USAID Eliminate TB Project

Supportive supervision at Ejersa Goro health center, Jarso district in East Hararge zone.
Photo Credit: Tofik Abajebal

TECHNICAL HIGHLIGHT

DIGITALIZATION AS A KEY TOOL FOR ENSURING DATA QUALITY AND IMPROVEMENT OF THE TB PROGRAM IN ETHIOPIA

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BACKGROUND

Digital technologies are increasingly being harnessed to support the treatment of people with tuberculosis (TB). These technologies have immense potential to improve adherence and clinical outcomes (Ngwatu et al., 2018). Their value was demonstrated during the COVID-19 pandemic in Bangladesh, Ethiopia, and South Africa, where surveillance applications and video adherence monitoring systems helped to maintain TB service continuity during lockdowns and movement restrictions (World Health Organization [WHO], n.d.; USAID, 2023).

Digital technologies are being used worldwide to improve active TB case finding, education, treatment adherence, and emergency management, but with limited experience in the integration of overall data management (Ridho et al., 2022; Hiwale et al., 2022). Digital tools have also been applied to assess the quality of TB services by looking at health facility structure and service delivery processes and outcomes, including in Ethiopia (USAID and JSI, n.d.). In addition, they are valuable in monitoring and supervising TB programs.

In low-income countries, the advantages of digital tools for data capturing and reporting have been limited to research and health management information systems. However, they can also be applied to routine data quality improvement. The many applications of digitalization for TB program improvement have therefore been explored and used by the United States Agency for International Development (USAID) Eliminate TB Project in Ethiopia.

PROBLEM STATEMENT

TB remains a global public health threat, with an estimated 10.6 million people developing TB and 1.3 million dying of the disease in 2022 (WHO, 2023a). Digital technologies present opportunities to address this challenge on multiple fronts. TB programs and their technical partners worldwide have initiated various innovative e-Health (electronic health) and m-Health (mobile health) projects in support of their efforts to improve TB treatment and prevention.

Ethiopia is one of the 30 high-TB-burden countries striving to achieve the WHO End TB targets for reducing TB incidence and mortality by 2030 (WHO, 2015; Ministry of Health of Ethiopia, 2023) and also committed to meet the second United Nations high-level meeting on the fight against TB's target to reach 90% for treatment coverage and TB preventive treatment by 2027 (WHO, 2023b). Ethiopia uses its national health management information systems for TB data surveillance, including its District Health Information System (DHIS2) and other data sources such as patient registers (Adane et al., 2021). The country also conducts supportive supervision and performance review meetings for its TB program. However, this TB program monitoring effort through supportive supervision has mainly proceeded through paper-based forms at both the national and regional levels. Findings from the supervision have not been well summarized or stored and utilized to improve the program performance. While routine data quality audits are occasionally conducted to improve the TB data quality and its use, these also operate with paper-based forms, and the data are not effectively stored or used for evidence generation and program improvement.

Since June 2022, the country has transitioned from a quarterly to a monthly reporting system for TB data, and the DHIS2 tool, a national aggregated TB data capturing platform, has been revised and upgraded. In this revision, new indicators have been introduced and the definitions of other indicators modified. These changes have challenged the TB data use, reporting, collection, and recording activities of the TB program. Specifically, the changes in data-capturing tools (recording, reporting, and other administrative tools) and the differences between the online and offline features of DHIS2 (due to the delay in updating the revision at the district and health facility levels) have challenged the transition. This has been compounded by the lack of internet

connectivity for data entry and reporting in remote districts and health facilities and in conflict-affected regions and zones.

The application of expanded digital technologies promises solutions to these challenges. The use of digital tools for supportive supervision and data quality improvements in health facilities and at the district, regional, and national levels could be part of the future solution to the TB program in Ethiopia.

