availability, readiness, and performance of TB diagnosis at health facilities in Uganda and investigate how data from QTSA surveys can be used to complement the National TB DNA. An in-depth understanding of the availability and readiness of TB diagnosis in Uganda (and potentially other countries) will aid in the formulation of priority actions to improve TB diagnosis.

Methods

A TB DNA was conducted in 2019 by the Uganda Ministry of Health (MoH), National Health Laboratory and Diagnostic Services. It was a qualitative assessment of the extent to which the diagnosis network adhered to international standards and met the needs of the TB National Strategic Plan (NSP). A QTSA was also implemented in 2019 (by MEASURE Evaluation) to evaluate the quality of care for TB prevention, diagnosis, and treatment. Both surveys touched on aspects of the availability of TB services, readiness to deliver services (in terms of human, financial, and technical capacity), and the quality of services delivered (in terms of structure, process, and outcome). A comparison of results across the two surveys can potentially highlight the strengths and weaknesses of TB diagnosis in Uganda. This paper investigates the similarities and differences between the two surveys in terms of TB diagnosis capabilities only; other aspects of TB services are not addressed.

The following methods were used to cross-reference findings and explore the potential existence of synergy in the information on TB diagnosis performance in Uganda from a comparison of the two surveys:

1. Description of the surveys: the methods and application of the two surveys were reviewed, including subject matter details, expected outputs, sampling methods, and geographic coverage. Similarities and differences were explored and described.
2. Survey mapping: the surveys were reviewed to gauge the extent of the alignment of indicators and corroboration of results, organized by DNA core capacities.
3. Survey mapping for availability and readiness: indicators pertaining to availability and readiness were identified and mapped across the surveys.
4. Direct comparison of results: aggregate, or national-level results, of the two surveys were compared for indicators pertaining to availability and readiness.
5. Facility-level comparison: results for facilities participating in both surveys were compared.
6. An index of availability and readiness was explored to determine the utility of monitoring these attributes as a method of quality control for TB diagnosis.

Description of the Surveys

Diagnostic Network Assessment

A high-quality TB diagnosis network is essential to effectively identify people with TB disease, initiate timely and appropriate treatment, and monitor treatment effectiveness. Laboratory services are a critical component of the network, but only a partial component. All TB health workers and health facilities involved in the TB cascade of care—from case identification and bacteriologic confirmation to successful treatment—comprise

the essential elements of the diagnosis network. To assess whether the diagnosis network and all necessary linkages among components are functioning effectively and efficiently, a network-based tool is needed.[5]

The DNA uses a semi-quantitative scoring procedure modeled on the African Society of Laboratory Medicine/Association of Public Health Laboratories National Laboratory Network Assessment scorecard to identify the "capability stage" of various aspects of the diagnosis network, describe current capabilities, and identify areas for improvement. Based on a Capability Maturity Measurement Model,[6] the stages are quantified using a scoring system (0–5) to provide a semi-quantitative measure of the stepwise progression toward complete fulfillment of each core capacity.

Nine core capabilities are identified, each divided into several essential components (Appendix A—Table 18). A tenth capability (TB/HIV) is added for high burden TB/HIV countries. Each component is scored based on available information from the different parts of the assessment.

The assessment has four parts: (1) pre-assessment data collection and analysis; (2) self-assessment of TB diagnosis network core capacities by the country undertaking the DNA; (3) review of self-assessment and in-country verification by an external assessment team; and (4) review of the findings, identification of strengths and weaknesses, and development of evidence-based interventions to improve the TB diagnosis network.

The self-assessment and verification aspects of the assessment use standard checklists with questions designed to identify progress toward the achievement of each component of the core capabilities. The checklist questions are scored on a three-point scale: "Yes" (achieved), "No" (not achieved), or "Partial" (partially achieved). The scored components are then used to derive a level of achievement (i.e., the extent to which the standard is met) for each core capability.

The DNA conducted in Uganda covered the National TB and Leprosy Program (NTLP) and other stakeholders at the national level; the National TB Reference Laboratory (NTRL); 27 hospitals (public and private); and 22 primary care facilities (a total of 49 facilities) in 10 purposively selected geographic areas (Appendix A, Table 19). Regions, districts, and facilities were selected by the NTLP and NTRL, with the aim of including a range of laboratories at various levels of the health system, including private sector and nongovernmental organization (NGO) TB diagnosis facilities.

The data for the DNA are essentially qualitative. The questions, which represent individual standards, are given the responses "Yes, standard is met," "No, standard is not met," or "Partial – standard is partially met." The facility survey results are scored to quantify them according to the following logic: Yes = 1, Partial = 0.5, No = 0.

The scores are aggregated across facilities to derive a score representing the overall performance for the standard in the Uganda NTLP. Scores for individual questions are summed across facilities and divided by the total number of facilities to derive a percentage achievement. Because not all questions are appropriate for all facilities (for example, some are targeted to reference laboratories), the number of sites contributing to the score is also included in the Excel-based data collection tool.

The DNA was conducted at four to six sites in each of the 10 sub-regional focal areas (Appendix A, Table 19). Data from the Masaka focal area were missing from the data file obtained from the survey team. Therefore, a

[5] The results of the Uganda TB Diagnostic Network Assessment are not available online.

[6] Humphrey, W.S. (1988). *Characterizing the software process: A maturity framework.* Software Management. Retrieved from https://faculty.cs.byu.edu/~rodham/cs428/cmm.pdf.

total of 43 sites only in the nine focal areas are included in the analysis presented in this report. (See Figure 1 below for a map of QTSA and DNA sampled districts.)

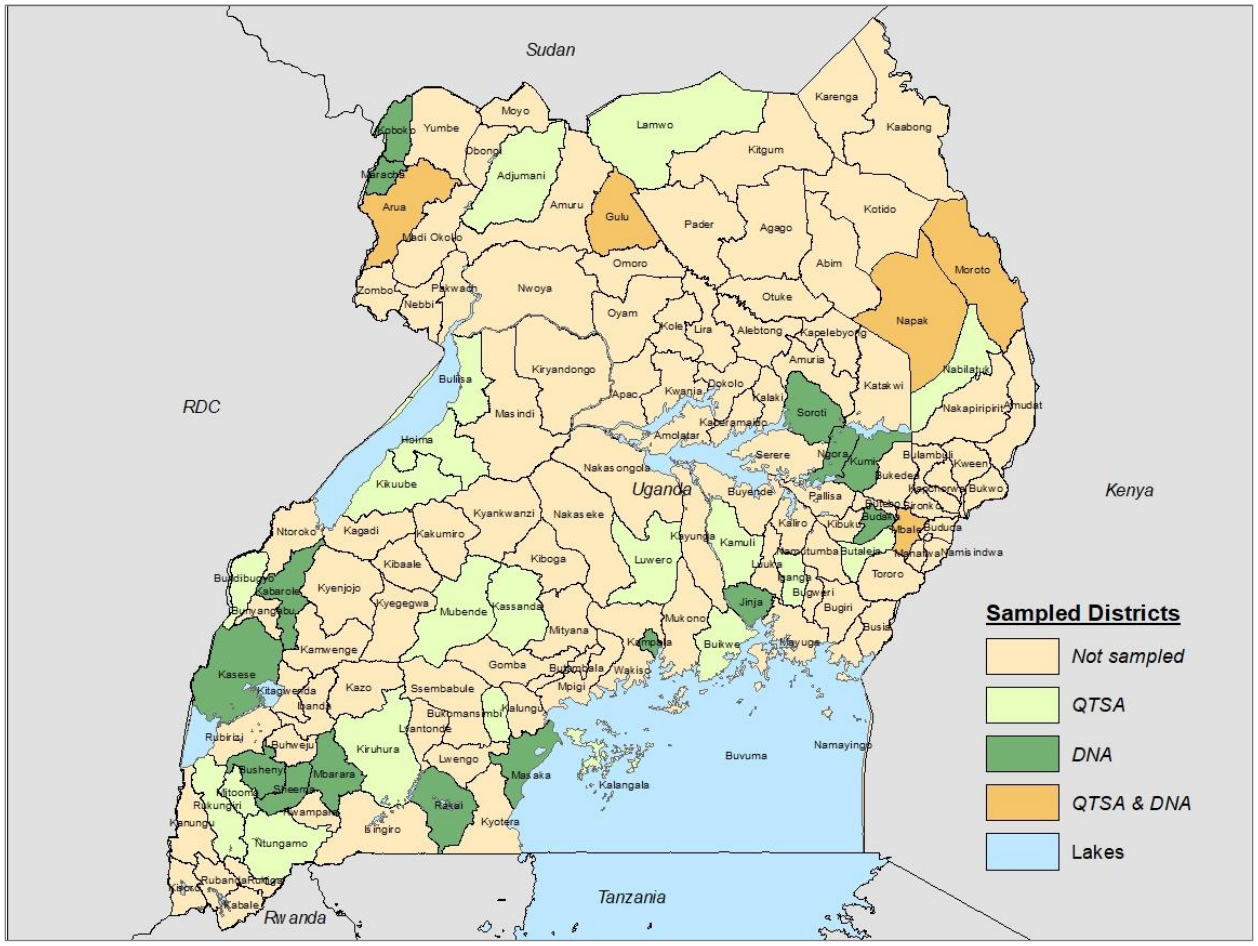


Figure 1. Map of QTSA & DNA Sampled Districts

Quality of TB Services Assessment

The QTSA is a MEASURE Evaluation tool designed to assess the quality of TB service delivery in multiple countries. The survey includes a facility audit, provider and client interviews, and a register review. A QTSA was conducted in Uganda in 2019. QTSAs have also been conducted, or are in the planning stages, in Afghanistan, the Democratic Republic of Congo, Ethiopia, Kyrgyzstan, Nigeria, and the Philippines during the period 2017 to 2020, by MEASURE Evaluation and subsequently, the TB Data, Impact Assessment and Communications Hub (TB DIAH) project, also funded by USAID.

Quality is assessed according to a framework model, which posits that access to and the availability of skillfully delivered services leads to quality of care. Quality of care consists of three key elements: structure or

the resources available at a health facility; process or the interaction between providers and patients; and outcomes or the consequences of care.[7]

The framework provides a logical pathway, linking key components of quality of care, including policy and regulations, infrastructure, providers' competency, service environment, and infection control, which, when well-functioning, lead to the desired health outcomes. Using this pathway to measure the key data elements for each component provides policymakers and program managers with the information they need to identify problem areas and to take action to improve the quality of TB service delivery.

The key components and elements of quality care are:

- Structure: Health facility infrastructure, medical equipment, drugs, and supplies; staff numbers and their characteristics; and other resources, such as funding payment schemes and incentives.
- Process: The interaction between service providers and patients, during which structural inputs from the healthcare system are transformed into health outcomes. Process is contextualized as "what is done" and "how it is done" (i.e., the actual delivery and receipt of care).
- Outcome: The consequences of care. Outcomes are measured in terms of health status and critical services, such as proper diagnosis and case notification; adherence to treatment regimens; treatment outcomes; and ultimately, incidence, prevalence, and death rates.[8]

The facility audit component of the QTSA aligns most readily with the DNA and was the primary resource for comparisons between the two surveys. Table 20 (in Appendix A) shows the different categories and sub-categories of the facility audit.

The Uganda QTSA was a nationally representative cross-sectional study conducted at diagnosis and treatment health facilities across nine of the 10 Uganda AIDS Indicator Survey regions, and the North-East region (Karamoja). Two hundred and sixteen TB diagnosis and treatment facilities (public and private) were randomly selected from among 1,583 facilities using a multistage sampling procedure (Appendix A—Table 21). (Details on the methodology for the Uganda QTSA are given in the study's technical report.[8])

Comparisons Between the Surveys

The quantitative output from the QTSA was used to complement the semi-quantitative output from the DNA in an effort to compile an in-depth understanding of the availability and readiness of TB diagnosis services. Not all content from across the two surveys was comparable. For example, the QTSA contains extensive content about the quality of TB treatment services, which is not covered in the DNA. The DNA has sections on policy and planning that are not addressed in the QTSA. Therefore, comparisons were only drawn for those aspects of the surveys that pertained to TB diagnosis and diagnosis capacity.

[7] Donabedian, A. (2005). Evaluating the quality of medical care. *The Milbank Quarterly*, 83(4), 691–729. Retrieved from https://onlinelibrary.wiley.com/doi/full/10.1111/j.1468-0009.2005.00397.x.

[8] Oyediran, K., Kirenga, B., Turyahabwe, S., Davis, N., Chauffour, J., Muttamba, W.,,,, Muyinda, H. (2020). *Quality of tuberculosis services assessment in Uganda: Report* (TR-20-398). Chapel Hill, NC, USA: MEASURE Evaluation, University of North Carolina. Retrieved from https://www.measureevaluation.org/resources/publications/tr-20-398.

Mapping Indicators Across the Surveys

Qualitative Comparison

The DNA results comprise a self-assessment using a standard template (adapted to the country context) that was completed by in-country NTLP personnel and validated by an external field assessment team. In conjunction with national stakeholders, the external team drew conclusions and made recommendations, informed by an extensive desk review conducted before the in-country visit. Many of the high-level findings constituted well-informed judgments by experts, and other findings were observations with no objective "indicator value." Although these types of results can accurately describe the functionality of a TB diagnostic network in-country especially with the input of qualified experts, they are inherently subjective and qualitative in nature, and problematic to compare with quantitative estimates. Nevertheless, they represent a rich source of information on diagnosis performance. Therefore, an initial comparison, henceforth termed "qualitative," was made of the DNA results against those of the QTSA. For each of the ten standards in the TB diagnosis network, high-level results are presented, along with the self-assessment and validation scores. Key findings are presented along with the questions (i.e., indicators) from the validated self-assessment, from which the quasi-quantitative scores derive. The QTSA survey estimates for matching indicators are presented alongside for comparison purposes.

Quantitative Comparison

Survey questions (i.e., indicators) were mapped between the DNA and QTSA, where possible, to permit direct comparisons for certain aspects of TB diagnosis. These comparisons were used to assess and corroborate evidence of performance across the surveys. Indicators with the greatest degree of matching (e.g., on indicator definitions) were identified and constitute a priority indicator set for subsequent analyses. Values for these indicators were then compared across the surveys for the national level (aggregate overall facilities). Although only the QTSA employed probability sampling in the selection of facilities, comparing values from QTSA with values from the DNA gives an understanding of the DNA results and their relationship to estimates derived from a probability sample. Given the sound sampling methodology of the QTSA and the close match in indicator definitions, the QTSA results can serve to validate the results derived from the DNA.

The percentage difference between the QTSA survey values and the DNA scores was calculated for national-level estimates to gauge how closely the results concurred. Results for the DNA were dichotomized (by setting the "partial" responses to zero) to make them more comparable with the QTSA.

The facilities that participated in both the DNA and the QTSA (n=11) offer an opportunity to compare facility-level results for the priority indicator set. In some cases, the indicators are similar, but not an exact match; where necessary, guidance is included to assist in understanding the specific differences between the matched survey questions. Indicators are organized by type—either availability or readiness.

Index of Availability and Readiness

Availability is indicated by whether a facility provides a service. Readiness is reflected by the extent to which important elements of service delivery are present and functional at a given time. Elements of readiness are defined as recent training, the availability of guidelines and other technical documentation (decision support tools, flowcharts, algorithms, etc.), and the availability of standard inputs required to perform the service (e.g., consumable commodities, such as personal protective equipment [PPE], test kits, and reagents). Composite indices for TB diagnosis availability and readiness were created from relevant indicators across the surveys to produce scores that can help guide the monitoring of system performance and the development of interventions to improve performance. The indices combine data elements for aspects of availability and readiness, as follows:

- Availability: the service is offered
    - Specific diagnostic testing is offered, according to the national algorithm
        - Mycobacterium tuberculosis (MTB): screening, diagnosis, and follow-up, by type
        - DST (first- and second-line drugs), by type
- Readiness
    - Training: staff have received the appropriate training (in the past 1–2 years), by type
    - Existence of technical manuals and other guidance, by type
    - Supervision and QC/QA mechanisms are in place
    - Required inputs are present
        - Test kits, GeneXpert cartridges, reagents, PPE, materials for proper specimen handling, etc.

A scoring system was developed whereby a given data element was scored "1" if present and "0" if absent. In the DNA survey, a "partial" response was possible, which was given a value of 0.5. For certain data elements in the QTSA, a similar response pattern was available, whereby an attribute that was present and "observed" by the survey team was given a value of "1," and if present but "not observed," it was given a value of 0.5. The index of availability and readiness was calculated as the sum of the indicator-specific scores divided by the number of indicators in the index (minus those indicators deemed "not applicable"). The index was computed for each facility for each survey and across facilities (n=11). The extent of congruence of indicator values in each facility was also calculated and then averaged across facilities.

Research Questions

For the comparison of different surveys measuring the performance of the TB diagnosis network in Uganda, we sought to determine:

- What is the availability, readiness, and performance of TB diagnosis services at health facilities in Uganda?
- How can data from QTSA surveys be used to complement the National TB DNA survey? Can a more comprehensive picture of TB diagnosis availability and readiness be produced by linking the results of the two surveys?

Results

Description of Survey Results

TB Diagnostic Network Assessment

The DNA revealed that the essential elements of an effective TB diagnosis network were in place and functional, but with critical components performing sub-optimally.

The assessment found a diagnosis network staff committed to the goals of the TB program and receptive to new procedures and techniques for enhancing performance, with strong leadership and clearly defined roles and responsibilities. Guidelines and policies were in place that support the TB NSP. There was a clear TB diagnosis algorithm centered on the use of WHO recommended rapid diagnostic tests (WRDs). A TB diagnosis reporting system was in place, with standardized forms and reporting protocols. Supervision of network laboratories was a prominent feature in the TB NSP and a specimen referral network was in place.

