TB Data-to-Action Continuum in Bangladesh

Report

May 2023

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TB DIAH
Tuberculosis Data, Impact Assessment and Communications Hub

TB Data-to-Action Continuum
in Bangladesh

Report

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Abbreviations

ARC	Assessment of Reporting Capacity
BRAC	Bangladesh Rural Advancement Committee
D2AC	Data-to-Action Continuum
DGHS	Directorate General of Health Services
DHIS2	District Health Information Software version 2
DOTS	directly observed treatment short-course
DSMO	District Surveillance Medical Officer
eLMIS	electronic logistics management information system
HEED	Health, Education and Economic Development
HMIS	health management information system
HR	human resources
icddr,b	International Centre for Diarrhoeal Disease Research, Bangladesh
ICT	information and communications technology
IDDS	Infectious Disease Detection and Surveillance
IRD	Interactive Research & Development
JSI	John Snow, Inc.
M&E	monitoring and evaluation
MDR	multidrug-resistant
MEL	monitoring, evaluation, and learning
MIS	management information system
MTaPS	Medicines, Technologies, and Pharmaceutical Services
NTP	national tuberculosis program
PBMEF	Performance-based Monitoring and Evaluation Framework
RR	rifampicin-resistant
SOP	standard operating procedure
STAR	Sustaining Technical and Analytical Resources
TB	tuberculosis
TB DIAH	TB Data, Impact Assessment and Communications Hub
USAID	United States Agency for International Development

WHO	World Health Organization

Executive Summary

Background

A strong tuberculosis (TB) monitoring and evaluation (M&E) and surveillance system is vital for countries to reach global goals to end TB. The United States Agency for International Development (USAID) leads the U.S. Government's global efforts to end TB. USAID's Global Accelerator to End TB is the Agency's programmatic approach to fight TB. Under the Accelerator, USAID funds the TB Data, Impact Assessment and Communications Hub (TB DIAH) project, which developed a TB Data-to-Action Continuum (D2AC) Toolkit to measure countries' progress and guide efforts to improve their TB M&E and surveillance systems. The D2AC allows national TB programs (NTPs) to precisely gauge the barriers to data use and assess the decision making capabilities of different actors across their health systems. The purpose of a D2AC workshop is to guide the evaluation of data use capabilities to routinely monitor and improve data use attributes associated with TB program management and service delivery at subnational and national levels. The objective is to use the findings from the application of the D2AC Toolkit to evaluate TB M&E and surveillance systems by (1) assessing decision making capabilities of different actors; (2) precisely gauging the barriers to data use; (3) helping NTPs select appropriate interventions in the context of their health systems; (4) developing an implementation plan to apply in the future; and (5) using implementation recommendations for strategic planning purposes and decision making.

Methods

Bangladesh was selected as the fourth workshop location for the D2AC. The workshop was held in December 2022 in Dhaka. Thirty-seven participants attended, representing various levels of the Bangladesh health system and other TB stakeholder groups. The D2AC workshop was conducted in-person. The D2AC team applied a mixed methods approach conducted in three parts with the support of the D2AC Toolkit: (1) participants first completed the digital D2AC Toolkit's data collection instrument individually and then in groups; (2) individually and then in groups, participants provided evidence and justification in the data collection instrument for the response options selected; and (3) in groups, participants identified priority actions for post-workshop implementation. A semi-structured questionnaire and focus group discussion method were implemented during the assessment. The D2AC team facilitated the workshop with the use of slides and handouts, and there were several break-out group activities and report-backs. Quantitative data from the 36 (30 individual and 6 group) data collection instruments were automatically generated using the digital D2AC analysis dashboard. The qualitative data—observations, comments, and questions submitted in the 30 instruments and brought up in group discussions and report-backs—were transcribed and analyzed.

Results

The overall D2AC assessment score from the aggregate group responses was 3.21 (out of 5), putting Bangladesh at an "established" level according to the D2AC. The country performed best in domain 1 (Data Collection and Reporting, score of 3.71) and least well in domain 2 (Data Analysis and Use, score of 2.67). Domain 3 (Leadership, Governance, and Accountability), domain 4 (Capacity Building), and domain 5 (Information and Communications Technology

[ICT]) received scores of 3.42, 3.43 and 2.81, respectively. The overall score from the aggregated individual responses was similar (3.23 out of 5), albeit slightly higher, to the group aggregate score (3.21). Comparison of the individual and group responses revealed that individuals gave consistently lower scores in domains 1, 3, and 4 (with the exception of domain 3 subdomain 2) and higher scores in domains 2 and 5 than groups. Six subdomains were identified as priorities: D1S3 (Data quality), D2S2 (Analytics and visualization), D3S1 (Data use guidance), D3S5 (Monitoring, evaluation, and learning [MEL]), D4S2 (Skill and knowledge development), and D5S3 (ICT business infrastructure).

Discussion

The D2AC assessment in Bangladesh shed light on the perceived areas of improvement for the Bangladesh TB information system, namely in the areas of data integration and exchange, analytics and visualization, dissemination and communication, data use guidance, network and connectivity, and ICT. That being said, no subdomains received scores lower than 2 out of 5. The D2AC assessment in Bangladesh also shed light on the areas that were performing well. The strongest-performing area was data collection and reporting practices, followed by strong scores in MEL, data interpretation, and financial resources. Twelve of the eighteen subdomains received scores superior to 3 out of 5, meaning that they were identified as being at least at an "established" stage on the continuum, and two among those received scores superior to 4 out of 5 ("institutionalized" stage of the continuum). During the consensus-building process, the score for domain 4, subdomain 1 (Data interpretation) was reduced from 4.06 to 3.76 because respondents did not believe the system to be at an institutionalized level. This modification, combined with the adoption of the individual aggregate score for domain 4, subdomain 3 (Decision making ability) changed the domain 4 score from 3.70 to 3.43 and the overall score of the Bangladesh D2AC assessment from 3.26 to 3.21.

Recommendations

Priority recommendations were developed in small groups. They were then combined in plenary to develop a joint implementation plan and were validated by the workshop participants. The recommendations can be summarized in four broad categories: *trainings to be held* (sensitize staff on data quality characteristics, perform routine data quality checks, build a strong and sustainable MEL team, data entry analysis and its interpretation, and in-service training to build monitoring and supervisory capacity); *materials and systems to be developed or strengthened* (a reliable data repository system, a reliable, complete, and accurate routine checks and reviews for data quality, customized analytics and visualizations using the central data repository, a comprehensive data use guidance, a learning and adaptation mechanism integrated in the MEL process, specific guidance around quality assurance and control, a training module containing demonstration of data analysis and use for decision making at different levels, a training module for data entry, a training database, and an ICT/tech corner at TB facilities); *areas where monitoring is to be ensured* (to reduce bias and duplication in data reporting through quarterly data consistency checks between e-TB Manager and District Health Information Software version 2 [DHIS2], to monitor the implementation of the data use guidance in order to revise and update it as needed, to monitor and review the MEL plan implementation, to track the progress of the implementation of the MEL operationalization plan, to modify/upgrade the data

collection and analytics system, and to ensure funding availability for any kind of ICT equipment damage, repair, and maintenance); and *evaluations to be conducted* (periodically reporting on data quality operations, evaluating the impact of the new data use guidance, using data from MEL activities for research and evaluation, assessing perceived decision making needs [for decisions based on available data for programmatic improvement] for subnational managers, assessing the existing management information system [MIS], and implementing an ICT infrastructure operations and maintenance plan at the national and subnational levels).

Conclusion

Despite accounting for 3.6% of the worldwide TB burden and being among the 30 high TB burden countries, Bangladesh saw one of the largest relative reductions in annual TB case notifications between 2019 and 2020, was one of six high-burden countries to have reached or passed the first milestone of the End TB Strategy, and is one of the priority countries with the highest levels of treatment coverage in 2021 (World Health Organization [WHO], 2022). The D2AC assessment in Bangladesh highlighted both the high-performing elements of the NTP's data use capabilities and the challenges that should be addressed to improve evidence-based decision making. The assessment revealed good performance in certain dimensions of the D2AC, such as data collection and reporting, MEL, and data interpretation. However, it also revealed important gaps, such as standardized ICT and connectivity needs assessments, data integration, systematic trainings, and rigorous data use guidance. These findings provide evidence of the areas needing programmatic interventions, and can also inform policy makers, donors, and program managers who want to design and implement responsive programs and interventions to strengthen and improve data use capabilities for evidence-based decision making to provide targeted and informed high-quality services for all TB patients.

Background

A strong tuberculosis (TB) monitoring and evaluation (M&E) and surveillance system is vital for countries to achieve global goals to end TB. By routinely collecting high quality, detailed data and by effectively integrating various components of routine information systems (e.g., service statistics, disease surveillance, and financial and human resource data), national TB programs (NTPs) are better able to meet the many data demands of stakeholders, better target TB program implementation, improve the quality and efficiency of TB services, and effectively plan and advocate for resources.

USAID Leadership in Ending TB

The United States Agency for International Development (USAID) leads the U.S. Government's global efforts to end TB. USAID's Global Accelerator to End TB is the Agency's programmatic approach to fight TB. The Accelerator increases commitment from, and builds the capacity of, governments, civil society, and the private sector to accelerate national progress to reach global TB targets. The Accelerator focuses on countries with high burdens of TB where the Agency can unite with local communities and partners to deliver performance-based results. To ensure the Accelerator's effectiveness and increased transparency, USAID uses standardized data collection and performance-based indicators that align with the targets.

TB DIAH and D2AC

Under the Accelerator, USAID funds the TB Data, Impact Assessment and Communications Hub (TB DIAH). TB DIAH aims to ensure optimal demand for and analysis of TB data, and the appropriate use of that information to measure performance and to inform NTPs and USAID interventions and policies.

TB DIAH developed the TB Data-to-Action Continuum (D2AC) Toolkit to measure countries' progress and guide efforts to improve their TB M&E and surveillance systems. The D2AC builds on the work of the Performance-based Monitoring and Evaluation Framework[1] (PBMEF), the Assessment of Reporting Capacity (ARC), and other existing documentation (i.e., joint program reviews, epidemiological assessments). It allows NTPs to precisely gauge the barriers to data use and assess the decision making capabilities of different actors across their health systems. It also helps NTPs select appropriate interventions in the context of their health systems and develop implementation plans to apply them.

The D2AC framework aims to gauge country and NTP capacity to translate data into action to improve NTP performance. Through a systematic review of existing literature and a phased review by experts to validate the concept and pretest the approach, the D2AC team developed the D2AC Toolkit (Kumar, Silver, Chauffour, Boyle, & Boone, 2021; Kumar, Chauffour, Silver, Garcia-Mendoza, & Boone, 2022). More information on TB DIAH's D2AC Toolkit can be found at https://www.tbdiah.org/assessments/d2ac

[1] Available at https://www.tbdiah.org/resource-library/pbmef/

TB and Bangladesh

Bangladesh has a NTP tackling a TB burden of 221 cases per 100,000 people as of 2021 (World Health Organization [WHO], 2021a). The country's TB treatment coverage was 82 percent in 2021 (WHO, 2021). Bangladesh boasts a 95 percent treatment success rate (World Bank, 2020). In 2020, it was estimated that USD 135.3 million are still needed in TB funding (Stop TB Partnership, 2020), despite 70 percent of the 2021 TB budget being funded by foreign countries or institutions (WHO, 2021a).

Bangladesh appears in the WHO's 2021–2025 global list of high-burden countries for TB and accounted for 3.6% of all estimated incident cases worldwide (WHO, 2021b). Bangladesh is also on WHO's 2021–2025 global list of high-burden countries for MDR/RR-TB (WHO, 2021b), with an estimated 1 percent of new TB cases classified as drug resistant, compared with 3.3% worldwide (WHO, 2021). However, Bangladesh is also one of the 16 countries with the largest contributions to the global shortfall in TB notifications in 2020 compared with 2019 (WHO, 2021b).

Objectives

Workshop Objectives

The purpose of the D2AC workshop was to guide the evaluation of data use capabilities to routinely monitor and improve data use attributes associated with TB program management and service delivery at subnational and national levels.

The D2AC Toolkit was used for both individual and group responses. The objective was to use the findings to evaluate TB M&E and surveillance systems by:

- Assessing decision making capabilities of different actors
- Precisely gauging barriers to data use
- Helping the NTP select appropriate interventions in the context of its health system
- Developing an implementation plan to apply in the future
- Using implementation recommendations for strategic planning purposes and decision making

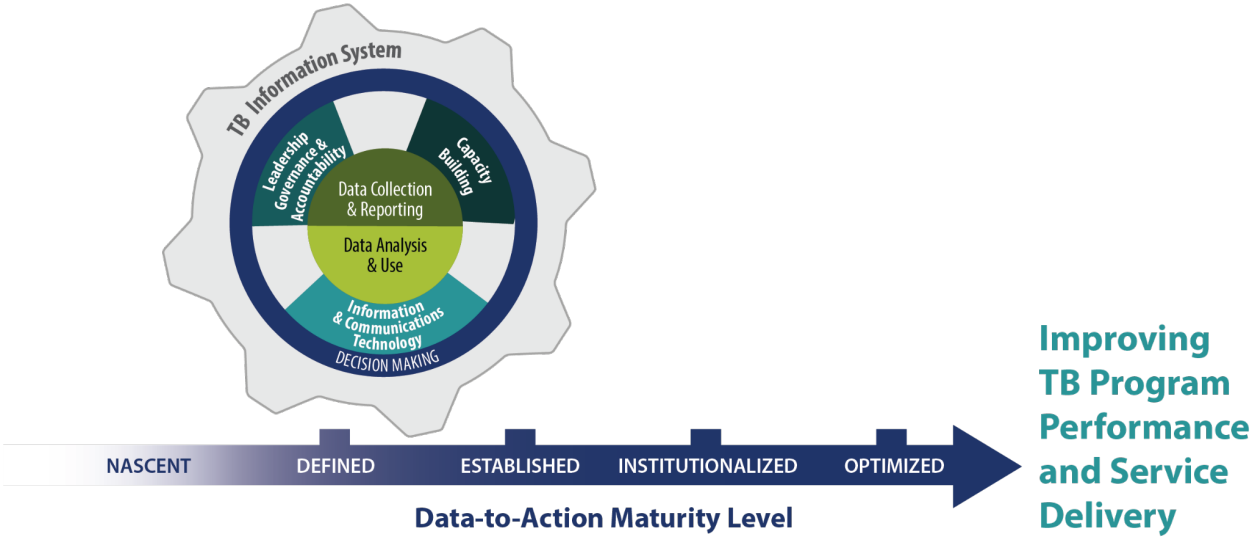
Beyond the standard objectives of the D2AC assessment, some objectives were also specific to Bangladesh. The Bangladesh NTP team expressed that the findings and recommendations from this workshop would be very useful contributions to the National Strategic Plan being finalized in January 2023, a new operational plan being developed in 2023, and identifying new activities USAID/HQ may be interested in undertaking in Bangladesh. Furthermore, the D2AC workshop in Bangladesh was the first workshop to use the digital D2AC Tool hosted on the TB DIAH Data Hub, so the D2AC team looked forward to a smooth workshop using the new platform.

Concept

The conceptual framework (Figure 1) describes the organizational, human, technology, and process-related factors affecting data use capabilities. The framework highlights an interlinked and cyclical evolution of the health information system involving TB data collection and

reporting, analysis, use, and dissemination-related interventions that build on the leadership and governance and capacity building efforts of a given NTP. The framework shows that the interlinked interventions follow a continuous improvement approach to achieve the advanced maturity levels (often identified by a descriptor, such as nascent, defined, established, institutionalized, and optimized), which are associated with an improvement of NTP performance in terms of using data for proactive and responsive clinical, programmatic, managerial, and policy decision making.

Figure 1. D2AC conceptual framework



Tool Design

The D2AC Toolkit was developed under the TB DIAH project, funded by USAID's Global Accelerator to End TB. D2AC was initially developed as a framework to gauge country and NTP capacity to translate data into action to improve NTP performance. Informed by a review of peer-reviewed and gray literature, the D2AC Toolkit and process builds on previous experience with maturity models. The D2AC team documented and published a journal article on this systematic review (Kumar, et al., 2021). A phased review of the Toolkit was also conducted by the D2AC Advisory group starting in March 2021. The D2AC team documented and published a journal article on the Toolkit validation process as well (Kumar, et al., 2022). More information on the Toolkit validation process can be found at https://www.tbdiah.org/assessments/d2ac

The digital version of the D2AC Toolkit—used for the first time in the context of a country assessment for the workshop in Bangladesh—includes five defined continuum levels (Table 1); a country profile template to collect socioeconomic, demographic, and epidemiological indicators (Appendix C); a D2AC scale with capability statements organized into five domains and 18 subdomains (Table 2) for each of the five continuum levels; a data collection instrument with closed-ended capability continuum response options which also features questions around whether the data needs of key TB data users are met (Appendix E); and an analysis dashboard to visualize responses with different aggregation options. The D2AC analysis dashboard on the

digital tool automatically aggregates responses from all completed data collection instruments and generates data visualizations and recommended priority actions. This enables decision makers to make sense of and apply the findings, and to develop an implementation plan using the template provided in the D2AC Toolkit.

The Toolkit measures the status of current and desired TB M&E and surveillance systems data use capabilities across 18 subdomains, grouped in five domains. The domains and subdomains are then measured across five continuum levels: nascent, defined, established, institutionalized, and optimized (Table 1). This method offers a systematic way to show a measurable impact of improvements across processes (e.g., data collection processes); human resources (HR) (e.g., skill and knowledge development); and institutional attributes (e.g., policy, strategy, and governance).

Table 1. The five D2AC continuum levels

Continuum Level	Description
1 (Nascent)	● Formal processes, capabilities, experience, or understanding of data use issues/activities are limited or emerging. ● Formal processes are not documented, and functional capabilities are at the development stage. ● Success depends on individual effort (few committed users). ● Predominantly paper-based data management system.
2 (Defined)	● Basic processes are in place, based on previous activities or existing and accessible policies. ● The need for standardized processes and automated functional capabilities is known. ● There are efforts to document current processes and policies, and capacity building needs.
3 (Established)	● There are approved documented processes and guidelines tailored to data use. ● There is increased collaboration and knowledge sharing. ● Need for external technical assistance is clearly identified. ● Innovative methods and tools can be implemented and used to extend functional capabilities.
4 (Institutionalized)	● Activities are under control using established processes. ● Requirements and goals have been developed and a feedback process is in place to ensure that they are met. ● Detailed measures for processes and products are being collected.
5 (Optimized)	● Best practices are being applied, and people and the system are capable of learning and adapting. ● The system uses experiences and feedback to correct problems and continuously improve processes and capabilities. ● Future challenges are anticipated, and a plan is in place to address them through innovation and new technology. ● Processes are in place to ensure review and incorporation of relevant innovation.

The D2AC scale is made up of five domains, with 18 corresponding subdomains (Table 2).

Table 2. The five D2AC domains and 18 D2AC subdomains

Domains	Subdomains
1. Data Collection and Reporting	1. Data collection tools and workflow 2. Reporting 3. Data quality
2. Data Analysis and Use	1. Data integration and exchange 2. Analytics and visualization 3. Dissemination and communication
3. Leadership, Governance, and Accountability	1. Data use guidance 2. Data access and sharing 3. Organizational structure and function 4. Leadership and coordination 5. Monitoring, evaluation, and learning (MEL) 6. Financial resources
4. Capacity Building	1. Data interpretation 2. Skill and knowledge development 3. Decision making ability
5. Information and Communications Technology (ICT)	1. Hardware 2. Network and connectivity 3. ICT business infrastructure

Workshop Design

The D2AC Toolkit is designed to be implemented as a facilitator-guided workshop with stakeholders from different aspects of the NTP (e.g., screening, diagnosis, and treatment) and from different levels of the health system. Participants discuss and achieve consensus on where the elements of NTP capacity fall on the continuum. The Toolkit then yields suggested interventions—called priority actions—tailored to stakeholders' assessments of NTP capacities. These priority actions help the NTP improve capacity to translate data into action, targeted to the current continuum level at different levels of the health system.

D2AC in the Context of TB DIAH Resources

The D2AC Toolkit can be used on its own, or as a complement to other TB DIAH tools and products as part of an assessment of a country's TB M&E and surveillance systems. When used alongside other TB DIAH tools and assessments, such as the PBMEF, ARC, or Quality of TB Services Assessment,[2] the D2AC activity contributes to a holistic view of a country's TB M&E and surveillance systems and its capacity to collect, analyze, and use key indicator data for TB service delivery, performance improvement, and data-based decision making.

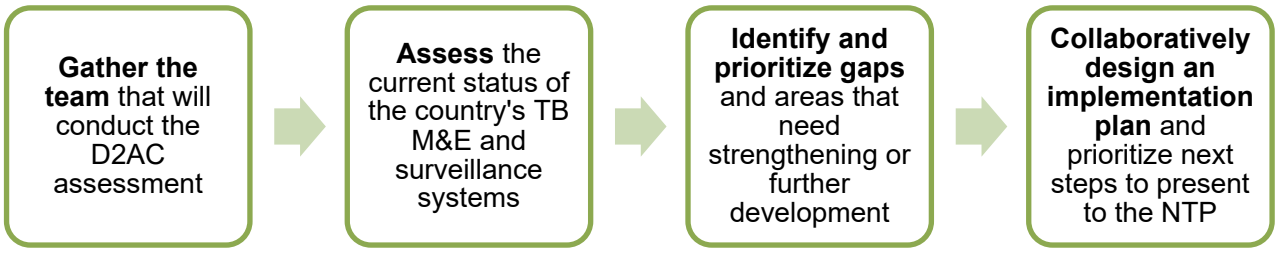
[2] Available at https://www.tbdiah.org/assessments/quality-of-tuberculosis-services-assessments/

Methods

Summary of Workshop Process

Planning for the D2AC workshop began in the fall 2022 with the formation of the leadership team (described in the next section). USAID played a key role in working with the NTP and the D2AC team to secure support, identify the assessment scope, discuss the planning process, and identify participants. During the workshop, participants assessed the current status of the TB M&E and surveillance systems, identified gaps, and prioritized actions in areas that needed strengthening or further development. Once this was completed, the participants designed an implementation plan to present to the NTP for further discussion (Figure 2).

Figure 2. The D2AC workshop approach and process



Identification of Bangladesh for D2AC Implementation

The D2AC team had several criteria in mind when considering what countries to partner with for the D2AC Toolkit implementation.

Bangladesh is one of USAID's 23 priority countries that TB DIAH usually works with closely as part of their portfolio of technical assistance activities, thereby providing the opportunity of administering the tool in a context where the findings would be of particular interest. Strong and established support from the NTP was another valuable consideration. Moreover, one of the D2AC Advisory Group members (and coauthor of this report) was previously based in Bangladesh and encouraged, introduced, and co-facilitated the implementation. After two field tests in Africa and one implementation in Central Asia, this implementation was also an opportunity to use the tool in South Asia. Finally, the TB DIAH team were able to facilitate the workshop and administer the tool in English without needing the digital tool to be translated in advance of the workshop. The D2AC core team began considering Bangladesh as a possible implementation location in April 2022, contacting the USAID/Bangladesh Mission and the Bangladesh NTP in June 2022.

Formation of the Leadership Team

The leadership team consisted of two advisors at the USAID/Bangladesh Mission, one senior staff from the NTP, one USAID Sustaining Technical and Analytical Resources (STAR) Program advisor, two D2AC team members acting as workshop co-facilitators, one D2AC Advisory Group member acting as workshop co-facilitator, and one D2AC team member supporting the event

from headquarters, with additional support provided by the TB DIAH Hub team. USAID was represented at the workshop all three days. The leadership team had the appropriate knowledge of the D2AC Toolkit and assessment process, and the expertise to oversee the assessment process (Table 3). The leadership team met over Zoom calls on November 2, 22, and 30, 2022 and on December 5, 2022.