STRATEGIC APPROACH

The USAID Eliminate TB Project is a five-year project (2020–2025) supporting the Ethiopian TB program from the national to the facility level. The project operates in seven regions of the country that are home to 95 million Ethiopians, or 86% of the national population. To improve the quality of supervision and monitoring, and to measure performance and epidemiology in the TB program, the project has introduced/adopted digital tools such as the electronic Standard of Care (e-SoC), GeneXpert connectivity solutions, Electronic Supportive Supervision (E-SS), the drug-resistant TB (DR-TB) Tracker, and Geographic Information Systems (GIS). These tools feature dashboards with the aim of increasing data visibility and utilization. They have been applied to all parts of the TB patient pathway to support patient care, surveillance and monitoring, and TB program management (figure 1).

TB patient pathway

KEY (Area)
- Patient care
- Surveillance and monitoring
- Program management
- Maintenance and supply chain

Identify presumptive TB case		Diagnose TB patient		Enroll TB patient		Provide TB care & support	
Tool	**Area**	**Tool**	**Area**	**Tool**	**Area**	**Tool**	**Area**
Electronic standard of care (e-SOC)	Patient care	GeneXpert connectivity solutions	Surveillance	GeneXpert connectivity solutions	Surveillance	Electronic standard of care (e-SOC)	Patient care, Surveillance, Program, Maintenance
Electronic supportive supervision (E-SS)	Surveillance	Electronic standard of care (e-SOC)	Patient care, Surveillance, Maintenance	Electronic standard of care (e-SOC)	Patient care, Surveillance, Maintenance	Drug-resistant TB (DR-TB) Tracker	Surveillance, Program
Geographic information systems (GIS)	Surveillance	Drug-resistant TB (DR-TB) Tracker	Surveillance, Program	Drug-resistant TB (DR-TB) Tracker	Surveillance, Program	Electronic supportive supervision (E-SS)	Surveillance, Program, Maintenance
GeneXpert connectivity solutions	Surveillance	Electronic supportive supervision (E-SS)	Surveillance, Program, Maintenance	Electronic supportive supervision (E-SS)	Program		

Data quality and management
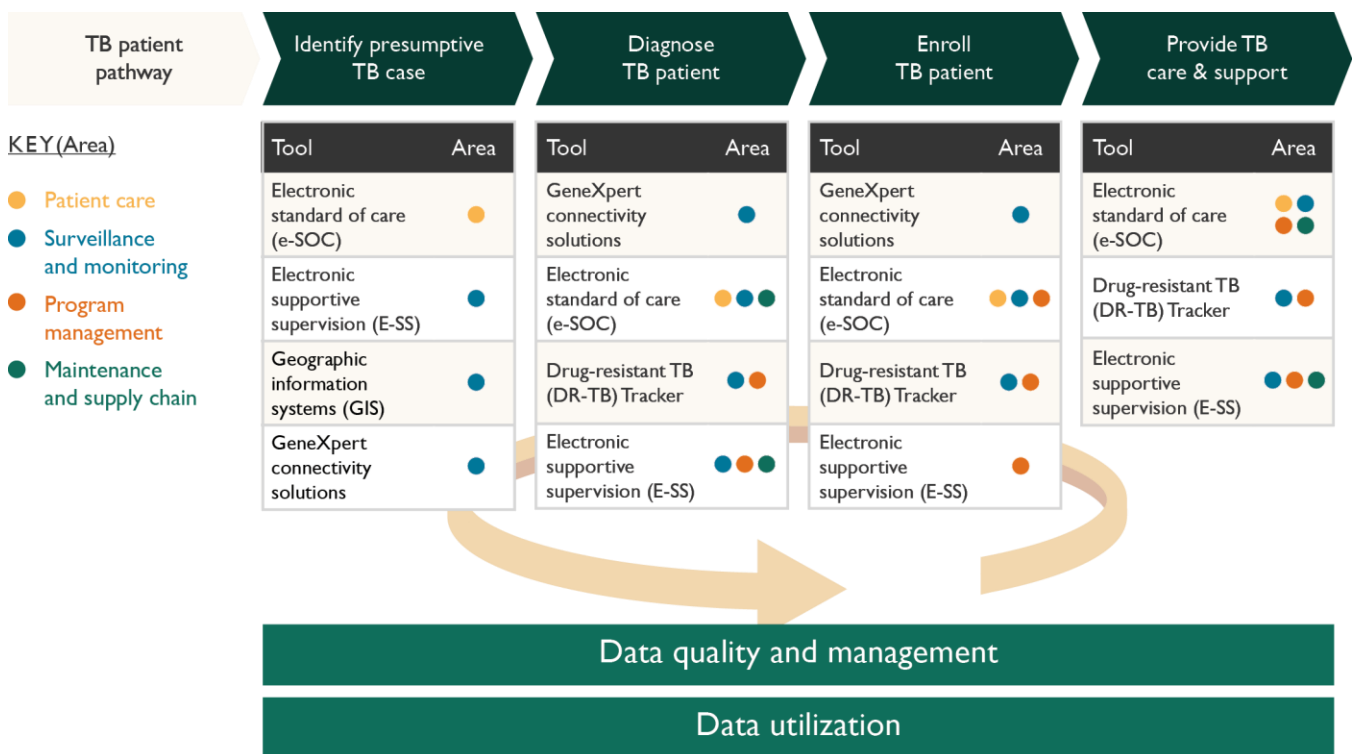
Data utilization