However, certain aspects of the TB diagnosis network were needed improvement:

- Although diagnostic testing was supposed to be widely available and free to the public, patients were charged for X-rays in some settings.
- The TB diagnosis algorithm did not fully address the patient pathway, from screening and diagnosis of patients through to treatment follow-up examination.
- At facilities that did not have a GeneXpert machine onsite, WRDs were available for all HIV-positive patients evaluated for TB (via specimen transport), but not for HIV-negative patients.
- Although TB information system forms were standard, they were not used in all settings.
- Although there was a supervision system in place by tier, resources and staffing were inadequate for supervision of the peripheral levels of the health system by the regions.
- The specimen referral system suffered from turn-around-times (TATs) of up to 14 days due to a specimen transfer system that did weekly specimen transfers. [9]

Summary results from the DNA are provided in Appendix A, Table 22.

Quality of TB Services Assessment

Although the QTSA measures the quality of several aspects of TB diagnosis and treatment, only the findings pertaining to the diagnosis network are given here. The QTSA found wide availability of TB screening and diagnosis (100% screening, 100% diagnosis) with only two percent of facilities reporting having access to offsite testing (83% had access to onsite testing, or both onsite and offsite diagnosis). The percentage of facilities found to offer different TB diagnosis services were:

- Clinical symptoms and signs 98%
- X-ray 12%
- Smear microscopy 96%
- Culture 2%
- GeneXpert 42%
- LAM (urine test) 39%

[9] Joint Assessment of the Tuberculosis Diagnostic Network of Uganda, August 25 – September 6, 2019, Final Report

For specimen management, the QTSA found that 60 percent of the facilities had approved laboratory request forms available on the day of the survey, and 30 percent had experienced stockouts of any specimen management supplies. Sixty-six percent of the facilities had SOPs for specimen collection. Hospitals were more likely to have standard forms and SOPs compared with health centers or clinics.

The average TAT for smear microscopy results was 8.5 hours, ranging from 7 hours for hospitals to 14 hours for Health Center (HC) IIs. For GeneXpert, the average TAT was 108 hours (ranging from 22 hours for the regional referral hospital (RRH), to 36 hours for hospitals, to 135 hours for HC IIIs).

As for QC/QA, five percent of the sampled sites had only internal QC systems, whereas 24 percent had only external systems. About 65 percent had both internal and external QC mechanisms. Very few facilities (<2%) had no system in place.

Summary results from the QTSA on TB diagnosis are found in Appendix A, Table 23.

Comparisons Between the Surveys

Qualitative Comparison of Results Across Surveys, by Core Capacities

The DNA indicators and QTSA indicators were mapped to one another according to DNA core capacity areas. The core capacities consist of individual questions organized by component or sub-category of the core capacity. Results of comparisons are presented as the number of sites assessed ("No. Sites") and the percent of these sites responding affirmatively ("% Yes"). Not all questions are asked at all sites since not all services are performed at all sites.

Table 1. Mapping results for the DNA/QTSA: Core Capacity 1

Core Capacity 1: Political, legal, regulatory, and financial framework The country has a fully endorsed political, legal, and regulatory framework in place that supports the achievement of the NSP, and that organizes and controls all public and private diagnostic services to support the NSP, with sufficient dedicated funding available. Policies are in place that enable the continuous, country-wide availability of free, quality-assured diagnosis according to the national guidelines.				
No.	Components/ questions	Self-assess-ment score	Validated score	DNA findings
1.1	Legislation and policies	4	4	Many policies and plans were in place and were enforced. No legislation was in place.
1.2	National TB policies and plan	3	3	National TB Laboratory Strategic plan (2019–24) was in draft stage. The NTRL had policies for specific technical key areas (e.g., network), which were in line with the NSP and were partially implemented.
1.3	Governance	5	5	All laboratories were under the National Health Laboratory Services and Diagnosis with inter-ministerial coordination.

1.4	Financing and budgets	2	2	Copies of budgets were not available at individual facilities. Funds were available to cover all network management activities at all levels, but did not cover all external quality assurance (EQA) and supportive supervision.

Other Key Findings

Overall, there was a well-structured laboratory network with many policies and guidelines developed:

- National TB Laboratory Strategic Plan: draft; awaiting approval
  - Lab extensively covered in the NSP, with targets, budgets, and timelines, and implementation already started
  - Thirty of 46 sites reported that funding for lab activities was adequate for diagnosis services; however, future diagnosis strategies, (e.g., Xpert Ultra testing for all presumptive TB cases), was not fully funded.
- Supervisory functions (e.g., EQA, onsite evaluations, blinded rechecking) were not fully funded or resourced.
- TB diagnostic tests were provided for free in public sector facilities for people evaluated for TB
  - In some settings patients had to pay for chest X-ray.
  - In some settings X-ray machines were not working.

Comparison of results from the DNA and QTSA

DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 1.2. National TB policies and plan							
1.2.4	Does the laboratory report the detection of TB cases or DR-TB cases to the local TB control program?	42	96%	3.3.1	Does this facility report TB patients to the NTLP?	215	99%
Component 1.4.Financing and budget							
1.4.3	Verify the availability of free laboratory tests and chest X-ray at each level of the network	25	88%	2.1.2.1	Screening X-ray	24	63%
				3.1.2.4	Diagnostic X-ray	26	50%

For Core Capacity 1, the QTSA only aligned on certain questions (Table 1). For example, whether the laboratory reported to the NTLP, and a question on the availability of no cost X-rays for TB screening and diagnosis. The latter question helps determine whether the policy on no cost testing was followed at the level of the health facility or laboratory. The QTSA does not address governance or financing of the NTLP or the laboratory network.

Table 2. Mapping results for the DNA/QTSA: Core Capacity 2

Core Capacity 2: Structure and organization of the diagnosis network

A sustainable, rational, and efficient TB diagnosis network provides integrated, essential, quality diagnosis services for patient care and public health. The TB diagnosis network is coordinated by a national reference or public health laboratory, and includes the public and private sector and community-level diagnosis services. All facilities have clearly defined terms of reference and are adequately supervised.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
2.1	Diagnosis network	3	3	Community screening was done in some districts or in some portions of a district. Laboratory services were available in most communities onsite or by referral of samples to testing hubs.
2.2	Coordination and management	5	4	There was little or no communication within laboratory tiers. Meetings were not held at regular intervals; instead, they were scheduled on an ad hoc basis. There was good communication between NTRLs and lower-level laboratories.
2.3	Programmatic and operational research	4	4	High-quality research was conducted at the NTRL. Little research was conducted at or by peripheral laboratories.

Other Key Findings:

- The NTRL did not have adequate oversight of the TB laboratory network, including oversight of operations, data quality and management, and supply chain management of Xpert cartridges.
- Some private and academic institutions were functionally integrated in the network; otherwise, there was limited engagement of private (commercial) sector laboratories.
- Decentralization of diagnosis services, such as screening or sample collection at the community level, varied by region. A recently intensified case finding project will foster decentralization.
- Written documentation of roles and responsibilities were not always available.

Comparison of results from the DNA and QTSA

DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 2.1. Diagnosis network							
2.1.3	Are basic TB laboratory services (e.g., screening, referral for testing, specimen collection) decentralized to the community level?	13	77%	2.5	Some health facilities use village health teams (VHTs) or community linkage facilitators to provide additional support to TB patients. Does this facility work with VHTs, community linkage facilitators, or	216	96%

					volunteers who support TB patients?		
	If yes, are community-level services provided by public sector and private sector providers?		80%		Public	167	96%
					NGO/Private	27	93%
					Faith-based	22	100%

Similar to Core Capacity 1, few questions in the QTSA map to the DNA Core Capacity 2 (Table 2). Sub-question 2.1.3 concerning decentralization of TB laboratory services covers community-level providers conducting community outreach from public facilities, pharmacies, etc.[10] The QTSA question is specific to VHTs or community linkage facilitators, who are expected to conduct screening as part of TB contact tracing. Although Core Capacity 2 calls for clear terms of reference and adequate supervision, the QTSA does not address terms of reference, other than the existence of national plans and guidelines. Supervision is also covered in Core Capacity 9.

Table 3. Mapping results for the DNA/QTSA: Core Capacity 3

Core Capacity 3: Coverage

The national TB diagnosis network provides complete coverage and universal access to TB diagnosis services to the entire population of the country. Referral mechanisms exist to refer specimens rapidly and safely to the appropriate level for testing and to provide timely results to enable the initiation of appropriate treatment. An efficient diagnosis-clinical interface allows for appropriate diagnostic tests to be ordered and performed and ensures the timely linkage of diagnosed patients to appropriate care and treatment.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
3.1	Diagnosis network coverage	3	2	Lists and geographic information system maps of some sites (Xpert testing hubs) exist at the national level, but 10 of 43 sites did not have lists, and only half of the sites had lists of diagnostic tests available at other sites.
3.2	Sample referral system	3	2	Most people are trained in the specimen referral system, although 13 of 49 laboratories reported gaps in training. Competency testing and sanctioning with a certificate were not routinely done.

[10] TB Diagnostic Network Assessor's Manual April 2019

3.3	Linkages	4	2	Formalized procedures were in place in some settings. Eleven of 27 sites did not have formalized procedures. Some sites simply reported results to the clinician who was responsible for linkage to care.
3.4	Emergency preparedness	4	2	Eight of 49 sites did not have contingency plans. Many contingency plans were informal agreements without written documentation.

Other Key Findings:

- Onsite testing or referral services for Xpert Ultra testing for patients with presumptive TB was available in all districts, although the extent of coverage varied by district.
  - At Xpert testing sites, Xpert was available for all persons presumed to have TB.
  - At sites that referred specimens for testing, Xpert was only available for priority populations (e.g., HIV-positive persons).
  - GeneXpert instruments were underutilized in some settings (<50 tests per month) and overutilized in some settings (>30 tests per day).
- There were clear procedures in place to link persons with presumptive pulmonary TB to testing at 36 of 47 facilities.
  - Screening of all patients to increase the identification of presumptive TB was not consistently implemented at the entry point.
- A well-developed, shared system for specimen referral (hub system) was in place.
  - There were good procedures for tracking shipments, but no nationally implemented procedure for tracking individual TB specimens.
  - The Central Public Health Laboratories (CPHL) had piloted a system for tracking individual HIV specimens.
  - Most staff were trained on specimen collection, packaging, and transport.
  - Proper triple packaging was used routinely, but 24 of 47 sites reported stockouts of packaging material.
  - The motorcycle system was dependent on partner support. There were challenges with maintenance, repair, replacement, and fueling of motorcycles.
  - The transition from Posta Uganda to CPHL vehicles for higher-level referrals initially resulted in an increase in the TAT but was improving.
- The impression from the site visits was that the frequency and timing of sample pick-up and the manual return of results were the key determinants of TATs.
  - TATs for Xpert tests through the hub system varied from two days to 14 days.
  - TATs were two hours to 24 hours at sites that had GeneXpert.
- The design of referral system would benefit from network optimization that includes consideration of both TB and HIV needs.
- Data collection tools and a monitoring and evaluation framework with defined indicators were in place but were not always used at every level. There was a slow implementation of monitoring indicators at the hubs.

Comparison of results from the DNA and QTSA

DNA No.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 3.2 Sample referral system							
3.2.3	Are SOPs for specimen referral available? Does the laboratory adhere to the SOP for transport of all specimens?	42	74%	14.7.2	Do you have SOPs for QC (either internal or external) for the specimens assessed in this facility?	198	78%

3.2.4	Are systems in place for referring samples from collection sites to the primary testing laboratory and from primary testing laboratories to secondary testing laboratories?	42	98%	15.1.3	Are there approved laboratory request forms? (observed)	216	62%

The QTSA gauges the capacity for testing by measuring the availability of different diagnostic tests, including GeneXpert for certain priority subpopulations (e.g., pediatric) and availability of GeneXpert Ultra cartridges, and recent training of facility staff. The DNA covers the distribution of GeneXpert quite extensively and discusses the availability of this method for priority sub-populations (e.g., HIV-positive TB patients). GeneXpert was available onsite at 42 percent of the facilities sampled in the QTSA and Xpert Ultra cartridges were available at 44 (49%) of those facilities. The availability of GeneXpert is also discussed under Core Capacity 4.

As to specimen referral systems (Component 3.2), the DNA asks about SOPs for referral whereas the QTSA asks about SOPs for specimen collection and for QC. The DNA asks about systems for referring samples from collection sites to testing laboratories; the QTSA asks about the use of approved laboratory request forms (a component of specimen referral) (Table 3).

The DNA found that the TAT for specimen referral for Xpert tests through the hub system varied from two days to 14 days, although the TAT for Xpert tests done onsite was only two to 24 hours. The QTSA found similar results: the median TAT for results from onsite laboratories was three hours compared with 168 hours for offsite labs (7 days) (Table 4).

Table 4. Turnaround time reported by service providers for GeneXpert in hours, by location of testing and facility type, QTSA

Facility type	# sites	Onsite		Offsite	
		Mean	Median	Mean	Median
Hospital	28	29	3	88	72
HC IV	36	35	2	107	120
HC III	137	123	78	139	168
Other	15	85	85	114	156
	216	**71**	**3**	**133**	**168**

In the DNA, Core Capacity 3 is primarily about coverage of TB diagnosis services, with the goal of establishing whether coverage ensures that laboratory facilities met the estimated needs for the basic TB testing package available in all districts or in such a way that more than 80 percent of the population was at a maximum of 5 km (or 1 hour travel time) away from the lowest laboratory tier in each district. This question relates to the geographic coverage of the network and is dependent on the availability of an up-to-date map and inventory of laboratories in the country. It also depends on an estimate of the country's need for TB diagnosis services based on epidemiology, patient accessibility, specimen referral networks, and national diagnosis algorithm. The QTSA does not provide any information on the adequacy of the coverage of services beyond the availability of services at specific sites.

Table 5. Mapping results for the DNA/QTSA: Core Capacity 4

Core Capacity 4: Diagnosis algorithm

A national TB diagnosis algorithm(s) that is responsive to the epidemic, patient-centered, includes the appropriate use of diagnosis technologies, is based on the current structure of the health system, and is enforced at all levels of the TB diagnosis network. A minimum package of tests and quality standards is defined for each level of the network. Laboratorians, healthcare workers, and TB program staff are trained in the application of the algorithm.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
4.1	Algorithms	3	3	WRDs were available for all HIV-positive patients evaluated for TB, but WRDs were not available for all HIV-negative persons at sites that did not have GeneXpert. The algorithm clearly addressed laboratory aspects of the diagnosis cascade, but the pre-analytic and post-analytic phases of diagnostic services were not fully addressed.
4.2	Detection of TB	5	3	The network had the capacity to conduct full diagnostic testing required by the national algorithm. WRDs were being used according to the algorithm. However, there were gaps in testing for pediatric TB and extrapulmonary TB.
4.3	Detection of drug-resistant TB	5	3	WRDs were used for rifampicin testing, but not for all bacteriologically confirmed patients (e.g., smear-positive HIV-negative patients at sites lacking GeneXpert). DST for isoniazid was available at the NTRL but was rarely done.

Other Key Findings:

- The 2019 algorithm clearly addressed the laboratory aspects of the diagnosis cascade, but there were gaps in the patient pathway from identification of presumptive patients (screening) to diagnosis, treatment, and monitoring, in both the algorithm and its implementation.
- A draft 2019 national diagnosis algorithm that incorporated the use of rapid diagnosis test formed the basis of TB diagnosis services.
- Staff at all levels of the network were aware of the 2019 diagnosis algorithm and the algorithm was properly implemented in 40 of 48 facilities. However, at some sites, Ultra testing was not well understood, especially at the eight sites that were not following the 2019 national algorithm.
- There appeared to be limited understanding among healthcare workers (HCWs) of the TB cascade and how to use it to close gaps in TB detection and outcomes.
- Access to molecular DST for rifampicin was widely available onsite or by referral. DST for isoniazid was not readily available.
- Access to DST for key second-line drugs was available by referral for all RR-TB patients at 37 of 43 facilities.