Table 3. Bangladesh D2AC leadership team

Name	Position	Institution
Samina Choudhury	Infectious Diseases Team Lead	USAID
George Das	Project Management Assistant	USAID
Ahmadul Hasan Khan	M&E Expert	NTP
Maksudul Hannan	Senior TB Strategic Planning Technical Advisor	STAR Program – USAID
Jeanne Chauffour	D2AC Team Lead/M&E Advisor	TB DIAH
Meredith Silver	Data Systems and Use Technical Advisor	TB DIAH
Mohammad Golam Kibria	Doctoral student/Graduate Research Assistant (formerly, STAR Fellow, USAID)	TB DIAH
Yanira Garcia-Mendoza	M&E Officer	TB DIAH

Invitation of Participants

The leadership team used purposive sampling to identify and select participants. Criteria for selection included participants from the national level (e.g., NTP, national reference laboratory, health management information system [HMIS] department); peripheral level (e.g., division health TB units); and health facility level (TB clinic/health unit). Emphasis was placed on diversifying participants working on TB case outreach, treatment, prevention, research, and TB program sustainability (USAID TB pillars of reach, cure, prevent, innovate, and sustain). Forty-two people were carefully identified by name or institution and invited by the NTP, of which 32 attended, and another 5 were in attendance either as substitutes for the original invitees or as additional invitees, for a total of 37 participants. This total did not include the D2AC facilitation team.

Workshop Process

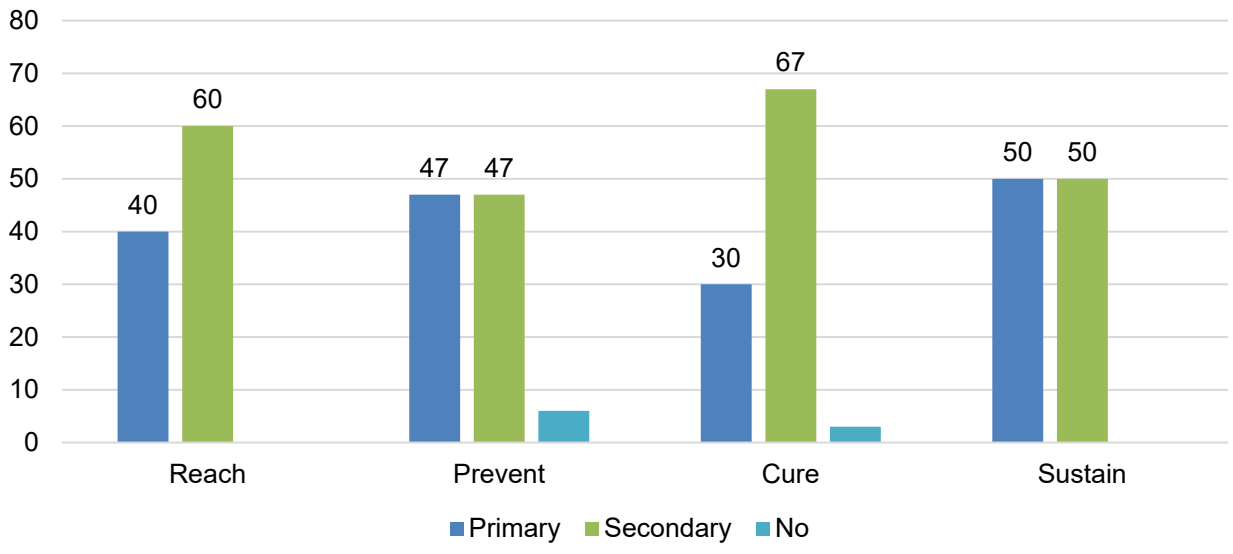
The D2AC assessment can be implemented using a variety of approaches, including individual assessment, group assessments, or a hybrid approach. In Bangladesh, a hybrid approach was implemented. The assessment was conducted in-person. The workshop was conducted over a three-day period and included 37 key personnel identified and invited by the NTP.

The assessment took place on December 19–21, 2022, at the Lakeshore Hotel in Dhaka, Bangladesh. The workshop was facilitated by Jeanne Chauffour, D2AC Team Lead and M&E Technical Advisor, of TB DIAH, John Snow Inc. (JSI); Meredith Silver, Data Systems and Use Technical Advisor, of TB DIAH, University of North Carolina at Chapel Hill; and Mohammad Golam Kibria, doctoral student and Graduate Research Assistant at the University of North Carolina, Chapel Hill and D2AC Advisory Board member. The workshop agenda can be found in Appendix A.

Workshop Participants

Of the 37 participants, 10 (27%) were women. Of the 30 participants who submitted individual responses to the data collection tool, over three-quarters of the participants came from the national level (77% – 23 participants), 2 participants represented the regional level, 3 represented the district level, and 1 person came from the facility level and 1 from the community level. The 4 USAID TB pillars of reach (12 participants identified with this pillar), cure (9 participants), prevent (14 participants), and sustain (15 participants), were all represented by participants' primary areas of work and focus (Figure 3 and Appendix B, Table B1). The split was also relatively even when examining secondary responsibilities, falling into the 4 USAID TB pillars of reach (18 participants), cure (20 participants), prevent (14 participants), and sustain (15 participants).

Figure 3. Primary and secondary TB work areas of participants, as a percentage

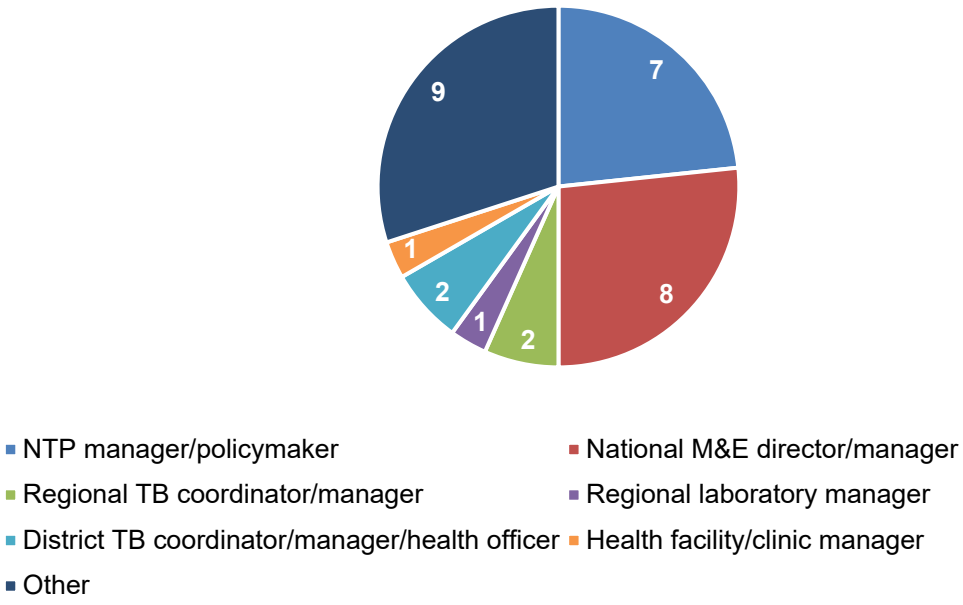


The implementing partners (listed in alphabetical order) represented by 15 participants were Bangladesh Rural Advancement Committee (BRAC) (2 participants), the Damien Foundation, Health, Education and Economic Development (HEED) Bangladesh, the International Centre for Diarrhoeal Disease Research, Bangladesh (icddr,b) (2 participants), Infectious Disease Detection and Surveillance (IDDS), Interactive Research & Development (IRD) (2 participants), the Medicines, Technologies, and Pharmaceutical Services (MTaPS) program (2 participants), the USAID STAR program (3 participants), and SystemOne, LLC.

Five of Bangladesh's eight divisions were represented at the workshop: Barisal, Dhaka, Khulna, Rajshahi, and Sylhet. Appendix B provides the full list of participants (Table B1).

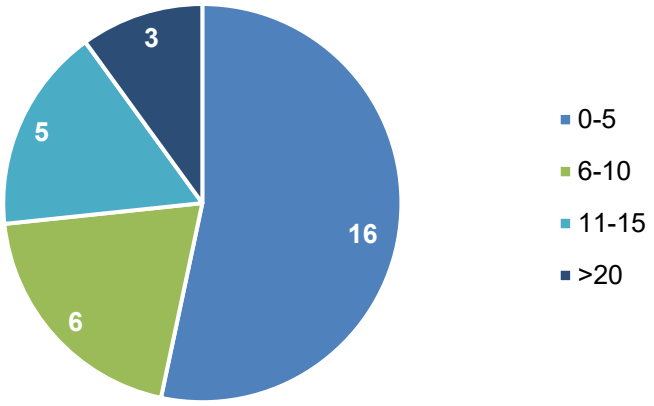
Participants reported associating with six types of roles: NTP manager/policy maker (23%), national M&E director/manager (27%), regional TB coordinator/manager (7%), regional laboratory manager (3%), district TB coordinator/manager/health officer (7%), and health facility/clinic manager (3%). Nine respondents (30%) selected "other".

Figure 4. Participant composition, by TB user role



Sixteen attendees had less than five years of work experience (53%). Twenty percent of attendees had 5–10 years of experience (6 participants) and another 17 percent had 11–15 years of experience (5 participants). Three participants had more than 20 years of work experience (10%) (Figure 5 and Appendix B, Table B2).

Figure 5. Years of experience in TB work among workshop participants



Workshop Proceedings

Workshop Opening

The opening address was given by Dr. Samina Choudhury and Dr. Ahmadul Hasan Khan. Ms. Chauffour, Ms. Silver, and Mr. Kibria concluded the opening words of welcome.

The D2AC team lead presented the workshop overview, including its purpose and how the findings would be used, and the D2AC assessment approach and Toolkit.

The D2AC team lead applied a mixed methods approach conducted in three parts: (1) participants completed the D2AC Toolkit's data collection instrument first individually and then in groups; (2) individually and then in groups, participants provided evidence and justification in the data collection instrument for the response options selected; and (3) in groups, participants identified priority actions for post-workshop implementation. A semi-structured questionnaire and focus group discussion method were implemented during the assessment.

The D2AC team lead facilitated the workshop with the use of slides and handouts. There were also several break-out group activities and report-backs. The D2AC team lead introduced the objectives of the workshop; the background of the Toolkit's development and method; the workshop approach; and the Toolkit in detail, tab-by-tab.

The Bangladesh country profile was developed by a D2AC core team member, Yanira Garcia-Mendoza, M&E Officer for TB DIAH, JSI (who was not facilitating the workshop). The country profile is provided in Appendix C.

Individual Instrument Completion

The participants were invited to fill out the digital D2AC data collection instrument individually with the help of the D2AC Glossary (Appendix D). This gave each participant the chance to

explore the digital tool, become familiar with the instrument questions and their answer options (Appendix E), and to indicate their views on the Bangladesh TB program and information system's current status for each of the 48 capability questions associated with the five domains and 18 subdomains (Table 4). The data collection instrument also includes a set of customized questions based on the user category that the respondent associates with. The 30 individual submissions received were automatically aggregated in the D2AC Data Analysis Tool dashboard. The findings from the aggregated individual responses were shared in plenary using data visualizations automatically generated by the dashboard. The floor was then opened for comments and questions.

Table 4. Data collection instrument questions, by domain and subdomain

Domain	Subdomain	Questions by subdomain	Questions by domain
Data Collection and Reporting	Data collection tools and workflow	6	11
	Reporting	3	
	Data quality	2	
Data Analysis and Use	Data integration and exchange	4	10
	Analytics and visualization	4	
	Dissemination and communication	2	
Leadership, Governance, and Accountability	Data use guidance	1	11
	Data access and sharing	1	
	Organizational structure and function	1	
	Leadership and coordination	2	
	Monitoring, evaluation, and learning	4	
	Financial resources	2	
Capacity Building	Data interpretation	3	12
	Skill and knowledge development	5	
	Decision making ability	4	
Information and Communications Technology (ICT)	Hardware	2	4
	Network and connectivity	1	
	ICT business infrastructure	1	
Total number of questions		48	

Group Instrument Completion

The 30 participants in attendance on the second day of the workshop were divided into 6 groups of 4 to 6 people which were designed to be as homogeneous as possible. Each group had at least one representative from the NTP and from an implementing partner, and with at least one woman per group (Table 5). Each group had at least one member working in an M&E or management information system (MIS) role, and other roles (clinical, laboratory, training, etc.) were evenly distributed across groups.

Table 5. Group composition for the D2AC instrument completion exercise

Group number	Number of central government staff	Number of subnational levels represented	Number of partners	Man-to-woman ratio
1	3 NTP (M&E, laboratory, MIS)	-	3 (BRAC, IRD, IDDS)	4:2 (n=6)
2	1 NTP (M&E)	2 (Rajshahi, Khulna)	1 (MTaPS)	3:1 (n=4)
3	2 NTP (M&E, secretary)	2 (Patuakhali, Khulna)	2 (icddr,b, Damien Foundation)	4:2 (n=6)
4	2 NTP (M&E, training)	1 (Narayanganj)	2 (MTaPS, HEED Bangladesh)	4:1 (n=5)
5	1 NTP (MIS) 1 General Hospital	-	3 (SystemOne, LLC, icddr,b, STAR Program)	4:1 (n=5)
6	2 NTP (training, MIS) 1 General Hospital	-	1 (BRAC)	2:2 (n=4)

Participants were invited to fill out the D2AC data collection instrument (Appendix E) as a group. Each group discussed and built consensus on all 48 capability questions before submitting their completed instrument. The six group submissions were automatically aggregated in the D2AC Data Analysis Tool. Each group presented the scores, findings, and discussion points raised during this group exercise in plenary, by selecting a question that had prompted debate or dialogue, and the discussion was open in plenary for all groups to contribute. The findings from the aggregated group responses were then shared in plenary using data visualizations generated by the D2AC dashboard, and the floor was then opened for comments and questions.

Co-Created Priority Actions

Following the groups' completion of the data collection instrument and plenary presentation of results, which was a moment for consensus building around the aggregate group score, the D2AC team facilitated an activity where participants individually identified the six subdomains

(out of a total of 18 in the D2AC Toolkit) that were of highest priority for action, according to their experience and results (i.e., personal opinion).

Once the 6 priority subdomains were identified by tallying the individual votes (6 votes per person, to assign to 6 subdomains of their choice among the 18), the D2AC facilitators asked participants to divide themselves equally across 6 groups (with each group assigned 1 of the 6 priority subdomains) based on their interests and votes. Participants chose what subdomain to work on and created groups of four to six people. The six groups each filled out an implementation plan worksheet. Once submitted, the six worksheets were compiled into a combined implementation plan. The combined implementation plan was projected on the screen, with each group presenting their suggested priority actions and rationale. The combined implementation plan was approved and validated by all attendees in plenary.

Workshop Closing

Representatives from the NTP and TB DIAH gave closing words. At the end of the workshop, all participants received a certificate of completion.

Data Analysis

Quantitative Data

The quantitative data from the 36 (30 individual and 6 group) data collection instruments were automatically generated using the digital D2AC Analysis Tool; these data included the scores by domain, subdomain, user level, etc. The scores were automatically generated and displayed in summary data tables and bar charts. Responses were averaged across subdomain, domain, and overall to derive scores for each. Although subdomains are given an equal weight in the calculation of domain aggregates, domains are weighted by the number of subdomains they include to derive the overall score.

Qualitative Data

The qualitative data from the assessment workshop consisted of the observations, comments, and questions presented and posed in plenary and in groups; the comments entered in the individual and group data collection instruments; the work entered on the implementation plan worksheets; and the group presentations and report-backs. The group presentation takeaways and the plenary observations, comments, and questions were carefully noted in real time during the workshop. All 36 (30 individual and 6 group) data collection instruments were reviewed manually one-by-one and all comments were noted. Last, all six group implementation plan worksheets were transcribed and analyzed.

Limitations

There are limitations to the generalizability and applicability of the findings in other contexts, given that all participants were from and were responding to questions about the context of the Bangladesh system. Furthermore, the workshop was not representative of the diversity and range of experiences across Bangladesh due to the limited number of peripheral-level

participants and an overwhelming majority of participants representing the central level. The purposive sampling strategy could have led to some biases, with the most engaged or involved actors in the Bangladesh system being invited, agreeing to attend, and participating in the three-day workshop, as opposed to other actors who were perhaps less engaged or involved.

It is also possible that some courtesy bias may have been introduced, meaning that participants wished to convey an image of quality that was better than reality. This may have occurred for several reasons, including the fact that they were invited by the NTP's leadership and were participating in the workshop in the presence of their hierarchical superiors and even potentially assigned to the same groups. To minimize this bias, the D2AC team first asked each participant to individually share their responses, without discussing or sharing those with anyone else in the room. Subsequently, the group work was organized so that no one person could sway a group's answers or potentially, even unintentionally, inhibit other group members from freely expressing their opinions.

Ultimately, the value of the output of the workshop depended heavily on the expertise and experience of the participants. A potential limitation can arise if insufficient knowledge and experience of the local system are not brought to bear when completing the tool.

Quality is challenging to guarantee, especially when it comes to the individual tool completion exercises. All participants completed the same data collection instrument. It took the fastest participant 2 hours and 40 minutes less time to complete the tool than the last person to submit.

Challenges

Having learned from the challenges of the two field tests, the logistical and technical challenges previously encountered were avoided, in part thanks to a workshop lasting three days instead of two.

This workshop was the first of its kind to use the digital D2AC tool. Some users reported experiencing some glitches in the system which were addressed in real-time to the extent possible. No participant was unable to submit their responses using the digital tool. Overall, the ability to view dashboards and priority actions on their own screens was beneficial to participants for the portion of the workshop where groups develop recommendations. The digital interface was more user-friendly and easier to navigate than the Excel tool used in previous workshops.

Ethics

The D2AC team explored the need for institutional review board approval, but it was deemed not necessary by the University of North Carolina and JSI institutional review board committees.

Risks

There were no major risks associated with participating in this workshop. The nonphysical risks included personal information about participants being shared with the D2AC team. This was considered of minimal risk because little or no information of a confidential nature was

collected, and all personal information collected during the assessment was treated as confidential; all responses aggregated in the D2AC Data Analysis Tool were anonymized before being shared back with the participants. The primary research burden for participants was the time spent providing information to the D2AC facilitators team.

Advantages

No direct benefits accrued to participants from attending this workshop. Participants were each given a transportation per diem for the two workshop days, and the only participant coming from outside Dhaka had their flights and accommodation paid for by TB DIAH. Each participant was awarded a certificate of attendance.

At the national level, there were several important societal benefits from this assessment, namely that the NTP and its partners will receive feedback on the quality of data use and evidence-based decision making in the TB program, and that useful policy and program implications and targeted funding allocation may result from the findings.

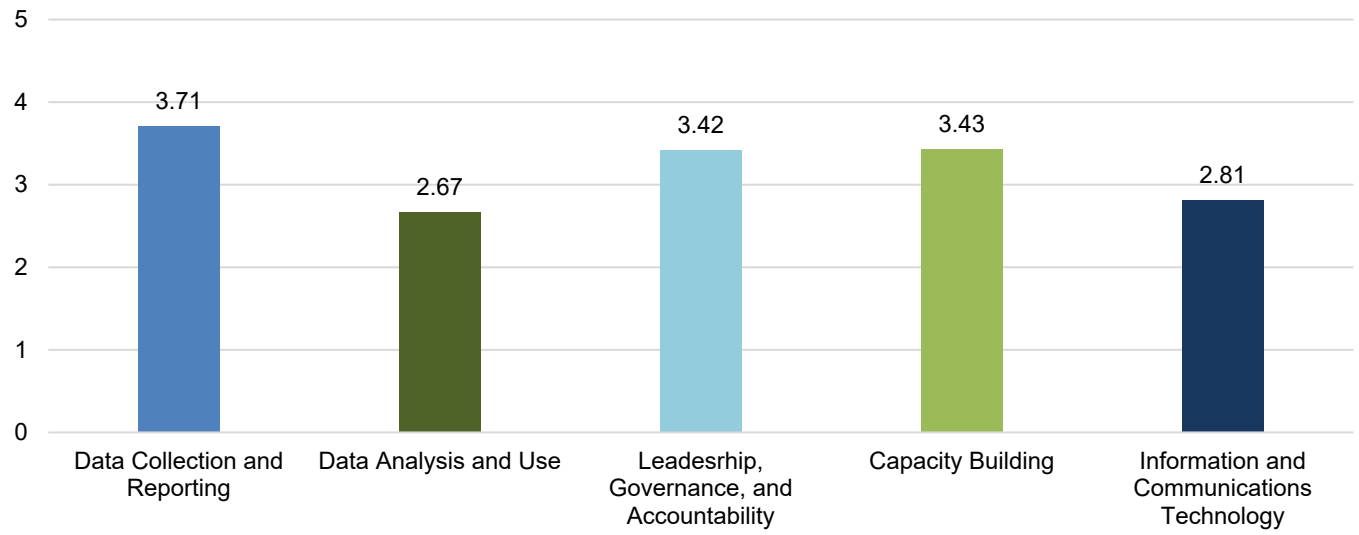
Results

Overall Results

The overall D2AC assessment score from aggregate group responses was 3.21 (out of 5), putting Bangladesh at an "established" level according to the D2AC. The country performed best in domain 1 (Data Collection and Reporting, score of 3.71) and least well in domain 2 (Data Analysis and Use, score of 2.67). Domain 3 (Leadership, Governance, and Accountability), domain 4 (Capacity Building), and domain 5 (ICT) received scores of 3.42, 3.43, and 2.81, respectively (Figure 6). Summary tables of results are provided in Appendix F. The answer equivalents to the aggregate group score for each of the 48 questions are highlighted in yellow in Appendix E.

The overall score from aggregated individual responses was very similar to the group aggregate score, with a score of 3.23 (out of 5).

Figure 6. Overall domain scores (aggregate of group responses)

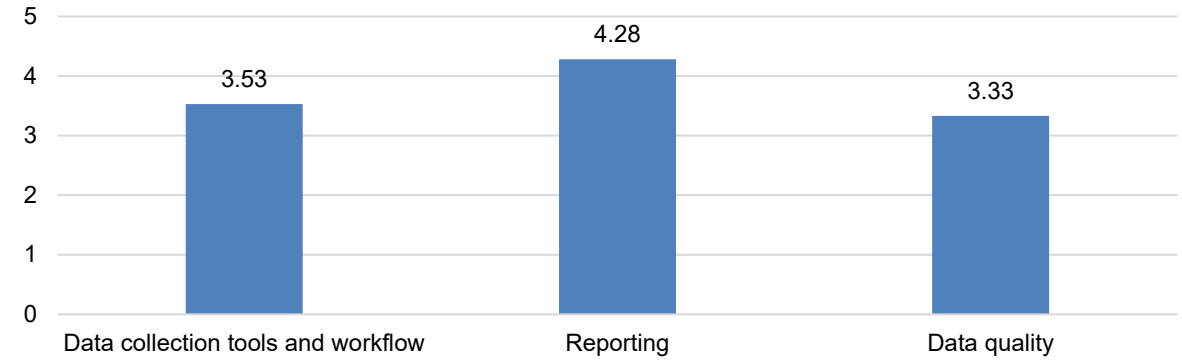


Results by Domain

Domain 1: Data Collection and Reporting

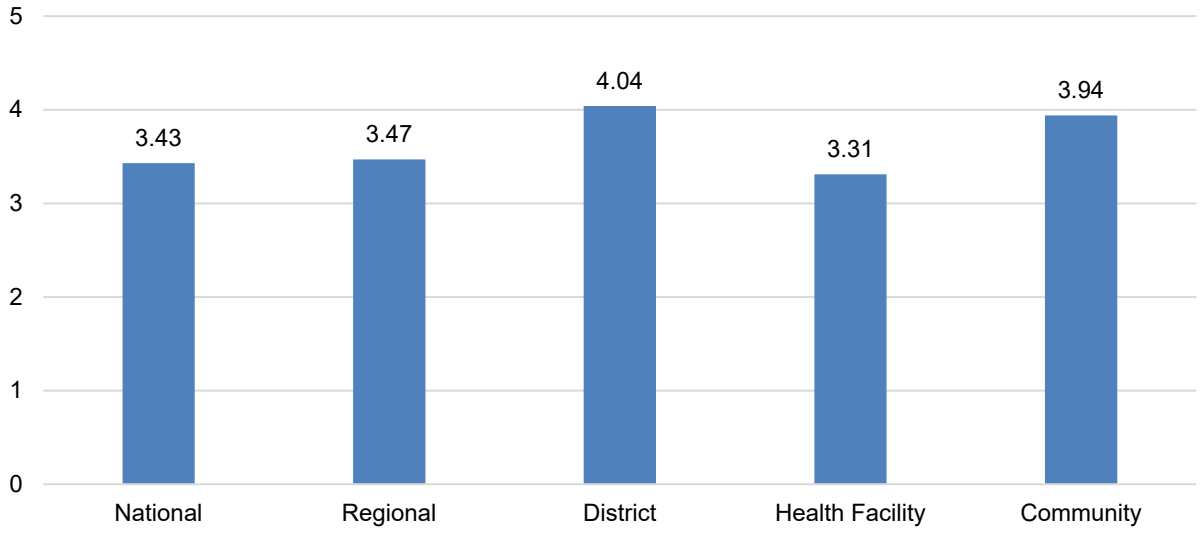
Domain 1, subdomain 1 (Data collection tools and workflow) received an aggregate score of 3.53; subdomain 2 (Reporting) received an aggregate score of 4.28; and subdomain 3 (Data quality) received an aggregate score of 3.33 (Figure 7). Domain 1 was the highest performing domain and domain 1, subdomain 2 was the highest performing subdomain.