Figure 1: Digital tools introduced and applied by the USAID Eliminate TB Project, presented within the WHO (2017) digital health activities framework

The e-SOC, E-SS, and DR-TB Tracker are the monitoring and supervision tools where all TB data quality parameters (completeness, accuracy, consistency, validity, uniqueness, and integrity) are monitored. GeneXpert connectivity solutions (particularly the GxAlert) mainly focus on improving the data quality parameters of GeneXpert utilization and drug susceptibility testing in the TB program but later expanded to notifications of

results to patients and machine failure/ near failure status and supply status to authorities with the shift from GxAlert to the USAID-supported LabXpert. GIS helps to monitor the geolocation of supervised health facilities and is used to check the representation of monitored health facilities for data quality and TB program improvement. These digital tools can improve data quality and thereby lead to improvements in the TB program (figure 2).
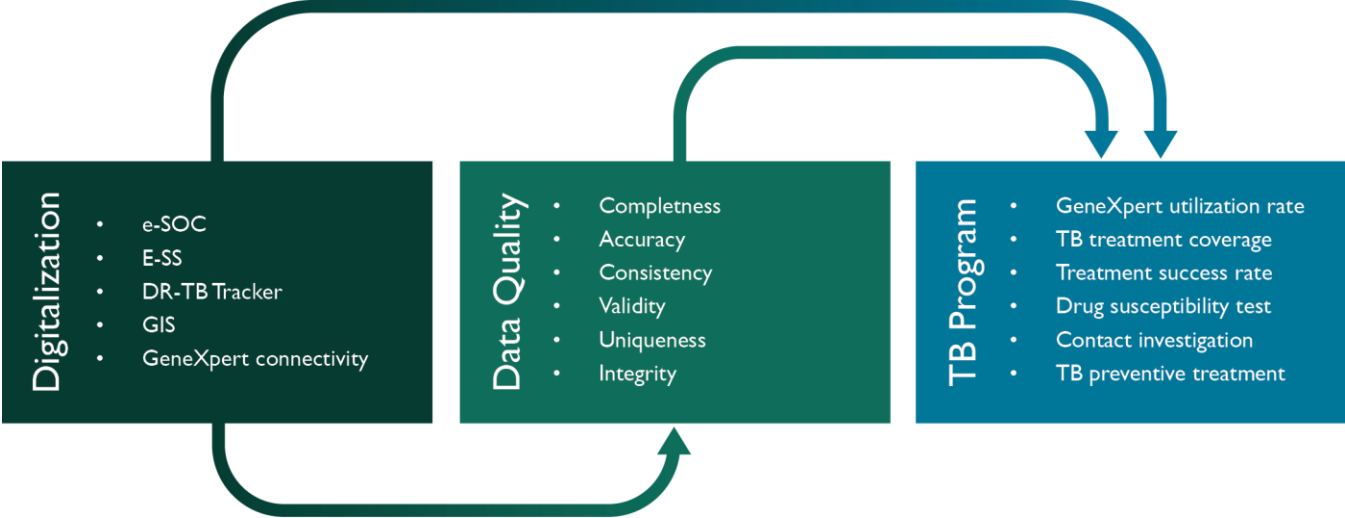