Comparison of results from the DNA and QTSA							
DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 4.1. Algorithms							
4.1.1	Is the current national TB diagnosis algorithm available and followed for all testing?	41	87%	8.1.2.1	Clinical algorithm to determine if a child has TB (physical exam) (yes-unprompted)	190	85%
				10.1.1	Flowcharts or algorithms on TB screening, such as the intensified case finding (ICF) form or the Uganda TB diagnosis and screening algorithm? (yes, observed)	216	88%
				10.2.1	Flowcharts or algorithms on TB diagnosis (yes, observed)	215	79%
4.1.3	Are the national guidelines for evaluating patients and using X-ray findings followed by all clinicians?	11	91%	10.1.2	Guidelines for diagnosis and treatment of TB among children (yes, observed)	216	84%
				11.1	Screening algorithm for TB	216	88%
				10.1.3	Guidelines for diagnosis and treatment of TB among adults (TB manual) (yes, observed)	216	82%
				10.2.2	Guidelines on the use of chest X-ray for TB screening and diagnosis (yes, observed)	215	16%
					Did any providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months?		
4.1.4	Has training on diagnosis algorithms, testing methods, specimen collection, test requisition forms and specimen referral been provided to:			11.1	Training for: Screening algorithm for TB (by management authority)		
	• Public sector laboratorians?	12	92%		Public	167	87%
	• Private sector laboratorians?	13	81%		NGO/Private	27	89%
	• Public sector clinicians and other providers?	11	86%		Faith-based	22	91%
	• Private sector clinicians and other providers?	12	75%	11.2			
	• TB program staff?	9	83%		Training for: Screening or diagnosis of TB based on X-rays (by management authority)	216	37%
					Public	167	35%

					NGO/Private	27	37%
					Faith-based	22	50%
				11.3	Training for: Diagnosis of TB based on clinical symptoms or examination for adults (by management authority)		
					Public	167	84%
					NGO/Private	27	89%
					Faith-based	22	91%
				11.4	Training for: Diagnosis of TB based on sputum tests using smear microscopy (by management authority)		
					Public	167	82%
					NGO/Private	27	82%
					Faith-based	22	86%
				11.5	Diagnosis of TB based on sputum tests using culture (by management authority)		
					Public	167	28%
					NGO/Private	27	22%
					Faith-based	22	23%
				11.6	Diagnosis of TB using GeneXpert (by management authority)		
					Public	167	71%
					NGO/Private	27	78%
					Faith-based	22	77%
4.1.4	Are healthcare workers involved in the TB diagnosis cascade provided with standardized sensitization content (e.g., algorithm diagrams, brochures, training materials, customer handbook)?	17	85%	10.1.1	Flowcharts or algorithms on TB screening, such as the ICF form or the Uganda TB diagnosis and screening algorithm? (yes, observed)	216	88%
				10.1.6	TB posters on walls, leaflets, brochures, and/or pamphlets for distribution, (i.e., educational materials about TB)	216	57%

Component 4.2. Detection of TB							
4.2.1	Is rapid molecular DST for rifampicin available onsite or by referral for all priority groups identified in the NSP?	42	93%	3.2.1	Has this facility provided testing to presumptive or confirmed TB patients to see if they are resistant to first-line TB drugs in the past 12 months (i.e., DST)?	215	68%
				3.2.2 (a)	(a) Has this facility referred patients elsewhere for DR-TB diagnosis (DST) in the past 12 months?	215	46%
				3.2.2 (b)	(b) Is there a record or register of patient referrals for DR-TB diagnosis?	99	84%
				3.2.2 (c)	(c) Are the results recorded?	83	96%
4.2.1	Are WRDs available for all persons with signs and symptoms of TB?	42	76%	3.1.5	Diagnosis of TB by GeneXpert	215	42%
				3.1.6	Diagnosis of TB by LAM (urine test)	215	39%
				2.2.2	Is TB diagnosis at this facility (unit or clinic) done by an onsite laboratory, offsite laboratory, or both?		
					Onsite lab only		15%
					Offsite lab only		2%
					Both onsite and offsite labs		83%
Component 4.3. Detection of DR-TB							
4.3.1	Is DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients? If yes, which first-line drugs (INH, RIF, ETH, PZA)?	42	96%	15.4.1	GeneXpert to detect resistance to rifampicin (or other molecular method)	146	98%
				15.4.2	Line probe assays (e.g., MTBDRplus to MTBDRsl)	146	7%
				15.4.3	Solid culture	146	14%
				15.4.4	Liquid culture	146	12%
4.3.1	Is rapid molecular DST for rifampicin available onsite or by referral for bacteriologically confirmed TB patients?	42	96%	15.3.1.2	GeneXpert	183	89%
				15.3.1.3	First-line DST (other than GeneXpert)	183	51%

Component 4.2. Detection of TB							
4.3.2	Is phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB?	36	85%	15.3.1.4	Second-line DST	183	31%
4.3.2	Is rapid DST (e.g., SL-LPA) for second-line injectable drugs and fluoroquinolones available onsite or by referral for all patients with RR-TB?	36	86%				
				6.5.2	DST for patients who were previously treated for TB (including GeneXpert)	216	86%
				6.5.3	DST for patients who fail to convert on treatment (including GeneXpert)	216	82%
				6.5.4	Any type of DST for suspected DR-TB (including GeneXpert)	216	66%

Core Capacity 4 had by far the most overlap with the QTSA (Table 5). For algorithms (Component 4.1), the DNA asks whether the algorithm was available and followed at facilities (87%), whereas the QTSA found that they were observed as available at the facilities (85%). As for training on the algorithm (and testing methods, specimen collection, test requisition forms, and specimen referral), the DNA disaggregated the question by function (clinician vs. laboratorian) and management authority (public vs. private). The QTSA did not disaggregate between clinician and laboratorian, but the results can be disaggregated by type (as above). For comparison, the QTSA has indicators for the different items in DNA 4.1.4, (i.e., testing methods, specimen collection, test requisition forms, and specimen referral). All disaggregation by type revealed comparable estimates to the DNA findings, with the notable exception of the use of X-ray for diagnosis. Only 37 percent of facilities received recent training on X-ray compared with the DNA finding of 83 percent for "TB program staff."

As for the detection of TB (Component 4.2), the DNA asks whether WRDs are available for all persons with signs and symptoms of TB. The result was 76 percent. In Uganda, WRD mainly means GeneXpert because this rapid molecular test has been adopted and implemented by the NTLP. The QTSA has two comparable questions: question 3.1.5, which asks whether GeneXpert is available at the facility (42%), and question 3.1.8, which asks whether GeneXpert is available by referral (87%, Appendix A Table 23). The percentage of facilities at which GeneXpert was available onsite *or* by referral was 96 (Table 13, below).

The DNA also asks whether laboratories have the capacity to conduct all the tier-specific diagnosis testing required by the national algorithm. The DNA result was 92 percent—Annex Table 22. At the time of the DNA and QTSA surveys, Uganda was transitioning from an algorithm put in place in 2017. The 2019 National TB Diagnosis Algorithm is given in Figure 2. Although the QTSA does not directly address this question, it is possible to derive a result by determining all diagnosis required by a tier and gauging the availability of those tests at each site.

For Component 4.3, Detection of DR-TB, the DNA found that facilities with DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients was 96 percent. The QTSA found that 68 percent of facilities offered DST onsite, whereas 46 percent referred patients elsewhere

(the percentage of facilities with DST onsite or by referral was 93%). (Appendix A Table 23, and Table 13 below.)

For phenotypic DST of second-line drugs (for patients with RR-TB) onsite or by referral, the DNA documented that 85 percent of facilities had this capacity, whereas the QTSA found only 31 percent of facilities with this capacity.

Figure 2. 2019 National TB diagnostic algorithm

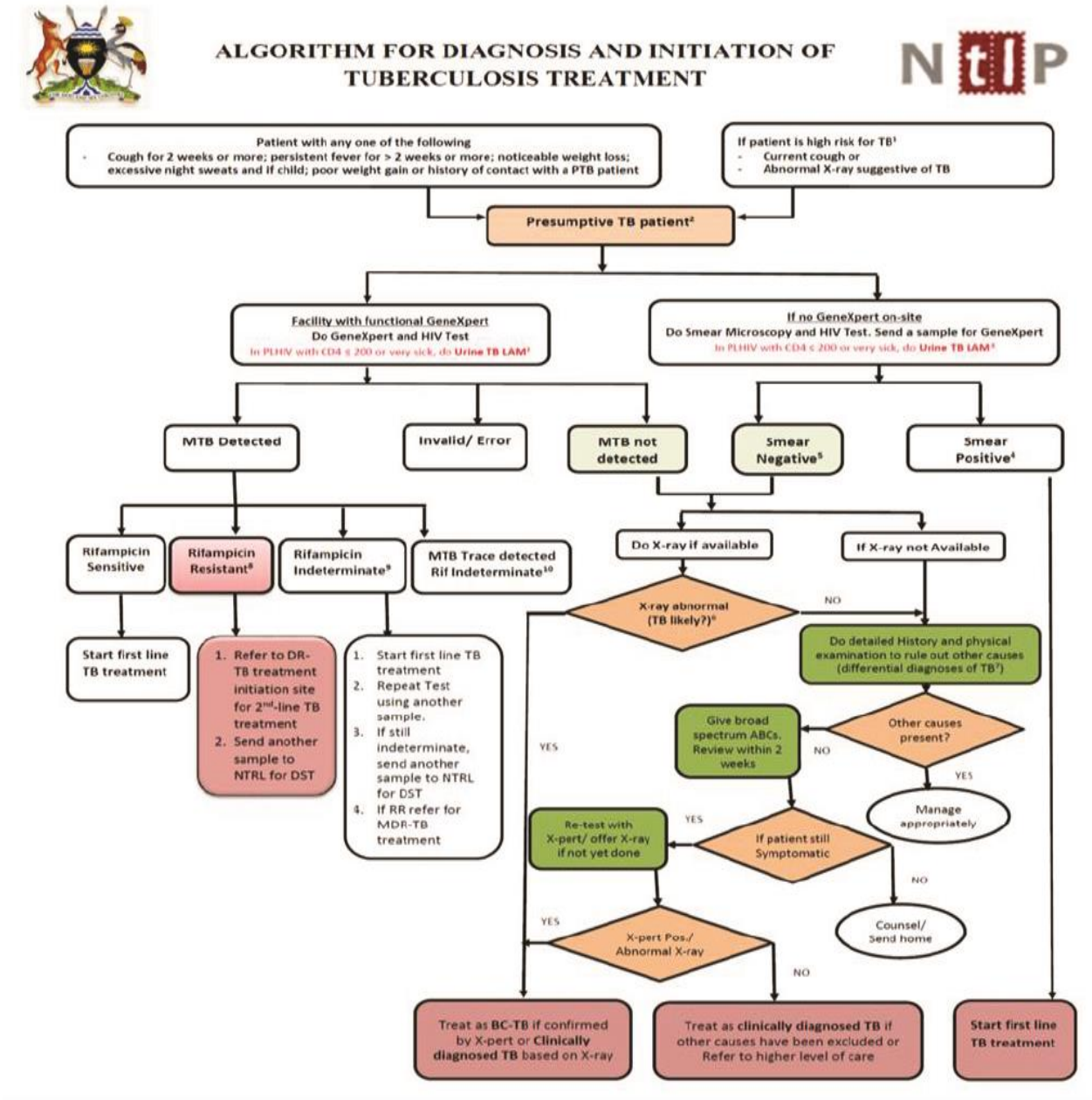


Table 6. Mapping results for the DNA/QTSA: Core Capacity 5

Core Capacity 5: Biosafety

Testing is performed in a manner and in facilities that ensure safety for the staff, the customers, the community, and the environment. Sufficient materials, means, and skills are available throughout the system to ensure safe and secure procurement, handling, storage, transportation, and disposal of samples and materials, in both routine and emergency circumstances.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
5.1	Facilities	2	1	National requirements for TB laboratories existed but they were not consistently applied. Seven of 49 laboratories had inadequate space or ventilation. Seventeen of 49 laboratories reported issues with the availability of utilities (water, electricity).
5.2	Biosafety and biosecurity manual	3	2	A national biosafety manual existed but was not well implemented. Ten of 37 peripheral levels did not have a current biosafety manual or did not have biosafety requirements incorporated in SOPs. Documentation of risk assessments was not available. Biosecurity was not completely addressed.
5.3	Biosafety systems	2	1	Twenty-one of 49 laboratories reported that staff were screened for TB. Screening was most often only done on request and was not part of a scheduled health assessment. Twenty-nine of 49 facilities had occupational health services available.
5.4	Waste management	1	1	Fourteen of 46 laboratories did not have access to proper waste disposal facilities and some were burning waste in open pits or burn barrels.

Other Key Findings:

- Basic occupational health services and annual TB screening of HCWs were available in only 21 of 49 facilities.
- Ten of 47 sites did not have up-to-date biosafety manuals or SOPs. Few sites had conducted risk assessments. Stockouts of PPE (e.g., gloves, respirators) were reported.
- Fourteen of 46 laboratories did not have access to autoclaves, incinerators, or proper waste disposal facilities, and some were burning waste in open pits or burn barrels.
- National requirements for TB laboratories existed but they were not consistently applied. Seventeen of 49 laboratories were noted as having inadequate space, ventilation, electricity, or water.
- Designated safety officers were available only in some facilities, primarily in those enrolled in Strengthening Laboratory Management Toward Accreditation (SLMTA) training.
- Biosafety cabinets (BSC) were available in many RRH laboratories and most were certified annually. In-country capacity was available for certification and maintenance.

Comparison of results from the DNA and QTSA							
DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 5.1. Facilities							
5.1.2	Does the TB laboratory have adequate ventilation and physical facilities for the procedures being performed?	42	89%	14.5a	Is a biosafety hood or cabinet used in this facility?	211	12%
				14.5b	Was the biosafety hood or cabinet observed?	26	92%
				14.5c	Is the biosafety hood or cabinet functioning?	24	96%
				14.5.1	Is the biosafety hood or cabinet certified?	24	96%
Component 5.2. Biosafety and biosecurity manual							
5.2.2	Is the TB laboratory biosafety manual implemented and incorporated into SOP?	40	80%	14.6	(a) Does the facility have a NTLP Lab Manual?	211	50%
					(b) Was it observed? [If 14.6=Yes]	106	84%
				18.2.1	An updated and approved infection prevention and control plan (yes, observed)	216	46%
Component 5.3. Biosafety systems							
5.3.1	Are designated, trained safety officers available in all facilities? (part-time or full time)	25	92%	18.1.1	Has a staff member been designated as an infection prevention and control focal point with specifically articulated duties?	216	71%
5.3.2	Is safety equipment available (e.g., PPE)?	42	95%	18.3.10	Gowns, scrubs, or clinical coats (yes, observed)	216	88%
				18.3.11	Eye protection/goggles or face protection (yes, observed)	216	27%
				18.5.1	Are N-95 and FFP2 respirators (particulate respirators) readily available for staff? (yes, observed)	216	63%
				18.5.1.1	Have staff members been trained on the proper fit of the respirators?	149	58%
				18.5.1.2	How often do facility staff members use the N-95 and/or FFP2 respirators according to the national IPC guidance?		
					Never	149	11%

					Sometimes	149	54%
					Always	149	35%
					Don't know	149	1%
5.3.3	Are certified BSC available where needed according to international recommendations for the tests being conducted?	30	63%		As above (hoods or cabinets)		
5.3.4	Have all TB laboratory staff received health screening and training in signs and symptoms of TB in the past 1 year?	42	43%	18.1.7	Is a system in place to screen and evaluate staff for TB disease?	216	47%
				18.1.7.1	Have any staff been diagnosed with active TB disease in the last 2 years?	102	19%
Component 5.4. Waste management							
5.4.1	Are standardized procedures for collecting, storing, and disposing of waste implemented according to national standards?	40	88%	18.3.4	Medical waste receptacle (pedal bin) with lid and plastic bin liners	216	99%
5.4.2	Are adequate methods used to safely dispose of infectious waste?	39	85%	18.3.4	Medical waste receptacle (pedal bin) with lid and plastic bin liners (as above)		
				18.3.5	Other waste receptacle	216	82%
				18.3.6	Sharps container (i.e., safety box)	216	100%

The QTSA generally found lower prevalence of biosafety mechanisms and capacity at health facilities/ laboratories than did the DNA. The DNA and QTSA disagreed on the extent to which the biosafety manual was implemented (80% vs. 50% of facilities found to have a copy of the manual, without asking about the extent of implementation) (Table 6).

The DNA found that 92 percent of facilities had trained biosafety officers, whereas the QTSA found only 71 percent of facilities had a member of staff designated as an infection prevention and control focal point. As for PPE, the DNA found that 95 percent of facilities had such material available, whereas the QTSA found gowns, scrubs, or clinical coats in 88 percent of the facilities, N-95 respirators at 63 percent, and eye protection at 27 percent. Moreover, the DNA found that 43 percent of staff received screening for TB, whereas the figure was 47 percent for the QTSA (Table 6).

Table 7. Mapping results for the DNA/QTSA: Core Capacity 6

Core Capacity 6: Equipment and Supplies

Testing is performed with state-of-the-art and well-maintained equipment, and an uninterrupted supply of quality reagents and consumables using standardized testing methods throughout the country.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
6.1	Supply chain management	3	1	The National Drug Authority had responsibility for the regulation of in-vitro diagnostic. However, TB diagnosis did not yet appear on the list of approved in-vitro diagnostics.
6.2	Equipment management	1	1	There were no guidelines on the integration of multi-disease testing on the diagnosis platform (e.g., use of GeneXpert for TB and HIV testing) and multi-disease testing was conducted in only a few facilities as a pilot.

Other Key Findings:

- Procurement was managed through the National Medical Stores.
    - Delays in obtaining needed amounts of reagents and supplies had led to stockouts; logistics issues were noted.
- Stock cards were in place at some levels but not all, and forecasting and monitoring may not be well informed.
- A maintenance contract was available for GeneXpert instruments and was working well, but maintenance of microscopes was challenging at some facilities.
- Pre-service validation exists for GeneXpert instruments; post-market surveillance was not comprehensive.
- A list of approved equipment and reagents existed for the diagnosis network, but the list had not been updated since 2011.
- Lot-to-lot verification of reagents was performed in 20 of 24 laboratories.
- GeneXpert multi-disease testing was not present at most sites, although pilot projects sharing TB and HIV testing were being conducted.

Comparison of results from DNA and QTSA

There was no alignment of the DNA and QTSA for supply chain management or equipment management.

