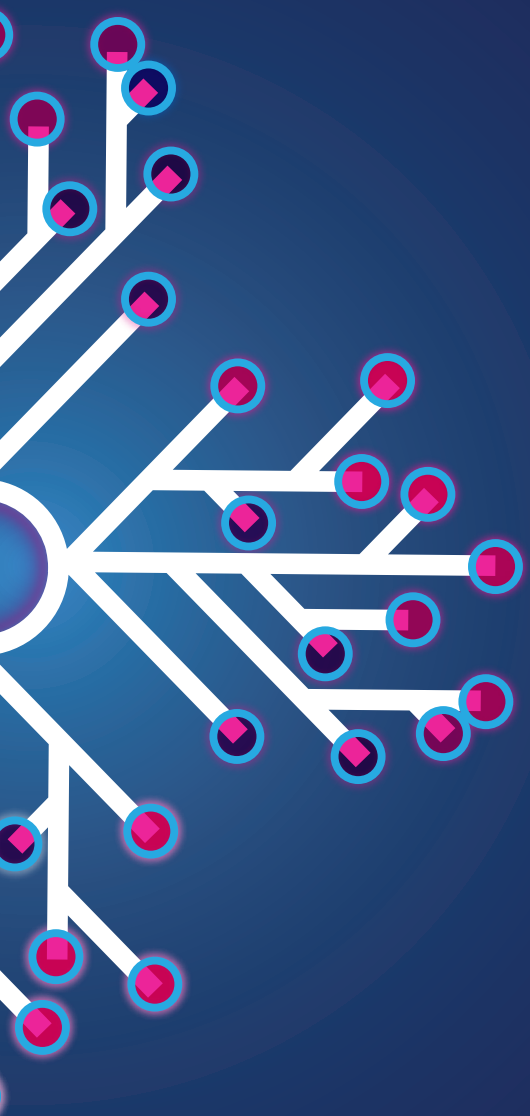
Consolidated guidance on tuberculosis data generation and use
Module 1

Tuberculosis surveillance

Web Annex F

Evaluation of the WHO DHIS2 case-based package for tuberculosis surveillance (TB tracker) in five pilot countries: summary of key findings



World Health Organization

Consolidated guidance on tuberculosis data generation and use
Module 1

Tuberculosis surveillance

Web Annex F

Evaluation of the WHO DHIS2 case-based package for tuberculosis surveillance (TB tracker) in five pilot countries: summary of key findings

World Health Organization

Consolidated guidance on tuberculosis data generation and use. Module 1. Tuberculosis surveillance. Web Annex F. Evaluation of the WHO DHIS2 case-based package for tuberculosis surveillance (TB tracker) in five pilot countries: summary of key findings

ISBN 978-92-4-008094-2 (electronic version)

Suggested citation. Web Annex F. Evaluation of the WHO DHIS2 case-based package for tuberculosis surveillance (TB tracker) in five pilot countries: summary of key findings. In: Consolidated guidance on tuberculosis data generation and use. Module 1: Tuberculosis surveillance. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO.

Cataloguing-in-Publication (CIP) data. CIP data are available at http://apps.who.int/iris.

This publication forms part of the document entitled Consolidated guidance on tuberculosis data generation and use. Module 1. Tuberculosis surveillance. It is being made publicly available for transparency purposes and information.

Contents

Chapter 1
Introduction

The World Health Organization (WHO) has a DHIS2 case-based module for tuberculosis (TB) surveillance, referred to as the "TB tracker". WHO's TB Monitoring, Evaluation and Strategic Information Unit (TME), which is part of the Global TB Programme (GTB), is responsible for the continued development of this package, in collaboration with the University of Oslo (UiO). The first version of TB tracker was released in 2017, and it has been adopted for pilot use in five countries: Ghana, the Lao People's Democratic Republic, Pakistan, Rwanda and the United Republic of Tanzania. The metadata package for the WHO DHIS2 case-based module for TB surveillance is available online[1] for countries to download, customize and implement.