Figure 7. Domain 1 subdomain scores (aggregate of group responses)



When looking at individual respondent data for domain 1, district-level participants gave higher scores, on average (4.04), whereas the health facility level was the most conservative (3.31). The national-level score was 3.43, the regional-level score was 3.47, and the community-level score was 3.94 (Figure 8).

Figure 8. Domain 1 scores, by health system level (aggregate of individual responses)



The qualitative findings for domain 1 (11 questions) identified the current electronic data collection tools (**question 1)** as e-TB Manager[3] (Figure 9), GxAlert/Aspect[4] (Figure 10), and the electronic logistics management information system (eLMIS). While e-TB Manager is implemented nationwide and used at all levels, GxAlert/Aspect and the eLMIS are in the process of being rolled out throughout the whole country.

[3] Available at http://etbmanagerbd.org/etbmanager/login.seam (see Figure 9)
[4] More information at https://www.stoptb.org/sites/default/files/gxalert.pdf

Figure 9. Screen capture of the e-TB Manager system website

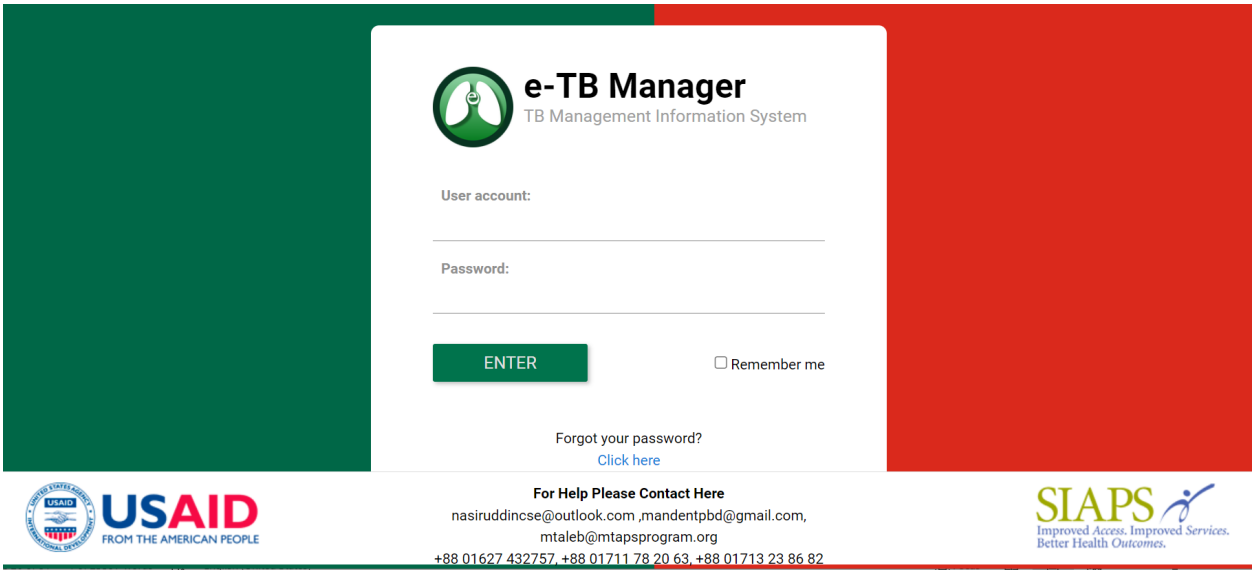
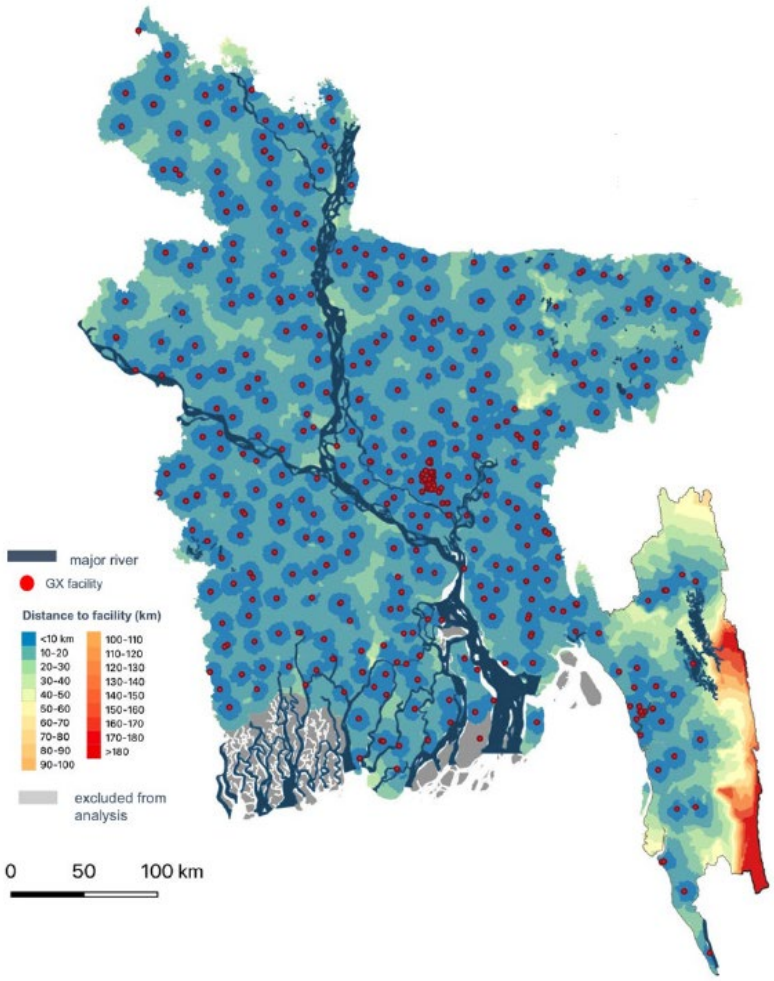


Figure 10. Accessibility map of GX facilities in Bangladesh



Note: Blue-yellow-red show the road neatwork distances to existing GX facilities in 10km intervals. GX facilities (red dots) are located in the center of the dark blue areas.

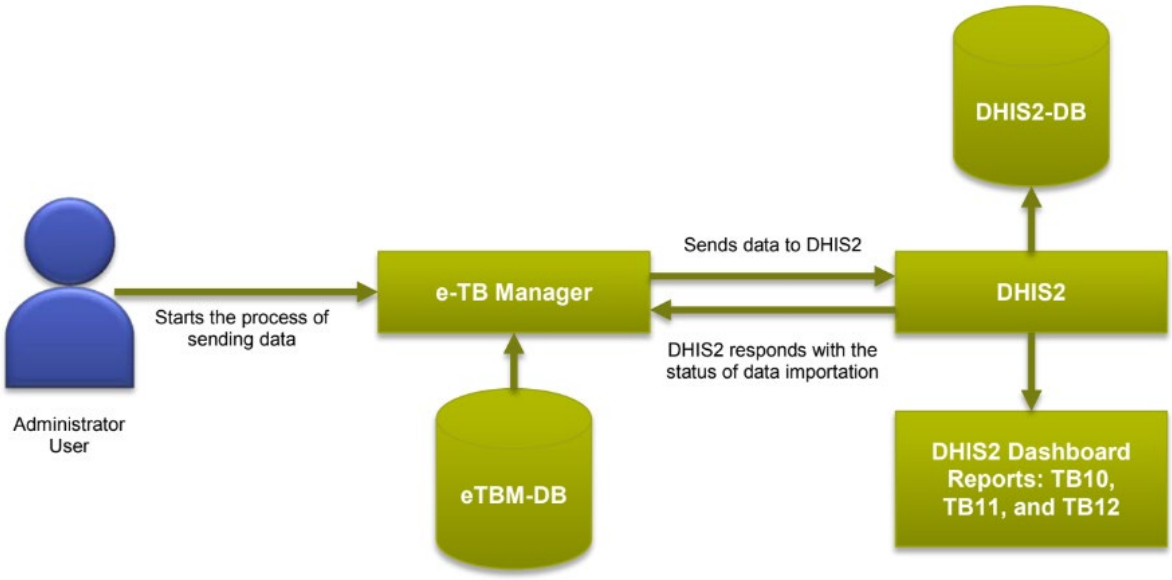
Source: Rehr et al., 2021.

The NTP receives individual case data from 868 reporting sites through e-TB Manager, which is integrated with the country's HMIS (District Health Information Software version 2, or DHIS2), on a quarterly basis (Figure 11)[5]. The development of electronic tools for laboratory data collection and integration with e-TB Manager is currently in progress. Initial discussions with vendors for Aspect integration with e-TB Manager have been initiated, but the launch of the process depends on availability of funding. These electronic tools are managed and supported by

[5] The NTP is currently not dependent on DHIS2 for TB data. e-TB Manager and its dashboard have been customized in such a way to produce aggregated data. TB data available to DHIS2 by interoperability can all now be generated into e-TB Manager. However, DHIS2 produces aggregated reports that include TB data among other program data.

the NTP and partners for data collection at all levels, while DHIS2 is managed by the MIS at the Directorate General of Health Services' (DGHS). The e-TB Manager server is located at the MIS, DGHS.

Figure 11. Architectural structure of the e-TB Manager to DHIS2 data flow



Source: Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program

Some participants responded that the NTP regularly updates the TB data collection systems inventory (**question 2)** if any new system is added, however other participants noted that while the TB data collection system inventory is in place the list might not be complete and the related information is available only at the national level. Qualitative data also suggests that while many data collection tools exist in Bangladesh, there is no real-time inventory management system currently available. Regarding data flow, clinical and laboratory data are available from the peripheral to central levels while commodity and training users are limited mostly to the central level. Furthermore, while different types of data are collected at the central level, analysis and feedback to the field is limited.

Regular monitoring is in place to assess if data collection processes are aligned with TB service delivery guidance (**question 3**) and the NTP strictly follows these guidelines. Updates and revisions are made according to monitoring findings and assessment processes. One group noted that there are still some missing links in the TB care cascade, which need to be captured and monitored regularly. The NTP conducts quarterly monitoring meetings at district/subnational levels where data are analyzed and presented using e-TB Manager for programmatic review and future decision making. This meeting is conducted in the presence of a district health manager from the Bangladesh government (the civil surgeon), subdistrict health managers (government employees), and nongovernmental organizations.

e-TB Manager generates a unique identification number for each TB case (**question 4**) allowing for the NTP to use unique identifiers across program sites. Developing national unique identifiers for patients was identified as a need by participants.

The NTP has a complete, web-based site list (**question 5**) from which it receives reporting at the central level. However, the list only contains the sites' name and physical address. At the local level, a paper-based mapping of the catchment area, including geographical location information, is available at some sites. There is a need to develop a master facility list incorporating the required parameters, and for the web-based site list to be updated regularly.

The NTP monitors and reviews disaggregated data routinely (**question 6**), although some resource gaps remain. Specifically, the M&E team works with the data collection system team to keep the disaggregated data reviewed and updated based on disaggregation requirements.

Aggregate data is generated at the central level by using standardized electronic data reporting tools (**question 7**) in e-TB Manager, although real-time data at the point of care is not collected and reported. The NTP is also able to utilize e-TB Manager to report both individual case and laboratory data at all levels and is linked to the central health system data hub in DHIS2. However, there is a need to develop a system to capture and report on TB prevention and control indicators and to incorporate these data into DHIS2.

The NTP monitors disaggregated data, as well as routinely reviews and updates disaggregated data (**question 8**) reporting requirements in the quarterly M&E meetings. It was noted by participants that some resource gaps still exist.

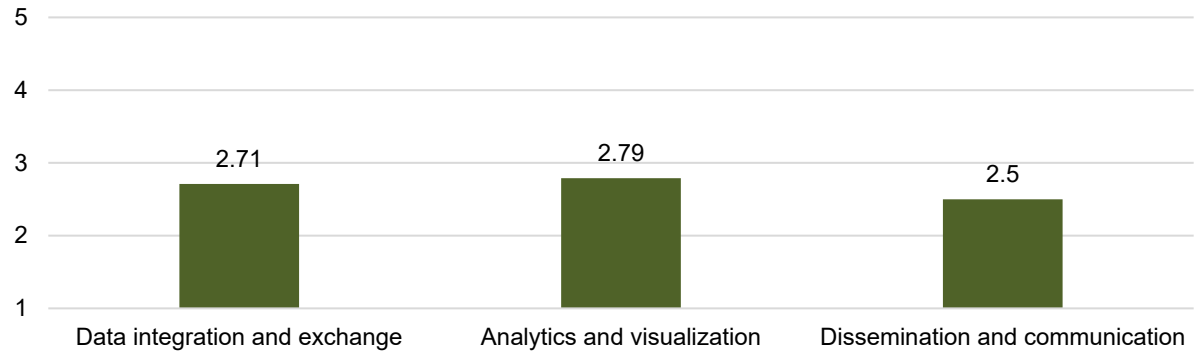
Data reporting processes (**question 9**) are monitored and the NTP follows national and international guidance to routinely update reporting processes. Specific HR are dedicated to recording and reporting – positions called TB and Leprosy Control Assistants, but it is unclear how widespread these postings are.

Data quality assurance is routinely performed for priority indicators; however, resources are needed to capture other indicators related to data quality (**question 10**). Furthermore, the NTP regularly monitors and supervises data entry and assesses the quality of data during their monitoring and supervision visits in the field. At all levels, supervisors ensure data quality regularly by reviewing treatment cards and other source documents (**question 11**), however it was noted that more resources are needed for facility-level data quality assurance. Data quality assurance findings are addressed, and actions are taken to improve the data and capacity to collect and report good quality data.

Domain 2: Data Analysis and Use

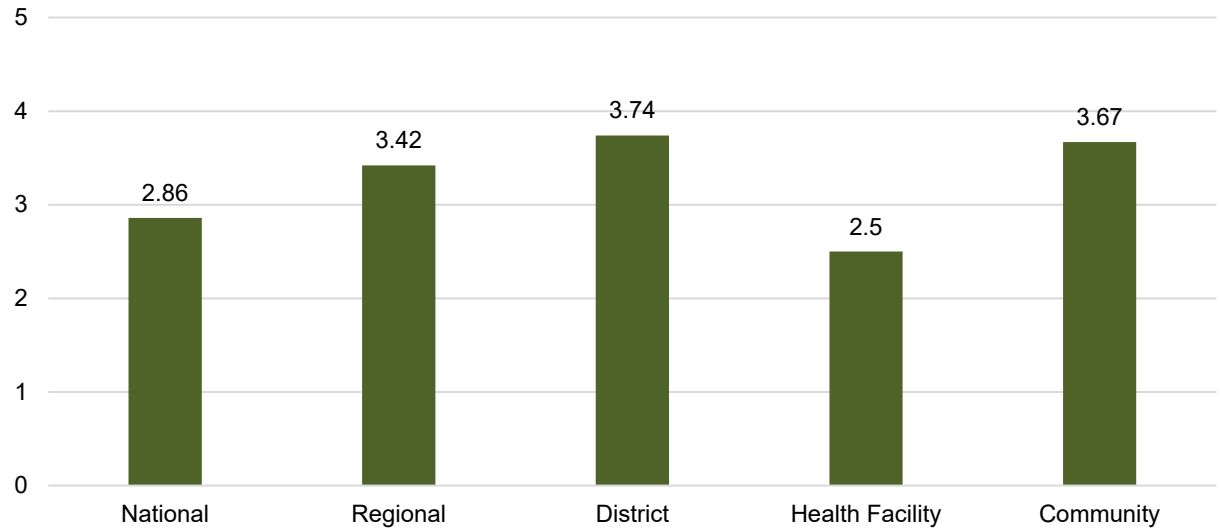
Domain 2, subdomain 1 (Data integration and exchange) received an aggregate score of 2.71; subdomain 2 (Analytics and visualization) received an aggregate score of 2.79; and subdomain 3 (Dissemination and communication) received an aggregate score of 2.50 (Figure 12). Domain 2 was the lowest performing domain.

Figure 12. Domain 2 subdomain scores (aggregate of group responses)



When looking at individual respondent data for domain 2, district-level participants gave higher scores, on average (3.74), whereas the health facility-level was the most conservative (2.50). The national-level score was 2.86, the regional-level score was 3.42, the, and the community-level score was 3.67 (Figure 13).

Figure 13. Domain 2 scores, by health system level (aggregate of individual responses)



The qualitative findings for domain 2 (10 questions) were that the NTP has an electronic data repository system (**question 12**) (i.e., e-TB Manager, DHIS2, GeneXpert, GxAlert/Aspect) for individual case and laboratory data (partially) for the management of TB, although the server is housed at the MIS, DGHS and not the NTP. There is scope to capture and collate other data at all levels. Furthermore, TB case notification data on e-TB Manager are interoperable with DHIS2[6] (**question 13**), while the majority of laboratory data still need to be incorporated (data exchange occurs between laboratory systems and DHIS2 through GeneXpert, but not with other forms of testing such as microscopy). The system for automated exchange for all laboratory data

[6] For more information: https://siapsprogram.org/publication/dhis2-and-e-tb-manager-interoperability-creating-a-stronger-digital-health-system-in-bangladesh/

is in the process of being developed (**question 14**). Participants noted that there was not an adequate budget to support data exchange beyond what is already being implemented and that different platforms are using different exchange standards when implementing data exchange (**question 15**).

While some qualitative data suggest that NTP staff can conduct advance analysis at the national and subnational levels (**question 16**), most of the data acknowledged that further training to build analytics capacity within the NTP staff was needed, such as in Tableau, Power BI, and advanced coding. A minimum set of standard data analyses and visualization requirements and needs are documented (**question 17**).

Program resources and patient data reports are mainly used as data sources for decision making (**question 18**) and some decision support tools may exist for specific implementations, however a model for decision making is required for further development. It was noted that some tools (i.e., e-TB Manager, GxAlert/Aspect) have options to show the results through dashboards and provide reference information that can help policy makers make programmatic decisions (**question 19**).

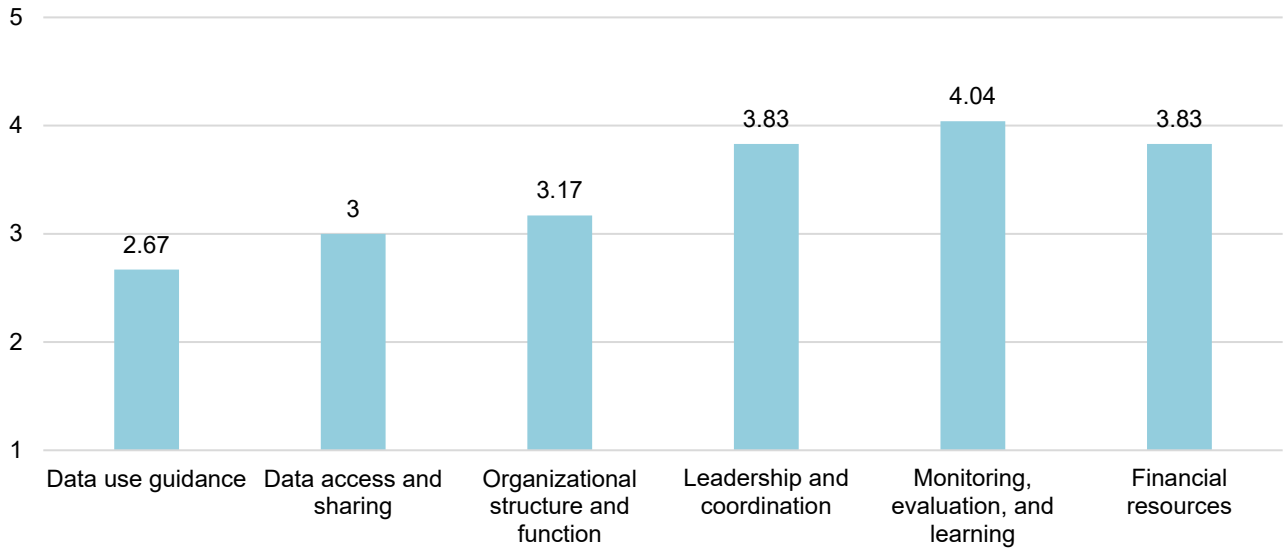
While no formal communication strategy exists, there is guidance within a circular issued by the NTP Line Director in April 2022[7]; however, full documentation needs development and operationalization (**question 20**). It was acknowledged that communication is still conducted in a formal manner, regardless of the existence of an actual strategy. Information products such as guidelines, standard operating procedures (SOPs), and reports are produced and disseminated to stakeholders at all levels; however, this is not done in a routine manner (**question 21**).

Domain 3: Leadership, Governance, and Accountability

Domain 3, subdomain 1 (Data use guidance) received an aggregate score of 2.67; subdomain 2 (Data access and sharing) received an aggregate score of 3.00; subdomain 3 (Organizational structure and function) received an aggregate score of 3.17; subdomain 4 (Leadership and coordination) received an aggregate score of 3.83; subdomain 5 (Monitoring, evaluation, and learning – MEL) received an aggregate score of 4.04; and subdomain 6 (Financial resources) received an aggregate score of 3.83 (Figure 14).