Table 8. Mapping results for the DNA/QTSA: Core Capacity 7

Core Capacity 7: Workforce

Adequate numbers of competent, well-trained, and motivated technical and managerial staff are available at all levels of the diagnosis network.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
7.1	Education and training	3	3	Competency-based educational curricula were in place for some categories of laboratory workers. The National Council of Higher Education reviewed and certified the curricula.
7.2	Staffing	2	1	Sixteen of 48 laboratories reported that they did not have sufficient staff for conducting diagnostic testing and EQA activities. It was not clear whether the entire TB-related workloads of laboratory staff were captured, and staff needs based on TB workloads may have been underestimated. Sixteen of 48 laboratories reported that they did not have sufficient staff for conducting diagnostic testing and EQA activities.
7.3	Human resources strategies and plans	3	3	A national policy for human resources was approved and available. Twenty-three of 42 laboratories reported that human resource strategies were being implemented.
7.4	Competency-based job descriptions	3	1	Six of 45 sites did not have standard, competency-based job descriptions. Seventeen of 48 labs did not conduct and document competency assessments.

Other Key Findings:

- Training for lab and clinical staff varied across sites, with some staff not trained.
    - Staff had access to training and continuing medical education; however, it was more sensitization than refresher training.
    - Staff from private laboratories were not included in some training sessions or meetings.
    - Staff received pre-service training, but there was no evidence of competency assessment before they started work.
    - Post-training competency was often not assessed or documented.
- Most laboratories reported that the available workforce was sufficient for diagnostic testing, but some laboratories (e.g., RRHs) reported that they did not have adequate staff for EQA services, such as blinded rechecking.
    - Training in laboratory management (Strengthening Laboratory Management Toward Accreditation and Lot Quality Management System) was available in some laboratories, primarily at RRHs, but was lacking at lower-level laboratories and in private laboratories.
- Competency assessments were not routinely done in many laboratories, did not include method knowledge questions, and were not documented in personnel files.
- Personnel files and related documents, (e.g., competency-based job descriptions) were not available at six of 45 sites.
- A licensing system was available; however, there was no certification body for lab staff.

Comparison of results from the DNA and QTSA							
DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 7.1. Education and training							
7.1.4	Have staff received pre-service or in-service training on quality, biosafety, and biosecurity practices?	14	86%	11.12	Staff received training (last 24 months) - TB infection control	216	82%
7.1.6	Are private sector laboratory staff included in TB diagnosis training? If yes:	26	77%	11.1	Screening algorithm for TB (disaggregated by management authority)	27	89%
7.1.6	Is in-service training available to keep laboratory staff up to date with laboratory technologies and guidelines?	40	76%		Did any providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months? (See breakdown of training by topic and management authority in DNA: 4.1.4)		

The comparison of DNA and QTSA for Component 7.1 (education and training) revealed comparable results. The DNA found that 86 percent of facilities had staff who had received pre-service or in-service training on quality biosafety and biosecurity practices, whereas the QTSA found 82 percent of facilities with staff having received training in TB infection control (Table 8). See Core Capacity 4 for more information on the training that TB control program staff received on various aspects of TB diagnosis. Apart from Component 7.1, the surveys did not align well for Core Capacity 7: Workforce.

Table 9. Mapping results for the DNA/QTSA: Core Capacity 8

Core Capacity 8: Diagnosis data management

Inter-operable and inter-connected electronic recording and reporting systems are in place that generate reliable data that are monitored and analyzed in real time. These systems comply with international standards to allow the rapid exchange of information in standardized formats at national and sub-national levels. A laboratory information management system provides up-to-date information about the status of the laboratories and is linked to the Health Management Information System of the country.

No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
8.1	Data collection forms	4	3	Four of 48 sites reported that the standard health management information system forms were not being used. Evidence of verification of request data was not available at sites. Procedures for tracking referred samples were not in place in 13 of 46 sites.
8.2	Reporting	0	2	Seven of 45 laboratories reported having an electronic system supporting the reporting of diagnosis data to clinicians for patient management. Results reporting forms did not include information on the interpretation of results and did not include all information relevant to Xpert Ultra results. Standardized reporting forms for lateral flow lipoarabinomannan assay (LF-LAM) were not available.
8.3	Data connectivity and remote monitoring	0	0	Diagnosis connectivity solutions had been implemented in four of 41 laboratories, but national policies and procedures had not been developed and implemented. The CPHL had implemented policies and procedures to connect and monitor all GeneXpert instruments in the CPHL (used primarily for HIV testing).
8.4	Data analysis and sharing	4	4	Quarterly and annual program reports were produced, but some sectors had no ready access.

Other Key Findings:

- The results of NTRL testing are returned directly to the clinician and not to the referring laboratory (e.g., RRH). In addition to being a shortcoming of 8.1.3, this violates a Stepwise Laboratory Quality Improvement Process Toward Accreditation/International Standards Organization requirement
- Standard test requisition forms are used but do not include all the required information needed for testing. Separate request forms for microscopy (examination books) and Xpert were used at some sites
- The current standard form for reporting test results does not reflect the use of Xpert Ultra and does not include information on the interpretation of results
- Standardized forms were being used for programmatic data collection (HMIS 105, 106a) but the forms were not reviewed or quality controlled in 13 of 45 sites
- The national forms for reporting laboratory statistics and KPIs are not always used, particularly in private laboratories and reporting to NTRL was not complete (e.g., 6 sites did not report Xpert test statistics in Q2 2019)
- There is a fully functional data unit that receives laboratory data from all levels, analyzes the data and generates reports. However, concerns with the quality of the data were raised by the NTRL

• Procedures governing data security were either unavailable or not implemented fully in 14 of 44 facilities							
Comparison of results from the DNA and QTSA							
DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 8.1. Data collection forms							
8.1.1	Are standardized request forms available for all testing and are they being used?	42	83%	15.1.3	Are there approved laboratory request forms? (Specimen collection)	216	62%

The QTSA does not address the management of laboratory diagnostic data in any depth so there was little to compare for this core capacity. Under data collection (Component 8.1), the DNA documented that standard request forms for all testing were available and used at 83 percent of sites, whereas the QTSA found approved laboratory request forms for specimen collection in just 62 percent of sites (without addressing the use of the forms) (Table 9).

Table 10. Mapping results for the DNA/QTSA: Core Capacity 9

Core Capacity 9: Quality of the diagnosis network High-quality diagnosis services producing accurate and reliable results are available throughout the network. Continuous quality improvement targets all facilities within the network and includes quality indicator monitoring, external quality assurance, and regular onsite supervision. A system of national certification is in place for all public and private laboratories within the network, and reference and referral level laboratories are accredited according to national or international standards.				
No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
9.1	Documents and document control	3	2	Document control systems were available at 31 of 48 laboratories. Lower level and private laboratories often did not have document control systems. Nationally approved documents (e.g., recording and reporting forms; key performance indicator data collection forms) were not available for all tests at 13 of 49 laboratories. Some documents (e.g., request forms for Xpert Ultra testing) were not up-to-date and did not include all information relevant for Xpert Ultra testing.
9.2	Quality assurance	2	1	Thirteen of 49 laboratories reported that they did not use internal quality controls. Documenting of internal quality control results was not done in many laboratories.
9.3	Quality management system	3	3	Thirty-six of 47 laboratories reported having a QC officer. Only 14 laboratories (mainly the RRHs) reported participating in a structured quality management system process (e.g. TB- Strengthening Laboratory Management Toward Accreditation).

9.4	Certification and accreditation	0	0	Certification standards were available in draft form, but were not yet approved (Guidelines for Registration, Licensing and Monitoring of Health and Veterinary Laboratories in Uganda, 2018, Draft). No laboratory certification body was available in Uganda.

Other Key Findings:

- Although quality policies and procedures were well-developed at the national level, there was not a well-developed system of supportive supervision in the TB diagnosis network.
  - RRHs had the mandate for supervision but did not perform supervisory activities in some regions.
  - Written feedback on supervision visits was uncommon.
  - EQA was in place for Xpert testing and microscopy; feedback on results was sometimes quite slow.
  - The position of QA officer was filled only in a few labs.
- Key quality indicators and performance measures (e.g., TAT) were not routinely reviewed or analyzed by laboratories; a review was conducted by the District TB Laboratory Supervisor but not consistently.
- Internal quality controls were not routinely used at all laboratories, especially microscopy centers.
- The National SOP manual was available, but SOPs were not readily accessible or available at lower-level laboratories.
- There were licensing requirements, but not certification standards for laboratories.

Comparison of results from the DNA and QTSA

DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 9.1. Documents and document control							
9.1.2	Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory?	43	85%		Policies, Protocols, and Guidelines: Do you have the following documents, and if so, may I see them?		
				10.1.0	Uganda NTLP Manual for Management and Control of Tuberculosis and Leprosy	216	67%
				10.1.1	Flowcharts or algorithms on TB screening, such as the ICF form or the Uganda TB diagnosis and screening algorithm?	216	88%
				10.1.2	Guidelines for diagnosis and treatment of TB among children	216	84%
				10.1.3	Guidelines for diagnosis and treatment of TB among adults (TB manual)	216	82%
				10.1.4	Guidelines for TB infection control	216	61%
				10.1.5	TB/HIV guidelines (i.e., management of HIV and TB coinfection)	215	85%

Component 9.2. Quality assurance							
9.2.2	Does the laboratory have standardized internal QC procedures in place for all tests?	42	65%	14.7	For smear microscopy tests, what type of QC and QA do you use in this facility?		
					None	211	5%
					Internal QC/QA only	211	5%
					External QC/QA only	211	24%
					Internal and external QC/QA	211	65%
					Don't know	211	1%
				14.7.2	Do you have SOPs for QC (either internal or external) for the specimens assessed in this facility? (14.7 1,2,3 only)	198	78%
9.2.5	Does the laboratory receive regular supervisory visits from a higher-level laboratory?	42	82%	12.1	Has a supervisor from any upper-level office come here on a supervisory visit in the past three months? (Yes, observed in the facility supervision book)	216	81%
					Disaggregated by management authority		
					• Public	167	79%
9.2.5	Are collaborating NGO and private laboratories included in the supervision program?	15	83%		• NGO/Private	27	82%
					• Faith-based	22	91%
	How many of the elements of supportive supervision are conducted? Review of quality indicators, results of proficiency testing, and corrective actions?	11	73%	12.1.4	The last time that a supervisor from outside the facility visited the supervisor discussed the performance of the facility based on TB service data	188	89%
	Are supervision reports available at the laboratory?	39	56%	12.1.6	Provide a record of written comments or suggestions from their visit (e.g., the documentation manual)	188	81%

For documents and document control (Component 9.1), the DNA asks about SOPs and job aids for TB diagnosis methods performed in the laboratory. Eighty-five percent of facilities were found to have them. For the QTSA, the questions that aligned the most with the DNA pertain to the availability of guidelines, (e.g., for diagnosis and treatment of TB among adults [82%] and children [84%], and the Manual for Management and Control of TB and Leprosy [67%]). Flowcharts or algorithms on TB screening, such as the ICF form or the TB Diagnosis and Screening Algorithm were found at 88 percent of the facilities (Table 10).

For Component 9.2, Quality Assurance, the DNA asks whether the laboratory has standardized internal QC procedures in place for all tests (found at 65% of the facilities). The QTSA sought a breakdown of QC/QA by type: internal, external, or both. Both internal and external QC/QA was found at 65 percent of sites, whereas external QC/QA was found at 24 percent. Five percent had internal QC/QA only, and the same percentage had none (Table 10).

As for supervision, the DNA documented that 82 percent of laboratories received regular supervision visits from a higher-level laboratory (56% had written feedback from the supervision visit), whereas the QTSA found that 81 percent of facilities had received a supervision visit in the past three months (81% had a written report). The DNA also asked whether private sector labs were included in supervision (83%), whereas the QTSA found 82 percent (Table 10).

Table 11. Mapping results for the DNA/QTSA: Core Capacity 10

Core Capacity 10: TB/HIV				
No.	Components/ questions	Self-assess-ment score	Vali-dated score	DNA findings
10.1	Legislation and policies	4	3	Excellent national policy was available that aligns with national TB and HIV policies and plans. Seventeen of 28 labs reported that isoniazid preventive therapy was implemented in accordance with national policy.
10.2	Structure and organization of the network	4	4	A national-level technical working group coordinated collaboration between TB and HIV diagnosis networks.
10.3	Coverage	4	4	The TB diagnosis network collaborated with the HIV diagnosis network about specimen transport (hub system, Posta Uganda, CPHL transport). A system was in place to track shipments of TB specimens, but a system was not in place to track transport of individual TB specimens or the return of results. The CPHL was piloting an individual specimen tracking mobile app using barcodes for HIV specimens.
10.4	Diagnosis algorithm	4	4	Forty-three of 43 sites reported that testing for HIV was available for all persons with signs and symptoms of TB. The LF-LAM test was being implemented in 29 of 45 sites, but there was variability in adherence to the national algorithm.
10.5	Workforce	4	2	Training was provided to HCWs on LF-LAM at some sites. However, the LF-LAM testing algorithm was not implemented as intended in some sites. Up-to-date sensitization material for LF-LAM testing was not available.
10.6	Diagnosis data management	4	4	TB, HIV, and TB-HIV statistical data were aggregated and reported by all regions and analyzed at the national level routinely for multiple purposes.
Other Key Findings:				

- LF-LAM testing was being implemented at many sites. However, there was some variability in adherence to the national algorithm and SOPs.
- Not all HCWs involved in LF-LAM testing had been trained on which patients should be tested, how to order the test, the limitations of the test, and how to interpret results.
- There was no EQA being conducted for LF-LAM testing.
- Rapid HIV testing was available for all persons with signs or symptoms of TB (onsite testing or by referral) at all tiers of the TB laboratory network.
- There were systems in place to link persons found to be HIV- positive with appropriate HIV treatment and counseling.

Comparison of results from the DNA and QTSA

DNA no.	DNA indicator	No. sites	% Yes	QTSA no.	QTSA indicator	No. sites	% Yes
Component 10.1. Legislation and policies							
10.1.1	Has the national policy on isoniazid preventive therapy been implemented in the laboratory?	26	58%	5.5	Was TB preventive therapy (TPT) offered in the past 12 months?	215	94%
				5.5.1	Type of TPT available -INH 100 mg (6, 9, 12 months or continuous) [5.5=YES]	203	94%
				5.5.2	Type of TPT available -INH 300 mg (6, 9, 12 months or continuous) [5.5=YES]	203	83%
				5.5.3	Type of TPT available -3HP (a combination of rifapentine and INH) [5.5=YES]	203	5%
				5.5.4	Type of TPT available -Q-TIB (a combination of cotrimoxazole, isoniazid, and vitamin B6) [5.5=YES]	203	2%
				5.5.5	Type of TPT available -Is TPT provided by someone other than a health worker (community support group, VHTs, community linkage facilitators, etc.)? [5.5=YES]	203	19%
Component 10.4. Diagnosis algorithm							
10.4.3	Does the laboratory have the capacity to conduct HIV testing onsite or by referral as required by the national algorithm?	36	100%	5.1	This facility offered the service at any time in the past 12 months - HIV testing and counseling for presumptive TB patients	215	99%
				5.2	This facility offered the service at any time in the past 12 months - HIV testing and counseling for confirmed TB patients	215	100%

10.4.4	Is the LF-LAM assay available onsite or by referral for priority HIV-positive patients?	39	64%	3.1.6	This facility offered the TB service onsite at any time in the past 12 months. - Diagnosis of TB by LAM (urine test)	215	39%
Component 10.5. Workforce							
10.5.1	Are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?	30	85%	11.11	Providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months - Management of TB/HIV coinfection	216	87%

For Legislation and Policies (Component 10.1), the DNA and QTSA aligned on the policy for TPT for HIV patients. The DNA asks whether the national policy has been implemented (58% of laboratories), whereas the QTSA found that 94 percent of facilities offered TPT in the past 12 months and documented the percentage of each formulation (Table 11).

As for the diagnosis algorithm for HIV-positive patients, the DNA asks whether laboratories have the capacity to conduct HIV testing onsite or by referral (100%). The QTSA found a similar result by asking whether facilities offered HIV testing and counseling for presumptive TB patients (99%), and confirmed patients (100%) (Table 11).

Concerning the workforce, the DNA documented that TB staff were trained in HIV testing at 85 percent of the facilities, whereas the QTSA found that 87 percent of the facilities had staff trained in TB/HIV coinfection in the last 24 months (Table 11).

Comparison of Indicators Across Surveys for Availability and Readiness

The DNA focuses completely on TB diagnosis systems whereas the QTSA focuses on the quality of all TB services. Due to the differing foci of the surveys, finding comparable indicators between the DNA and QTSA was a challenge. Certain indicators measured the same aspect of TB diagnosis in both surveys but had slightly different emphases. Other indicators addressed the same aspect of service delivery but had different response patterns or disaggregation. However, a limited number of indicators pertaining to availability and readiness of TB diagnosis services were found to be sufficiently similar for comparison.

Comparison Between the DNA and QTSA

In comparing the DNA and QTSA, nine indicators were matched for availability and seventeen for readiness. Table 12 shows the list of indicators organized by type (availability, readiness) that align between the DNA and QTSA, and provides commentary on the extent of the alignment.