To gain a better understanding of country-level experience, GTB/TME commissioned a retrospective evaluation, to evaluate the implementation and use of the DHIS2 TB tracker in the five pilot countries. Carried out in 2020, the evaluation was undertaken by an independent team from eSHIFT Partner Network[2] and LogicalOutcomes,[3] under the technical guidance of WHO.

This document summarizes the key findings from the evaluation, highlighting best practices identified across the five countries. It also discusses the factors that facilitate or hinder successful implementation, and provides suggestions on how to address common challenges. Although the evaluation focused on the DHIS2 TB tracker, the key messages can be applied to the implementation of any digital system for recording and reporting TB data.

[1] See https://dhis2.org/metadata-package-downloads/.

[2] See https://www.eshift.org/ .

[3] See https://www.logicaloutcomes.net/.

Chapter 2
Methods

A mixed-methods (quantitative and qualitative) design was used for the evaluation. The evaluation team conducted a desk review of relevant documents developed by international, multilateral and nongovernmental organizations, and of country-specific documents provided by each country's national TB programme (NTP) and other local partners.

Semistructured interviews were conducted with stakeholders from each country, with UiO and the Global Fund to Fight AIDS, Tuberculosis and Malaria (Global Fund). Individuals interviewed included those who hold senior roles within the NTP, individuals from partner organizations (e.g. Health Management Information System [HMIS] and UiO's Health Information System Programme [HISP]) and, where possible, individuals from lower administrative levels and users of the DHIS2 TB tracker.

A survey of front-line workers was conducted in each country. In the context of the evaluation, a front-line worker was defined as anyone who uses DHIS2 for capturing, managing or visualizing data at the lowest administrative unit in which DHIS2 is implemented. The number of responses for each country is shown in Table WF.2.1.

All data were collected remotely through virtual forums between March and December 2020.

The evaluators analysed the qualitative data by looking for emerging themes and pertinent information. They looked at factors that might contribute to, or interfere with, the successful implementation of the DHIS2 TB tracker, investigating what worked for each country, considering the context and circumstances. Given the different contexts, it was not possible to look at cause and effect.

The evaluation was undertaken across seven dimensions:

- relevance and appropriateness of the DHIS2 TB tracker to meet country needs and expectations;
- implementation of the DHIS2 TB tracker and operations;
- effectiveness of the DHIS2 TB tracker in relation to global and country-level goals and objectives;
- sustainability of implementation and use;
- key factors that facilitate implementation;
- key factors that hinder implementation; and
- identifying best practices.

Table WF.2.1 Number of responses to the evaluation, by country

Country	Number of responses
Ghana	40
Lao People's Democratic Republic	82
Pakistan	3[a]
Rwanda	36
United Republic of Tanzania	39

[a] The low number of responses from Pakistan reflects the low number of users of the programme, which is due to the limited rollout of the DHIS2 TB tracker in the country.

Chapter 3
Results

This section provides the results for each of the seven dimensions listed in the Methods section above.

3.1 Relevance and appropriateness of the DHIS2 TB tracker

Shared expectations, motivations and goals regarding the DHIS2 TB tracker implementation are to:

- **increase case detection**, by identifying at-risk groups, **strengthening routine case notification**, and addressing vulnerable groups, including children with TB;
- **improve patient care** by giving staff real-time access to information in a safe and secure way, to support patient management from diagnosis to outcome;
- **support TB activity planning, implementation and monitoring**, by improving the timeliness and quality of reporting, and by strengthening the overall HMIS; and
- **inform operational research priorities**, by improving collaboration between the TB programme and research or academic institutions.

To varying degrees, each country will have strategies related to digital health information systems. For example, in Ghana and Pakistan, these plans are embedded within their national strategic plan; in the Lao People's Democratic Republic, Rwanda and the United Republic of Tanzania, documents that explicitly outline the country's strategy on digital health information are available.

All five countries acknowledged the need for a platform that allows the collection of case-based TB data to support patient management, TB surveillance and management of health facility operations. The Lao People's Democratic Republic and Rwanda have a particular focus on the need for case-based data for health planning purposes.

Strong political commitment to case-based surveillance using the DHIS2 TB tracker is seen in Ghana, the Lao People's Democratic Republic, Rwanda and the United Republic of Tanzania. In Pakistan, the health system structure is heavily decentralized; therefore, more extensive coordination with provincial-level authorities is required to reach an agreement on which case-based system should be officially adopted and rolled out across the country.