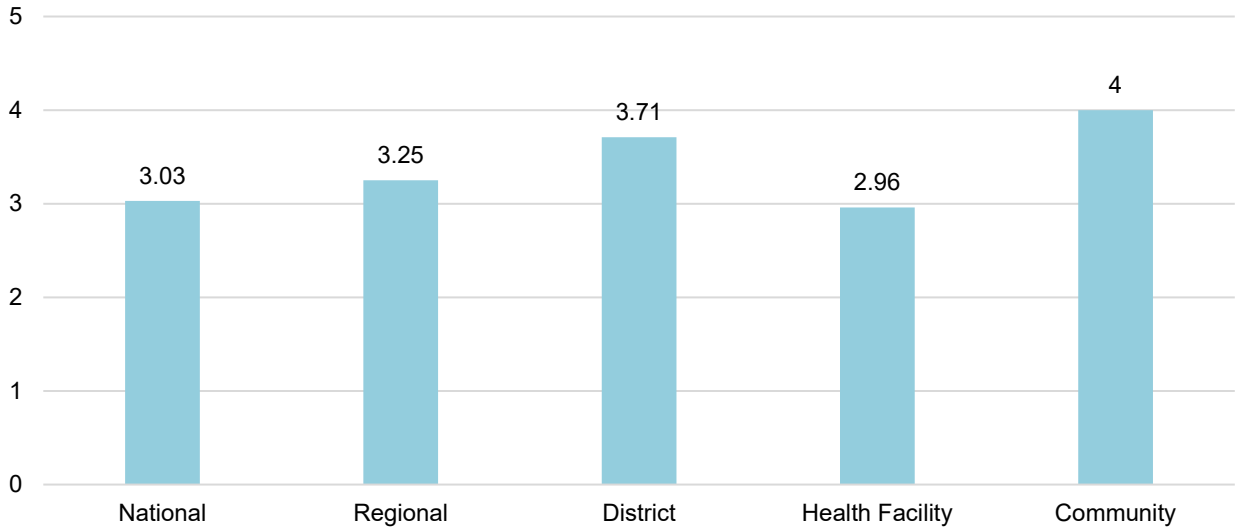
[7] The April 6, 2022 circular issued by the Line Director instructed the use e-TB Manager at the district level quarterly monitoring meeting for TB (to compare the subdistrict level performance of different indicators for programmatic decision making) and for the minutes and data to be periodically sent to the central level. At the central level quarterly monitoring meeting, minutes from all the districts are collected and analyzed every quarter to identify different thematic recommendations. These are communicated to the program personnel and partner representatives at the quarterly monitoring working group meeting at the central level and later communicated to the divisional TB experts by email every quarter.

Figure 14. Domain 3 subdomain scores (aggregate of group responses)



When looking at individual respondent data for domain 3, community-level participants gave higher scores, on average (4.00), whereas the health facility-level was the most conservative (2.96). The national-level score was 3.03, the regional-level score was 3.25 and the district-level score was 3.71 (Figure 15).

Figure 15. Domain 3 scores, by health system level (aggregate of individual responses)



The qualitative findings for domain 3 (11 questions) were that the NTP issued instructions to the districts and subdistricts to use data use guidelines found in both e-TB Manager and GxAlert/Aspect during quarterly monitoring meetings for review and evaluation (**question 22**). One group noted that while there exist data use guidelines, they suggest developing a standardized updated guideline for all levels.

When TB implementing partners require data, the request is reviewed by the NTP M&E lead and approved by program authorities. After the request has undergone this process and been approved, the data are shared (**question 23**). This approval process occurs mostly through email.

Data use roles and responsibilities are clearly outlined in job descriptions and staff roles are monitored at different levels (**question 24**). Feedback is regularly provided by the supervisors to staff on data use.

An M&E working group is in place at the central level and is responsible for the review and assessment of routine data sharing (**question 25**). The central level M&E team coordinates with the divisional teams to review the findings of the scheduled working group meetings at divisional levels (**question 26**).

An M&E plan is in place and undergoes programmatic review (**question 27**). Furthermore, health outcome parameters are documented and monitored at all levels (**question 28**). A routine health outcome assessment and evaluation is needed.

The NTP conducts different performance review meetings at different levels. During those reviews, M&E processes are routinely reviewed (**question 29**). Programmatic data are also reviewed as well as monitored at all levels (**question 30**); however, one group noted that this review could be strengthened. M&E data are used for program improvement at all levels.

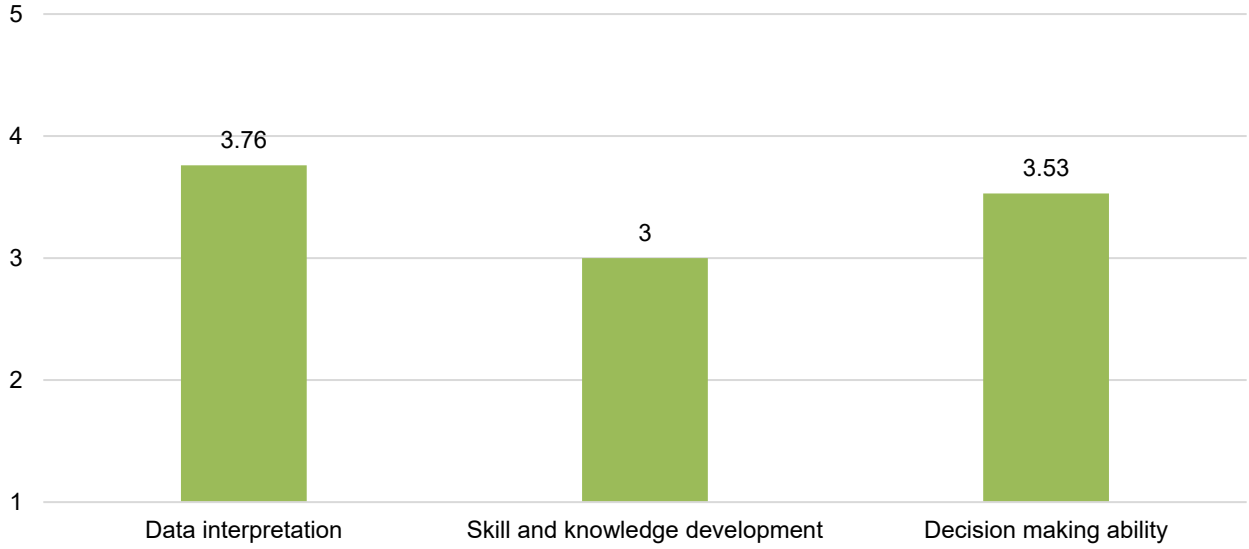
The M&E budget is reviewed annually; however, the M&E team does not monitor the budget (**question 31**). While the group average acknowledged that the NTP has a comprehensive financial plan that diversifies funding, qualitative data suggest that financial mobilization only happens among the government and donors (**question 32**).

Domain 4: Capacity Building

Domain 4, subdomain 1 (Data interpretation) received an aggregate score of 3.76 and subdomain 2 (Skill and knowledge development) received an aggregate score of 3.00 (Figure 16). Domain 4, subdomain 3 (Decision making ability), received an aggregate score (from individual responses) of 3.53.

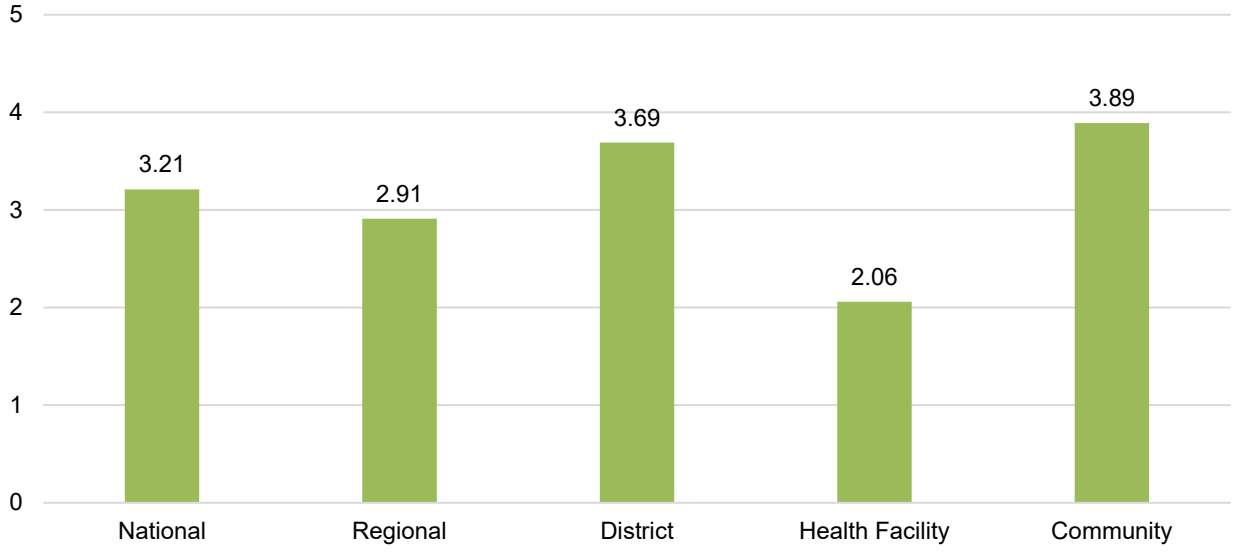
This third subdomain, from the aggregate of group responses, received a score of 4.04, but the average group score was not considered for this subdomain, since the questions pertain to personal and subjective opinions on job satisfaction, mentorship, training, and incentives/motivation. Instead, the aggregate score from individual responses was used.

Figure 16. Domain 4 subdomain scores (aggregate of group responses for subdomain 1 and 2 and of individual responses for subdomain 3)



When looking at individual respondent data for domain 4, the community-level participants gave higher scores, on average (3.89) while the health facility level was the most conservative (2.06). The national-level score was 3.21, the regional-level score was 2.91, and the district-level score was 3.69 (Figure 17).

Figure 17. Domain 4 scores, by health system level (aggregate of individual responses)



The qualitative findings for domain 4 (12 questions) showed that the performance of data use forums is monitored and assessed in review meetings and findings from these meetings are analyzed and actions are taken based on the review (**question 33**).

Data are reviewed quarterly at all levels such as the quarterly monitoring meeting, M&E working meetings, program review meetings, and TB technical meetings (**question 34**). Furthermore, qualitative data suggest that NTP staff receive supportive supervision for data use (**question 35**) at both the national and subnational levels. However, further capacity building is required for "enhancing mentorship on data use." One group pointed out that an experienced M&E team exists to provide supportive supervision.

Groups acknowledged that a national pre-service training program for skills and knowledge development (**question 36**) exists (though public and private academic institutions), but some qualitative data suggest that the trainings require monitoring to determine their efficacy. No preservice training program exists that is coordinated or hosted by the NTP. However, all cadres of NTP staff are provided training while being onboarded.

When pressed about the extent to which institutions offer preservice training established in the NTP guidance (**question 37**), group qualitative data again provide varying understanding of pre-service training availability. It was clarified that private training institutions provide such services and that "there is no pre-service training program in the NTP setting."

Regarding in-service training (**question 38**), group qualitative data suggest that the NTP organizes needs-based training programs. Qualitative data also suggest that there is a training focal person at the NTP who oversees the training program for both public and private institutions (**question 39**). Trainings organized by public and private institutions are conducted according to their own strategies which may not always fulfill NTP needs.

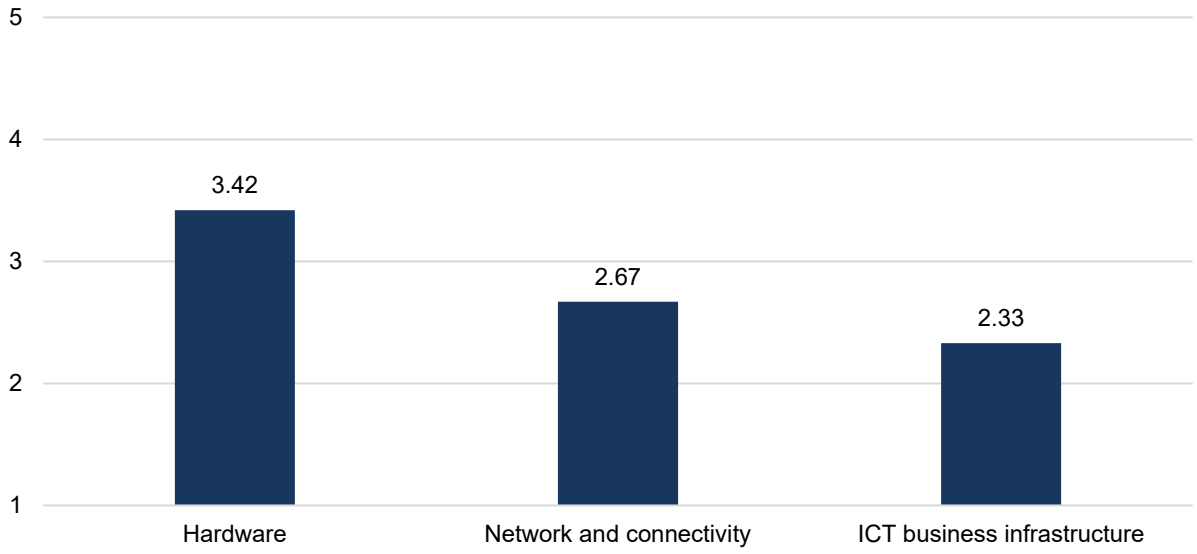
Divisional TB experts and District Surveillance Medical Officers (DSMO) conduct needs assessments at subdistrict levels, however one group stated that assessments at the central level are required to determine how effective in-service training programs are while other groups pointed out that trainings are aligned with needs at all levels (**question 40**).

No individual or group level qualitative data exists for **questions 41–44.**

Domain 5: ICT

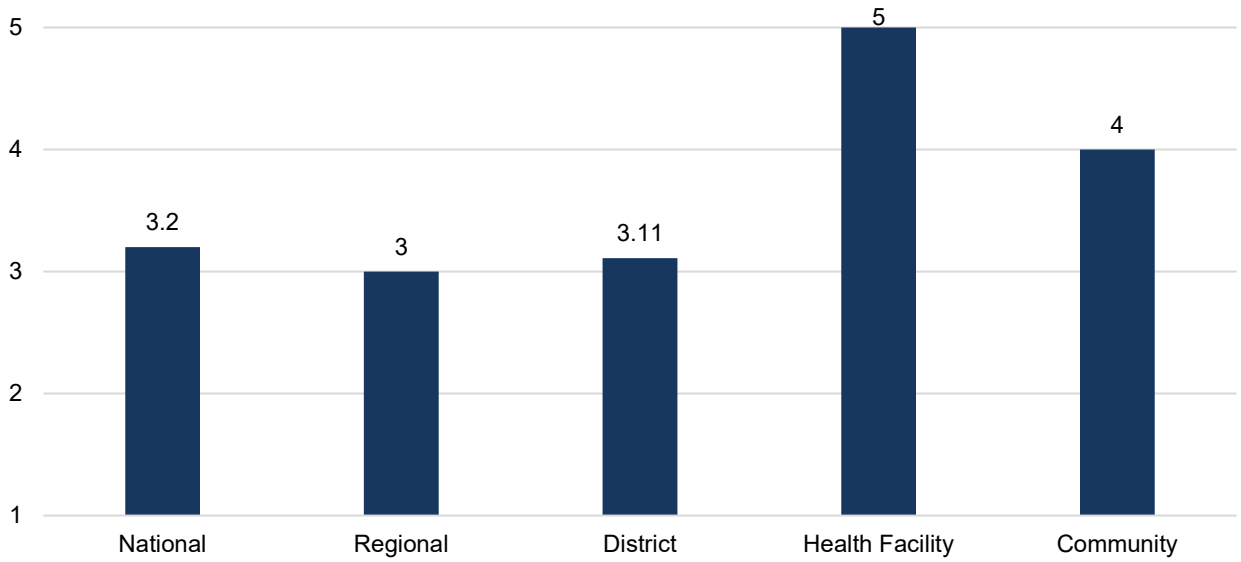
Domain 5, subdomain 1 (Hardware) received an aggregate score of 3.42; subdomain 2 (Network and connectivity) received an aggregate score of 2.67; and subdomain 3 (ICT business infrastructure) received an aggregate score of 2.33 (Figure 18). Domain 5, subdomain 3 was the lowest performing subdomain.

Figure 18. Domain 5 subdomain scores (aggregate of group responses)



When looking at individual respondent data for domain 5, health facility level participants gave higher scores, on average (5.00), whereas the regional level was the most conservative (3.00). The national-level score was 3.20, the district-level score was 3.11, and the community-level score was 4.00 (Figure 19).

Figure 19. Domain 5 scores, by health system level (aggregate of individual responses)



The qualitative findings for domain 5 (four questions) were that there is a lack of funding in the hardware repair and maintenance contract, and that hardware needs are assessed on a "on demand basis" through annual program planning and when required (**question 45**). Hardware specifications are documented at the national level only (**question 46**).

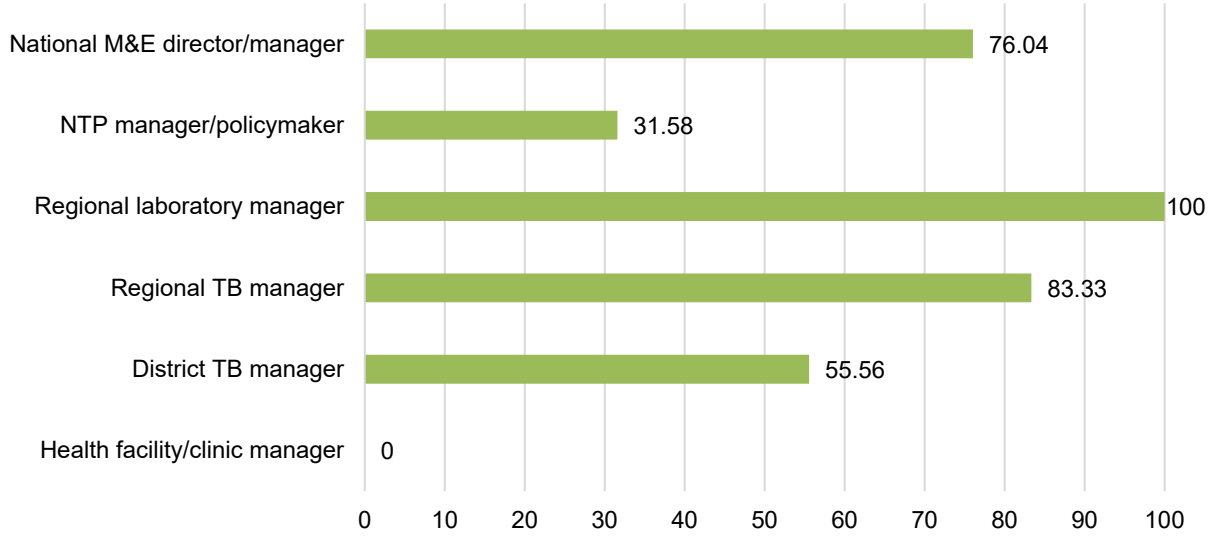
Qualitative data suggest that there is no dedicated technology support team, but that reliable internet service supports data entry and reporting processes (**question 47**), however one group acknowledged that there is a network communication gap in hard-to-reach areas. The country's ICT infrastructure needs to be further developed (**question 48**).

TB Users' Data Needs

Participants in the workshop identified with five key user roles, and for which they answered the relevant user role questions. These questions can be found at the end of Appendix E.

The range of responses for TB data needs met varied, with participants in managerial and policy roles at the NTP reporting that a third (31.6%) of their TB data needs were being met while the regional laboratory managers/technicians reported that all of their TB data needs were being met (100%). It should be noted that only one respondent in the "health facility/clinic manager" category submitted an individual response to the D2AC data collection instrument and did not complete the user role section – these data could be interpreted either as none of this participant's TB data needs being met, or it could be that the participant decided to skip that section altogether. Most user groups were overall satisfied with district TB coordinators/managers/health officers reporting at 55 percent, national M&E directors/managers at 76 percent, and regional TB coordinators at 83 percent (Figure 20). NTP managers/policy makers only had 32 percent of their TB data needs met. Nine participants identified with an "other" role in the questionnaire, resulting in a lack of responses in this part of the instrument in their case.

Figure 20. Participants' perspectives on how well TB data needs are met, by user role, in percentage

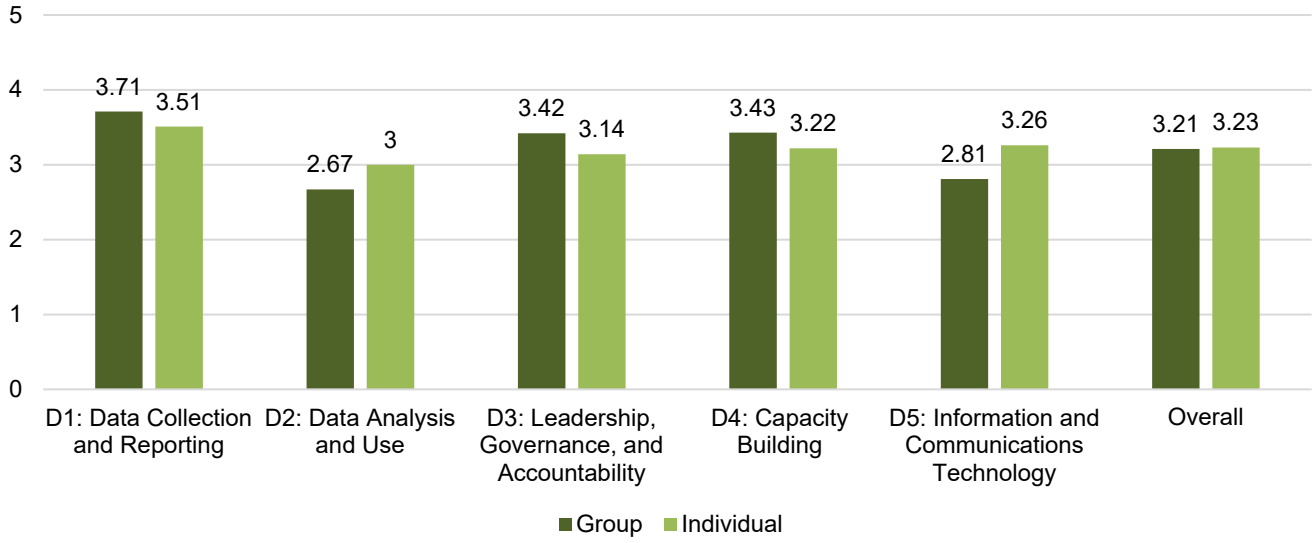


Comparing Individual and Group Results

A comparison of the individual and group responses revealed that groups scored higher than individuals for domains 1, 3 and 4, but that individuals scored higher than groups for domains 2

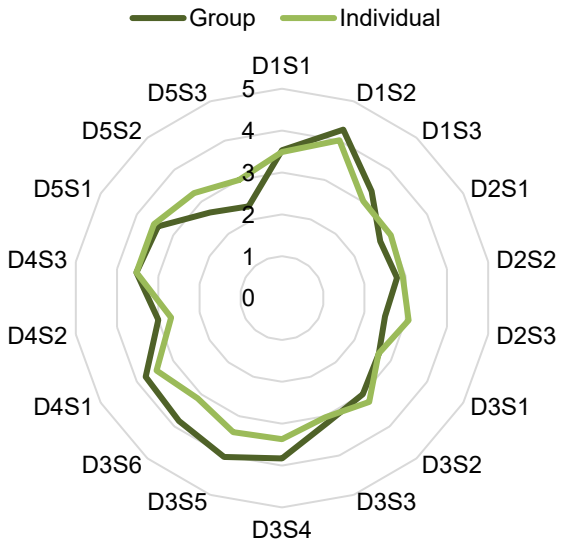
and 5, with the biggest gap at 0.45 points for domain 5, and the smallest at 0.20 for domain 1 (Figure 21).

Figure 21. Difference between individual and group results, by domain



When examining individual and group differences at the subdomain level, the trend is also that group scores were overall higher than individual scores for all subdomains under domains 1, 3, and 4, with the exception of D3S2. Individuals scored higher for all subdomains under domains 2 and 5 (Figure 22 and Appendix F).

Figure 22. Difference between individual and group results, by subdomain



Co-Created Priority Actions

The count of individual votes resulted in six subdomains being identified as priority subdomains (receiving between 13 and 19 votes each). Five other subdomains received between 11 and 9 votes each, six subdomains received between 8 and 1 votes each, and finally, one subdomain received no votes at all (Table 6). The six priority subdomains were D2S2 (Analytics and visualization), D1S3 (Data quality), D3S1 (Data use guidance), D4S2 (Skill and knowledge development), D5S3 (ICT business infrastructure), and D3S5 (MEL).