Table 12. Alignment of indicators between the DNA/QTSA

Type	DNA question	QTSA question	Alignment of question
Availability			
1	1.2.4: Does the laboratory report the detection of TB cases or DR-TB cases to the local TB control program?	3.3.1: Does this facility report TB patients to the NTLP?	
2	1.4.3: Verify availability of free laboratory tests and chest X-ray at each level of the network.	2.1.2.1: X-ray is available for screening for TB in the facility - Are patients charged a fee for screening X-rays?	DNA asks about availability of free tests AND X-ray, whereas QTSA just asks about free X-rays (for screening and for diagnosis).
3	2.1.3: Are basic TB laboratory services (e.g., screening, referral for testing, specimen collection) decentralized to the community level?	2.5: Some health facilities use VHTs or community linkage facilitators to provide additional support to TB patients. Does this facility work with VHTs, community linkage facilitators, or volunteers who support TB patients?	
4	4.2.1: Are WRDs available for all persons with signs and symptoms of TB?	3.1.5 | 3.1.8: GeneXpert is available onsite or by referral (created variable)	The DNA question is not clear about whether the tests are available onsite or by referral so the QTSA questions pertaining to both were combined. GeneXpert is the only WRD available at the periphery in Uganda. The QTSA referral question includes smear microscopy.
5	4.2.1: Is rapid molecular DST for rifampicin available onsite or by referral for all priority groups identified in the NSP?	15.4.1: In the past 12 months, what methods have been used to detect resistance to first-line drugs regardless of whether these methods are used onsite or offsite (includes National TB Reference Lab, Makerere University, etc.)? GeneXpert to detect resistance to rifampicin (or other molecular method).	The DNA specifies availability for "bacteriologically confirmed patients" but the QTSA does not. The QTSA value combines results for DST onsite and by referral to align with the DNA. QTSA is limited to GeneXpert because this method is what is primarily used for DST in Uganda.

Type	DNA question	QTSA question	Alignment of question
6	4.3.1: Is DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients? If yes, which first-line drugs (INH, RIF, ETH, PZA)?	3.2.1 | 3.2.2: Has this facility provided testing (or referred patients for testing) to presumptive or confirmed TB patients to see if they are resistant to first-line TB drugs in the past 12 months (i.e., DST)? (both provided testing or referred for DST).	The DNA specifies availability for "priority groups" but the QTSA does not. The QTSA value combines results for DST onsite and by referral to align with DNA.
7	4.3.2: Is phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB?	15.3.1.4: What testing services does the offsite laboratory offer this facility?- Second-line DST	
8	10.4.3: Does the laboratory have the capacity to conduct HIV testing onsite or by referral as required by the national algorithm?	5.1: This facility offered the service at any time in the past 12 months - HIV testing and counseling for presumptive and confirmed TB patients.	The QTSA is specific for presumptive patients and has another question for confirmed cases. They are combined here.
9	10.4.4: Is the LF-LAM assay available onsite or by referral for priority HIV-positive patients?	3.1.6: This facility offered the TB service onsite at any time in the past 12 months. - Diagnosis of TB by LAM (urine test)	The QTSA is specific for onsite testing whereas the DNA is specific for onsite plus by referral.
Readiness			
1	3.2.3: Are SOPs for specimen referral available? Does the laboratory adhere to the SOP for transport of all specimens? (assuming the SOPs were observed for the DNA).	15.1.2: Are there SOPs for specimen collection? (observed)	The DNA asks about SOPs for specimen referral and adherence to SOPs for transport. The QTSA just asks whether the SOPs for specimen collection are available (and observed).
2	4.1.1: Is the current national TB diagnosis algorithm available and followed for all testing?	10.2.1: Flowcharts or algorithms on TB diagnosis (yes, observed)	Both pertain to the availability of the diagnosis algorithm but the DNA specifies use of the algorithm whereas the QTSA does not.
3	4.1.3: Are the national guidelines for evaluating patients and using X-ray findings followed by all clinicians?	10.2.2: Guidelines on the use of chest X-ray for TB screening and diagnosis (yes, observed)	The DNA specifies that guidelines are available and followed whereas the QTSA only asks about availability.

Type	DNA question	QTSA question	Alignment of question
4	4.1.4: Has training on diagnosis algorithms, testing methods, specimen collection, test requisition forms, and specimen referral been provided to TB program staff?	11.1: Providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months - Screening algorithm for TB (by management authority).	The DNA has a composite question asking about training for multiple subjects. The QTSA has separate questions for each subject. The QTSA specifies "last 24 months" whereas the DNA does not.
5	4.1.4: Are healthcare workers involved in the TB diagnosis cascade provided with standardized sensitization content (e.g., algorithm diagrams, brochures, training materials, customer handbook)?	10.1.6: TB posters on walls, leaflets, brochures, and/or pamphlets for distribution, (i.e., educational materials about TB were observed as available in the facility).	
6	5.3.1: Are designated, trained safety officers available in all facilities? (part-time or full time)	18.1.1: Has a staff member been designated as an infection prevention and control focal point with specifically articulated duties?	
7	5.3.2: Is safety equipment available (e.g., PPE)?	18.3.10: Gowns, scrubs, or clinical coats observed as available at the facility.	The DNA asks about PPE, whereas the QTSA asks separately about (1) gowns, scrubs, and clinical coats, (2) eye protection (e.g., goggles), and (3) N-95 respirators.
8	5.3.2: Is safety equipment available (e.g., PPE)?	18.3.11: Eye protection/goggles or face protection (observed).	The DNA asks about PPE, whereas the QTSA asks separately about (1) gowns, scrubs, and clinical coats, (2) eye protection (e.g., goggles), and (3) N-95 respirators.
9	5.3.2: Is safety equipment available (e.g., PPE)?	18.5.1: Are N-95 and FFP2 respirators (particulate respirators) readily available for staff?	The DNA asks about PPE, whereas the QTSA asks separately about (1) gowns, scrubs, and clinical coats, (2) eye protection (e.g., goggles), and (3) N-95 respirators.
10	5.3.4: Have all TB laboratory staff received health screening and training in the signs and symptoms of TB in the past 1 year?	18.1.7: Is a system in place to screen and evaluate staff for TB disease?	DNA: health screening and training vs. QTSA: system in place for screening.
11	7.1.4: Have staff received pre-service or in-service training on quality, biosafety, and biosecurity practices?	11.12: Staff received training (last 24 months) - TB infection control.	The DNA specifies biosafety and biosecurity, whereas the QTSA asks about TB infection control.

Type	DNA question	QTSA question	Alignment of question
12	8.1.1: Are standardized request forms available for all testing and are they being used?	15.1.3: Are there approved laboratory request forms? (for specimen collection).	DNA: standard request forms for all tests available and used vs. QTSA: approved lab request forms for specimen collection available.
13	9.1.2: Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory?	10.1.3: Guidelines for diagnosis and treatment of TB among adults (TB manual).	The DNA specifies SOPs and job aids for diagnosis methods. The QTSA asks about guidelines.
14	9.2.2: Does the laboratory have standardized internal QC procedures in place for all tests?	14.7: QC/QA is done in the facility (internal only + internal and external)	The DNA only asks about internal QA/QC whereas the QTSA has responses for both internal and external QA/QC. The responses were combined to align with the DNA.
15	9.2.5: Does the laboratory receive regular supervisory visits from a higher-level laboratory?	12.1: Has a supervisor from any upper-level office come here on a supervisory visit within the past 3 months?	The QTSA specifies a visit in the past three months.
16	9.2.5: Are supervision reports available at the laboratory?	12.1.6: Does the supervisor provide a record of written comments or suggestions from their visit (e.g., the documentation manual)?	
17	10.5.1: Are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?	11.11: Providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months - Management of TB/HIV coinfection	The DNA specifies TB staff trained in the HIV diagnosis algorithm and procedures for HIV testing whereas the QTSA emphasizes training in management of TB/HIV coinfection.

Comparisons were made for the national and regional levels, and for the facility level where the same facility was surveyed for both the QTSA and the DNA.

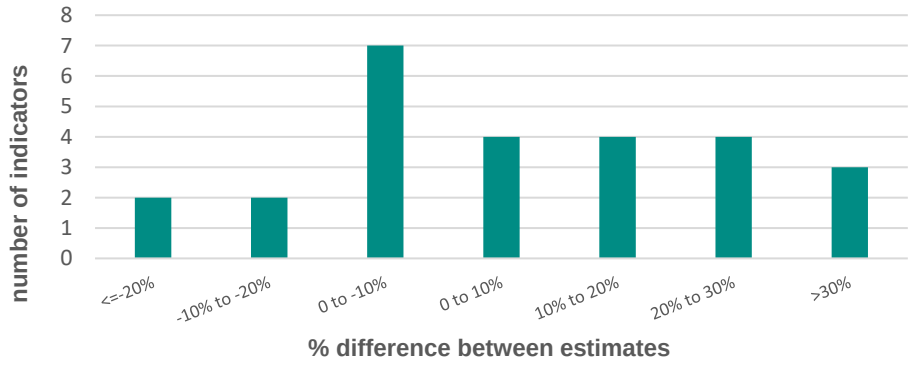
National Level

Health facility indicator values aggregated to the national level were compared between the DNA and QTSA (26 total comparisons). The percentage difference between the indicator values was calculated for each comparison and then averaged over all indicators. The average absolute percentage difference for all comparisons between the DNA and QTSA was 24 percent (median = 18%). The absolute difference gives the magnitude of the difference without direction (+/-). The averages for availability and readiness were 23

percent and 24 percent, respectively. Nearly half (46%) of the comparable indicators differed by more than 20 percent (Table 13).

With the DNA estimate as the minuend, and the QTSA estimate as the subtrahend, the straight average difference (i.e., factoring the direction of the difference) was nine percent. This indicates that DNA estimates were nine percent greater than those for the QTSA, on average. Figure 3 shows the distribution of the differences among the compared indicators. In 15 comparisons, the DNA estimate was larger, whereas in 11 comparisons, the QTSA estimate was larger. The average difference tended to be larger when the DNA estimate was greater.

Figure 3. Histogram of distribution of difference between indicators, DNA/QTSA (26 comparisons)



Indicators with the most and least congruence for availability and readiness follow.

Availability

Indicators with the most congruence were:

- Availability of HIV testing for TB patients (1% difference)
- Facility (or laboratory) reports TB cases (or DR-TB) to the NTLP (3% difference)
- Availability of DST for first-line drugs (at least rifampicin) onsite or by referral (6% difference)

Indicators with the least congruence were:

- Availability of phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB (63% difference)
- Health facilities use VHTs or community linkage facilitators to provide additional support to TB patients (38% difference)
- Availability of LF-LAM assay onsite or by referral for priority HIV-positive patients (37% difference)

Readiness

Indicators with the most congruence were:

- National SOPs and job aids are available for all TB diagnosis methods performed in the laboratory (1% difference)
- PPE is available in the facility (e.g., gowns, scrubs, clinical coats) (2% difference)
- Facility receives supervision from a higher level of the health system (3% difference)

Indicators with the least congruence were:

- Availability of guidelines for TB diagnosis with chest X-ray (81% difference)
- PPE available in the facility – QTSA = Eye protection/goggles or face protection (70% difference). (The DNA asks about PPE in the aggregate, whereas the QTSA asks about individual components of PPE, such as masks, gowns, goggles, etc.)
- Supervision reports are available at the laboratory (65% difference)

Table 13. Comparison of results for availability and readiness, national level: DNA, QTSA

Type	DNA question	QTSA question	DNA (n=43)	QTSA (n=216)	% Difference
Availability					
1	1.2.4: Does the laboratory report the detection of TB cases or DR-TB cases to the local TB control program?	3.3.1: Does this facility report TB patients to the NTLP?	95%	99%	4%
2	1.4.3: Verify availability of free laboratory tests and chest X-ray at each level of the network.	2.1.2.1: X-ray is available for screening for TB in the facility - Are patients charged a fee for screening X-rays?	84%	63%	26%
3	2.1.3: Are basic TB laboratory services (e.g., screening, referral for testing, specimen collection) decentralized to the community level?	2.5: Does this facility work with VHTs, community linkage facilitators, or volunteers who support TB patients?	69%	96%	38%
4	4.2.1: Are WRDs available for all persons with signs and symptoms of TB?	3.1.5 | 3.1.8: GeneXpert is available onsite or by referral (created variable).	74%	96%	30%
5	4.2.1: Is rapid molecular DST for rifampicin available onsite or by referral for all priority groups identified in the NSP?	15.4.1: In the past 12 months, what methods have been used to detect resistance to first-line drugs regardless of whether these methods are used onsite or offsite (includes National TB Reference Lab, Makerere University, etc.)? GeneXpert to detect resistance to rifampicin (or other molecular method).	90%	98%	9%
6	4.3.1: Is DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients? If yes, which first-line drugs (INH, RIF, ETH, PZA)?	3.2.1 | 3.2.2: Has this facility provided testing (or referred patients for testing) to presumptive or confirmed TB patients to see if they are resistant to first-line TB drugs in the past 12 months (i.e., DST)? (both provided testing or referred for DST).	93%	77%	17%
7	4.3.2: Is phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB?	15.3.1.4: What testing services does the offsite laboratory offer this facility?- Second-line DST.	83%	31%	63%

Type	DNA question	QTSA question	DNA (n=43)	QTSA (n=216)	% Differ-ence
8	10.4.3: Does the laboratory have the capacity to conduct HIV testing onsite or by referral as required by the national algorithm?	5.1: This facility offered the service at any time in the past 12 months - HIV testing and counseling for presumptive and confirmed TB patients.	100%	99%	1%
9	10.4.4: Is the LF-LAM assay available onsite or by referral for priority HIV-positive patients?	3.1.6: This facility offered the TB service onsite at any time in the past 12 months. - Diagnosis of TB by LAM (urine test).	62%	39%	37%
Readiness					
1	3.2.3: Are SOPs for specimen referral available? Does the laboratory adhere to the SOP for transport of all specimens? (assuming the SOPs were observed for the DNA).	15.1.2: Are there SOPs for specimen collection? (observed)	71%	66%	8%
2	4.1.1: Is the current national TB diagnosis algorithm available and followed for all testing?	10.2.1: Flowcharts or algorithms on TB diagnosis (observed).	83%	79%	5%
3	4.1.3: Are the national guidelines for evaluating patients and using X-ray findings followed by all clinicians?	10.2.2: Guidelines on the use of chest X-ray for TB screening and diagnosis (yes, observed).	82%	16%	81%
4	4.1.4: Has training on diagnosis algorithms, testing methods, specimen collection, test requisition forms, and specimen referral been provided to TB program staff?	11.1: Providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months - Screening algorithm for TB (by management authority).	78%	88%	13%
5	4.1.4: Are healthcare workers involved in the TB diagnosis cascade provided with standardized sensitization content (e.g., algorithm diagrams, brochures, training materials, customer handbook)?	10.1.6: TB posters on walls, leaflets, brochures, and/or pamphlets for distribution, (i.e., educational materials about TB were observed as available in the facility).	76%	57%	24%
6	5.3.1: Are designated, trained safety officers available in all facilities? (part-time or full time)	18.1.1: Has a staff member been designated as an infection prevention and control focal point with specifically articulated duties?	92%	71%	23%
7	5.3.2: Is safety equipment available (e.g., PPE)?	18.3.10: Gowns, scrubs, or clinical coats observed as available at the facility.	90%	88%	2%
8	5.3.2: Is safety equipment available (e.g., PPE)?	18.3.11: Eye protection/goggles or face protection (observed).	90%	27%	70%

Type	DNA question	QTSA question	DNA (n=43)	QTSA (n=216)	% Difference
9	5.3.2: Is safety equipment available (e.g., PPE)?	18.5.1: Are N-95 and FFP2 respirators (particulate respirators) readily available for staff?	90%	63%	31%
10	5.3.4: Have all TB laboratory staff received health screening and training in signs and symptoms of TB in the past 1 year?	18.1.7: Is a system in place to screen and evaluate staff for TB disease?	64%	47%	27%
11	7.1.4: Have staff received pre-service or in-service training on quality, biosafety, and biosecurity practices?	11.12: Staff received training (last 24 months) - TB infection control.	79%	82%	5%
12	8.1.1: Are standardized request forms available for all testing and are they being used?	15.1.3: Are there approved laboratory request forms? (for specimen collection).	76%	62%	19%
13	9.1.2: Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory?	10.1.3: Guidelines for diagnosis and treatment of TB among adults (TB manual).	81%	82%	1%
14	9.2.2: Does the laboratory have standardized internal QC procedures in place for all tests?	14.7: QC/QA is done in the facility (internal only + internal and external).	62%	70%	13%
15	9.2.5: Does the laboratory receive regular supervisory visits from a higher-level laboratory?	12.1: Has a supervisor from any upper-level office come here on a supervisory visit within the past 3 months?	79%	81%	3%
16	9.2.5: Are supervision reports available at the laboratory?	12.1.6: Does the supervisor provide a record of written comments or suggestions from their visit (e.g., the documentation manual)?	49%	81%	65%
17	10.5.1: Are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?	11.11: Providers of TB services at this facility receive new or refresher training in the following topics in the last 24 months - Management of TB/HIV coinfection.	77%	87%	13%
	Overall average		80%	71%	24%
	Average—indicators measuring availability		77%	83%	23%
	Average—indicators measuring readiness		24%	67%	24%

Facility Level

Agreement of Indicators for Availability and Readiness Across Facilities

Availability and readiness indicators from the DNA and QTSA were compared at the facility level for facilities that participated in both surveys (n=11) (Tables 14 and 15, Appendix A, Table 24). Indicators with the most and the least agreement follow (agreement measured as the percentage of facilities that have matching indicator results):

Indicators with the most agreement across surveys:

- Availability (of services)
    1. Availability of DST for first-line drugs (100%)
    2. Availability of DST for second-line drugs, onsite or by referral (100%)
    3. Availability of HIV testing for presumptive TB patients (91%)

- Readiness (to provide services)
    1. PPE are available for TB program staff (e.g., N-95 respirators) (91%)
    2. The laboratory receives regular supervisory visits from a higher-level laboratory (91%)
    3. Facility has designated infection control officer (86%)

Indicators with the least agreement across surveys:

- Availability
    1. Availability of free X-rays for screening and diagnosis (0%)
    2. Availability of standard laboratory request forms (73%)
    3. Facility reports TB cases to the NTLP (86%)
    4. WRDs are available for all persons with signs and symptoms of TB (86%)
- Readiness
    1. A system is in place to screen and evaluate staff for TB disease (45%)
    2. The facility has adequate ventilation (e.g., biosafety hood or cabinet) (45%)
    3. TB diagnosis algorithm available at the facility (50%)
    4. Facility has QC mechanisms in place for TB testing (55%)

The average agreement over all indicators between facility survey results for the DNA and the QTSA was 73% (Table 14). Indicators pertaining to the availability of services had average agreement of 80 percent whereas those for readiness had average agreement of 69 percent. There were many missing values in the two surveys, but this did not seem to influence the agreement of indicators across surveys at the facility level. Facilities with more than 50 percent of comparisons "not done" due to missing values in either survey had an average agreement between indicators across facilities of 60 percent (combined availability and readiness).