All five countries had prior experience of using DHIS2 for the collection of aggregate TB data. This familiarity with the software facilitated the uptake of the DHIS2 TB tracker. Also, all five countries continue to use a paper-based system to varying degrees (either recording data on paper or reporting aggregate data) in parallel with the DHIS2 TB tracker, highlighting the need for additional support in improving overall efficiency.

3.2 Implementation of the DHIS2 TB tracker and operations

The HISP network, set up by UiO, has supported countries in their implementation and maintenance of DHIS2-based systems. For example, the complexity of implementation, configuration and the long-term costs of support and maintenance have been reduced through the development of the WHO DHIS2 TB tracker, which provides a standardized package for health information.

As mentioned above, countries expect the system to support activities related to surveillance, patient management, reporting and management of health facility operations. Although the primary intended use of the DHIS2 TB tracker is to support recording and reporting activities, the evaluation showed that the tracker was also being used to indirectly support patient management and the management of health facility operations.

Taking time to improve system configuration on the basis of country needs and then undertaking appropriate testing cycles can slow implementation. However, the evaluation showed that such an approach is beneficial, ultimately contributing to workflows that are more efficient than would be the case if the system had been implemented hastily.

Two major challenges with implementation of the DHIS2 TB tracker (or any digital system) are the need for integration (i.e. data linkage and interoperability) across different systems and the need for integration with digital testing equipment (e.g. connected diagnostics, such as GeneXpert). Since the evaluation, these

challenges have been addressed through the expansion of the laboratory stage in both aggregate and case-based packages and the development of a household contact tracing module.

It is important to have a local DHIS2 implementation team to act as an internal service provider and contribute to successful implementation. The role of the team should be to support the customization, design, development, management and provision of technical assistance across the various DHIS2 programmes implemented in the country. Pakistan provided an example of the composition of a typical team:

- **IT manager**, responsible for server infrastructure and the backend;
- **management information system (MIS) manager**, responsible for information system management;
- **DHIS2 coordinator**; and
- **MIS officer**, responsible for the DHIS2 TB tracker specifically (supported by the MIS manager, who will also be dealing with other DHIS2 programmes).

Aspects that are "core" to DHIS2 (e.g. infrastructure, database and training) can be supported through collaboration with HISP. However, an important factor for sustainability is to build capacity locally, so that the country is not overly reliant on foreign staff (e.g. HISP and UiO) or on external technical assistance. UiO has developed a standardized implementation approach to address building local capacity by:

- supporting the establishment of large **local DHIS2 implementation teams** that will share knowledge and build capacity throughout the process;
- setting up **DHIS2 academies** to provide intensive training and deep insight into the DHIS2 system, laying the foundations for continual learning;
- encouraging participation in a large **international virtual community of practice**;
- establishing a **multilayered support system**, where the first line of support is at the district level, the second is with the DHIS2 TB tracker team and the third (for the most complex questions) is provided directly by UiO.

Most front-line workers find the DHIS2 TB tracker easy to use; however, more training, particularly on the use of dashboards and analytical functions, is often requested.

High rates of staff turnover are a common challenge, making it difficult for countries to hold in-person classroom training and creating a need for other approaches to the provision of effective training and retraining.

Ghana and Rwanda have shown how useful it is to set up a middle layer of support at the district level, to act as first responder to lower levels when support is needed, provide on-the-job training of new recruits and provide routine formal retraining on an annual basis. The skillset required for this position is public health management with some skills in data use, statistics and software. Other settings have had difficulty filling the district-level positions with individuals who have the appropriate skillset.

The DHIS2 TB tracker metadata package is well documented, with guidance on installation, configuration, and use. The tracker is organized as a series of stages that record data along the patient pathway of prevention and care (Fig. WF.3.1). Countries can customize the package to meet their specific needs by including additional stages (Pakistan) or modules (the Lao People's Democratic Republic). However, deviation from the standard configuration could lead to the need for more individualized support for complex modifications, because these modifications are country specific and thus are not documented within the standard package.