Table 6. Number of votes by subdomain

Subdomain		Votes
D2S2	Analytics and visualization	19
D1S3	Data quality	17
D3S1	Data use guidance	16
D4S2	Skill and knowledge development	14
D5S3	ICT business infrastructure	14
D3S5	Monitoring, evaluation, and learning	13
D3S4	Leadership and coordination	11
D4S1	Data interpretation	11
D3S2	Data access and sharing	10
D2S1	Data integration and exchange	9
D5S2	Network and connectivity	9
D2S3	Dissemination and communication	8
D5S1	Hardware	8
D4S3	Decision making ability	7
D3S3	Organizational structure and function	5
D1S1	Data collection tools and workflow	4
D1S2	Reporting	1
D3S6	Financial resources	N/A

For the six subdomains evaluated, the groups came up with 30 priority actions in a combined implementation plan (Appendix G).

For D1S3 (Data quality), the group suggested that the priority actions should be to undertake capacity building activities to sensitize staff on data quality characteristics and perform routine data quality checks; develop a reliable data repository system; reduce bias and duplication in data reporting; conduct quarterly data consistency checks between e-TB Manager and DHIS2;

periodically report on data quality operations; and set up reliable, complete, and accurate routine checks and reviews for data quality.

For D2S2 (Analytics and visualization), the group suggested that the priority actions should be for NTP staff to develop customized analytics and visualizations using the central data repository and sustain the use of advanced models for decision making and incorporate multiple data sources (including the central data repository) that optimize and influence TB health outcomes.

For D3S1 (Data use guidance), the group suggested that the priority actions should be to develop a comprehensive data use guidance, implement it nationwide, monitor its implementation, revise and update the guidance as needed and based on feedback from all levels, and finally evaluate the impact of said data use guidance.

For D3S5 (MEL), the group suggested that the priority actions should be to monitor and review the MEL plan implementation, track the progress of the implementation of the MEL operationalization plan, integrate a learning and adaptation mechanism in the MEL process, build a skilled and sustainable MEL team, develop specific guidance around quality assurance and control, and use data from MEL activities for research and evaluation.

For D4S2 (Skill and knowledge development), the group suggested that the priority actions should be to assess perceived decision making needs (for decisions based on available data for programmatic improvement) for subnational managers, assess the existing MIS, modify/upgrade the data collection and analytics system, develop a training module containing demonstration of data analysis and use for decision making at different levels, develop another training module for data entry, train staff on data entry analysis and its interpretation, build monitoring and supervisory capacity through in-service training, and set-up a training database.

For D5S3 (ICT business infrastructure), the group suggested that the priority actions should be to implement an ICT infrastructure operations and maintenance plan at the national and subnational levels; ensure funding availability for any kind of ICT equipment damage, repair, and maintenance; and set up an ICT/tech corner at every TB facility.

Discussion

The December 2022 D2AC assessment in Bangladesh shed light on the perceived areas of improvement of the Bangladesh TB information system, namely in the areas of data integration and exchange, analytics and visualization, dissemination and communication, data use guidance, network and connectivity, and ICT. That being said, overall Bangladesh scored well, with no subdomains receiving scores lower than 2 out of 5. Participants selected a number of these weaker-performing subdomains as areas to focus on for the priority action exercise.

The D2AC assessment in Bangladesh also shed light on the areas that were performing well. The strongest-performing area was data collection and reporting practices, followed by strong scores in MEL, data interpretation, and financial resources. Twelve of the eighteen subdomains received scores superior to 3 out of 5, meaning that they were identified as being at least at an "established" stage on the continuum, and two among those received scores superior to 4 out of 5 ("institutionalized" stage of the continuum). Interestingly, some of these strongest categories like MEL were among the ones selected by participants for priority actions.

Upon reveal of the aggregate group score, some comments were raised concerning the perceived high score achieved by Bangladesh in the subdomains of data interpretation (initial group aggregate score of 4.06). This subdomain was subject to score revision in plenary—a debate discussion followed by a hand revoting process so that the score more accurately reflected the level of the TB system for this subdomain based on the opinion of participants. During the consensus-building process, the score for domain 4, subdomain 1 (Data interpretation) was reduced from 4.06 to 3.76 because respondents did not believe the system to be at an institutionalized level (for reference, the individual aggregate score for D4S1 was 3.46). This modification, combined with the adoption of the individual aggregate score for domain 4, subdomain 3 (Decision making ability) – see explanation for this decision in the results under domain 4 or in Appendix F– changed the domain 4 score from 3.70 to 3.43 and the overall score of the Bangladesh D2AC assessment from 3.26 to 3.21 (Appendix F). It should be noted that both data interpretation and decision making ability were still among the highest performing subdomains, even after lowering the group score from 4.06 to 3.76 for data interpretation and considering the individual score (3.53) for the overall assessment score instead of the group score (4.04) for decision making ability.

The D2AC records data in two ways: individual and group responses. The individual responses provided an opportunity for workshop participants to orient themselves to the content of the tool and engage in forethought on the maturity of the various capabilities, subdomains, and domains. The group-level exercise provided an opportunity for participants to derive a consensus view following discussion among themselves. The group-level results should be considered the more reasoned responses (which is therefore why we reference these as the "assessment scores"), given that a post hoc analysis of group constitution yielded reassurance that the appropriate background and experience were present in the groups. The individual responses could be used to validate the group responses if they were not substantially different (that is, if they were similar, it could be reasonably assumed that the group responses reflected the actual maturity of the system). If individual and group responses differed significantly, a

comparison of individual and group responses at the capability and subdomain level could provide insight on the disparity. For example, the comparison may reveal that individual respondents lacked significant background or experience, or it could bring to light an overly influential group member. Differences in individual versus group responses do not indicate bias in the responses per se, rather, the potential for such that should be evaluated further and rectified, if possible. Low variance was noticed between individual and group responses (see Figure 19), and the overall aggregate assessment scores between groups and individuals varied by only 0.02 points (see table F1 in Appendix F), so the introduction of bias was not a concern in this assessment.

Recommendations

The recommendations are presented in two parts. The first part discusses recommendations developed in plenary and by consensus by all workshop participants. They are described in detail in the implementation plan (Appendix G). The second part presents, in greater breadth, recommendations that apply to the Bangladesh context. They are based on the average scores in the D2AC data collection instrument and were both generated from the priority actions for implementation tab in the D2AC Data Analysis Tool and inspired by the group discussions during the workshop.

Priority Recommendations from Combined and Validated Implementation Plan

As previously mentioned, the priority recommendations were developed in small groups, combined in a joint implementation plan in plenary, and validated by the workshop participants.

The recommendations can be summarized in four broad categories. First, participants recommended developing and implementing the following **trainings to be held**: to sensitize staff on data quality characteristics, to perform routine data quality checks, to build a strong and sustainable MEL team, on data entry analysis and its interpretation, and in-service training to build monitoring and supervisory capacity.

Second, participants also compiled a host of **materials and systems to be developed or strengthened**: a reliable data repository system; a reliable, complete, and accurate routine checks and reviews for data quality; customized analytics and visualizations using the central data repository; a comprehensive data use guidance; a learning and adaptation mechanism integrated in the MEL process; specific guidance around quality assurance and control; a training module containing demonstration of data analysis and use for decision making at different levels; a training module for data entry; a training database; and an ICT/tech corner at TB facilities.

Third, participants reflected on areas where **monitoring was to be ensured**: in order to reduce bias and duplication in data reporting, through quarterly data consistency checks between e-TB Manager and DHIS2, to monitor the implementation of the data use guidance in order to revise and updated it as needed, to monitor and review the MEL plan implementation, to track the progress of the implementation of the MEL operationalization plan, to modify/upgrade the data collection and analytics system, and to ensure funding availability for any kind of ICT equipment damage, repair, and maintenance.

Last, participants suggested various types of **evaluations to be conducted**: periodically reporting on data quality operations, evaluating the impact of the new data use guidance, using data from MEL activities for research and evaluation, assessing perceived decision making needs (for decisions based on available data for programmatic improvement) for subnational managers, assessing the existing MIS, and implementing an ICT infrastructure operations and maintenance plan at the national and subnational levels.

The 30 detailed priority recommendations can be found in Appendix G and the recommendations by domain and subdomain generated by the D2AC Analysis Tool's Priority Actions can be found in Appendix H.

Other Recommendations from Plenary Discussions

Other recommendations not included in the priority actions are as follow:

1. Develop and implement a comprehensive user-role specific data use guidance to enhance managers' and staff capacity on routine data quality checks, epidemiological analysis (disease burden), and data interpretation for making data-informed actions.

2. Review the NTP's existing and future MIS ecosystem and mitigate the challenges in terms of data flow (interoperability between systems like Truenat and Aspect[8]), data presentation (dashboard for key indicators) and decision making capacity; this should also include time dedicated to developing an inventory of data collection system (clinical, lab, commodity, training) and regularly updating a master facility list.

3. Review the existing NTP's ICT infrastructure (IT equipment including connectivity, data storage, server management, patient privacy, security protocols, etc.) with the support from an in-country IT expert team and prepare a detailed time-bound plan for improvement and standardization of basic processes.

4. Build a data use culture through the development or strengthening of a data science team, building more robust data analysis systems, enhancing guidelines around quality assurance and control, developing trainings on data management, improving practices around data quality checks, and developing a more comprehensive communication strategy around data quality and use.

5. Improve the capacity building of TB staff nationwide by continuous monitoring, supervision, and on-the-job training and by strengthening and expanding access to preservice training (and finding ways for the NTP to be more involved), with the aim of reducing brain drain and loss of institutional memory at the peripheral level.

6. Increase the budgetary allocation for M&E activities, strengthen M&E working group and data quality management group meetings, develop and implement a MEL operationalization plan, and integrate learning and adaptation mechanism in the MEL process.

[8] Truenat is a chip-based, rapid molecular diagnostic technology for diagnosis of TB and rifampicin-resistant (RR) TB; it is not a data collection system. Aspect is a data collection software that captures data from the GeneXpert sites only. The Bangladesh NTP is exploring solutions for Aspect to be capable of capturing data from the Truenat sites as well as GeneXpert sites, but this will require additional logistic and software customization support, and therefore funding.

Conclusion

Despite accounting for 3.6% of the worldwide TB burden and being among the 30 high TB burden countries and on 2 (TB and MDR/RR-TB) global TB watchlists, Bangladesh saw one of the largest relative reductions in annual TB case notifications between 2019 and 2020 (>20%) (WHO, 2022). Following large falls in 2020, the reported number of people newly diagnosed with TB in 2021 recovered to 2019 levels (or beyond). Bangladesh was among the top 10 countries that accounted for ≥90 percent of the global reduction in case notifications of people newly diagnosed with TB in 2020, compared with 2019 and by 2021, Bangladesh was 1 of 6 high-burden countries to have reached or passed the first milestone of the End TB Strategy of a 35 percent reduction in TB deaths compared with 2015 (WHO, 2022). Bangladesh is also, among the 30 high TB burden countries, one with the highest levels of treatment coverage in 2021 (WHO, 2022).

The D2AC assessment in Bangladesh highlighted both the high-performing elements of the NTP's data use capabilities and the challenges that should be addressed to improve evidence-based decision making. The assessment revealed good performance in certain dimensions of the D2AC, such as data collection and reporting, MEL, and data interpretation. However, it also revealed important gaps, such as standardized ICT and connectivity needs assessments, data integration, systematic trainings, and rigorous data use guidance. These findings provide evidence of the areas needing programmatic interventions, and can also inform policy makers, donors, and program managers who want to design and implement responsive programs and interventions to strengthen and improve data use capabilities for evidence-based decision making to provide targeted and informed high-quality services for all TB patients.

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Appendix A. D2AC Bangladesh Workshop Agenda

Monday, December 19, 2022 D2AC Assessment Workshop Day 1 Location: Lakeshore Hotel, Dhaka		
Time	**Description**	**Participants**
8:30–9:00	Registration, welcome tea-coffee	
9:00–9:45	Welcome Workshop opening addresses Introductions	NTP Leadership USAID Mohammad Golam Kibria Jeanne Chauffour Meredith Silver All
9:45–10:30	Workshop Overview	Jeanne/Meredith/Kibria
10:30–12:30	Introducing the D2AC assessment approach and Toolkit	Jeanne/Meredith/Kibria
12:30–13:30	Lunch	
13:30–16:00	Step 1: Individual instrument submission using digital D2AC Toolkit	All (individually)
16:00–16:30	Tea break and closing	
Tuesday, December 20, 2022 D2AC Assessment Workshop Day 2 Location: Lakeshore Hotel, Dhaka		
Time	**Description**	**Participants**
8:30–9:00	Registration, welcome tea-coffee	
9:00–9:15	Welcome, day one recap and overview of day two	Jeanne/Meredith/Kibria
9:15–12:00	Step 2: Group assignments and group instrument submission using digital D2AC Toolkit	All (in groups)
12:00–13:00	Lunch	
13:00–14:00	Step 3: Plenary discussion on group work	All (group leads) Facilitator: Kibria
14:00–14:45	Step 4: Presentation of individual and aggregate group assessment data	All Facilitator: Jeanne/Meredith
14:45–16:00	Step 5: Plenary discussion on aggregate data	All Facilitator: Kibria/Jeanne

16:00–16:30	Tea break and closing	
Wednesday, December 21, 2022 D2AC Assessment Workshop Day 3 Location: Lakeshore Hotel, Dhaka		
Time	**Description**	**Participants**
8:30–9:00	Registration, welcome tea-coffee	
9:00–9:30	Welcome, day two recap and overview of day three	Jeanne/Meredith/Kibria
9:30–10:00	Step 6: Identify priority action items	All (individually)
10:00–11:30	Step 7: Draft implementation plan for priority action items	All (in groups)
11:30–12:45	Step 8: Discuss implementation plan and next steps	All (group presentations) Facilitator: Kibria
12:45–13:00	Closing words and acknowledgments Certificate ceremony and group photo	Kibria/Jeanne Bangladesh NTP Leadership USAID
13:00	Lunch	

Appendix B. D2AC Bangladesh Workshop Participants

Table B1. Workshop participant list

Names of IPs appear in alphabetical order by name.

Name	Affiliation	Role
Dr. Samina Choudhury	USAID	Infectious Disease Team Lead
George A Das	USAID	Project Management Assistant
Dr. Afzalur Rahman	NTP, DGHS	Assistant Director, MBDC & Program Manager - TB
Dr. Ahmadul Hasan Khan	NTP	M&E Expert
Dr. Shakila Yeasmin	NTP	M&E Officer
Dr. Sanjida Anjum	NTP	M&E Officer
Dr. Sadia Serjana Haque	NTP	M&E Officer
F.M. Monirul Haque	NTP	MIS Officer
Md. Tanvir	NTP	MIS Officer
Nasir Uddin	NTP	MIS Officer
Dr. Pronab Kumar Modak	NTP	DPM Training & MDR Focal
Dr. Sinthia Tarin	NTP	Training Coordinator
Dr. Fahima Islam Liza	NTP	DSMO - Patuakhali
Dr. F. M. Nasirul Haque	NTP	DSMO - Narayanganj
Dr. Shah Mehedi Bin Zahur	NTP	Divisional TB Expert - Khulna
Dr. Md. Saiful Islam	NTP	Divisional TB Expert - Rajshahi
Umme Tasnim Maliha	NTP	Microbiologist
Md. Mamun Hasan	RTRL Khulna	Microbiologist
Brig Gen Kabir	Kurmitola General Hospital	Director
Dr. Sayadul Bashar	Kurmitola General Hospital	IMO Surgery
Mr. Mamunur Rashid	NTP	FMS
Md. Azizur Rahman	NTP	Office secretary
Dr. Farhana Nishat Seheli	BRAC	Senior Manager
Dr. Tasmiah Selim	BRAC	Senior Manager, Grants Management and M&E
Dr. Dipak Kumar Biswas	Damien Foundation	Medical Coordinator
Mark Atanu Biswas	HEED Bangladesh	Upazila Coordinator
Dr. Ahammad Shafiq Sikder Adel	icddr,b	Senior Research Investigator
Anjan Saha	icddr,b	Senior MEL Advisor

Name	Affiliation	Role
Sarder Tanzir Hossain	IDDS	Senior TB Diagnostics Specialist
Dr. Tapash Roy	IRD	Country Director
Md. Shamsher Alam	IRD	Senior M&E Manager
Md. Abu Taleb	MTaPS	Senior Technical Advisor - TB
Md. Ferdous Alam	MTaPS	Senior Technical Advisor - HIS
Md. Maksudul Hannan	STAR Project - USAID	Senior TB Strategic Planning Technical Advisor
Dr. Adneen Moureen	STAR Project - USAID	TB New Technologies and Diagnostics Advisor
Dr. Salim Hamid	STAR Project - USAID	STAR Fellow
Md. Ebne Sayeed Imtiaz	SystemOne LLC	Bangladesh Country Manager

Table B2. Workshop participant characteristics

Participant information			Percentage and count
Individual instrument responses			81% (30 of 37)
Participated in group instrument			81% (30 of 37)
Among those who did fill out the individual instrument (N=30):			
Gender		Men	27% (n=8)
		Women	73% (n=22)
Level	Central	NTP	37% (n=11)
		STAR Advisors to NTP	10% (n=3)
		Partners	30% (n=9)
		All (subtotal)	77% (n=23)
	Regional		7% (n=2)
	District		10% (n=3)
	Health facility (hospital)		3% (n=1)
	Community		3% (n=1)
Roles affiliated with USAID TB pillars		Reach	40% *
		Cure	30% *
		Prevent	47% *
		Sustain	50% *
Years of work experience		0–5	53% (n=16)
		5–10	20% (n=6)
		10–15	17% (n=5)
		15–20	-
		20+	10% (n=3)

* No *n* is provided here because participants were able to identify with more than one pillar (and up to all four pillars), so the percentages illustrate representativeness of each pillar.

Appendix C. D2AC Toolkit Bangladesh Country Profile

Demographic, Geographic, and Socioeconomic Features		Response	Year	Source
Demographic				
Area/size of the country (km^2)		147,6	N/A	
Notable borders		India,nmar (Burma)	N/A	
Estimation of population size		166.3 mllion	2021	The World Bank[1]
Administrative structure				
Regions/provinces/states (#)		8 (divisons)	2020	N/A
Districts/councils/counties (#)		64 distcts; 495 su-districts; 4,571 uon councils; 330 mnicipalities	2020	Government of Bangladesh[2]
Service delivery sites	Facility-based (#)	Not available		
	Community-based (#)	Not available		
Socioeconomic features				
United Nations classification		Low iome	N/A	
Population below the poverty line		34 milln	2019	Asian Development Bank[3]
	Rural (%)	61.05	2021	Statista[4]
	Urban (%)	39	2021	Statista[5]
Major revenue sources		Agriculure (rice, jute, tea)	2022	Britannica[6]

TB Epidemiologic Burden and Trends	Response	Year	Source
TB mortality rate	27 cas per 100,000 people	2020	World Data Atlas[7]
TB incidence	221 p 100,000 people; 375,0otal	2021	WHO TB Global Report 2021[8]
TB case notification rate	307,5	2021	WHO TB Global Report 2021[8]
TB treatment coverage	82%	2021	WHO TB Global Report 2021[8]
TB treatment success rate	95%	2020	WHO TB Global Report 2021[8]
MDR/RR-TB incidence	1%	2021	WHO TB Global Report 2021[8]
MDR/RR-TB treatment enrollment rate	1,488	2021	WHO TB Global Report 2021[9]
XDR-TB incidence	7	2019	WHO TB Global Report 2021[10]
HIV coinfection rate	0.43 per00,000 people	2021	WHO TB Global Report 2021[8]
TPT coverage *(number of people started on TPT)*	37,889	2021	TB DIAH[11]
WHO impact indicators			
Reduction in TB incidence rate (compared with 2015)	3 per0,000 people. 221 (2015) 218 (2020)	2020	The World Bank[12]

Reduction in TB deaths (compared with 2015)		17 per00,000 people. (201 42; 2021 = 25)	2021	WHO TB Global Report 2021[10]
TB-affected families facing catastrophic costs dues to TB (%)		Not avlable		
NTP Laboratory and Workforce Capacity		**Response**	**Year**	**Source**
Laboratory centers (#)				
Total number of laboratories conducting TB diagnosis (#)		1,119	2021	WHO TB Global Report 2021[10]
	Microscopy centers	1,104	2014	WHO TB Global Report 2021[10]
	GeneXpert sites	200	2019	WHO TB Global Report 2021[10]
	Culture laboratories	6	2021	WHO TB Global Report 2021[10]
	Reference laboratories	1	2014	WHO TB Global Report 2021[10]
Does a laboratory referral network exist? (Yes/No)		Yes	2014	WHO TB Global Report 2021[10]
Human resources				
NTP staff supported by government (#)		Not avlable		
NTP M&E staff supported by government (#)		Not avlable		
Resources allocated toward M&E or TB M&E ($)		Not avlable		
TB/HIV officers recruited under partner's support absorbed into payroll (%)		Not avlable		
TB Health Financing		**Response**	**Year**	**Source**
WHO recommended level for the country		135.illion	2020	STOP TB Partnership[13]
TB treatment is free (Yes/No)		Yes	N/A	
People eligible for exemptions who receive those exemptions (%)		Not ailable		
Proportion of population with TB who received social protection under the national health insurance scheme (%)		Not avlable		
Proportion of health budget allocated to TB services (%)		121,6illion	2021	WHO TB Global Report 2021[8]
Proportion of annual TB budget funded by donors (%)		70%	2021	WHO TB Global Report 2021[8]
Proportion of domestic TB financing (%)		30%	2021	WHO TB Global Report 2021[8]
Proportion of cases that led to catastrophic costs due to TB (%)		Not avlable		
Research and Development		**Response**	**Year**	**Source**
Proportion of national TB budget allocated to research		5,744,39 (9%)	2020	STOP TB Partnership[13]
Surveys and research being conducted (e.g., prevalence surveys). Please provide name, year, and implementing/financing entity.				

[1] https://data.worldbank.org/indicator/SP.POP.TOTL

[2] http://www.bangladesh.gov.bd/site/view/division-list/List-of-Divisions

[3] https://www.adb.org/countries/bangladesh/poverty

[4] https://www.statista.com/statistics/760934/bangladesh-share-of-rural-population/

[5] https://www.statista.com/statistics/761021/share-of-urban-population-bangladesh/

[6] https://www.britannica.com/place/Bangladesh/Economy

[7] https://knoema.com/atlas/Bangladesh/topics/Health/Risk-factors/Tuberculosis-death-rate

[8] https://worldhealthorg.shinyapps.io/tb_profiles/?_inputs_&entity_type=%22country%22&lan=%22EN%22&iso2=%22BD%22

[9] https://app.powerbi.com/view?r=eyJrIjoiZDhjNDM0YmMtOGExOS00ODIxLWEzMjktZDk0NmI4YTAwODgwIiwidCI6ImY2MTBjMGI3LWJkMjQtNGIzOS04MTBiLTNkYzI4MGFmYjU5MCIsImMiOjh9

[10] https://www.who.int/teams/global-tuberculosis-programme/data

[11] https://hub.tbdiah.org/pbmef/indicators/tb-preventive-treatment-coverage?country=2612

[12] https://data.worldbank.org/indicator/SH.TBS.INCD?end=2020&locations=BD&name_desc=false&start=2015

[13] https://www.stoptb.org/static_pages/BGD_Dashboard.html

Appendix D. D2AC Toolkit Glossary

Term	Definition
ad hoc	Arranged or happening when necessary and not planned in advance.
aggregate data	Compilation of individual data systems and data that could result in the totality of the information being classified and stratified at a higher level.
algorithm	A process or a set of rules to be followed in calculations or other problem-solving operations, especially by a computer; a common term used to show decision trees for diagnostic or treatment procedures (e.g., treatment algorithm; diagnostic algorithm).
aligned	The fit between the data flow and data collection or program goals and data analysis and data collection.
analytics	The process of discovering, interpreting, and communicating significant patterns in data.
capacity building	Capacity building focuses on strengthening the skills and knowledge of personnel, the management and governance of a program or project, and organizational infrastructure.
cascade analysis	Cascades are frameworks for monitoring gaps in program services needed to achieve goals and health outcomes.
case-based data	Patient-level data for a series of key or sentinel (reportable) events, used to measure and monitor the incidence, progression, and outcome of a disease.
central data repository	A centralized place to store and maintain data *(see standards-based central data repository for more information).*
client	An individual who is a potential or current user of health services; may also be referred to as a patient or beneficiary.
commodities	A raw material that can be bought and sold.
communication strategy	An outlined method used for exchanging information that can be visual, verbal, or in written form. A plan to achieve communications objectives internal or external.
data	A reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing (e.g., a sequence of bits, a table of numbers, the characters on a page, and the recording of sounds made by a person speaking).
data analysis	The examination of acquired data for its significance and probative value to the case.
data audit	A guided inspection of an organization's health data registries and forms, typically by an independent body.
data collection system	A computer application that facilitates the process of data collection, allowing specific, structured information to be gathered in a systematic fashion, subsequently enabling data analysis to be performed on the information.
data element	A basic unit of information that has a unique meaning and subcategories (data items) of distinct value (e.g., gender, race, and geographic location).
data exchange	The process of taking data structured under a source schema and transforming it into a target schema, so that the target data are an accurate representation of the source data. Data exchange allows data to be shared between different computer programs.
data governance	A set of processes that ensures that data assets are formally managed throughout the healthcare system. A data governance model establishes authority, management, and decision-making parameters related to the data produced or managed by the healthcare system.