Figure 2: Strategic approach: digitalization contributes to data quality and TB program improvement

IMPLEMENTATION, RESULTS, AND ACHIEVEMENTS

ELECTRONIC STANDARD OF CARE (E-SOC)

The USAID Eliminate TB Project transitioned the paper-based Standard of Care to an e-SOC application to make data collection more efficient and to better monitor the performance of the TB program using relevant quality improvement indicators. The indicators include TB screening, presumptive TB identified, TB cases detected, cure rate, TB preventive treatment coverage, and contact investigation. These indicators are not usually reported through DHIS2, but they significantly aid in TB program monitoring as they address the complete patient cascade of care from screening to treatment completion. USAID Eliminate TB Project advisors, zonal project coordinators, and government district TB focal persons use their phones and computers to enter data into the e-SOC database, which is established on DREAM@MSH, MSH's data management system built on DHIS2. This system includes a dashboard with visualizations of e-SOC indicator performance, which is reviewed quarterly against targets (figure 3).
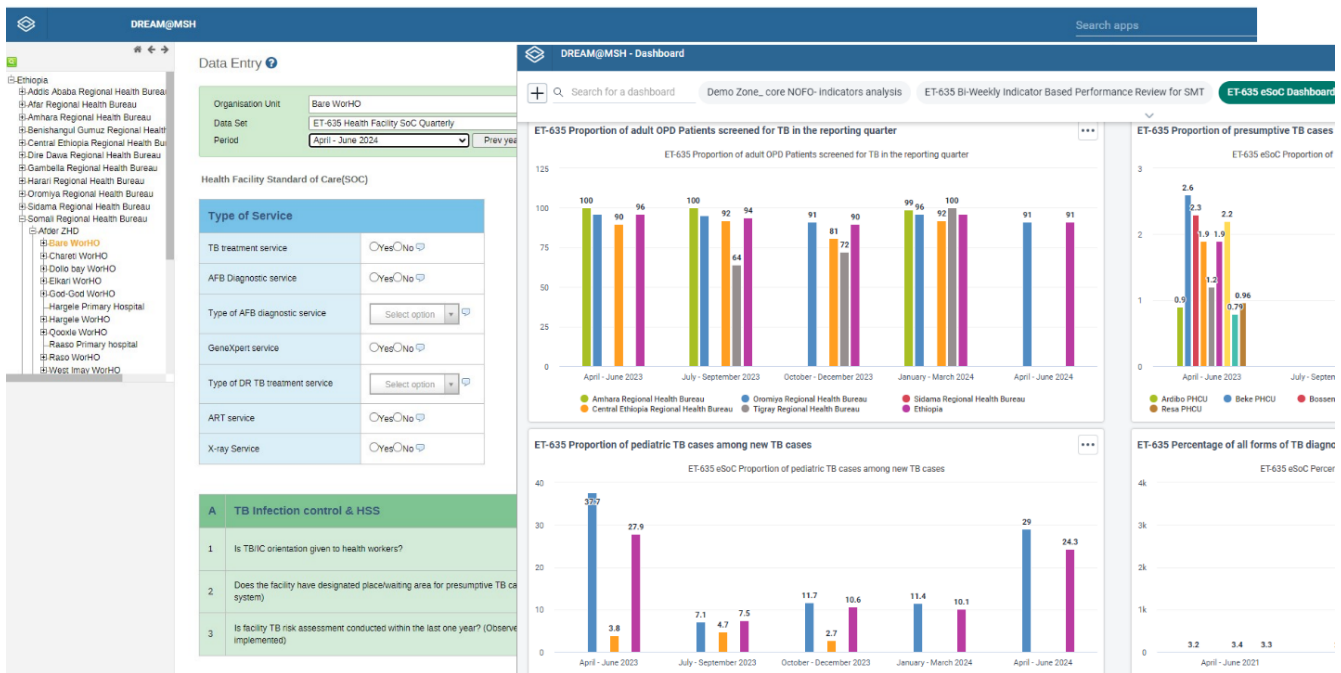
Figure 3. e-SOC dashboard established on DREAM@MSH