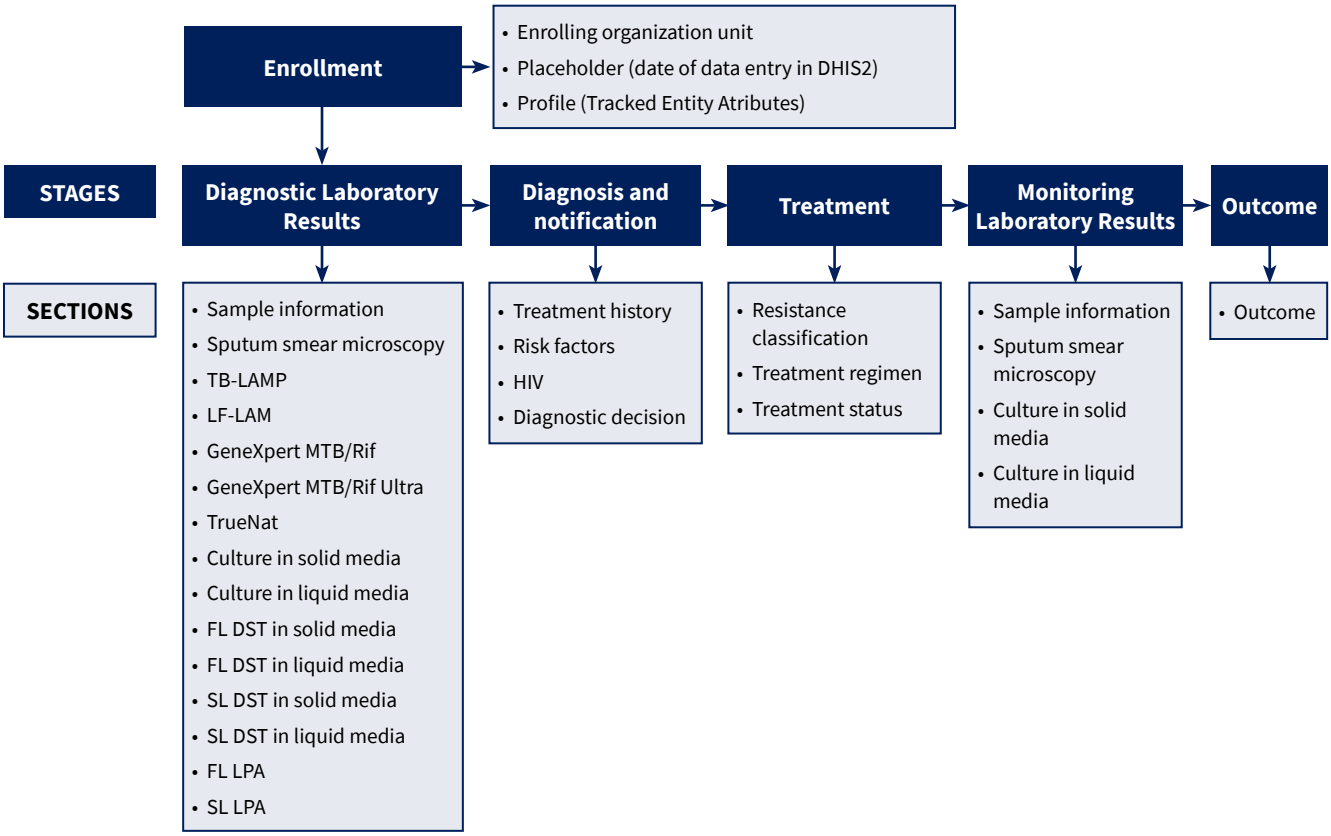
There is the potential to capture data in real time; however, all countries experience delays in data entry as they continue to rely on first capturing information in paper registers and on patient cards. Factors that interfere with an exclusively electronic workflow for data entry include:

- the time taken to transition from paper to electronic systems; this leads to the use of the two systems in parallel, which is an inefficient use of staff time and affects the timeliness of reporting;
- issues with electricity and stable internet connection, leading to information being captured on paper and then being batch entered into the electronic platform, or being entered into the electronic platform at a higher administrative unit (e.g. district) rather than at the health facility level; and
- inadequate staffing at the health facility, particularly where health care workers are also responsible for data entry (where support from data entry clerks is unavailable).