Term	Definition
data quality parameters	Dimensions used to examine, evaluate, and improve data quality— they include accuracy (are the data collected and reported in a manner by which the data are to be trusted because they are a reflection of the reality, [i.e., there are no omissions or duplicates]?), timeliness (are the data collected, cleaned, reviewed, or reported according to issued protocol and guidance?), completeness (are the data submitted complete, and are all the variables and indicator data fields properly filled out?), among others.
data quality reviews	A process whereby data and associated data files are assessed and required actions are taken to ensure that files are independently understandable for informed reuse. This is an active process involving a review of the files, documentation, the data, and the code.
data reporting tools	The paper and electronic tools used to transfer collected or received data to a higher level in an organized, streamlined, and consistent manner.
data source	The location from which the data being used originates and can include primary, secondary, and tertiary data sources.
data use	Instances where data are currently reviewed, updated, processed, erased, accessed, or ready to inform a recommendation for action in strategic planning, policymaking, program planning and management, advocacy, or delivering services.
data use forum	An event, series of events, or space (physical or virtual) dedicated to and gathering multiple actors in data use activities, practices, and exercises (e.g., quarterly data review and use meetings; online discussion groups/listservs).
decision making	The selection of a course of action from among two or more possible alternatives in order to arrive at a solution for a given problem.
decision support tools	Electronic applications to assist decision makers by providing evidence-based knowledge in the context of clinical decision making (e.g., decision tree, drug interaction alerts at the time medication is prescribed or reminders for specific guideline-based interventions during the care of patients with chronic disease) or policy/program decision making (e.g., dashboards or scorecards to help guide policy/program decisions).
descriptive analysis	Statistical techniques used to summarize and describe a data set, and also the statistics measures used in such summaries.
disaggregate data	Breaking down of data into smaller groupings, often based on such characteristics as sex, income, or racial/ethnic group.
exchange standards	Refers to the exchange of information according to a set of standards. Standards are agreed on methods for connecting systems together and may pertain to security, data transport, data format or structure, or the meaning of codes or terms.
evaluation	The systematic assessment of an ongoing or completed intervention to determine whether the intervention is fulfilling its objectives and to demonstrate an effect on health outcomes.
function	The functionality of a system is how well the system works when examining it against relevant documents that describe the conceptual design of the system(s).
guideline	A general rule, principal, or piece of advice.
health information system (HIS)	The HIS provides the underpinnings for decision making and has four key functions: data generation, compilation, analysis and synthesis, and communication and use. The HIS collects data from the health sector and other relevant sectors, analyzes the data, ensures their overall quality, relevance, and timeliness, and converts data into information for health-related decision making.
indicator	A quantitative or qualitative factor or variable that provides a simple and reliable means to measure achievement.

Term	Definition
information and communications technology (ICT)	The means employed to provide access to information through Internet, wireless networks, cell phones, and other communication media.
information products	Data that has been compiled, managed, and analyzed becoming evidence that can be used by decision makers.
in-service training program	Training concurrent to official responsibilities for improving professional qualifications or skills. Can be compulsory related to official professional development activities to maintain or upgrade professional qualifications or it can be optional for the sole purpose of improving skills.
in source documents	Documents from which data were originally collected (i.e., facility registers and tally sheets).
integration	The inter-connectivity requirements needed for two applications to securely communicate data to and receive data from another.
inventory	An itemized list of current information system/digital assets.
master facility list	A standard mechanism for uniquely identifying health facilities, which allows for information to be compared across time and across data sources for individual facilities.
mandate	An official order or commission to do something.
monitoring	The process of collecting and analyzing routinely collected data to compare how well an intervention is being implemented against expected results and measure changes in performance over time.
monitoring and evaluation plan	Describes and manages the process of assessing and reporting progress toward achieving project outputs and outcomes, and to identify what evaluation questions will be addressed through evaluation.
national health management system (HMIS)	A system whereby health data are recorded, stored, retrieved, and processed to improve decision making.
operational/ operationalized	In use or ready for use/put into use.
points of service	Of, relating to, or being a healthcare insurance plan that allows enrollees to seek care from a physician affiliated with the service provider at a fixed co-payment or to choose a nonaffiliated physician and pay more.
policy	A course or principal of action adopted or proposed by a government, party, business, or individual/a definite course or method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions.
pre-service training program	Recognized and organized programs designed to train future professionals to formally enter the profession at a specified level of education.
procedures	An established or official way of doing something.
process	Services that the program provides to accomplish its objectives, such as outreach activities, curriculum development, materials developed, counseling sessions, workshops, and training events.
real-time data entry	Data that are not kept or stored, but are passed along/delivered to the end user immediately after being collected.

Term	Definition
requirements (for data analysis and visualization)	Necessary components for bringing order and structure to collected data and putting data into a chart, graph, or other visual format that helps inform analysis and interpretation.
retrospective (data entry)	Data recorded, or the process of recording data, later than the period or moment at which they should have been recorded (e.g., updating patient charts or registers days after the patient visit, when guidance instructs to update the charts and registers immediately following the patient visit).
scenario	A set of simple statements that summarize what the end-user needs the digital health intervention to do.
standard operating procedures (SOPs)	A set of descriptive directions that ensure the correct development of specific activities and processes.
stakeholder	Any person or party with an interest in the financing, implementation, or outcome of a service, practice, process, or decision made by another (e.g., healthcare, health policies).
standardize	Standardized measures are nationally recognized criteria for evaluating the quality of healthcare provided to patients. These measures are endorsed or developed by organizations, specialty medical boards, national accreditors, or government agencies.
standardized electronic data collection tools	A streamlined ensemble of digital data collection tools meant to be used in a consistent manner across a territory or system, as opposed to ad hoc or misaligned systems that make data difficult to compare or combine.
standards	Accepted methods or models of practice; they may be formally approved or de facto standards.
standards-based central data repository	A data bank or data warehouse, centrally managed, which stores and merges data with standardized definitions and terminology from existing databases so that these data can be accessed, shared, integrated, analyzed, reported, or updated as required.
supportive supervision	A process of helping staff improve their own work performance continuously, carried out in a respectful and non-authoritarian way with a focus on using supervisory visits as an opportunity to improve knowledge and skills of health staff and provide feedback.
synthesize (data)	A process of combining data into a coherent whole with the aim of drawing conclusions.
TB service delivery workflows (or just workflows)	A repeatable pattern of activity that can be organized with adequate resources, defined roles, and information and feed into a process that can be documented and learned.
unique identification	An identifier that is guaranteed to be unique among all identifiers; a long-lasting reference that allows for continued access to a digital object for a specific purpose.
visualization (data)	The representation of data in charts, infographics, video graphics, and dashboards or other images.

Appendix E. D2AC Data Collection Instrument

The highlighted sentences correspond to the average group response (except for questions 41–44 which correspond to the average individual response). The User Roles questionnaire can be found at the end.

Domain 1	**Data collection and reporting**
Subdomain (D1S1)	**Data collection tools and workflows**
Definition	The tools/devices/instruments and processes used for the ongoing systematic data collection to support analysis, interpretation, and sharing of data according to the National TB Program (NTP) guidelines for TB treatment, prevention, and control.
1. To what extent are standardized electronic data collection tools used?	
1	Non-standardized paper-based tools are the primary tools for data collection at all levels.
2	Standardized paper-based data collection tools are the primary tools for data collection at all levels.
3	Standalone standardized electronic data collection tools are often used, including for retrospective data entry, at higher levels.
4	Standardized electronic data collection tools are used at all levels and integrated with the national health management information system (HMIS) data collection system.
5	National HMIS data collection system is used for real-time data entry.
2. Do you have an inventory of TB data collection systems (clinical, lab, commodities, training)?	
1	There is an ad hoc list of TB data collection system.
2	A list of all the TB data collection systems exists but information about its data and users is limited to the national level.
3	A complete inventory of all the TB data collection systems, its data, and target users is available with the NTP.
4	The inventory information is used to inform the need for a new TB data collection system.
5	TB data collection system inventory is routinely updated to add information about a new TB data collection system.
3. To what extent are data collection processes aligned with TB service delivery guidance?	
1	Data collection is ad hoc or mainly driven by donor or external stakeholder mandate for data collection.
2	Some data collection processes align with service delivery guidance.
3	Data collection processes are aligned with the TB service delivery guidance.
4	Data collection processes are monitored and assessed to check alignment with the service delivery guidance.
5	Data collection process monitoring and assessment findings guide revisions and updates.
4. To what extent is unique identification used for TB cases?	
1	Unique identification is absent or rarely used to identify TB cases.
2	Some TB program sites use their own unique identifiers to identify TB cases.
3	The NTP uses unique identifiers for TB cases across program sites.

4	Unique identifiers for TB cases are aligned with the national unique (person or patient) identifiers.
5	The NTP ensures use of unique identifiers to track and treat TB cases across all TB sites (program, testing, pharmacy).
5. To what extent is the NTP site list standardized and in what format is it?	
1	The NTP site list is absent or only includes site names.
2	The NTP has an electronic site list but it is incomplete.
3	The NTP has a web-based site list (similar to a master facility list) that is complete.
4	The NTP web-based site list is integrated into the master facility list.
5	The NTP web-based site list is routinely reviewed and updated together with the national master facility list.
6. How is data disaggregation (e.g., by sex or age, treatment/retreatment, drug-resistant/drug susceptible) addressed in data collection?	
1	Data are rarely or inadequately disaggregated in the site level data collection.
2	Data collection tools (paper or digital) and processes allow disaggregation of data but disaggregate data are not collected.
3	NTP guidance require collection of disaggregate data.
4	NTP monitoring and review assesses quality of disaggregated data collection.
5	The NTP routinely reviews and updates disaggregate data collection requirement in the monitoring and evaluation (M&E) plan.

Domain 1	**Data collection and reporting**
Subdomain (D1S2)	**Reporting**
Definition	The tools/devices/instruments and processes used for the ongoing systematic data reporting to support analysis, interpretation, and sharing of data according to the NTP guidelines for TB treatment, prevention, and control.
7. To what extent are standardized electronic data reporting tools used?	
1	Non-standardized paper-based tools are the primary tools for reporting at all levels.
2	Standardized paper-based reporting tools are used at all levels.
3	Standalone standardized electronic data reporting tools are used at national and district levels for aggregate data reporting, at higher levels.
4	Standardized electronic data reporting tools for aggregate data (i.e., not real time) are used at all levels and integrated into the national HMIS.
5	Standardized real time (e.g., case-based or point of service data entry) electronic data reporting tools are used.
8. How is data disaggregation (e.g., by sex or age, treatment/retreatment, drug-resistant/drug susceptible) addressed in reporting?	
1	Data are rarely or inadequately disaggregated in the site level reporting.
2	Data reporting tools (paper or digital) and processes allow disaggregation of data but data are incomplete or rarely collected.
3	NTP guidance require reporting of disaggregate data.
4	NTP monitoring and review assesses quality of disaggregated data reporting.
5	The NTP routinely reviews and updates disaggregate data reporting requirement in the M&E plan.

9. To what extent are data reporting processes aligned with TB service delivery guidance?	
1	Data reporting is ad hoc or mainly driven by donor or external stakeholder mandate for reporting.
2	Some data reporting processes align with TB service delivery guidance.
3	Data reporting processes are aligned with the TB service delivery guidance.
4	Data reporting processes are monitored and assessed to check alignment with TB service delivery guidance.
5	Data reporting processes are routinely updated based on NTP service delivery guidance revisions.

Domain 1	**Data collection and reporting**
Subdomain (D1S3)	**Data quality**
Definition	The accuracy, completeness, timeliness, consistency, reliability, and integrity of data.
10. To what extent is data quality assurance defined and applied in NTP data systems?	
1	Data quality is defined and measured in an ad hoc manner.
2	Data quality parameters are clearly defined and documented by NTP.
3	Data quality assessments are routinely conducted for priority indicators.
4	Data quality problems are documented and factored in data analysis to be comparable across sources and time.
5	High quality data (complete, consistent, and accurate) are available for at least the priority indicators for the last two years or more.
11. To what extent has the NTP integrated data quality assurance into standard practice?	
1	Data quality is not checked or ad hoc and non-standardized data quality assessments are conducted.
2	Data quality assessments are limited to donor-funded programs.
3	The NTP conducts routine standardized data quality assessments for both in-source documents at the facility and for the reported data.
4	The NTP uses data quality assessment findings to improve the data and capacity to collect and report good quality data.
5	Data quality limitations identified in data quality assessments are routinely factored in the evaluation of program performance and management (e.g., program review).

Domain 2	**Data analysis and use**
Subdomain (D2S1)	**Data integration and exchange**
Definition	The mechanism for transforming and integrating data from multiple sources into a target destination environment; can also refer to the activities of matching, merging, and deleting records within a single data store.
12. To what extent has a central data repository been developed?	
1	The NTP lacks central data repository(ies) (e.g., a national reporting system, a TB case report repository) where TB case report data are analyzed/reported to (at case or aggregate level).
2	The system requirements for a central data repository are documented but not implemented.

3	An electronic central data repository collates aggregate program data only at national level.
4	A standard-based central data repository collates data from all the TB data collection systems.
5	The central data repository is routinely used by NTP stakeholders to address program data analytics and visualization needs.
13. To what extent are there data exchange processes between systems at points of service for TB cases and reporting and/or central repositories currently in place?	
1	Data exchange processes are missing or are limited and require manual intervention.
2	There is some data exchange at the national level but limited automated exchange.
3	Data exchange occurs extensively on a national level and is mostly automated.
4	All data exchange is automated with adequate budgetary resources in the program to meet custom requirements.
5	All data exchanges are automated, resourced, and no specialized engineering efforts or expertise is needed to meet new requirements.
14. To what extent are there data exchange processes between systems at points of service for laboratory testing and reporting and/or central repositories currently in place?	
1	Data exchange processes are missing or are limited and require manual intervention.
2	There is some data exchange at the national level but limited automated exchange.
3	Data exchange occurs extensively on a national level and is mostly automated.
4	All data exchange is automated and integrated with the national health data exchange (if it exists).
5	All data exchanges are automated, integrated, and no specialized engineering efforts or expertise are needed to meet new requirements.
15. To what extent are exchange standards (interoperability and/or health data standards, e.g., XML, JSON, LOINC, FHIR) integrated into the data exchange implementation?	
1	No defined technical standards exist for use in the TB data management and exchange but may exist for other diseases or HIS activities.
2	The country has adopted and/or developed standards for TB data management and exchange, but standards may be localized to specific projects.
3	Standards for TB data management and exchange are approved and require certification of new exchange partners for compliance.
4	The national TB data management and exchange standards are integrated in the national HIS and/or health plan.
5	TB data management and exchange standards are tracked, monitored, and reviewed through a standardized process.

Domain 2	**Data analysis and use**
Subdomain (D2S2)	**Analytics and visualization**
Definition	The use of analytics and visualization techniques/tools to provide new insights and patterns from data analysis to stakeholders at different levels to enhance health and healthcare decision making.
16. To what extent are users able to conduct analysis and develop visualization?	
1	Basic or no knowledge/skill exists to conduct analysis and develop visualization.

2	NTP staff can conduct descriptive analysis and generate some visualization (tables, graphs, charts, etc.) to make comparisons and evaluate trends.
3	NTP staff are able to conduct advanced analysis (e.g., cascade analysis) and develop visualization in real-time mostly at the national level.
4	NTP staff at national, subnational, and facility levels are able to conduct advanced analysis (e.g., cascade analysis) and develop visualization in real-time (e.g., for identifying causes of poor performance, implementation problems, and monitor and forecast services/commodities demand) as part of the M&E activities.
5	NTP staff can develop customized analytics and visualization using the central data repository (e.g., to monitor stock availability and forecast demand at all levels).
17. To what extent are analytics and visualization requirements documented?	
1	Data analysis and visualization requirements/needs are missing or ad hoc.
2	Data analysis and visualization requirements/needs are documented to support NTP decision making.
3	The NTP has identified and documented a minimum set of standard data analyses and visualizations requirements/needs at all levels.
4	The NTP's analytics and visualization requirements are monitored and budgeted in the NTP plan.
5	The NTP routinely updates analytic and visualization needs using monitoring data.
18. To what extent are data sources used?	
1	Decision making is informal or only one data source is used for decision making.
2	Some guidance is available that explains how multiple data sources support decision making.
3	Decision making is focused only on program resources and/or patient data reports and summaries. Some decision support tools exist locally or for specific implementations.
4	Program staff routinely make decisions with data incorporated from multiple sources (e.g., to provide scenario-based, health-system level specific decision making support, and predict the impact of decisions and policy).
5	Advanced models, used for decision making, incorporate multiple data sources (including the central data repository) to optimize and influence TB health outcomes.
19. To what extent are decision support tools used?	
1	The need for decision support tools has yet to be identified.
2	Decision support tools need is documented and exist locally or for specific implementations.
3	Decision support tools are automated to use the knowledge base for contextually-relevant reference information.
4	Assessments to ensure the knowledge relevance, value, and accuracy of decision support algorithms are conducted on a regular schedule.
5	Assessment findings are used for continuous improvement of decision support algorithms (in terms of relevance of information and accuracy).

Domain 2	Data analysis and use
Subdomain (D2S3)	**Dissemination and communication**
Definition	The analyzed data are synthesized and can be shared in appropriate visualizations, understood, and used by the target audience.
20. To what extent is a communication strategy in place?	
1	Communication is informal and lacks documented communication strategy.
2	A documented national communications strategy is in place but not operationalized.
3	An approved communication strategy is being implemented but confined to the national level.
4	Implementation monitoring and assessment are routinely conducted to gauge the effectiveness of the communication strategy as part of the NTP review.
5	A communication strategy and its implementation are adjusted based on the assessment findings.
21. To what extent are information products developed and subsequently disseminated?	
1	Development and sharing of information products are ad hoc or driven by specific program needs.
2	Dissemination of information products is typically limited to senior-level decision makers.
3	Targeted information products are disseminated in multiple formats (print, digital) using electronic and web-based platforms at higher levels.
4	Information products are routinely produced and distributed to stakeholders at all levels of the health system is monitored and evaluated.
5	Information product dissemination is improved using monitoring and evaluation data.

Domain 3	Leadership, Governance, and Accountability
Subdomain (D3S1)	**Data use guidance**
Definition	The process, procedures, and actions of an organization associated with collection and sharing of their data.
22. Does the NTP have a data use guidance?	
1	The need for policies that govern data use at health system levels has been identified but no such guidance exists.
2	The NTP uses data use guidance to manage its data use activities at various levels.
3	The NTP has an approved and comprehensive data use guidance implemented at all health system levels to support data use for decision making.
4	Implementation of data use guidance is monitored and assessed by the national governing/leadership body.
5	The NTP's data use guidance is annually reviewed and updated using the monitoring data.

Domain 3	Leadership, Governance, and Accountability
Subdomain (D3S2)	**Data access and sharing**
Definition	The disclosure of data from one or more organizations to another organization(s), or the sending of data between different parts of a single organization. This can take the form of routine data sharing, where the same data sets are shared between the same organizations for an on-going established purpose and exceptional, one-off decisions to share data for a specific purpose or shared with external stakeholders.
23. What is the data access and sharing status within NTP and with external stakeholders?	
1	The NTP lacks a data sharing mechanism.
2	Data access and sharing processes and methods are mostly documented but data are shared mainly through email.
3	Access-based control and data sharing agreements are established to allow access to and sharing of NTP data within and outside the NTP.
4	Access-based control and data sharing agreement implementation is monitored to ensure compliance with data use guidance/policy.
5	The NTP uses monitoring data to support access to and sharing of data with all relevant stakeholders (e.g., NTP, external stakeholders).

Domain 3	Leadership, Governance, and Accountability
Subdomain (D3S3)	**Organizational structure and function**
Definition	The organizational structures and processes, including job titles and clear descriptions of duties and responsibilities with a focus on data management, data quality, data governance, data analytics, data integration, and exchange.
24. To what extent are data use roles and responsibilities documented for NTP staff?	
1	Job descriptions are absent or lack data use roles and responsibilities.
2	Job descriptions clearly document data use roles and responsibilities but only at the national level.
3	NTP staff at all levels have access to their written role and responsibilities related to data use.
4	Supervisor(s) regularly review staff data use roles using the job description to offer constructive feedback.
5	Supervisor(s) follow NTP guidelines to review and update data use roles and responsibilities of staff.

Domain 3	Leadership, Governance, and Accountability
Subdomain (D3S4)	**Leadership and coordination**
Definition	The exercise of technical, political, and administrative authority to manage the NTP at all levels of a country's health system. The leadership and coordination structure consists of the mechanisms, processes, and institutions through which actors and stakeholders (both internal and external) articulate their interests, exercise their rights, meet their obligations, mediate their differences, and oversee the performance of the NTP.
25. To what extent is the interagency leadership and coordination team (including internal and external stakeholders) structure developed?	
1	The leadership and coordination team structure is informal or ad hoc.
2	Some formal leadership and coordination team structure with a clearly-defined scope of work exists.

3	A formal leadership and coordination team is managing implementation of the data use policy and data access and sharing guidance with attention to gender and equity.
4	A formal leadership and coordination team is an integral part of the NTP review and assessment process.
5	The formal leadership and coordination team facilitates an annual review of TB data use activities at all levels of the health system and decisions are evident in the updated program/guidance documents.
26. To what extent is the leadership and coordination team effective?	
1	An informal leadership and coordination team meets at the national level.
2	Meetings are held periodically among individual health system levels, but there is no standard operating procedure (SOP) related to meeting management.
3	Leadership and coordination team meetings occur on a periodic, regular schedule across the health system levels with SOPs to follow related to meeting management.
4	The monitoring, evaluation, and learning (MEL) team monitors and assesses ability of leadership and coordination team to lead and coordinate regularly scheduled meetings.
5	Assessment findings are used to improve leadership and coordination team meeting outcomes.

Domain 3	**Leadership, Governance, and Accountability**
Subdomain (D3S5)	**Monitoring, evaluation, and learning (MEL)**
Definition	A plan supporting management of program activities and informing the organization about what activities to implement, timeline, resources, responsible party, and whether and how an activity is contributing toward stated NTP goals including equity and inclusion.
27. To what extent is the MEL plan implemented?	
1	MEL activities are informal or ad hoc.
2	An MEL guidance document exists but is only accessible at the national level.
3	An approved MEL plan with adequate budget allocation is being implemented at the national level.
4	The MEL plan implementation is monitored and reviewed as part of the program/strategy review.
5	Monitoring data are used to inform the annual review/update of the MEL plan.
28. To what extent does MEL contribute to improved health outcomes?	
1	Health outcomes are yet to be defined or lack standardized outcome parameters.
2	Some health outcomes are defined and monitored at the national level.
3	Health outcome parameters are documented and monitored at all the levels.
4	Routine health outcome assessment and evaluation is conducted to measure improvement in individual and population level health outcomes.
5	Health outcome measurement data are used to revise and prioritize program interventions.
29. To what extent are MEL processes developed?	
1	MEL processes are ad hoc.
2	MEL processes are documented but project- or intervention-focused.