The USAID Eliminate TB Project zonal coordinators provide technical support (mentoring, supervision, one-to-one discussion, and review meetings) to woreda TB officers. One of the many supports to the woreda and zonal TB officers is to collate and use e-SOC data for decision making and program improvement in all supported zones and woredas. Each e-SOC TB quarterly report refers to the previous quarter's performance, as it takes time to complete and compile the woreda-level supervision data at the zonal level. To collate data in real time from health facilities, e-SOC is prepared as a mobile application. The data collected is compiled and analyzed. Finally, feedback based on the analyzed data is provided to the health facilities' TB focal persons, health facility leadership, and other relevant health authorities. Other USAID implementing partners working in the TB space have adopted the use of e-SOC as well.

One of the key applications of e-SOC is improving the TB program's data quality (Melese et al., 2018). The USAID Eliminate TB Project identifies indicators that have data quality concerns and monitors them using e-SOC. For specific indicators or data elements, the counts in the TB unit register are compared with the quarterly reports made by each health facility's TB focal person. The project has defined the acceptable level of precision for each indicator's data quality audits to be between −5% and +5% of discrepancy. Four examples of such indicators are the number of TB patients, number of TB patients tested for HIV, number of household contacts over 15 initiated on TB preventive treatment, and number cured. Compared to the baseline audit in 2020, where these indicators ranged in discrepancy from −2% to +10.5%, all four came in between −1.8% and +1.3% by 2023.

The e-SOC data also show that from 2020 to 2023, stockout rates of anti-TB drugs fell to just 1%, and the share of facilities with specific TB infection control measures doubled and quadrupled (figure 4).
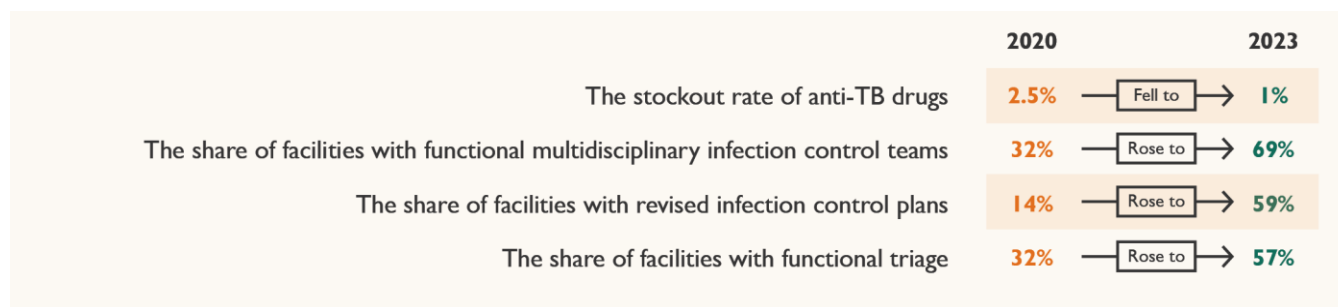
	2020			2023
The stockout rate of anti-TB drugs	2.5%	— Fell to →	1%
The share of facilities with functional multidisciplinary infection control teams	32%	— Rose to →	69%
The share of facilities with revised infection control plans	14%	— Rose to →	59%
The share of facilities with functional triage	32%	— Rose to →	57%

Figure 4. Improvements in health facilities in project-supported zones
Source: e-SOC data, October 2019–September 2020 and October 2022–September 2023

ELECTRONIC SUPPORTIVE SUPERVISION (E-SS)

Ethiopia's TB program undertakes supervision at least once a year at the national, regional, zonal, district, health facility, and community levels, using comprehensive supervisory checklists for each level. The checklists were previously distributed on paper and the data collected manually. In 2022, the USAID Eliminate TB Project automated the national supportive supervision tools and introduced the E-SS tool. Supportive supervision, a TB program audit with on-site feedback and orientation, includes a data quality audit component with a checklist and indicators to help assess the level of TB program data quality and utilization of data for decision making. The supervisory team receives a summary report from the E-SS tool after using it, which is valuable for site-level feedback. The national report organizing team also benefits from the tool's ability to store data for later use, decision making, and easy writing up of findings.