Overall, 94% of front-line worker survey respondents reported that entering data into the DHIS2 TB tracker is either easy (53%) or moderately easy (41%). Data entry can still be a time-consuming process, particularly in health facilities with a high client load, with 11% of respondents reporting having spent more than 8 hours per week on data entry; however, 54% of respondents reported that data entry was quicker with the DHIS2 TB tracker than with their previous system.

Most countries have used the web browser version of DHIS2 for data entry, although the (offline) mobile Android version is increasingly being used, particularly in

Fig. WF.3.1 Stages of the DHIS2 TB tracker (as of September 2022)



DST: drug susceptibility testing; FL: first line; HIV: human immunodeficiency virus; LF-LAM: lateral flow urine lipoarabinomannan; SL: second line; TB: tuberculosis; TB-LAMP: TB loop-mediated isothermal amplification.

rural areas where network issues are common. Problems in uploading and syncing data have been reported by those using Android devices; these issues have been addressed and a new Android version has been released. There is some scepticism about the use of mobile devices rather than computers for data entry because the devices have a lower life expectancy, need more attention and frequent replacement, and require a higher budget.

At the health facility level, the DHIS2 TB tracker was being used for management of patient data, to inform clinical decisions and, at times, for management of health facility operations. At the district, regional and provincial levels, the TB tracker contributed to decisions on resource allocation and policy development. At the national level, it informed decisions on resource allocation, policy development and public dialogue.

All five countries host the DHIS2 server locally, through either the centralized government data centre or a privately run centre. Also, all countries are either already using, or transitioning to, virtualized cloud servers, allowing for easy maintenance of the application (e.g. back-ups, restoring and modifying). All servers have been described as reliable and secure, with no downtime issues reported.

Data on the budget for implementation were largely unavailable during the evaluation. Ghana was the only country that provided any cost-related information, indicating that half of the resources went towards central activities (system reconfiguration and documentation), and half towards system rollout (training, monitoring and support visits). Ghana reported that the budget was not sufficient; hence, those health centres that had a heavy client load were prioritized for training. An additional ongoing cost is the need to continually replace malfunctioning and old hardware (computers and tablets).

All countries reported that they were satisfied by the technical performance and scalability of the DHIS2 TB tracker.

3.3 Effectiveness of the DHIS2 TB tracker in relation to global and country-level goals and objectives

At the global level, the DHIS2 TB tracker directly contributes to two pillars of the End TB Strategy: integrated patient-centred care and prevention, and bold policies

and supportive systems. Research carried out using data collected in the TB tracker indirectly contributes to the third pillar – intensified research and innovation – because the system can contribute to the understanding of specific determinants of TB, both in a country and globally.

At the national level, the TB tracker was found to contribute to country goals in improving case detection, patient care, planning, monitoring, and reporting and data sharing:

- front-line workers are using data from the TB tracker for patient management and management of health facility operations (Ghana and Rwanda); and
- the TB tracker is being used to monitor interventions and contributions to national and global targets (the United Republic of Tanzania).

The following country-level improvements were observed in this evaluation:

- the recording and reporting of TB data;
- the accuracy and completeness of the data collected; and
- decisions related to health facilities (if the system is used for this) or policy development.

3.4 Sustainability of implementation and use

Sustainability is defined as successful long-term use of the DHIS2 TB tracker. It is indicated by the tracker being embedded in a shared learning experience that empowers local stakeholders and progressively decreases the need for external support.

The evaluation determined that the TB tracker was implemented in a sustainable way in four of the five countries. In Pakistan, the choice of system to be officially adopted nationally is heavily influenced by the provincial level, requiring additional multilayer coordination to come to a unified decision.

The following factors appear to promote sustainability of implementation:

- country commitment to the implementation and long-term use, with some degree of centralized governance;
- participation of the ministry of health (MoH) in implementation, roll out and maintenance, with financing and running costs available through the MoH budget;
- multilayered support and technical maintenance with well-defined activities, including the availability of third-level international support for the most complex issues;
- a clear digital health information strategy that explicitly calls for patient-centred, case-based systems as a priority; and
- availability of continued funding from multiple sources at the national and global levels (e.g. the Global Fund).