3	MEL processes are documented and aligned with the data collection and reporting at all levels.
4	MEL processes are routinely reviewed as part of the NTP performance review.
5	Program performance review findings are used to routinely revise/update MEL processes.
30. To what extent does MEL support program improvement?	
1	MEL is informal and relies on individual experiences.
2	MEL data are sometimes used to monitor implementation and program performance.
3	Leadership and coordination team(s) uses MEL data at the national level for program review and course correction.
4	The MEL data are used to monitor, measure, and improve program data use at all levels.
5	The MEL data are used to continuously improve the MEL plan for achieving better program goals.

Domain 3	**Leadership, Governance, and Accountability**
Subdomain (D3S6)	**Financial resources**
Definition	The legal and administrative systems and procedures in place that permit a government ministry and its agencies and organizations to conduct activities that ensure the correct use of public funds and that meet defined standards of probity and regularity. Activities include management and control of public expenditures, financial accounting, reporting, and asset management (in some cases).
31. To what extent are data use activities funded in the NTP budget?	
1	Budget for data use activities is absent or ad hoc.
2	Budget for data use activities is allocated but tied with specific interventions/projects.
3	Operations of data use activities have been secured with annual budgets.
4	Budget for data use activities is monitored and reviewed during the program review process.
5	Monitoring and review findings are used to revise/update the budget allocated to data use activities.
32. How are financial resources mobilized?	
1	Availability of financial resources is ad hoc or specific to interventions.
2	Financial resource needs are documented for national level data use activities.
3	The NTP has a comprehensive financial plan that diversifies funding (resources from NTP, donors, and private sector) in place.
4	Availability and utilization of financial resources is monitored and measured by the MEL team.
5	The leadership and coordination team revises financial plan using the monitoring data to align with the national TB goals.

Domain 4	Capacity building
Subdomain (D4S1)	**Data interpretation**
Definition	The organizational structure and individual ability that enables reading, writing, and communicating data in context, including an understanding of data sources and constructs, analytical methods, and techniques applied — and the ability to describe the use case, application, and resulting value.
33. To what extent are data use forums (e.g., monthly or quarterly program review meetings) developed?	
1	Data use forums are missing or ad hoc.
2	Data use forums with terms of reference are convened, but only at the national level.
3	Data use forums with approved terms of reference are operational at all levels.
4	Performance of data use forums is monitored and assessed as part of the program performance review.
5	Monitoring and assessment findings are used to improve performance of data use forums.
34. How often are data reviewed and by whom?	
1	Data review by program staff are rare or ad hoc.
2	Program staff review data at the national level for specific program implementation.
3	Program staff routinely conduct data review at all levels using the data use forums to identify corrective action.
4	MEL staff routinely monitor and assess implementation of actions identified in the data review.
5	Monitoring and assessment data are used to continuously improve implementation of actions identified in the data review.
35. Is NTP staff receiving supportive supervision for practicing data use?	
1	NTP staff receive ad hoc supervision support for data use.
2	NTP staff receive program specific supervision and mentoring to take action on reported findings from indicators.
3	NTP staff receive supportive supervision for data use at the national level.
4	Supportive supervision is monitored to help identify technical resources NTP staff can access to meet supportive supervision needs.
5	NTP staff can mentor/coach peers on data use.

Domain 4	Capacity building
Subdomain (D4S2)	**Skill and knowledge development**
Definition	The availability of adequate personnel with characteristics, attributes, and capabilities to perform a task(s) pertaining to data system, data quality, data analytics, and data use to achieve clearly defined results.
36. To what extent has the NTP developed a national pre-service training program for skill and knowledge development?	
1	A national pre-service training program to impart knowledge and skills is ad hoc.
2	A national pre-service training program for imparting knowledge and skills exist but only for clinical staff.
3	A national pre-service training program for all cadres of the NTP is being implemented.
4	Pre-service training programs are monitored and assessed for their effectiveness and relevance.

5	The pre-service training program is routinely updated using the monitoring and assessment data.
37. To what extent are institutions offering pre-service training established in the NTP guidance?	
1	Institutions offering pre-service training are identified in an ad hoc manner.
2	Pre-service training is conducted by government and/or private training institutions.
3	A designated NTP authority oversees pre-service training programs.
4	The NTP offers opportunities and incentives to promote pre-service training of potential staff.
5	Institutions and their pre-service training offerings are identified based on the NTP strategic goals.
38. To what extent has the NTP developed an in-service training program for skill and knowledge development?	
1	A national in-service training program to impart knowledge and skills is ad hoc.
2	A national in-service training program for imparting knowledge and skills exist but only for clinical staff.
3	A national in-service training program for all cadres of the NTP is being implemented.
4	In-service training programs are monitored and assessed for their effectiveness and relevance.
5	The in-service training program is routinely updated using the monitoring and assessment data.
39. To what extent are institutions (both public and private) offering in-service training established in the NTP guidance?	
1	Opportunities for in-service training offered by institutions other than the NTP are limited.
2	In-service training is conducted by government and/or private training institutions.
3	A designated NTP authority oversees in-service training programs.
4	Training institutions offer opportunities and incentives to promote continuous education of staff at all levels.
5	Institutions and their offerings are identified based on the program review findings.
40. How effective are the in-service training programs?	
1	In-service training offerings are not effective.
2	In-service training offerings are aligned with training needs but only at the national level.
3	Training needs assessment data are used for identification and recommending appropriate trainings.
4	Assessment of training programs is routinely conducted as part of the MEL activities to gauge skill and knowledge of trainees.
5	Training assessment data are used to improve design and delivery of targeted in-service training programs.

Domain 4	**Capacity building**
Subdomain (D4S3)	**Decision making ability**
Definition	Individual stakeholder's autonomy, capabilities, and motivation to use data for action.
41. Do you feel your use of data for decision making inputs are valued?	
1	My responsibilities do not include using data for decision making.

2	My responsibilities include using data for decision making, however I do not have access to data.
3	I have access to data but I do not feel empowered or encouraged to use the data for decision making.
4	I feel like my input to my colleagues around decision making is often taken into consideration and valued, but I am not often encouraged to make decisions myself.
5	I feel like my input is often taken into consideration and valued, and that I am almost always able and encouraged to make decisions based on the available data.
42. How satisfied do you feel by your job?	
1	I feel discouraged because my job often does not seem to matter.
2	I feel my job is important but the work environment is unsatisfactory.
3	I enjoy and find interest in my work and I feel valued in my team but I do not feel I have many opportunities for growth.
4	I feel that I work in an encouraging environment that promotes growth and the development of skills I need to perform well.
5	I feel that I work in an encouraging environment that promotes growth and learning, and I am rewarded for strong performance (e.g., incentives).
43. How adequately have you been trained to use data for action?	
1	I have never received training specific to data use.
2	I have only received informal training on data use (e.g., on-the-job training from a colleague).
3	I have received formal training on data use but it was neither pertinent nor recent.
4	I have received formal training that was pertinent to data use at my level, but over two years ago.
5	I have received formal training that was pertinent to data use at my level, and within the last two years.
44. Is there a person you go to for support and mentorship?	
1	I do not have a colleague (e.g., knowledgeable peer or mentor) to whom I can go to for support for data use.
2	I have identified a colleague whom I would like to work with more closely for data use support, but I have not reached out for support yet.
3	I have a colleague knowledgeable about my responsibilities and skills but I cannot regularly turn to them for support for questions related to data use (e.g., due to their unavailability).
4	I have a colleague knowledgeable about my responsibilities and skills with whom I am increasingly collaborating and sharing knowledge about data use.
5	I have a colleague knowledgeable about my responsibilities and skills whom I can regularly turn to for support and who provides feedback based on best practices in data use.

Domain 5	**Information and communications technology (ICT)**
Subdomain (D5S1)	**Hardware**
Definition	An assembly of tangible physical parts of a system of computers, including servers and virtual private networks (VPN), that provide services to a user in the health information ecosystem. E.g., computers, printers, connecting devices.
45. To what extent does the NTP have adequate hardware?	
1	The NTP has few computers to support it or hardware is dedicated to specific TB HIS activities.

2	Less than half of the NTP's central and subnational offices have adequate hardware.
3	Hardware needs are documented national offices have adequate hardware, including backup services.
4	Hardware needs are monitored and assessed at all levels and is conducted annually as part of the program performance review.
5	Hardware needs for the program are updated and addressed routinely through annual program planning.
46. To what extent are hardware specifications developed and budgeted?	
1	No guidance exists on the minimum hardware specifications for TB data system.
2	Hardware specifications are documented at the national and subnational levels.
3	Hardware specifications are documented and followed in procurement at all levels.
4	Hardware specifications are supported by adequate budget in the program plan.
5	Hardware specifications are routinely updated based on the program data analytics, visualization, and data exchange needs.

Domain 5	**Information and communications technology (ICT)**
Subdomain (D5S2)	**Network and connectivity**
Definition	Network is the disparate elements of a system connected in a way that data and information can be shared among all elements. Connectivity is the ability to access the data in the system.
47. To what extent does Internet and Internet connectivity exist at NTP sites?	
1	No network and Internet connectivity exists or is limited to the national level.
2	Network and Internet connection exist at the national level and about half of subnational offices have a reliable network and Internet connection.
3	Adequate dedicated network and Internet connectivity exist at the national and subnational level sites.
4	Network and Internet connectivity needs are routinely monitored and assessed to identify and address gaps to support programmatic data collection, reporting, and analysis.
5	All or almost all of the NTP national and subnational sites have reliable network and Internet connections supported by a dedicated technology support team.

Domain 5	**Information and communications technology (ICT)**
Subdomain (D5S3)	**ICT business infrastructure**
Definition	Design and planning, operations management, and technical support for information and communications technology (ICT) infrastructure maintenance.
48. To what extent has ICT infrastructure been developed?	
1	There is basic or no support for ICT or electronic systems equipment installation and maintenance related to the TB HIS.
2	There is a recognized need to standardize processes to oversee and support ICT infrastructure, but no established or harmonized process exists specific to HIS needs.
3	An ICT operations and maintenance plan is being implemented at the national level.

	4	Data are collected and regularly reviewed on the ICT infrastructure operations and maintenance plan as mandated by the NTP strategic plan.
	5	The ICT operations and maintenance plan is continuously reviewed and adapted based on the review data.

User Roles Questionnaire

User group	#	Data Need	Need met by TB information system?
Community health worker	1	Is TB screening in the community effective (i.e., finding the expected number of cases)?	Yes/No
	2	Are case contacts being traced and investigated effectively for all index TB cases?	Yes/No
	3	Are people with presumptive TB being referred effectively to the nearest health facility (for laboratory test and further evaluation for TB)?	Yes/No
	4	Is TB treatment being administered effectively to TB patients according to established treatment protocols?	Yes/No
	5	Are patients being educated about TB prevention?	Yes/No
	6	Is awareness of TB being raised in the community (i.e., are we conducting health education effectively)?	Yes/No
Healthcare provider	1	Are TB patients being screened appropriately for HIV (according to the TB diagnostic algorithm)?	Yes/No
	2	Are presumptive cases being referred appropriately for diagnostic testing?	Yes/No
	3	Are confirmed TB cases being treated according to established treatment protocols?	Yes/No
	4	Is treatment being accurately recorded using the recommended procedures and tools?	Yes/No
	5	Is TB preventative therapy (TPT) being appropriately prescribed in the facility?	Yes/No
	6	Are patients being educated about TB prevention?	Yes/No
	7	Is good infection control and prevention (ICP) being practiced in the facility?	Yes/No
	8	Are contacts of cases being traced effectively?	Yes/No
Health facility/ clinic manager	1	Are all TB cases being detected (based on the estimated prevalence)?	Yes/No
	2	Are patients being screened and diagnosed efficiently?	Yes/No
	3	Are staff levels sufficient to address needs for TB screening and diagnosis in the facility?	Yes/No
	4	Are quality control mechanisms in place for screening and diagnosis?	Yes/No

User group	#	Data Need	Need met by TB information system?
	5	Are the required supplies available for screening and diagnosis (tests, reagents, specimen containers, referral forms, etc.)?	Yes/No
	6	Are TB patients treated effectively and their outcomes monitored/recorded accurately?	Yes/No
	7	Are patients being adequately educated for TB prevention?	Yes/No
	8	Are sufficient supplies available for preventing infection at the facility (e.g., personal protective equipment [PPE])?	Yes/No
	9	Are the necessary (or government-required) tools available for data collection and reporting?	Yes/No
Laboratory manager/ technician	1	Does the laboratory have sufficient capacity (e.g., staffing, equipment, supplies, power, maintenance) to perform the expected number of tests based on estimated prevalence?	Yes/No
	2	Are the right tests available in the right quantities and in the right places (according to the country diagnostic algorithm)?	Yes/No
	3	Is testing efficient (turn-around-time) and up to standard (quality assurance), and always available when needed (no stockout of testing materials)?	Yes/No
	4	Is treatment effectively monitored to ensure the best treatment outcomes (e.g., re-test at 2 and 5 months)?	Yes/No
	5	Is the laboratory practicing good infection prevention and control (e.g., PPE)?	Yes/No
	6	Is there a laboratory referral network?	Yes/No
District TB coordinator/ manager/ health officer	1	Are all TB cases being found (based on estimated prevalence and within relevant population sub-groups)?	Yes/No
	2	Are the screening and diagnosis (e.g., coverage) targets being achieved?	Yes/No
	3	Is there sufficient capacity for TB screening and diagnosis (e.g., staff, finances, logistics, recording and reporting forms, Internet connectivity, etc.) for facilities in the district?	Yes/No
	4	Are TB treatment outcomes monitored adequately?	Yes/No
	5	Are TB treatment targets being achieved in the district?	Yes/No
	6	Is treatment of high quality in the district (e.g., DOTS coverage)?	Yes/No
	7	Are there sufficient supplies for treating the expected number of cases in the district (medications, diagnostics, etc.)?	Yes/No
	8	Is coverage for TB preventive therapy (TPT) adequate in the district (including among subpopulations)?	Yes/No

User group	#	Data Need	Need met by TB information system?
	9	Are sufficient supplies available for infection prevention and control in the district (e.g., PPE)?	Yes/No
Regional TB coordinator/ manager	1	Are all TB cases in the region being detected (based on the estimated prevalence)?	Yes/No
	2	Are all TB cases in the region disaggregated by age, gender, TB condition (disease vs LTBI), TB site (pulmonary, extra-pulmonary), HIV status, drug susceptibility, etc.?	Yes/No
	3	Are TB treatment target(s) being achieved in the region?	Yes/No
	4	Is coverage of TB diagnostic services in the region adequate?	Yes/No
	5	Are sufficient resources for TB screening and diagnosis available in the region (e.g., staff, finances, logistics, diagnostics, medications, recording and reporting forms, Internet connectivity, etc.)?	Yes/No
	6	Is monitoring and supervision of diagnosis and treatment being conducted adequately in the region?	Yes/No
	7	Are TB treatment outcomes meeting targets for the region?	Yes/No
	8	Are sufficient resources available for treating the expected number of cases in the region (supplies, human and financial resources)?	Yes/No
	9	Are the resources required for TB prevention in the region available (supplies, human and financial resources)?	Yes/No
Regional laboratory manager	1	Is the quality of TB screening and diagnosis at facilities and districts in the region being adequately monitored?	Yes/No
	2	Do facilities and districts in the region have all the supplies they need for effective TB screening and diagnosis?	Yes/No
	3	Do facilities and districts in the region have adequate human and financial resources to conduct TB screening and diagnosis?	Yes/No
	4	Is adequate monitoring and oversight of TB screening and diagnosis being conducted in the region?	Yes/No
	5	Are TB laboratory services adequately supporting TB treatment in the region?	Yes/No
	6	Do the laboratories in the region have sufficient resources for TB prevention?	Yes/No
NTP manager/ policymaker	1	Is the NSP and national guidelines for screening and diagnosis up to date?	Yes/No
	2	Is the TB diagnostic algorithm still appropriate for the country's need?	Yes/No

User group	#	Data Need	Need met by TB information system?
	3	Is coverage of TB diagnosis and treatment adequate in the country?	Yes/No
	4	Is the distribution of drug-resistant TB in the country adequately monitored?	Yes/No
	5	Is there sufficient laboratory capacity in the TB program?	Yes/No
	6	Is the quality of TB screening and diagnosis adequate?	Yes/No
	7	Are there sufficient resources for TB screening and diagnosis in the program (staff, finances, logistics, referral systems, and recording and reporting forms, Internet connectivity, etc.)?	Yes/No
	8	Is the TB treatment success rate in the country acceptable (i.e., meets the target)?	Yes/No
	9	Is the coverage of TB treatment services in the country adequate (i.e., meets the target)?	Yes/No
	10	Are sufficient supplies (drugs, other commodities) needed to treat TB patients in the country available?	Yes/No
	11	Is the coverage of TPT adequate nationally?	Yes/No
	12	Are there sufficient resources needed for TB prevention in the country (supplies, human and financial resources)?	Yes/No
	13	Are good infection control and prevention measures practiced in the country?	Yes/No
	14	Are there adequate funds dedicated to TB M&E?	Yes/No
	15	Is domestic funding for TB treatment and control adequate?	Yes/No
	16	Are there adequate governance structures for TB M&E (e.g., M&E technical working groups)?	Yes/No
	17	Is the program performance being appropriately monitored (e.g., review and oversight of completeness and timeliness of reporting from facilities)?	Yes/No
	18	Are there sufficient healthcare workers for the expected number of TB cases?	Yes/No
	19	Is the performance of the healthcare workers assigned to TB high quality?	Yes/No
National M&E director/ manager		Does the NTP conduct assessments to understand capacity and quality in the TB program? Please indicate whether the following assessments are conducted:	
	1	service availability and readiness (e.g., SARA)	Yes/No
	2	quality of care (e.g., QTSA)	Yes/No
	3	diagnostic system readiness (e.g., diagnostic network assessment)	Yes/No

User group	#	Data Need	Need met by TB information system?
	4	data quality (e.g., data quality review)	Yes/No
	5	progress towards targets (e.g., program review)	Yes/No
	6	Is the performance of the recording and reporting systems (e.g., paper-based, electronic, mixed) ever assessed?	Yes/No
		Do routine assessment and monitoring mechanisms exist for program performance in terms of:	
	7	progress towards targets?	Yes/No
	8	quality?	Yes/No
	9	coverage?	Yes/No
	10	equity?	Yes/No
	11	efficiency?	Yes/No
	12	Does program management include the practice of using routine data to inform and improve program implementation?	Yes/No
National reference laboratory manager	1	Is the laboratory section of the national guideline up to date?	Yes/No
	2	Is the national quality assurance guideline up to date?	Yes/No
	3	Do we have the right tests available in the right places?	Yes/No
	4	Do we have sufficient laboratory capacity (i.e., staffing, equipment, supply, power, maintenance)?	Yes/No
	5	Is the turn-around time for testing efficient and responsive to the needs?	Yes/No
	6	Do we have enough testing material (test kits, reagents, cartridges, slides, microscopes, media, etc.) in the labs?	Yes/No
	7	Is there a quality control mechanism in place (i.e., EQA or IQC)? Is it active (e.g., supervisory visits producing written reports)?	Yes/No
	8	If a quality control mechanism is in place (i.e., EQA or IQC), is it active (e.g., supervisory visits producing written reports)?	Yes/No/NA
		Does the TB information system provide information on:	
	9	TB diagnosis?	Yes/No
	10	presumptive RR-TB/MDR-TB?	Yes/No

User group	#	Data Need	Need met by TB information system?
	11	whether the patient received follow-up, and at what month?	Yes/No
	12	microscopy results?	Yes/No
	13	culture results?	Yes/No
	14	Xpert MTB/RIF results?	Yes/No
	15	drug susceptibility test (DST) results?	Yes/No
	16	line probe assay (LPA) results?	Yes/No
	17	HIV status?	Yes/No
	18	Is the NTP monitoring the performance of the diagnosis network?	Yes/No
TB advocates, civil society, and media	1	Is there improved awareness on TB so that people are able to recognize symptoms and seek timely healthcare?	Yes/No
	2	Is there advocacy for improved quality of service at health facilities, to improve capacity for diagnosis of TB?	Yes/No
	3	Is there improved awareness on TB so that people understand the need to take TB treatment exactly as it is prescribed by healthcare workers?	Yes/No
	4	Is there advocacy for improved quality of service at health facilities, to improve uninterrupted availability of TB medicines?	Yes/No
	5	Is there improved awareness on TB so that people understand how TB is transmitted from person to person, and take the necessary precaution to prevent it?	Yes/No
	6	Is there advocacy for improved quality of services at health facilities, to improve capacity for TB preventive therapy?	Yes/No

Appendix F. D2AC Bangladesh Summary Findings (Group and Individual Responses Aggregation)

Table F1. Continuum score from aggregate responses, by domain

Domain number	Domain name	Average group score (N=6)	Average individual score (N=30)	D2AC level
D1	Data Collection and Reporting	3.71	3.51	Established
D2	Data Analysis and Use	2.67	3.00	Defined/Established
D3	Leadership, Governance, and Accountability	3.42	3.14	Established
D4	Capacity Building	3.43 *(previously 3.70)*	3.22	Established
D5	Information and Communications Technology	2.81	3.26	Defined/Established
	Overall	**3.21** *(previously 3.26)*	**3.23**	**Established**

Table F2. Continuum score from aggregate responses, by subdomain

Subdomain number	Subdomain name	Average group score (N=6)	Average individual score (N=30)	D2AC level
D1S1	Data collection tools and workflow	3.53	3.49	Established
D1S2	Reporting	4.28	4.01	Institutionalized
D1S3	Data quality	3.33	3.02	Established
D2S1	Data integration and exchange	2.71	3.00	Defined/Established
D2S2	Analytics and visualization	2.79	2.93	Defined
D2S3	Dissemination and communication	2.50	3.07	Defined/Established
D3S1	Data use guidance	2.67	2.66	Defined
D3S2	Data access and sharing	3.00	3.24	Established

Subdomain number	Subdomain name	Average group score (N=6)	Average individual score (N=30)	D2AC level
D3S3	Organizational structure and function	3.17	3.03	Established
D3S4	Leadership and coordination	3.83	3.37	Established
D3S5	Monitoring, evaluation, and learning	4.04	3.41	Institutionalized/Established
D3S6	Financial resources	3.83	3.13	Established
D4S1	Data interpretation	3.76 (instead of 4.06)	3.46	Established
D4S2	Skill and knowledge development	3.00	2.69	Established/Defined
D4S3	Decision making ability	3.53* (instead of 4.04)	3.53	Established
D5S1	Hardware	3.42	3.53	Established
D5S2	Network and connectivity	2.67	3.27	Defined/Established
D5S3	ICT business infrastructure	2.33	3.00	Defined/Established

* The average group score was not considered for this subdomain, where the questions pertain to personal and subjective opinions on job satisfaction, mentorship, training, and incentives/motivation. Instead, the aggregate score from individual responses was used.