Table 14. Agreement of indicators across surveys for availability and readiness, DNA/QTSA

QTSA	DNA	# agree	# partial agree	# dis-agree	# not done	% agree-ment
Availability						
1.2.4: Does the laboratory report the detection of TB cases or DR-TB cases to the local TB control program?	3.3.1: Does this facility report TB patients to the NTLP?	9	1	1	0	86%

QTSA	DNA	# agree	# partial agree	# dis-agree	# not done	% agree-ment
1.4.3: Verify the availability of free laboratory tests and chest X-ray at each level of the network.	2.1.2.1: Are patients charged a fee for screening X-rays?	0	0	2	9	0%
2.1.3: Are basic TB laboratory services (e.g., screening, referral for testing, specimen collection) decentralized to the community level?	2.5: Some health facilities use VHTs or community linkage facilitators to provide additional support to TB patients. Does this facility work with VHTs, community linkage facilitators, or volunteers who support TB patients?	3	1	0	7	88%
4.2.1: Are WRDs available for all persons with signs and symptoms of TB?	3.1.5 | 3.1.8: GeneXpert is available onsite or by referral (created variable).	9	1	1	0	86%
4.3.1: Is DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients?	15.4.1: In the past 12 months, what methods have been used to detect resistance to first-line drugs regardless of whether these methods are used onsite or offsite - GeneXpert (or other molecular method) to detect resistance to rifampicin.	8	0	0	3	100%
4.3.2: Is phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB?	15.3.1.4: What testing services does the offsite laboratory offer this facility?- Second-line DST.	3	0	0	8	100%
10.4.3: Is rapid testing for HIV available onsite or by referral?	5.1: This facility provides HIV counseling and testing services for presumptive TB patients.	10	0	1	0	91%
10.4.4: Is the LF-LAM assay available onsite or by referral for priority HIV-positive patients?	3.1.6: This facility offered the TB service onsite at any time in the past 12 months. - Diagnosis of TB by LAM (urine test).	9	0	1	1	90%
Readiness						
3.2.3: Are SOPs for specimen referral available? Does the laboratory adhere to the SOP for transport of all specimens?	15.1.2: Are there SOPs for specimen collection? (observed)	5	1	3	2	65%

QTSA	DNA	# agree	# partial agree	# dis-agree	# not done	% agree-ment
4.1.1: Is the current national TB diagnosis algorithm available and followed for all testing?	10.2.1: Flowcharts or algorithms on TB diagnosis (yes, observed).	8	0	2	1	80%
4.1.3: Are the national guidelines for evaluating patients and using X-ray findings followed by all clinicians?	10.2.2: Guidelines on the use of chest X-ray for TB screening and diagnosis (yes, observed).	1	2	1	7	50%
4.1.4: Has training on diagnosis algorithms, testing methods, specimen collection, test requisition forms, and specimen referral been provided to TB program staff?	11.1: Staff received training last 12 months - Screening algorithm for TB.	2	0	2	7	50%
4.1.4: Are healthcare workers involved in the TB diagnosis cascade provided with standardized sensitization content (e.g., algorithm diagrams, brochures, training materials, customer handbook)?	10.1.6: TB posters on walls, leaflets, brochures, and/or pamphlets for distribution, (i.e., educational materials about TB were observed as available in the facility).	2	0	2	7	50%
5.3.1: Are designated, trained safety officers available in all facilities? (part-time or full time)	18.1.1: Has a staff member been designated as an infection prevention and control focal point with specifically articulated duties?	6	0	1	4	86%
5.3.2: Is safety equipment available (e.g., PPE)?	18.5.1: Are N-95 and FFP2 respirators (particulate respirators) readily available?	9	2	0	0	91%
5.3.4: Are basic occupational health services available to all laboratory workers?	18.1.7: Is a system in place to screen and evaluate staff for TB disease?	5	0	6	0	45%
7.1.4: Have staff received pre-service or in-service training on quality, biosafety, and biosecurity practices?	11.12: Staff received training last 24 months - TB infection control.	4	0	1	6	80%
8.1.1: Are standardized request forms available for all testing and are they being used?	15.1.3: Are there approved laboratory request forms (for specimen collection)?	7	2	2	0	73%

QTSA	DNA	# agree	# partial agree	# dis-agree	# not done	% agree-ment
9.1.2: Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory?	10.1.3: Guidelines for diagnosis and treatment of TB among adults (TB manual).	7	2	2	0	73%
9.2.2: Does the laboratory have standardized internal QC procedures in place for all tests?	14.7: QC/QA is done in the facility (internal only + internal and external).	5	1	4	1	55%
9.2.5: Does the laboratory receive regular supervisory visits from a higher-level laboratory?	12.1: Has a supervisor from any upper-level office come here on a supervisory visit within the past 3 months?	9	2	0	0	91%
10.5.1: Are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?	11.11: Staff received training last 12 months - Management of TB/HIV coinfection.	6	2	1	2	78%
Average agreement						73%
Average agreement—availability						80%
Average agreement—readiness						69%

Comparison of Results Using an Index of Availability and Readiness

An index was constructed to measure the performance of facilities for availability and readiness of diagnosis services. The index was informed with indicator values from the two surveys for facilities participating in both the DNA and QTSA. The performance of facilities as measured by an index of availability and readiness was compared. The index was calculated by ascribing a value of "1" for an affirmative response (i.e., the attribute was present), "0.5" for a partial response, and "0" for negative response (i.e., the attribute was not present), and dividing by the number of complete responses. Table 15 shows the value of the index for both DNA and QTSA for each facility (availability and readiness combined), the magnitude of the difference between the index values, and the agreement in the facilities for each matched indicator.

On aggregate, the index performed similarly for the two surveys, with the average value of the index across facilities for the QTSA at 82 percent and at 79 percent for the DNA. The average percentage difference in index scores was 17 percent. The congruence of indicators in facilities was also fairly high when excluding comparisons that were not possible due to missing values. The average agreement in facilities was 81 percent (Table 15 and Appendix A, Table 24).

Table 15. Comparison of results across surveys for availability and readiness, facility level, DNA/QTSA

Facility name	District/ community	Facility type	Sub-region	Survey	Index of availability & readiness	% Differ-ence between surveys on index value	% Agreement of indicators in facilities
Iriri HC III	Moroto	HC III	Karamoja	QTSA	78%		
				DNA	63%	19%	79%
Moroto Army HC IV	Moroto	HC IV	Karamoja	QTSA	74%		
				DNA	38%	49%	47%
Moroto RRH	Moroto	Hospital	Karamoja	QTSA	86%		
				DNA	86%	0%	82%
St Pius, Kidepo HC III	Moroto	HC III	Karamoja	QTSA	74%		
				DNA	46%	37%	75%
Busiu HC IV	Mbale	HC IV	Mid-Eastern	QTSA	83%		
				DNA	79%	4%	93%
Kolonyi HC III	Mbale	HC III	Mid-Eastern	QTSA	90%		
				DNA	89%	2%	82%
Gulu RR	Gulu	Hospital	Mid Northern	QTSA	88%		
				DNA	86%	2%	90%
St. Mary's Hospital Lacor	Gulu	Hospital	Mid Northern	QTSA	63%		
				DNA	93%	49%	70%
Arua RRH	Arua	Hospital	West Nile	QTSA	89%		
				DNA	93%	3%	88%
Kuluva Hospital	Arua	Hospital	West Nile	QTSA	95%		
				DNA	93%	2%	93%
Rhino Camp HC IV	Arua	HC IV	West Nile	QTSA	88%		
				DNA	100%	14%	93%
Average			DNA 79%; QTSA 82%			17%	81%

Discussion

The main goal of the analysis presented is to gauge the utility of using results from other surveys to inform and corroborate results from the DNA, and to investigate methods using these data to further inform our understanding of the performance of the TB diagnosis network in countries, especially with respect to the availability, readiness, and quality of diagnosis services.

The comparison of results across different surveys on TB diagnosis in Uganda produces quite disparate results. The principle reasons for the differences are the imperfect alignment of indicators across surveys, the methodological differences of the surveys, and potentially, the lag time between the different surveys.

Although the DNA focuses exclusively on TB diagnosis, the QTSA measures the quality of all TB services. Roughly 40 percent of the indicators in the QTSA facility audit pertain to TB diagnosis, and the facility audit is just one aspect of the QTSA (other aspects are the provider knowledge survey, client satisfaction survey, and the register review).

Qualitative Comparison

The qualitative comparisons examined the QTSA survey's estimates for TB diagnosis against the high-level conclusions of the DNA. The DNA and QTSA align most readily for Core Capacities 4. Diagnosis Algorithm; 5. Biosafety; 9. Quality; and 10. TB/HIV (Table 16).

Table 16. Distribution of matched indicators by core capacity, DNA/QTSA

Core capacity		Number	%
1	Political, legal, regulatory, and financial framework	2	8%
2	Structure and organization of the diagnosis network	1	4%
3	Coverage	1	4%
4	Diagnosis algorithm	8	31%
5	Biosafety	5	19%
6	Equipment and Supplies	0	0%
7	Workforce	1	4%
8	Diagnosis data management	1	4%
9	Quality of the diagnosis network	4	15%
10	TB/HIV	3	12%
		26	

For Core Capacity 4 (Diagnosis Algorithm), the QTSA largely corroborates the results from the DNA. Both surveys show widespread availability of WRDs (that is, GeneXpert; DNA result is 72% of facilities for "WRD," whereas for the QTSA, 92% of facilities have access to GeneXpert onsite or by referral). The DNA also documents that WRDs are available for all HIV-positive patients being evaluated for TB but are not available for all HIV-negative persons at sites that do not have GeneXpert (other than by referral). The QTSA finds that the LF-LAM assay is available at 39 percent of the sites. (It does not ask about availability by referral.)

The DNA documents that "staff at all levels of the network are aware of the 2019 diagnosis algorithm." However, Ultra testing is not well understood, especially at sites found not following the 2019 algorithm. The QTSA has very little to say about the Ultra test, only asking about the availability of cartridges.

The DNA also finds a "limited understanding of the TB cascade and how to use it to close gaps in TB detection and outcomes" among healthcare workers. The QTSA facility audit does not specifically address this issue, and the provider knowledge survey does not specifically ask about the diagnosis algorithm, but it does address the elements that comprise the algorithm (i.e., knowledge of diagnosis procedures, etc.). The QTSA aligns well with the DNA more generally on training in diagnosis methods. The DNA finds that training on the diagnosis algorithm, testing methods, specimen collection and referral, etc. was received by public sector

laboratorians (92%), private sector laboratorians (81%), public sector clinicians (86%), private sector clinicians (75%), and "TB program staff" (83%). Although the QTSA does not disaggregate by provider type, estimates for the diagnosis algorithm and specific diagnosis methods all align well with these findings (e.g., 87% to 90% of providers received training in the last 24 months on the diagnosis algorithm, by different management authority).

As for the detection of DR-TB, the DNA finds that WRDs are used for rifampicin testing, but not for all bacteriologically confirmed patients (e.g., smear-positive HIV-negative patients are not always tested by GeneXpert). DST for isoniazid is available at the NTRL but is rarely done. The QTSA largely confirms this result, finding that 77 percent of facilities have access to DST for rifampicin onsite or by referral (although the result for DNA is much higher, at 96%). For DST of second-line drugs, the DNA reports that 83 percent of facilities have access, whereas the QTSA finds that only 31 percent of facilities that use offsite labs have DST for second-line drugs available from the offsite lab.

DNA Core Capacity 5, Biosafety, states that "testing is performed in a manner and in facilities that ensure safety for the staff, the customers, the community, and the environment." The DNA reports national standards and policies for biosafety are in place but not uniformly adhered to or applied in all facilities. Three of four components are scored "1" (out of 5 total possible) on the validation of the self-assessment. The QTSA results match with this finding fairly closely, although the indicators do not align particularly well for the standard. For example, the DNA asks about the availability of biosafety hoods or cabinets (60%) whereas the QTSA only finds 12 percent of facilities reporting having one.

As for health screening of TB laboratory staff, the DNA finds 43 percent of facilities reporting staff as receiving such screening, whereas the QTSA reports 47 percent of facilities have such as system in place. For PPE, the DNA asks about availability in general (95%), whereas the QTSA assesses the availability of specific methods, (e.g., N-95 respirators [63%]; eye protection [27%]; gowns, scrubs, or clinical coats [88%]). For trained safety officers, the DNA reports 92 percent whereas the QTSA reports 71 percent of facilities having a staff member designated as an infection prevention and control focal point with specifically articulated duties.

For waste management, the DNA finds that 88 percent of facilities have a standard procedure for collecting, storing, and disposing of waste implemented according to national standards. The QTSA has only questions pertaining to the availability of "medical waste receptacles with lid and bin liners" (99%) and sharps containers (99%).

Core capacity 9 addresses QC. The DNA finds that quality policies and procedures are well-developed at the national level, but implementation is lacking at the periphery, and supervision is inadequate from the regions to the lower levels. At facilities, the DNA reports that 65 percent of facilities have standardized internal quality controls in place for all tests. The QTSA asks specifically about smear microscopy and finds that 94 percent of facilities have either internal, external, or both types of QC available.

As for supervision, the DNA finds that 82 percent of facilities receive regular supervision visits from a higher-level laboratory, whereas the QTSA reports that 81 percent of facilities received a supervision visit in the past three months. Supervisory reports are available in the laboratory in 56 percent of the facilities assessed by the DNA, whereas the QTSA finds that 81 percent of the facilities received written comments or suggestions from a supervision visit.

For TB/HIV (Core Capacity 10), the DNA finds that rapid HIV testing is available to all persons with signs or symptoms of TB (onsite or by referral) at all tiers of the laboratory network (the QTSA reports 99%). LF-LAM testing is available onsite or by referral in 64 percent of sites (the QTSA reports 39% onsite only). However, the DNA also finds "variable" adherence to the national algorithm and SOPs, and that training was inadequate

for conducting the LF-LAM test. The QTSA is mute on the adequacy of implementation of LF-LAM at facilities.

The DNA addresses whether the national policy on isoniazid prevention therapy is implemented in the laboratory (58%), whereas the QTSA provides a breakdown of the availability of the type of TPT available at facilities (e.g., 94% of facilities offered INH 100 mg).

The DNA asks, "are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?" (85%), whereas the QTSA asks whether providers received training (in the last 24 months) in TB/HIV coinfection (87%).

Quantitative Comparisons

Mapping the indicators between the DNA and QTSA yields 26 indicators that align to varying degrees. Some indicators match on the subject, but differ in emphasis, target group, or scope. For example, questions on the availability of certain diagnostic tests specify availability onsite or by referral in the DNA, but the QTSA analogue encompasses only testing onsite. For some (e.g., DST for first-line drugs), it is possible to combine results in the QTSA to construct a closer match with the DNA. Table 12 provides information on the alignment of each indicator.

Comparing the findings for the different levels of the health system reveal variable results. Table 17 shows the closest and most discrepant matches, by type of indicator (availability and readiness) and level. The availability of HIV testing matches closely for all levels, and facility reports of TB cases to the NTLP ranks in the top three for the two levels. The availability of PPE (QTSA = gowns, scrubs, clinical coats) is a good match for the two levels.

As to the most discrepant matches, the availability of the LF-LAM test ranks among the discrepant matches at national and regional levels, as does the availability of DST for second-line drugs. (Conversely, the availability of second-line drugs is one of the better matches at the facility level.) For readiness, no particular pattern is apparent.

The large differences in estimates between the two surveys are likely the result of small yet significant differences in the definitions of matched indicators, the different methodologies used to derive estimates, and for the regional estimates, the small sample sizes. The DNA has only a handful of sites per region (5–6 sites versus an average of 24 sites per region for the QTSA).