All five countries have carried out training sessions on the use of DHIS2 TB tracker. However, there is a need to improve refresher training and ensure adequate training of new staff (in the case of staff turnover), to make the system more sustainable.

3.5 Key factors that facilitate successful implementation

The individuals interviewed reported several factors that facilitated implementation, at both national and lower levels.

Key factors identified as facilitating successful implementation at the national level were as follows:

- Having a health system with centralized elements and a clear strategy for digital health information. Countries need to combine centralized elements for coordination of activities with a strong decentralized middle layer of support (e.g. at the district level).
- Receiving buy-in and commitment from the MoH, which will be accountable for the implementation of the TB tracker, including oversight of its introduction and maintenance.
- A well-defined strategy for planning, design and implementation, including a well-defined practice for system use. This leads to successful uptake, and helps to avoid negative reactions to short-term setbacks.
- Having the TB tracker well embedded within a coherent health system architecture, which includes the provision of high-quality technical support through experienced national DHIS2 teams at the MoH or internationally from HISP. This appears to increase long-term engagement.
- Having a strong local implementation team that includes technical experts from relevant areas of information technology (IT) and TB, and involves the participation of other departments (e.g. health programmes and HMIS) and levels of the MoH. This ensures that all stakeholders have a long-term commitment to the chosen technology and a collaborative approach.
- Support from WHO, particularly for the initial strategic consultancy and orientation.

Key factors identified as facilitating successful implementation at lower administrative levels, in health facilities and among end-users were as follows:

- Having a realistic pilot implementation and rollout plan that clearly defines the user roles and avoids overly ambitious (and politically motivated) expectations, such as immediately abandoning paper forms. A well-designed staged rollout plan should be adopted to help countries find a measured approach that can take them to the next attainable stage. The plan should be pragmatic, building on existing institutional procedures, collaboration and experience from similar implementation projects.
- Ensuring adequate staffing and capacity within health facilities and administrative units, with opportunities for skill development and potential provision of incentives to meet data input and processing needs. Having staff at the district level who are familiar with or have previous experience of DHIS2 is a bonus.
- Ensuring a strong middle layer of support and encouraging communication across the layers (routinely, with ad hoc elements) enables district coordinators to monitor and support staff in their administrative units.
- Ensuring sufficient funding for the procurement and maintenance of data entry equipment (e.g. computers or tablets).
- Ensuring that the backend of the system is adequately managed and serviced to minimize downtime and increase overall confidence in the TB tracker.

3.6 Key factors that hinder successful implementation

Common challenges and potential mitigation strategies are presented in Table WF.3.1.

3.7 Identifying best practices

Some best practices that emerged from the pilots include:

- having a robust policy context (e.g. clear digital health information strategy) that highlights the need for a patient-centred data platform, and strong planning (e.g. clear implementation plan) to support piloting and eventual staged rollout;
- having strong governance of the process, with a multisectoral approach involving all relevant stakeholders at all levels, with strong involvement of the NTP;
- building on existing knowledge of DHIS2;
- having supportive policies such as incentives to encourage staff retention and use of system;
- having communities of practices or forums that support learning and development; and
- setting up a virtual working group that allows discussion of issues and challenges in real time (e.g. as done in the United Republic of Tanzania).

Table WF.3.1 Factors that hinder successful implementation of the DHIS2 TB tracker, and mitigating strategies