For instance, the E-SS used in the 2023 national supervision showed that the regions of Gambella, Afar, Somali, and Benishangul Gumuz had overall severe TB program data quality problems, while almost all regions had severe inconsistencies in the 'DR-TB notified and enrolled' indicator. The 'all forms of TB notified' indicator was the initial indicator with acceptable levels of data quality in most regions. Addis Ababa City Administration and Oromia had acceptable levels of data quality. The National TB Program together with USAID used the data and other information and designed a data quality improvement project that is being implemented by the National TB Program and the USAID-funded Tuberculosis Implementation Framework Agreement led by JSI. This demonstrates how the E-SS is very useful for a continuous program improvement, data storage, easier technical assistance and data collection, and utilization for decision making.

DRUG-RESISTANT TB (DR-TB) TRACKER

The DR-TB Tracker is a case-based DR-TB electronic registration tool that was developed and implemented by the National TB Program with USAID's support through its Digital Health Activity. In collaboration with the USAID Digital Health Activity, the National TB Program, and the national Health Management Information Systems Unit, the USAID Eliminate TB Project has been supporting the implementation of the DR-TB Tracker through trainings, supply of tablets for data entry, airtime for mobile internet connectivity, and regular supportive supervision.

Patient information entry has been accelerated to clear a backlog and accommodate new patients who began treatment during the implementation of the DR-TB Tracker. Data for 3,000 patients were enrolled at the end of June 2024 at treatment initiating centers (TICs). The gap between DR-TB cases that are notified by health facilities and the cases that are enrolled and treated by TICs is captured in the DR-TB enrollment rate, and this

should fall within the globally accepted range of 85–115%. In Ethiopia, the enrollment rate narrowed from an excessive 120% in October 2022 to 101% in March 2024 (figure 5).
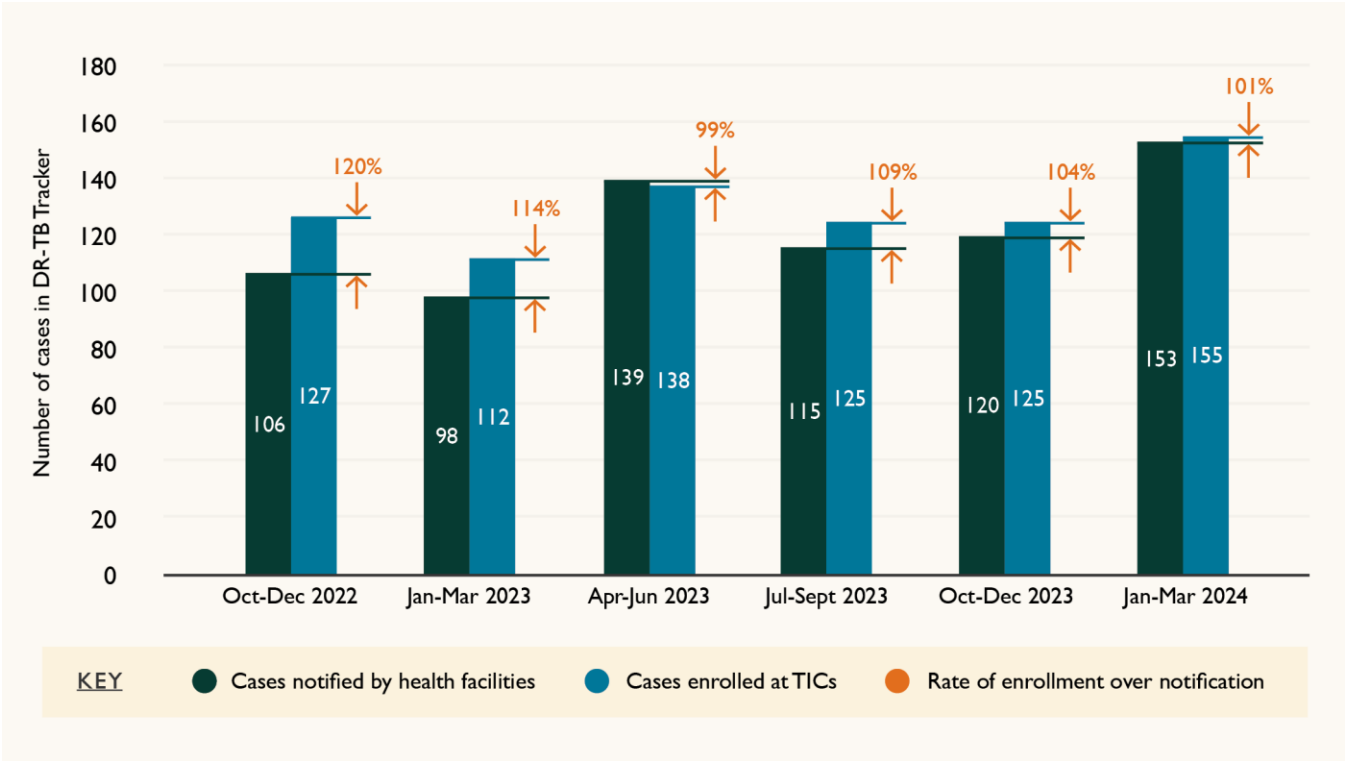