Table 17. Extent of corroboration of estimates, by level, DNA/QTSA

	National	Facility
Closest match	Availability • Availability of HIV testing for TB patients (1% difference) • Facility (or laboratory) reports TB cases (or DR-TB) to the NTLP (3% difference) • Availability of DST for first-line drugs (at least rifampicin) onsite or by referral (6% difference) Readiness • Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory? (1% difference) • Is PPE available in the facility (e.g., gowns, scrubs, clinical coats)? (2% difference) • Facility receives supervision from a higher level of the health system. (3% difference)	Availability • Availability of DST for first-line drugs (100% agreement) • Availability of DST for second-line drugs, onsite or by referral (100% agreement) • Availability of HIV testing for presumptive TB patients (91% agreement) Readiness • PPE are available for TB program staff (e.g., N-95 respirators). (91% agreement) • Does the laboratory receive regular supervisory visits from a higher-level laboratory? (91% agreement) • Facility has designated infection control officer. (86% agreement)

	National	Facility
Most discrepant	Availability • Availability of phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB? (63% difference) • Health facilities use VHTs or community linkage facilitators to provide additional support to TB patients. (38% difference) • Availability of LF-LAM assay onsite or by referral for priority HIV-positive patients? (37% difference) Readiness • Availability of guidelines for TB diagnosis with chest X-ray. (81% difference) • PPE available in the facility – QTSA = eye protection /goggles or face protection. (70% difference) • Are supervision reports available at the laboratory? (65% difference)	Availability • Availability of free X-rays for screening and diagnosis. (0% agreement) • Availability of standard laboratory request forms. (73% agreement) • Facility reports TB cases to the NTLP. (86%) • WRDs are available for all persons with signs and symptoms of TB. (86% agreement) Readiness • A system is in place to screen and evaluate staff for TB disease. (45% agreement) • The facility has adequate ventilation (e.g., biosafety hood or cabinet). (45% agreement) • TB diagnosis algorithm available in the facility. (50%) • Facility has QC mechanisms in place for TB testing. (55% agreement)

The overlap of the DNA and QTSA in 11 sites gives an opportunity to gauge a direct comparison of results at the facility level and explore the development of an index on the availability and readiness of diagnosis services. Twenty-two indicators were evaluated in this way. Agreement across facilities for these indicators measures at 73 percent. The availability of HIV testing and DST for first- and second-line drugs matches well, as does the availability of PPE (N-95 respirators), and recent supervision visits. In facilities, the average agreement of indicators is 81 percent. These results indicate that an index of availability and readiness could be constructed from some, or all, of the 22 indicators to identify facilities in need of support. Such an index could potentially be informed by routine supervision such that TB program planners need not wait until the next health facility survey to collect data on these specific parameters.

Recommendations:

1. Align priority indicators common to DNA and QTSA by adjusting/fine-tuning definitions, scope, and emphasis to make them more comparable.
2. Use QTSA results (when available) to objectively inform the self-assessment component of the DNA.
3. Use QTSA results (when available) to ground-truth DNA assessment results.

4. Identify the priority elements of TB diagnostic system availability and readiness that are common to both surveys, adapt to country context when necessary, and use them to routinely inform program management of the performance of the diagnosis system.

Conclusions

Quantitative comparisons between the DNA and QTSA show disparate results, especially when evaluated at different levels. The reasons for discrepancies are most likely the imprecise matching of indicators, the different methodologies used for calculating results for the DNA and QTSA, and the smaller sample size of the DNA (only 43 facilities included). However, much can be gleaned by comparing the QTSA with the DNA more qualitatively. Moreover, the QTSA can provide other information to better inform indices of availability and readiness for routine monitoring of the quality and performance of TB diagnosis.

Reviewing the research questions for this analysis, the first question asks, "What is the availability, readiness, and performance of TB diagnosis at health facilities in Uganda"? The results from the two surveys concur that diagnosis services are widely available in Uganda, although with some weaknesses (e.g., the optimal distribution of GeneXpert, the unfinished rollout of the LF-LAM test for HIV-positive patients, phenotypic DST for second-line drugs, etc.). Readiness is somewhat tougher to gauge because the indicators match less precisely. However, elements of readiness are found to be present in both surveys. For example, recent training was conducted for the vast majority of sites on aspects of TB diagnosis. Written guidance is likewise widely available at facilities and for different subject areas of TB diagnosis. Information on the availability of inputs needed is also available, but to a lesser degree. A weakness of the analysis is the inability to draw conclusions on the availability of certain inputs, such as reagents and other testing supplies. The DNA asks about reagents in a general way but does not probe for details. The QTSA also does not address readiness in such detail.

The second research question asks, "How can data from QTSA surveys be used to complement the National DNA survey?" There are three ways that the results from the QTSA can be used to complement the DNA. First, certain results can be used to validate, or ground-truth, results from the DNA. The DNA's scoring system tends to overestimate the prevalence of attributes of the diagnosis network (by up to 9%; see the section on Comparison of DNA and QTSA—National Level). This is likely the result of ascribing partial credit for some elements. For indicators with the same or very similar indicator definitions, results from the DNA can be confidently compared with the available QTSA results. The Uganda QTSA is based on a nationally representative sample of health facilities, whereas the DNA is done as a convenience sample. Moreover, the "estimates" in the DNA are derived, rather than measured, and rely on the perceptions or best guess of the surveyors. The QTSA results should be considered the more methodologically sound and should be used to validate the DNA results.

Second, the QTSA results can be used to inform the self-assessment of the DNA. The DNA methodology calls for a self-assessment by the NTLP, which is then validated in the field by an external team conducting the DNA. If recent QTSA values are available, they should be used to inform the self-assessment, given the methodological rigor cited above.

Last, indicators from the QTSA can be used to inform program monitoring, evaluation, and planning in the periods between DNAs and QTSAs. If information on availability, readiness, and quality can be obtained through routine supervision at health facilities, these parameters can be monitored regularly, and interventions formulated to improve performance as the needs arise.

Results from other surveys should also be used, as necessary. WHO's Service Availability and Readiness Assessment and the USAID Service Provision Assessment, although containing sparse information on TB diagnosis, have a wealth of information about facility readiness to provide services, such as the availability of essential commodities on the day of the visit, and health facility and health worker density.

Although the index of availability and readiness modeled here may not be the ideal tool for gauging availability, readiness, and performance, such a tool can be easily developed with the indicators available in a given TB program. Adaption to country programs would nevertheless be necessary to make the tool responsive to the needs of specific countries. This effort shows that such a tool is possible and adds value for evaluating the performance of the TB diagnosis network.

Appendix A. Results Tables

Table 18. Core capabilities and associated components: TB Diagnostic Network Assessment

Core capabilities	Component
1. Political, legal, regulatory, and financial framework	1.1 Legislation and policies
	1.2 National TB policies and plans
	1.3 Governance
	1.4 Financing and budgets
2. Structure and organization of the diagnosis network	2.1 Diagnosis network
	2.2 Coordination and management
	2.3 Programmatic and operational research
3. Coverage	3.1 Diagnosis network coverage
	3.2 Specimen referral system
	3.3 Linkages
	3.4 Emergency preparedness
4. Diagnosis algorithm	4.1 Algorithm
	4.2 Detection of TB
	4.3 Detection of DR-TB
5. Biosafety	5.1 Facilities
	5.2 Biosafety and biosecurity manual
	5.3 Biosafety systems
	5.4 Waste management
6. Equipment and supplies	6.1 Supply chain management
	6.2 Equipment
7. Workforce	7.1 Education and training
	7.2 Staffing
	7.3. Human resource development strategies and plans

Core capabilities	Component
	7.4. Competency-based job descriptions
8. Diagnosis data management	8.1 Data collection forms 8.2 Reporting 8.3 Data connectivity and remote monitoring 8.4 Data analysis and sharing 8.5 Surveillance and epidemiology 8.6 Security and confidentiality of information
9. Quality in the diagnosis network	9.1 Documents and document control 9.2 Quality assurance 9.3 Quality management system 9.4 Certification and accreditation
10. TB/HIV	No standard components – adapted for country use across other domains

Table 19. Distribution of sites selected for the TB Diagnostic Network Assessment

Team	Region	Laboratories visited
A	Arua	RRH, District hospital, HC III, Private not for profit (PNFP) hospital, HC IV
B	Gulu	RRH, PNFP hospital, Prison, Private for profit (PFP) hospital
C	Moroto	RRH, PNFP hospital, PNFP HC III, HC III, Military HC IV
D	Soroti	RRH, PNFP hospital, HC IV, HC III
E	Mbale	RRH, PNFP hospital, PFP hospital, HC III, HC III, HC IV
F	Jinja	RRH, HC III, Prison HC III, HC IV
G	Kampala	NTRL, HC III, PNFP hospital [2], General hospital, PFP hospital
H	Masaka	RRH, Police HC III, HC IV, PNFP hospital, General hospital, clinic
I	Mbarara, Bushenyi	RRH, Uganda People's Defense Force HC IV, HC III [2], PNFP hospital, Academic hospital
J	Fort Portal	RRH, PNFP hospital [2], HC III

Total = 49

Table 20. Contents of QTSA facility audit

Category	Sub-category
1. Facility characteristics	1.1 Facility classification
	1.2 Facility capacity
	1.3 Governance
	1.4 Financing and budgets
2. Availability of TB services	
3. TB diagnosis	3.1 TB diagnosis methods
	3.2 Drug susceptibility testing
	3.3 TB case notification
4. Contact investigation and management	
5. TB/HIV services	
6. TB treatment services	6.1 Available services
	6.2 Treatment practices
	6.3 Patient counselling and education on TB treatment
	6.4 Patients taking treatment without facility supervision
	6.5 Sputum tests – treatment

Category	Sub-category
7. DR-TB treatment services	7.2 DR-TB treatment
	7.3 Standard WHO long regimen
	7.4 Shorter standard regimen
	7.5 Other individualized regimen
	7.6 Ancillary drugs
	7.7 DR-TB treatment equipment
	7.8 DR-TB treatment practices
	7.9 Pediatric DR-TB treatment
8. Pediatric services	8.1 Pediatric TB diagnosis
	8.2 Pediatric TB treatment
	8.3 Data connectivity and remote monitoring
	8.4 Data analysis and sharing
	8.5 Surveillance and epidemiology
	8.6 Security and confidentiality of information
9. VHTs and community linkage facilitators	9.1 Services provided by VHTs or community linkage facilitators
	9.2 Management of VHTs and community linkage facilitators
	9.3 Financial support for VHTs
	9.4 Financial support for community linkage facilitators
10. Policies, protocols, and guidelines	10.1 General
	10.2 Diagnosis facilities
	10.3 Treatment facilities
11. Staff capacity to deliver TB Services	
12. Supervision and feedback practices	
13. Availability of basic equipment	

Category	Sub-category
14. TB laboratory procedures	General – if facility has an onsite lab Quality control/quality assurance
15. Management of specimens	15.1 Specimen collection 15.2 Onsite laboratory 15.3 Offsite laboratory 15.4 Drug susceptibility testing
16. Management of supplies and commodities	
17. Drug stock	
18. Infection control	18.1 General 18.2 Resources in service areas 18.3 Supplies in examination areas 18.4 Specimen collection 18.5 N-95 and FFP2 respirators

Table 21. Distribution of QTSA facilities, by facility type and region/sub-region

		Facility type									
		Hospital		HC IV		HC III		Other		Total	
Region	Sub-region	No.	%	No.	%	No.	%	No.	%	No.	%
Central	Central 1	0	0	2	6	7	5	2	13	11	5
	Central 2	9	32	4	11	27	20	2	13	42	19
Eastern	East Central	3	11	1	3	15	11	0	0	19	9
	Mid Eastern	2	7	3	8	16	12	2	13	23	11
Northern	Karamoja	2	7	1	3	10	7	3	20	16	7
	Mid Northern	2	7	3	8	9	7	0	0	14	7
	West Nile	3	11	5	14	17	12	2	13	27	13
Western	Mid Western	3	11	7	19	10	7	0	0	20	9
	South Western	4	14	10	28	26	19	4	27	44	20
Total		28	100	36	100	137	100	15	100	216	100

Table 22. Diagnostic Network Assessment questions and results for availability and readiness

Category	Type	Survey no.	Question	Result
Availability	DST	4.2.1	Is rapid molecular DST for rifampicin available onsite or by referral for all priority groups identified in the NSP?	93%
		4.3.1	Is DST for first-line drugs (at least rifampicin) available onsite or by referral for all bacteriologically confirmed patients? If yes, which first-line drugs (INH, RIF, ETH, PZA)?	96%
		4.3.1	Is rapid molecular DST for rifampicin available onsite or by referral for bacteriologically confirmed TB patients?	96%
		4.3.2	Is phenotypic DST for second-line drugs available onsite or by referral for all patients with RR-TB?	85%
		4.3.2	Is rapid DST (e.g., SL-LPA) for second-line injectable drugs and fluoroquilones available onsite or by referral for all patients with RR-TB?	86%

Category	Type	Survey no.	Question	Result
	HIV testing	10.1.2	Verify availability of free TB laboratory tests and HIV laboratory tests at each level of the network	95%
	Reporting	1.2.4	Does the laboratory report the detection of TB cases or DR-TB cases to the local TB control program?	96%
	TB testing - priority groups	3.1.3	Is there access to WRDs testing for the priority groups identified in the NSP (e.g., extra pulmonary TB, pediatric TB, PLHIV, etc.)?	95%
	TB Testing Capacity	4.2.1	Does the laboratory have the capacity to conduct all of the tier-specific diagnostic testing required by the national algorithm?	92%
	TB testing - WRDs	4.2.1	Are WRDs available for all persons with signs and symptoms of TB?	76%
	TB testing - Xpert Ultra	4.2.2	Has the Xpert Ultra test replaced the Xpert MTB/RIF test for all Xpert testing?	94%
		4.2.2	Has the Xpert Ultra test replaced the Xpert MTB/RIF test for the testing of priority groups (e.g., TB-HIV)?	94%
	Tier-specific lab services	2.1.4	Does the laboratory offer the package of services designed for their level?	96%
	TPT	10.1.1	Has the national policy on isoniazid preventive therapy been implemented in the laboratory?	58%
	Community involvement	2.1.3	Are basic TB laboratory services (e.g., screening, referral for testing, specimen collection) decentralized to the community level?	77%
	HIV testing	10.4.3	Does the laboratory have the capacity to conduct HIV testing onsite or by referral as required by the national algorithm?	100%
		10.4.3	Is rapid testing for HIV available onsite or by referral?	100%
	TB testing - free lab tests and X-rays	1.4.3	Verify availability of free laboratory tests and chest X-ray at each level of the network	88%
	TB testing - LF-LAM	10.4.4	Is the LF-LAM assay available onsite or by referral for priority HIV-positive patients?	64%
Readiness	Algorithm	4.1.1	Is the current national TB diagnosis algorithm available and followed for all testing?	87%

Category	Type	Survey no.	Question	Result
	Guidelines for X-ray	4.1.3	Are the national guidelines for evaluating patients and using X-ray findings followed by all clinicians?	91%
	HIV testing	10.5.1	Are staff in TB diagnosis laboratories and TB clinics trained in the HIV diagnosis algorithm and procedures for obtaining HIV testing onsite or by referral?	85%
	Infection control	5.1.2	Does the TB laboratory have adequate ventilation and physical facilities for the procedures being performed?	89%
		5.2.2	Is the TB laboratory biosafety manual implemented and incorporated into SOPs?	80%
		5.3.1	Are designated, trained safety officers available in all facilities? (part-time or full time)	92%
		5.3.2	Is safety equipment available (e.g., PPE)?	95%
		5.3.3	Are certified BSC available where needed according to international recommendations for the tests being conducted?	63%
		5.3.4	Are basic occupational health services available to all laboratory workers?	70%
		5.3.4	Have all TB laboratory staff received health screening and training in signs and symptoms of TB in the past 1 year?	43%
		5.4.1	Are standardized procedures for collecting, storing, and disposing of waste implemented according to national standards?	88%
		5.4.2	Are adequate methods used to safely dispose of infectious waste?	85%
		5.4.2	Does the laboratory have access to autoclaves and incinerators as needed?	72%
	Laboratory infrastructure	5.1.3	Are laboratory facilities regularly maintained and is there an uninterrupted availability of general utilities (water, energy, communication lines)?	76%
	QC/QA	6.1.1	Is there lot verification testing of laboratory reagents?	81%
		6.2.2	Is there pre-service validation of all pieces of equipment in the laboratory?	89%
		9.2.2	Does the laboratory have standardized internal QC procedures in place for all tests?	65%
		9.2.3	Does the laboratory participate in a national EQA program for each of the TB diagnostic tests used in the laboratory?	94%

Category	Type	Survey no.	Question	Result
		9.2.5	Do supervisory laboratories conduct a system of oversight that includes supervisory visits, feedback, corrective actions, and documentation? If yes:	63%
		9.2.5	Does the laboratory receive regular supervisory visits from a higher-level laboratory? If yes:	82%
		9.3.1	Is the position of quality or QA officer filled in each laboratory? (part-time or full-time)	74%
	Required inputs - reagents	6.1.1	Are standardized testing reagents used for all TB tests?	100%
		6.1.3	Have there been any stockouts during the past year because of problems with the procurement system? (pertaining to reagents)	54%
	Sensitization materials	4.1.4	Are healthcare workers involved in the TB diagnosis cascade provided with standardized sensitization content (e.g., algorithm diagrams, brochures, training materials, customer handbook)?	85%
	SOPs - TB diagnosis methods	9.1.2	Are the national SOPs and job aids available for all TB diagnosis methods performed in the laboratory?	85%
	SOPs specimen management	3.2.3	Are SOPs for specimen referral available? Does the laboratory adhere to the SOP for transport of all specimens?	74%
	Specimen management	3.2.2	Is triple packaging used for all local, national, and international sample transportation?	76%
	Specimen management	3.2.2a	Have you experienced any stockouts of the materials needed for triple packaging in the past year?	50%
	Staffing	7.2.2	Are a sufficient number of qualified staff available for diagnostic testing and EQA activities?	67%
	Standard forms	8.1.1	Are standardized request forms available for all testing and are they being used?	83%
		8.1.2	Are standardized forms available for collecting performance data and are they being used?	75%
		8.2.1	Are standardized reporting forms used for all TB tests and has information on interpretation of results included?	71%
	Training - biosafety	7.1.4	Have staff received pre-service or in-service training on quality, biosafety and biosecurity practices?	86%