Challenges	Mitigating strategies
At a national level	
Absence of an up-to-date overall policy framework for digital health. A decentralized health care system, whereby provincial-level authorities have and maintain a significant level of autonomy, and where business processes may ultimately significantly diverge.	Encourage countries to develop a digital health information strategy that clearly defines how to implement case-based systems for vertical disease areas such as TB, using the seven steps outlined by WHO. The planning process should be aligned nationally, to achieve a common understanding of and commitment to implementing a case-based system that is appropriate for the country, ultimately laying the groundwork for the implementation of the DHIS2 TB tracker.
Absence of a clearly structured digital health system architecture.	The digital health information strategy should map existing systems and system connections, to avoid system redundancies, and to promote interoperability across platforms and systematic data sharing with different organizations.
Conflicting priorities (e.g. COVID-19 and other communicable diseases) preventing staff from devoting time to the TB tracker.	Several countries adapted and implemented a DHIS2 tracker to monitor COVID-19 cases. Integrating the implementation of the TB tracker with existing DHIS2 systems could reduce the effect of conflicting priorities. In general, if vertical DHIS2 components are implemented as a coherent package at the front-line level as a unified system – for example, if there is one DHIS2 with several trackers for specialized disease programmes (e.g. COVID-19, malaria, TB and HIV) – users would need less individualized training to operate these systems.
Unsustainable support strategies for infrastructure and staffing.	Although some countries can ensure initial funding to implement a technical solution, a long-term plan to sustain these services is needed.

Table WF.3.1 Factors that hinder successful implementation of the DHIS2 TB tracker, and mitigating strategies (continued)

Challenges	Mitigating strategies
At provincial, regional and district levels	
Lack of funding to support adequate equipment management, including repair and replacement. Although laptops often have a life expectancy of more than 5 years, tablets wear out quickly and need to be replaced or upgraded.	In many countries, the Global Fund has covered catalytic funding for hardware costs. However, countries need to develop their own local commitment for sustained funding mechanisms to cover IT costs and ongoing integration of new technology (e.g. additional modules) into the national infrastructure. Developing professional national asset management systems with adequate funding, clear procedures for maintenance and repair, and sharing of devices among different programmes in smaller facilities can ensure there are sufficient devices.
Inadequate power and internet access in some areas, especially remote rural areas, often causing a lag in data entry or aggregation to national system.	In the short term, lack of internet connectivity can be mitigated using Android devices that collect data in offline mode and upload it later. Adequate budgeting and procurement can help to ensure that technology is available, at least in the highest burden areas (which can also sometimes be remote communities). Another mitigation strategy could be to continue to use paper at lower level facilities, with robust organizational measures to ensure that the data flow does not suffer (i.e. regular and frequent data transmission to higher levels for data entry). As a long-term solution, a multisectoral approach is needed, in which the MoH coordinates with other government agencies to prioritize the connecting of health facilities through a strong internet infrastructure.
Inadequate human resource capacity. Some countries indicated high turnover rates of staff at the subnational level, and others reported challenges in recruiting mid-level staff with IT skills. Front-line staff have asked for more training, with 87% of front-line survey respondents indicating that they needed more training.	Implementation and maintenance plans need to include budgets for training on an ongoing basis (e.g. in Rwanda, district coordinators assume responsibility for efficient and fast "on-the-job" DHIS2 training of new staff at facilities in their catchment areas). Self-learning programmes (e.g. using videos, user guides, manuals and personalized online support) can help to mitigate the negative effects of staff turnover.
The TB tracker has not yet exclusively replaced paper systems in any of the five countries, leading to double workload (in recording or reporting, or both) at the facility level. Programmes that rely on parallel paper-based reporting of aggregate data are especially affected by this double workload; also, manual reporting is time consuming and prone to errors.	A gradual transition to more electronically based systems is necessary and should be planned for in the pilot and rollout strategy. Given that all five countries are still using paper in addition to the DHIS2 TB tracker, this is likely to be a lengthy process. Simultaneously, trust in the reliability of digital data systems needs to be built through education, with evidence to show that data do not get lost. Mechanisms can be built into the digital system to automatically generate aggregate reports from case-based data. These aggregate reports can then be uploaded into an aggregate reporting system (if needed).

COVID-19: coronavirus disease 2019; Global Fund: Global Fund to Fight AIDS, Tuberculosis and Malaria; HIV: human immunodeficiency virus; IT: information technology; MoH: ministry of health; TB: tuberculosis; WHO: World Health Organization.

For further information, please contact:
Global Tuberculosis Programme
World Health Organization
20, Avenue Appia CH-1211 Geneva 27 Switzerland
Web site: www.who.int/tb