Figure 5: Drug-resistant TB cases notified by Ethiopian health facilities, cases enrolled at treatment initiating centers (TICs), and enrolment rate showing the gap between these data sources

After implementing for the last four years, the project has started transitioning the DR-TB Tracker activities – monitoring, training, airtime, and use of the dashboard – to the Ethiopian Ministry of Health.

MONITORING FIELD VISITS USING GEOGRAPHIC INFORMATION SYSTEMS (GIS)

During the inception of the USAID Eliminate TB Project, most sites visited were conducted using the existing system, and the geolocation and distribution of health facilities visited were not tracked. The project therefore began using GIS to track field visits quarterly and improve its monitoring and support of high-load health facilities and hotspot areas for TB. Project field visit locations could then be selected based on data and performance, focusing on high-TB-burden and hotspot areas to be efficient and effective. However, project field visits in conflict-affected areas continued to be restricted, which suggests the need for compensatory and intensified visits after conflict ceases (figure 6).

2022 **2023** **2024**

KEY   ⋆ Health facilities visited   ◯ Conflict in Tigray   ◯ Conflict in Amhara

Figure 6. GIS records of health facilities visited by project staff, 2022–2024, showing the effects of conflict in some regions. Note that data was not captured in Tigray in 2023 and 2024.
Source: Based on GIS data as reported in USAID Eliminate TB Project annual reports, 2022–2024

GENEXPERT CONNECTIVITY THROUGH GXALERT AND LABXPERT

To access and use real-time data from GeneXpert testing activities, the National TB Program introduced GxAlert connectivity software in 2018. With the expansion of GeneXpert and the growing need to have more comprehensive data for decision making and program improvement, the Ministry of Health together with the Ethiopian Public Health Institute tabled the agenda of having a more robust and comprehensive local digital solution that can accommodate continuous development. In response to the demand and request from Ministry of Health in 2022, with support from USAID, the program introduced a locally developed and owned digital solution called, LabXpert connectivity solution. The LabXpert connectivity solution makes it possible to rapidly transmit testing results to clinicians, enable timely enrollment of patients in treatment, automatically transmit data to real-time dashboards for on-site use, and improve the programmatic data reporting system to strengthen overall laboratory management (Stop TB Partnership, 2023). The USAID Eliminate TB Project has been supporting the introduction and implementation of these GeneXpert connectivity platforms by facilitating trainings on their use, establishing specimen referral networking for testing, and providing technical assistance on the preparation of real-time data entry and reporting.