Appendix G. D2AC Toolkit Bangladesh Implementation Plan

Domain and subdomain	Priority action	Specific gap addressed	Responsible party	Resources needed	Expected deliverable	Timeline
Domain 1, subdomain 3: Data quality	Undertake capacity building activities to sensitize staff on data quality characteristics and perform routine data quality checks	Lack of analytical capacity of the staff to undertake data quality procedures at the subnational level	NTP training department	• HR (focal point) • Budget for refresher training	Comprehensive quality training	December 2023
	Develop a reliable data repository system	No functional and operational national server to house all national TB data	NTP	Budget for national server	Secured storage for data in national server	
	Reduce bias and duplication in data reporting	Lack of training against biases and duplication in data reporting	NTP & stakeholders	• HR • Budget • Training • Workshop	No duplication and limited bias in data quality	
	Conduct quarterly data consistency checks between e-TB Manager and DHIS2	• Need to update the TB fields, forms and cards within DHIS2 incorporating the recent change (including those already incorporated into e-TB Manager) • Discrepancy in the aggregated data available across e-TB Manager and DHIS2			• Deployment of software developer support for DHIS2 • Routine assessment of data quality	
	Periodically report on data quality operations	Lack of documentation on the procedures performed to check data quality on a routine basis			Data quality performance report	June 2023
	Set up reliable, complete, and accurate routine checks and reviews for data quality	Lack of optimization of data quality checks	NTP M&E unit		Complete, accurate, and high-quality data	December 2024
Domain 2, subdomain 2: Analytics	Develop customized analytics and visualizations using the central data repository	• Incomplete knowledge and skill related to data	All users at all levels (NTP)	• Funds for classroom training, on-the-job	• 40 trainings (25 participants per group) for 2 days	December 2024 (2-year execution plan)

Domain and subdomain	Priority action	Specific gap addressed	Responsible party	Resources needed	Expected deliverable	Timeline
and Visualization	(e.g., to monitor stock availability and forecast demand at all levels)	analytics and visualization tools • Lack of continuous supervision and monitoring • Lack of on-the-job training		training, blended learning (eLearning), etc. • A/V equipment for eLearning	• Baseline assessment report • Endline assessment report	
	Sustain the use of advanced models for decision making and incorporate multiple data sources (including the central data repository) that optimize and influence TB health outcomes	• Job descriptions lacking mention of certain specific tasks related to decision making • Annual performance evaluations similarly not taking into consideration those aspects of the work • Incomplete knowledge of decision-makers to take decisions at their respective level • Limited knowledge on the inclusion and exclusion of priority TB health data indicators • Limited or improper use of right data analytical tools • Lack of a data use culture	NTP national and divisional level managers	Funds for HR to build a data science team, develop a data use guideline, for classroom training, on-the-job training, and blended learning	• Data use guideline and SOP • Baseline assessment report • Endline assessment report	
Domain 3, subdomain 1: Data use guidance	Develop a comprehensive data use guidance	Data use guidance does not cover all levels of data and the new indicators	NTP	• Technical assistance • Workshop • Dissemination of guidance	Comprehensive and updated data use guideline	June 2023
	Implement the new data use guidance	Ensuring the implementation of the data use guidance at all levels		• HR • Electronic data visualization tools (e.g.,	Deployment of HR	December 2023

Domain and subdomain	Priority action	Specific gap addressed	Responsible party	Resources needed	Expected deliverable	Timeline
				Tableau, Power BI) • Capacity building • Dissemination of data use guidance • IT equipment • Connectivity		
	Monitor the implementation status of the data use guidance	Ensure monitoring of the implementation at all levels		• Logistics • Technical assistance • Funds	Established robust monitoring system	June 2024
	Revise and update the data use guidance as needed, informed by feedback from the monitoring phase	Adapt data use guidance based on lessons learned from the implementation		• Technical assistance • Workshop • Dissemination	Updated guideline	December 2024
	Evaluate the impact of the introduction of a data use guidance	Understand the benefit of the work conducted over the course of the two previous years		• Technical assistance • Funds		December 2025
Domain 3, subdomain 5: MEL	Monitor and review the MEL plan implementation as part of the program/strategy review	Lack of a MEL operationalization plan	M&E unit	• Technical assistance • Funds	Specific operationalization plan	3 months
	Track the progress of the implementation of the MEL operationalization plan	Lack of a specific MEL implementation plan		• Capacity building training • Funds	Quarterly/annual progress report on MEL plan implementation	Continuous process
	Integrate a learning and adaptation mechanism in the MEL process	• Lack of proper documentation of learning • Lack of proper follow up after dissemination	• NTP • M&E Unit	Training on effective documentation	• Learning documentation • Success stories	

Domain and subdomain	Priority action	Specific gap addressed	Responsible party	Resources needed	Expected deliverable	Timeline
	Build a skilled and sustainable MEL team	Lack of capacities specific to MEL skills (e.g., analysis, database management)	NTP	• Technical assistance • Training on analysis and database management Budget	Improved analytical reports and data supports	
	Develop specific guideline on quality assurance and quality control	Lack of specific guideline on quality assurance and quality control	M&E unit	• Technical assistance • Coordination meeting with program and other stakeholders • Funds	Specific quality assurance and quality control guideline	3-6 months
	Use data for research and evaluation	Limited research and evaluation opportunities with available data	• NTP • M&E unit	• Technical assistance • HR • Funds	Research and policy papers	Continuous process
Domain 4, subdomain 2: Skill and knowledge development	Assess perceived decision-making needs based on available data for programmatic improvement for subnational managers	No knowledge about the decision-making needs of subnational level managers around the available TB data	NTP through external body	• Technical assistance • Funds	An assessment result on needs of subnational managers regarding data for decision making.	Mid-2024
	Assess existing MIS	No assessment data available of existing MIS		Technical assistance for assessing existing MIS	Assessment showing the current status of the MIS and suggesting possible changes required for development and upgrade of MIS to make it more comprehensive	
	Modify/upgrade data collection and analytics system	Challenges will be identified based on the assessments	DGMIS	• Technical assistance • Funds	Data collection and analysis tools upgrade according to assessment findings	2024
	Develop training module containing demonstration of data	No training module featuring detailed description for data analysis, interpretation, use,	NTP through external body	Technical assistance for module	A training module on data analysis and use for decision making	2023

Domain and subdomain	Priority action	Specific gap addressed	Responsible party	Resources needed	Expected deliverable	Timeline
	analysis and use for decision making at different levels	and decision making at different levels		development and its endorsement		
	Develop training module for data entry	Present module is not enriched			An enriched training module	2023
	Conduct training on data entry analysis and its interpretation	Necessary budgetary allocation	NTP	• Technical assistance • Funds	Skilled data entry staff and managers for data analysis and its interpretation	2025
	Build monitoring and supervisory capacity through in-service training	No master trainer	NTP through external body		Master trainer and skilled supervisors at national level to oversee data surveillance system	2024
	Set up training database	No training database available			Complete training database which allows staff to identify the correct person for appropriate training on capacity development	2025
Domain 5, subdomain 3: ICT business infrastructure	Implement an ICT infrastructure operations and maintenance plan at the national and sub–national levels	Limited servers, networks, storage, end user devices, network resources (network enablement, Internet connectivity, firewall, and security), hardware (servers, computers, switches, Modem hubs and routers, and other equipment) software, Cloud, etc.	NTP	ICT team	• Daily server maintenances and updates • Software developer charged with responding to tickets and troubleshooting • HR capacity building training	June 2023
	Ensure funding availability for any kind of ICT equipment damage, repair, and maintenance	No available tech support/HR to support ICT		HR	National level, division level and sub-division level HR capacity building	June 2023
	Set up ICT/tech corner at every TB facility		Individual health facilities	HR and logistic support	Infrastructure	2024

Appendix H. D2AC Analysis Tool Priority Actions for Bangladesh

This section lists the benchmarks and recommendations generated by the D2AC Toolkit's Priority Actions for Implementation function based on the subdomain scores, combined with the recommendations shared by the groups in small group discussions and in plenary.

Capability Question	**Capability Level** (based on average group response)	**Priority Action**
D1S1: Data Collection and Reporting – Data collection tools and workflow		
1. To what extent are standardized electronic data collection tools used?	Level 3: Established Standalone standardized electronic data collection tools are often used, including for retrospective data entry, at higher levels.	Complete the scale up of electronic data collection tools by building capacity for electronic data collection in sites identified as 'in need' on the readiness assessment (e.g., by ensuring adequate electrification, providing computer hardware, training, ensuring maintenance). Gradually build capacity and scale up until all sites are using the electronic tools. Integrate standardized electronic tools into the national HMIS.
2. Do you have an inventory of TB data collection systems (clinical, lab, commodities, training)?	Level 3: Established A list of all the TB data collection systems exists but information about its data and users is limited to the national level.	Make available and maintain a complete inventory of data sources with content details.
3. To what extent are data collection processes aligned with TB service delivery guidance?	Level 3: Established Data collection processes are aligned with the TB service delivery guidance.	Institute a system of formal review, and periodic monitoring, of data collection processes to ensure alignment with service delivery guidance (as reflected in the policies and priorities in the TB Strategic Plan).
4. To what extent is unique identification used for TB cases?	Level 3: Established The NTP uses unique identifiers for TB cases across program sites.	Conduct landscape analysis of all unique ID systems for national disease control programs (e.g., HIV/AIDS). Work with these programs to standardize and harmonize the unique ID systems. Institute the harmonized system in service delivery sites and monitor compliance.
5. To what extent is the NTP site list standardized and in what format is it?	Level 2: Defined The NTP has an electronic site list but it is incomplete.	Asses the site list for gaps, and make efforts to complete the list by calling facilities or District Health Management Teams. Put the list online where program stakeholders can access it.
6. How is data disaggregation (e.g., by sex or age, treatment/retreatment, drug-resistant/drug susceptible) addressed in data collection?	Level 4: Institutionalized NTP monitoring and review assesses quality of disaggregated data collection.	Institute a regular appraisal of disaggregated data collection needs and compare with requirements published in the M&E plan. Amend M&E plan as necessary to ensure it is up-to-date with M&E needs in

		disaggregated data. Suggested frequency is at the beginning of the TB Strategic Plan, and again at mid-term review.
D1S2: Data Collection and Reporting – Reporting		
7. To what extent are standardized electronic data reporting tools used?	Level 4: Institutionalized Standardized electronic data reporting tools for aggregate data (i.e., not real time) are used at all levels and integrated into the national HMIS.	Use standardized real time case-based electronic data reporting tools at all health care levels. With end-user input, develop and pilot test point-of-service electronic reporting tools (e.g., tablet-based provider data collection on a tablet computer in real time, i.e., as the services are being provided). Conduct user experience and acceptability testing. Conduct readiness assessments to guide scale-up of the real-time reporting system. Ensure appropriate links to TB EMR and National HMIS. Implementation of real-time, case-based TB reporting systems should be implemented in conjunction with the development of real-time, case-based data collection tools (D1S1_4).
8. How is data disaggregation (e.g., by sex or age, treatment/retreatment, drug-resistant/drug susceptible) addressed in reporting?	Level 4: Institutionalized NTP monitoring and review assesses quality of disaggregated data reporting.	Ensure the NTP routinely reviews and updates disaggregate data reporting requirement in the M&E plan. Institute a regular appraisal of disaggregated data collection needs and compare with requirements published in the M&E plan. Amend M&E plan as necessary to ensure it is up-to-date with M&E needs in disaggregated data. Suggested frequency is at the beginning of the TB Strategic Plan, and again at mid-term review. This should be implemented in conjunction with efforts to assess needs for disaggregation of data in data collection tools (D1S1_6).
9. To what extent are data reporting processes aligned with TB service delivery guidance?	Level 4: Institutionalized Data reporting processes are monitored and assessed to check alignment with TB service delivery guidance.	Ensure that routine NTP guidance revision/update guides the revision of data reporting processes. When NTP guidance is revised (e.g., during or just after strategic planning), set aside time and resources to gauge the impact on data collection and reporting tools/processes. Identify what impact the changes have on the tools/processes and develop and implement a plan to align the tools/processes to the revised strategy. If data

		collection and reporting tools are assessed annually to ensure alignment with NTP guidance assessment and revision could happen during this regularly scheduled event.
D1S3: Data Collection and Reporting – Data quality		
10. To what extent is data quality assurance defined and applied in NTP data systems?	Level 3: Established Data quality assessments are routinely conducted for priority indicators.	Document data biases and adjust in analysis for data to be comparable across sources and time. All data have errors. The goal of data quality assurance is to minimize the extent of data quality problems and understand how these problems affect the information used for monitoring, evaluation, and planning. Once data quality issues are known, they can oftentimes be corrected or adjusted for in data analysis. Incomplete results can be imputed if we know where the gaps are occurring. Under or over-reporting can be also be adjusted when we can document where, and to what extent, this is occurring. Routine analysis of reported data to identify gaps, inconsistencies, and outliers in reported data should be conducted. The WHO Data Quality Tool can facilitate this type of analysis. An Excel version of the tool is available with the DQR suite of tools, and an app has been developed to work with DHIS 2.
11. To what extent has the NTP integrated data quality assurance into standard practice?	Level 3: Established The NTP conducts routine standardized data quality assessments for both in-source documents at the facility and for the reported data.	Integrate data quality metrics into program review and are a routine feature of program management. Establish a technical working group (TWG) for data quality within the existing M&E working group. Include important international / NGO partners to ensure alignment of priorities for data quality assurance. This TWG can coordinate data quality activities within NTP and across the larger HMIS and partners. TWGs and interagency collaboration mechanisms for the larger HMIS probably already exist. NTP should be an active participant so that data quality assurance activities are harmonized to avoid overlap and duplication of efforts. Program reviews should be preceded by data quality assessments so that data quality problems can be found and addressed prior

		to using the data for program planning and evaluation. If problems cannot be corrected prior to the review (e.g., incompleteness) the limitations of the data should be well documented so that decision making can take into account what is known and unknown with regard to performance.
D2S1: Data Analysis and Use – Data integration and exchange		
12. To what extent has a central data repository been developed?	Level 3: Established An electronic central data repository collates aggregate program data only at national level.	Collate data from all the TB data collection systems in a standard-based central data repository.
13. To what extent are there data exchange processes between systems at points of service for TB cases and reporting and/or central repositories currently in place?	Level 2: Defined There is some data exchange at the national level but limited automated exchange.	Exchange data extensively on a national level and the exchange is mostly automated.
14. To what extent are there data exchange processes between systems at points of service for laboratory testing and reporting and/or central repositories currently in place?	Level 2: Defined There is some data exchange at the national level but limited automated exchange.	Exchange data extensively on a national level and the exchange is mostly automated.
15. To what extent are exchange standards (interoperability and/or health data standards; e.g., XML, JSON, LOINC, FHIR) integrated into the data exchange implementation?	Level 2: Defined The country has adopted and/or developed standards for TB data management and exchange, but standards may be localized to specific projects.	Approve standards for TB data management and exchange that require certification of new exchange partners for compliance.
D2S2: Data Analysis and Use – Analytics and visualization		
16. To what extent are users able to conduct analysis and develop visualization?	Level 2: Defined NTP staff can conduct descriptive analysis and generate some visualization (tables, graphs, charts, etc.) to make comparisons and evaluate trends.	NTP staff conduct advanced analysis (e.g., cascade analysis) and develop visualization in real-time mostly at the national level.
17. To what extent are analytics and visualization requirements documented?	Level 3: Established The NTP has identified and documented a minimum set of standard data analyses and visualizations requirements/needs at all levels.	Monitor and budget the NTP's analytics and visualization requirements in the NTP plan.

18. To what extent are data sources used?	Level 3: Established Decision making is focused only on program resources and/or patient data reports and summaries.	Ensure that program staff routinely make decisions that require combining data from multiple sources (e.g., to provide scenario-based, health-system level specific decision-making support, and predict the impact of decisions and policy).
19. To what extent are decision support tools used?	Level 2: Defined Decision support tools need is documented and exist locally or for specific implementations.	Make certain that decision support tools are automated to use the knowledge base for contextually-relevant reference information.
D2S3: Data Analysis and Use – Dissemination and communication		
20. To what extent is a communication strategy in place?	Level 2: Defined A documented national communications strategy is in place but not operationalized.	Implement an approved communication strategy even if confined to the national level.
21. To what extent are information products developed and subsequently disseminated?	Level 3: Established Targeted information products are disseminated in multiple formats (print, digital) using electronic and web-based platforms at higher levels.	Routinely produce/distribute information products to stakeholders at all levels of the health system.
D3S1: Leadership, Governance, and Accountability – Data use guidance		
22. Does the NTP have a data use guidance?	Level 2: Defined The NTP uses data use guidance to manage its data use activities at various levels.	Make sure that the NTP has an approved and comprehensive data use guidance implemented at all health system levels to support data use for decision making.
D3S2: Leadership, Governance, and Accountability – Data access and sharing		
23. What is the data access and sharing status within NTP and with external stakeholders?	Level 3: Established Access-based control and data sharing agreements are established to allow access to and sharing of NTP data within and outside the NTP.	Monitor access-based control and data sharing agreement implementation to ensure compliance with data use guidance/policy.
D3S3: Leadership, Governance, and Accountability – Organizational structure and function		
24. To what extent are data use roles and responsibilities documented for NTP staff?	Level 3: Established NTP staff at all levels have access to their written role and responsibilities related to data use.	Staff data use roles are regularly reviewed by supervisors using the job description to offer constructive feedback.

D3S4: Leadership, Governance, and Accountability – Leadership and coordination		
25. To what extent is the interagency leadership and coordination team (including internal and external stakeholders) structure developed?	Level 3: Established A formal leadership and coordination team is managing implementation of the data use policy and data access and sharing guidance with attention to gender and equity.	Ensure that the leadership and coordination team is an integral part of the NTP review and assessment process. For example, is the leadership and coordination team involved in strategic planning for NTP, and annual and mid-term performance reviews? Are they involved in determining what metrics should be evaluated to gauge performance? Are they involved in planning regular assessments for quality of TB care, diagnosis, and prevention activities? Are they involved in planning of data quality and use assessments, and developing and implementing system strengthening action plans in response to assessment findings?
26. To what extent is the leadership and coordination team effective?	Level 3: Established Leadership and coordination team meetings occur on a periodic, regular schedule across the health system levels with SOPs to follow related to meeting management.	Ensure that the MEL team evaluates and monitors the ability of the leadership and coordination team to lead and coordinate regularly scheduled meetings.
D3S5: Leadership, Governance, and Accountability – MEL		
27. To what extent is the MEL plan implemented?	Level 4: Institutionalized The MEL plan implementation is monitored and reviewed as part of the program/strategy review.	Use monitoring data to inform the annual review/update of the MEL plan.
28. To what extent does MEL contribute to improved health outcomes?	Level 3: Established Health outcome parameters are documented and monitored at all the levels.	Conduct routine health outcome assessment and evaluation to measure improvement in individual and population level health outcomes.
29. To what extent are MEL processes developed?	Level 4: Institutionalized MEL processes are routinely reviewed as part of the NTP performance review.	Use program performance review findings to routinely revise/update MEL processes.
30. To what extent does MEL support program improvement?	Level 4: Institutionalized The MEL data are used to monitor, measure, and improve program data use at all levels.	Use the MEL data to continuously improve the MEL plan for achieving better program goals.
D3S6: Leadership, Governance, and Accountability – Financial resources		
31. To what extent are data use activities funded in the NTP budget?	Level 4: Institutionalized Budget for data use activities is monitored and reviewed during the program review process.	Use monitoring and review findings to revise/update the budget allocated to data use activities.

32. How are financial resources mobilized?	Level 3: Established The NTP has a comprehensive financial plan that diversifies funding (resources from NTP, donors, and private sector) in place.	The MEL team monitors and measures the availability and utilization of financial resources.
D4S1: Capacity Building – Data interpretation		
33. To what extent are data use forums (e.g., monthly or quarterly program review meetings) developed?	Level 4: Institutionalized Performance of data use forums is monitored and assessed as part of the program performance review.	Ensure monitoring and assessment findings guide all decisions to improve performance of data use forums.
34. How often are data reviewed and by whom?	Level 3: Established Program staff routinely conduct data review at all levels using the data use forums to identify corrective action.	Ensure that MEL staff routinely monitor and assess implementation of actions identified in the data review.
35. Is NTP staff receiving supportive supervision for practicing data use?	Level 3: Established NTP staff receive supportive supervision for data use at the national level.	Monitor supportive supervision to help identify technical resources NTP staff can access to meet supportive supervision needs.
D4S2: Capacity Building – Skill and knowledge development		
36. To what extent has the NTP developed a national pre-service training program for skill and knowledge development?	Level 2: Defined A national pre-service training program for imparting knowledge and skills exist but only for clinical staff.	Implement a national pre-service training program for all cadres of the NTP.
37. To what extent are institutions offering pre-service training established in the NTP guidance?	Level 2: Defined Pre-service training is conducted by government and/or private training institutions.	Ensure that a designated NTP authority oversees pre-service training programs.
38. To what extent has the NTP developed an in-service training program for skill and knowledge development?	Level 4: Institutionalized In-service training programs are monitored and assessed for their effectiveness and relevance.	Routinely update the in-service training program using the monitoring and assessment data.
39. To what extent are institutions (both public and private) offering in-service training established in the NTP guidance?	Level 3: Established A designated NTP authority oversees in-service training programs.	Make certain that training institutions offer opportunities and incentives to promote continuous education of staff at all levels.
40. How effective are the in-service training programs?	Level 2: Defined In-service training offerings are aligned with training needs but only at the national level.	Use training needs assessment data for identification and recommending appropriate trainings.

D4S3: Capacity Building – Decision making ability		
41. Do you feel your use of data for decision making inputs are valued?	Level 3: Established I have access to data but I do not feel empowered or encouraged to use the data for decision making.	Try to earn the confidence of peers and supervisors by taking the initiative on certain decisions. Start small by using data and information products to show how decisions are linked to data. Be active in performance reviews and data review meetings to show what you can do.
42. How satisfied do you feel by your job?	Level 3: Established I enjoy and find interest in my work and I feel valued in my team but I do not feel I have many opportunities for growth.	Make a list of things you would like to do that would help you grow in your position (e.g., training in a new method or tool, more responsibility in your job). Speak to your supervisor about realizing some of the things on your list. Make sure they are practical, affordable, and worthwhile. Look for easily accessible, low or no cost opportunities on the internet (e.g., MOOCs or Massive Open Online Courses)
43. How adequately have you been trained to use data for action?	Level 2: Defined I have only received informal training on data use (e.g., on-the-job training from a colleague).	Ask around within your unit about training available through the TB program. Perhaps there was a training done in the past but which hasn't been implemented for a while. See what plans there are for in-service training and ask your supervisor if you can attend. If funding is an issue, perhaps a local NGO or a technical assistance organization (e.g., WHO, UNICEF, The Global Fund, etc.) can sponsor you.
44. Is there a person you go to for support and mentorship?	Level 3: Established I have a colleague knowledgeable about my responsibilities and skills but I cannot regularly turn to them for support for questions related to data use (e.g., due to their unavailability).	You may not require a formal mentor, which can be a big commitment. Perhaps you just need someone at your level with a somewhat different skill set and experience than you. Identify peers with skills and knowledge you would like to have. Be prepared to share skills and knowledge that you have and they may not. Ensure they would be available (i.e., have the time, and are around consistently) to help if asked.
D5S1: ICT – Hardware		
45. To what extent does the NTP have adequate hardware?	Level 3: Established Hardware needs are documented national offices have adequate hardware, including backup services.	Conduct an annual hardware needs assessment as part of the program performance review.
46. To what extent are hardware specifications developed and budgeted?	Level 3: Established Hardware specifications are documented and followed in procurement at all levels.	Ensure that hardware specifications are supported by adequate budget in the program plan.

D5S2: ICT – Network and connectivity		
47. To what extent does Internet and Internet connectivity exist at NTP sites?	Level 2: Defined Network and Internet connection exist at the national level and about half of subnational offices have a reliable network and Internet connection.	Establish an adequate dedicated network and Internet connectivity at the national and subnational levels to operate the TB HIS.
D5S3: ICT – ICT business infrastructure		
48. To what extent has ICT infrastructure been developed?	Level 2: Defined There is a recognized need to standardize processes to oversee and support ICT infrastructure, but no established or harmonized process exists specific to HIS needs.	Implement an ICT operations and maintenance plan at the national level.

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