Category	Type	Survey no.	Question	Result
	Training - laboratory management	7.1.5	Has the laboratory manager or supervisor received training in laboratory management?	54%
		7.1.6	Is in-service training available to keep laboratory staff up-to-date with laboratory technologies and guidelines?	76%
		7.1.6	Is there training for clinicians or medical officers on changes made to laboratory policies (i.e., changes in algorithms)?	75%
	Training - specimen management	3.2.1	Are all laboratorians, healthcare workers, clinicians, and transport personnel trained in the procedures for safely collecting, labelling, packaging, handling, and transporting TB specimens?	77%
	Training - TB diagnosis	7.1.6	Are private sector laboratory staff included in TB diagnosis training? If yes:	77%
		4.1.4	Has training on diagnosis algorithms, testing methods, specimen collection, test requisition forms, and specimen referral been provided to:	
			• Public sector laboratorians?	92%
			• Private sector laboratorians?	81%

Table 23. QTSA questions and results pertaining to availability and readiness

Category	Type	Survey no.	Question	%
Availability	TPT	5.5	Was TPT offered in the past 12 months?	94%
		5.5.1	Type of TPT available - INH 100 mg (6, 9, 12 months or continuous)	94%
		5.5.2	Type of TPT available - INH 300 mg (6, 9, 12 months or continuous)	83%
		5.5.3	Type of TPT available - 3HP (a combination of rifapentine and INH)	5%
		5.5.4	Type of TPT available - Q-TIB (a combination of cotrimoxazole, isoniazid, and vitamin B6)	2%
		5.5.5	Type of TPT available - Is TPT provided by someone other than a health worker (community support group, VHTs, community linkage facilitators, etc.)?	19%
	TB testing	2.2.2 (1)	TB diagnosis at this facility done by - Onsite lab only	15%

Category	Type	Survey no.	Question	%
		2.2.2 (2)	TB diagnosis at this facility done by - Offsite lab only	2%
		2.2.2 (3)	TB diagnosis at this facility done by - Both onsite and offsite labs	83%
		3.1.5	Diagnosis of TB by GeneXpert	42%
		3.1.6	Diagnosis of TB by LAM (urine test)	39%
		3.1.8(a)	Has this facility referred patients elsewhere for TB diagnosis, either via smear microscopy or GeneXpert, in the past 12 months?	87%
	HIV testing	5.1	Facility offered the service at any time in the past 12 months - HIV testing and counseling for presumptive TB patients	99%
		5.2	Facility offered the service at any time in the past 12 months - HIV testing and counseling for confirmed TB patients	100%
		5.3	Has this facility provided a one-stop shop for TB/HIV services within the last 12 months? (i.e., TB/HIV patients received services under the same roof by the same physician during the same consultation)	86%
	Free lab tests And X-rays	2.1.2.1	Screening X-ray	63%
		3.1.2.4	Diagnostic X-ray	50%
	DST	15.3.1.2	GeneXpert	89%
		15.3.1.3	First-line DST (other than GeneXpert)	51%
		15.3.1.4	Second-line DST	31%
		15.4.1	GeneXpert to detect resistance to rifampicin (or other molecular method)	98%
		15.4.2	Line probe assays (e.g., MTBDRplus to MTBDRsl)	7%
		15.4.3	Solid culture	14%
		15.4.4	Liquid culture	12%
		3.2.1	Has this facility provided testing to presumptive or confirmed TB patients to see if they are resistant to first-line TB drugs in the past 12 months (i.e., DST)?	68%
		3.2.2 (a)	Has this facility referred patients elsewhere for DR-TB diagnosis (DST) in the past 12 months?	46%

Category	Type	Survey no.	Question	%
		6.5.2	DST for patients who were previously treated for TB (including GeneXpert)	86%
		6.5.3	DST for patients who fail to convert on treatment (including GeneXpert)	82%
		6.5.4	Any type of DST for suspected DR-TB (including GeneXpert)	66%
	Community involvement	2.5	Some health facilities use VHTs or community linkage facilitators to provide additional support to TB patients. Does this facility work with VHTs, community linkage facilitators, or volunteers who support TB patients?	96%
Readiness	Training on TB testing	11.1	Received new or refresher training in the last 24 months - Screening algorithm for TB (by management authority)	88%
		11.2	Received new or refresher training in the last 24 months - Screening or diagnosis of TB based on X-rays	37%
		11.3	Received new or refresher training in the last 24 months - Diagnosis of TB based on clinical symptoms or examination for adults	86%
		11.4	Received new or refresher training in the last 24 months - Diagnosis of TB based on sputum tests using smear microscopy	82%
		11.5	Received new or refresher training in the last 24 months - Diagnosis of TB based on sputum tests using culture	27%
		11.6	Received new or refresher training in the last 24 months - Diagnosis of TB using GeneXpert	73%
	Training - TB/HIV	11.11	Received new or refresher training in the last 24 months - Management of TB/HIV coinfection	87%
	Training - infection control	11.12	Staff received training (last 24 months) - TB infection control	82%
	Standard forms - specimen collection	15.1.3	Are there approved laboratory request forms?	62%
	SOPs -specimen management	14.7.2	Do you have SOPs for QC (either internal or external) for the specimens assessed in this facility?	78%
		15.1.2	Are there SOPs for specimen collection? (observed)	66%

Category	Type	Survey no.	Question	%
	Sensitization materials	10.1.1	Flowcharts or algorithms on TB screening, such as the ICF form or the Uganda TB diagnosis and screening algorithm (yes, observed)	88%
		10.1.6	TB posters on walls, leaflets, brochures, and/or pamphlets for distribution, (i.e., educational materials about TB)	57%
	Required inputs	15.1.4	Were there any stockouts of specimen management supplies (e.g., sealable, leak-proof sputum containers) in the past 6 months?	30%
	Reporting	3.3.1	Does this facility report TB patients to the NTLP?	99%
	QC/QA	12.1	Has a supervisor from any upper-level office come here on a supervisory visit within the past 3 months?	80%
		12.1.4	The last time that a supervisor from outside the facility visited, the supervisor discussed the performance of the facility based on TB service data	89%
		12.1.6	Provide a record of written comments or suggestions from their visit (e.g., the documentation manual)	81%
		14.7(1)	QC/QA for smear microscopy tests used in facility - None	5%
		14.7(2)	QC/QA for smear microscopy tests used in facility - internal only	5%
		14.7(3)	QC/QA for smear microscopy tests used in facility - external only	24%
		14.7(4)	QC/QA for smear microscopy tests used in facility - internal and external	65%
	Infection control	14.6	(a) Does the facility have an NTLP Lab Manual?	50%
		14.5a	Is a biosafety hood or cabinet used in this facility?	12%
		18.1.1	Has a staff member been designated as an infection prevention and control focal point with specifically articulated duties?	71%
		18.1.7	Is a system in place to screen and evaluate staff for TB disease?	47%
		18.2.1	An updated and approved infection prevention and control plan (yes, observed)	46%
		18.3.10	Gowns, scrubs, or clinical coats (Yes, observed)	88%
		18.3.11	Eye protection/goggles or face protection (Yes, observed)	27%
		18.3.4	Medical waste receptacle (pedal bin) with lid and plastic bin liners	99%

Category	Type	Survey no.	Question	%
		18.3.5	Other waste receptacle	82%
		18.3.6	Sharps container (i.e., safety box)	100%
		18.5.1	Are N-95 and FFP2 respirators (particulate respirators) readily available for (Yes, observed)	63%
		18.5.1.1	Have staff members been trained on the proper fit of the respirators?	58%
		18.5.1.2	How often do facility staff members use the N-95 and/or FFP2 respirators according to the national infection prevention and control guidance? (always)	35%
	Guidelines for X-Ray	10.2.2	Guidelines on the use of chest X-ray for TB screening and diagnosis (yes, observed)	16%
	Guidelines TB diagnosis and treatment – Children	10.1.2	Guidelines for diagnosis and treatment of TB among children (yes, observed)	84%
	Guidelines TB diagnosis and treatment – Adults	10.1.3	Guidelines for diagnosis and treatment of TB among adults (TB manual) (yes, observed)	82%
	Guidelines – NTLP Manual	10.1.0	Uganda NTLP Manual for Management and Control of Tuberculosis and Leprosy	67%
	Guidelines	10.1.4	Guidelines for TB infection control	61%
	Guidelines – TB/HIV	10.1.5	TB/HIV guidelines, (i.e., management of HIV and TB coinfection)	85%
	decision support	11.1	Screening algorithm for TB	88%
		10.1.1	Flowcharts or algorithms on TB screening, such as the ICF form or the Uganda TB diagnosis and screening algorithm. (yes, observed)	88%
		10.2.1	Flowcharts or algorithms on TB diagnosis (yes, observed)	79%
	Algorithm	8.1.2.1	Clinical algorithm to determine if a child has TB (physical exam) (1-unprompted)	85%

Table 24. Facility-level comparison of mapped indicator results, QTSA, DNA

Facility name	Iriri HC III		Moroto Army HC IV		Moroto RRH		St Pius, Kidepo HCIII		Busiu HC IV		Kolonyi HC III		Gulu RRH		St. Mary's Hosp. Lacor		Arua RRH		Kuluva Hospital		Rhino Camp HC IV		
District	Moroto		Moroto		Moroto		Moroto		Mbale		Mbale		Gulu		Gulu		Arua		Arua		Arua		
Facility type	HC III		HC IV		Hospital		HC III		HC IV		HC III		Hospital		Hospital		Hospital		Hospital		HC IV		
Sub-region	Karamoja		Karamoja		Karamoja		Karamoja		Mid Eastern		Mid Eastern		Mid-North		Mid-North		West Nile		West Nile		West Nile		
Survey	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	%
Availability																							
QTSA: 3.3.1 | DNA: 1.2.4 -Report cases NTP	Yes	Yes	Yes	No	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	86%
QTSA: 2.1.2.1 | DNA: 1.4.3 - Avail. free X-ray		Yes		0	No	Yes		0		Yes		Yes	No	Yes		Partial		Yes	Yes	0		0	0%
QTSA: 2.5 | DNA: 2.1.3 - Community linkages	Yes	0	Yes	0	Yes	Partial	Yes	0	Yes	0	Yes	0	Yes	Yes	Yes	Yes	Yes	Yes	Yes	0	Yes	0	88%
QTSA: 3.1.5/3.1.8 DNA: 4.2.1- Availability of WRDs	Yes	Yes	Yes	Yes	Yes	Partial	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	86%
QTSA: 15.4.1 |	Yes	Yes		Yes		Yes		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	100%

Facility name	Iriri HC III		Moroto Army HC IV		Moroto RRH		St Pius, Kidepo HCIII		Busiu HC IV		Kolonyi HC III		Gulu RRH		St. Mary's Hosp. Lacor		Arua RRH		Kuluva Hospital		Rhino Camp HC IV		
District	Moroto		Moroto		Moroto		Moroto		Mbale		Mbale		Gulu		Gulu		Arua		Arua		Arua		
Facility type	HC III		HC IV		Hospital		HC III		HC IV		HC III		Hospital		Hospital		Hospital		Hospital		HC IV		
Sub-region	Karamoja		Karamoja		Karamoja		Karamoja		Mid Eastern		Mid Eastern		Mid-North		Mid-North		West Nile		West Nile		West Nile		
Survey	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	%
DNA: 4.3.1 -Availability of DST for first-line drugs																							
QTSA: 15.3.1.4 | DNA: 4.3.2 - Availability DST second-line drugs		Yes	No	0	Yes	Yes	No	0		No	Yes	Yes		Yes		Yes		Yes	Yes	Yes		Yes	100%
QTSA: 5.1 | DNA: 10.4.3 -Avail. HIV testing	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	91%
QTSA: 3.1.6 | DNA: 10.4.4 -Avail. of LF-LAM	No	Partial	Yes	No	Yes	0	No	No	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	90%

Readiness

QTSA: 15.1.2 | DNA: 3.2.3 -SOPs QC/QA	Yes	No	No	No	Yes	Partial		No	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes		Yes	Yes	Yes	No	Yes	65%
QTSA: 10.2.1 | DNA: 4.1.1	Yes, observed	Yes	Yes, observed	No	Yes, observed	0	Yes, observed	No	Yes, observed	Yes	Yes, observed	Yes	Yes, observed	Yes	Yes, observed	Yes	Yes, observed	Yes	Yes, observed	Yes	Yes, observed	Yes	80%

Facility name	Iriri HC III		Moroto Army HC IV		Moroto RRH		St Pius, Kidepo HCIII		Busiu HC IV		Kolonyi HC III		Gulu RRH		St. Mary's Hosp. Lacor		Arua RRH		Kuluva Hospital		Rhino Camp HC IV		
District	Moroto		Moroto		Moroto		Moroto		Mbale		Mbale		Gulu		Gulu		Arua		Arua		Arua		
Facility type	HC III		HC IV		Hospital		HC III		HC IV		HC III		Hospital		Hospital		Hospital		Hospital		HC IV		
Sub-region	Karamoja		Karamoja		Karamoja		Karamoja		Mid Eastern		Mid Eastern		Mid-North		Mid-North		West Nile		West Nile		West Nile		
Survey	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	%
-Avail. diagnosis algorithm																							
QTSA: 10.2.2 | DNA: 4.1.3- Guidelines diagnosis X-ray	No	-	Don't know	-	No	-	No	Partial	No	-	Yes, obser-ved	-	Yes, not obser-ved	Yes	No	Yes	No	Partial	Yes, obser-ved	-	No	-	50%
QTSA: 11.1 | DNA: 4.1.4 -Training screen. algorithm	Yes	0	Yes	No	Yes	Yes	Yes	0	Yes	0	Yes	0	Yes	Yes	No	Yes	Yes	0	Yes	0	Yes	0	50%
QTSA:10.1.6 | DNA:4.1.4 - Sensitization materials	Yes, observ ed	-	No	No	No	Yes	Yes, obser-ved	-	Yes, obser-ved	-	Yes, obser-ved	-	Yes, obser-ved	Yes	No	Yes	Yes, obser-ved	-	Yes, obser-ved	-	Yes, obser-ved	-	50%
QTSA: 18.1.1 | DNA: 5.3.1 - Infection control focal person	No	0	Yes	0	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	0	Yes	0	86%
QTSA: 18.5.1 | DNA: 5.3.2 - PPE readily available	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, not obser-ved	Yes	Yes, not obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	91%

Facility name	Iriri HC III		Moroto Army HC IV		Moroto RRH		St Pius, Kidepo HCIII		Busiu HC IV		Kolonyi HC III		Gulu RRH		St. Mary's Hosp. Lacor		Arua RRH		Kuluva Hospital		Rhino Camp HC IV		
District	Moroto		Moroto		Moroto		Moroto		Mbale		Mbale		Gulu		Gulu		Arua		Arua		Arua		
Facility type	HC III		HC IV		Hospital		HC III		HC IV		HC III		Hospital		Hospital		Hospital		Hospital		HC IV		
Sub-region	Karamoja		Karamoja		Karamoja		Karamoja		Mid Eastern		Mid Eastern		Mid-North		Mid-North		West Nile		West Nile		West Nile		
Survey	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	%
QTSA: 18.1.7 | DNA: 5.3.4 -TB screening staff	No	No	No	No	Yes	No	No	No	No	No	Yes	No	Yes	No	No	Yes	Yes	No	Yes	No	Yes	Yes	45%
QTSA: 11.12 | DNA: 7.1.4 -Training TB infection control	Yes	0	Yes	0	Yes	Yes	Yes	0	Yes	0	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	0	Yes	0	80%
QTSA: 15.1.3 | DNA: 8.1.1 - Standardized lab request forms	Yes, obser-ved	No	No	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	No	Partial	Yes, not obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	73%
QTSA: 10.1.3| DNA: 9.1.2 - Guidelines/SOPs for Dx avail.	Yes, obser-ved	No	Yes, obser-ved	No	Yes, obser-ved	Yes	Yes, obser-ved	Partial	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Partial	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	73%
QTSA: 14.7 | DNA: 9.2.2- Lab has Internal QC/QA	Exter-nal only	No	Both int. and ext	No	Both int. and ext	Yes	None	0	Both int. and ext	No	Both int. and ext	No	Both int. and ext	Partial	Exter-nal only	Yes	None	Yes	Both int. and ext	Yes	Both int. and ext	Yes	55%
QTSA: 12.1 | DNA: 9.2.5 - Regular supervision	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	No	Partial	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	Yes, obser-ved	Yes	91%

Facility name	Iriri HC III		Moroto Army HC IV		Moroto RRH		St Pius, Kidepo HCIII		Busiu HC IV		Kolonyi HC III		Gulu RRH		St. Mary's Hosp. Lacor		Arua RRH		Kuluva Hospital		Rhino Camp HC IV		
District	Moroto		Moroto		Moroto		Moroto		Mbale		Mbale		Gulu		Gulu		Arua		Arua		Arua		
Facility type	HC III		HC IV		Hospital		HC III		HC IV		HC III		Hospital		Hospital		Hospital		Hospital		HC IV		
Sub-region	Karamoja		Karamoja		Karamoja		Karamoja		Mid Eastern		Mid Eastern		Mid-North		Mid-North		West Nile		West Nile		West Nile		
Survey	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	QTSA	DNA	%
QTSA: 11.11 | DNA: 10.5.1 - Training in TB/HIV coinfection	Yes	Partial	Yes	No	Yes	0	Yes	0	Yes	Yes	Yes	Yes	Yes	Partial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	78%
																						Aver-age	73%
Index of availability and readiness	78%	63%	74%	38%	86%	86%	74%	46%	83%	79%	90%	89%	88%	86%	63%	93%	89%	93%	95%	93%	88%	100%	
% Difference		19%		49%		0%		37%		4%		2%		2%		49%		3%		2%		14%	
Agreement of results across surveys		50%		32%		64%		41%		64%		64%		86%		64%		68%		64%		59%	

	= agreement
	= partial agreement
	= no agreement

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Tuberculosis Data, Impact Assessment and Communications Hub