A lack of internet connectivity in most conflict-affected towns in the region of Amhara hinders use of the LabXpert connectivity solution. To mitigate this hurdle, the USAID Eliminate TB Project has procured and piloted a Virtual Private Network internet system in six sites, which has proven successful.

Real-time data capturing and reporting have improved alongside higher utilization of GeneXpert machines. From 2020 to 2023, the proportion of GeneXpert machines connected to a real-time platform increased from 24% to 90%, and the machine utilization rate improved from 59% to 80% (figure 7).
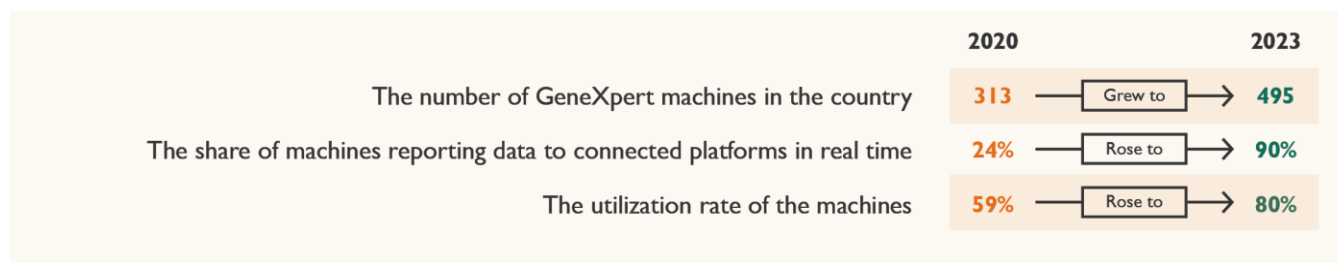
	2020		2023
The number of GeneXpert machines in the country	313	Grew to →	495
The share of machines reporting data to connected platforms in real time	24%	Rose to →	90%
The utilization rate of the machines	59%	Rose to →	80%

Figure 7. Growth in GeneXpert connectivity and utilization
Source: National TB Program report 2020–2023

The USAID Eliminate TB Project has also started to collaborate with the USAID Health Workforce Improvement Program in the digitalization of trainings and guidelines, including TB and leprosy guidelines and laboratory training.

CHALLENGES

The digitalization of TB program activities is hindered by several challenges, starting with the requirement of a smartphone, tablet, or computer with an uninterrupted internet connection for every person collecting and reporting data. Transitioning the TB program to a fully digital data collection system in areas of poor internet connectivity or low internet access still requires substantial investment. Additionally, the digital skills and knowledge of health care workers varies, and some may require significant training and orientation on the use of the tools, with additional costs.

Furthermore, there are no well-established databases for data storage and security in Ethiopia. Shifts in data reporting accountability and the need for reliable technology to link patient records to DHIS2 pose more challenges. Duplicated data entry – to the digital tools and paper-based registers – could be an added burden for health care workers with many competing priorities (Mergenthaler et al., 2022). These issues challenge the feasibility of implementing digital data capture and reporting systems in all areas of Ethiopia.

THE WAY FORWARD

The USAID Eliminate TB Project has adopted e-SOC for district monitoring and E-SS as the national supervisory tool. Zones, regions, and the Ministry of Health could all be supervised and monitored using E-SS, along with high-patient-load health facilities. In addition, the adoption of e-SOC at the zonal and regional level as well as in districts could be beneficial for the TB program in Ethiopia.

As a next point of focus, though DHIS2 and e-SOC both include some laboratory monitoring indicators, there is no comprehensive system for capturing TB laboratory data in Ethiopia. A comprehensive and digitalized TB laboratory information system should be established that is integrated with other program laboratory systems in Ethiopia. Full automation of TB unit registers, contact investigation, and TB preventive treatment using electronic medical records could further ensure data quality and objective TB program monitoring. This should be interoperable with DHIS2 and requires commitment from decision makers and implementing partners.

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