PROJECT TITLE: Data access, quality, and usage: Assessment of routine TB data (DAART-TB) in three South African provinces

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TECHNICAL REPORT

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List of Abbreviations

ART	Antiretroviral Therapy
DHIS	District Health Information System
DHIS2	District Health Information System 2; a tool for collection, validation, analysis, and presentation of aggregate and patient-based statistical data
DHMIS	District Health Management Information System
DOH	Department of Health
DR-TB	Drug-resistant Tuberculosis
DS-TB	Drug-susceptible Tuberculosis
DTTC	Desmond Tutu TB Centre
EC	Eastern Cape Province
EDRWeb	Electronic Drug-Resistant Tuberculosis Register
EHR	Electronic Health Record
EMR	Electronic Medical Register
ETR.Net	Electronic TB Register
FIO	Facility Information Officer
GP	Gauteng Province
HAST	HIV/AIDS/STI/TB
HIS	Health Information Systems
HISP-SA	Health Information Systems Programme - South Africa
HPRS	Health Patient Registration System
ICSM	Integrated Clinical Services Management
KZN	KwaZulu-Natal Province
MC & SHR	Maternal and Child Health & Sexual and Reproductive Health
NAAT	Nucleic Acid Amplification Test
NDOH	National Department of Health
NGO	Non-governmental organisations
NHLS	National Health Laboratory Services
NIDS	National Indicator Dataset
NHI	National Health Insurance
NHRD	National Health Research Database
NTP	National TB Programme
PHC	Primary Health Care
RIPDA	Rapid Internal Performance Data Audit
SOP	Standard Operating Procedure
SQL	Structured Query Language
TB	Tuberculosis
TB ID Register	Tuberculosis Identification Register
TIER.Net	Three Interlinked Electronic Registers
TPT	TB Preventive Therapy
TPT register	TB Preventive Therapy Register
WBPHCOT	Ward-based Primary Health Care Outreach Team
webDHIS	web-based District Health Information System, also known as DHIS2

Executive Summary

Introduction: Tuberculosis (TB) is a significant public health threat in South Africa and routine TB data collection is critical for effective TB management. Despite the country's progress in the adoption and implementation of multiple data systems, gaps remain and TB data access, usage, and needs across platforms and health system tiers are not well understood. In response to a request from the TB Think Tank, the DAART-TB (Data Access, Quality, and Usage: Assessment of Routine TB Data) project was initiated in three provinces in South Africa – KwaZulu Natal, Gauteng, and the Eastern Cape.

Purpose: The aim of this project was to assess drug-susceptible TB (DS-TB) routine data in terms of data access, usage, and quality. The objectives included (a) to describe current guidelines for DS-TB data management; (b) to describe barriers and facilitators to TB data access, use, and quality; (c) to evaluate concordance of aggregate-level data at facility and (sub)district levels and as it is exported from TIER.Net to webDHIS; and (d) to make recommendations for supporting and improving data access, quality, and usage to inform the development of the proposed Electronic Health Record (EHR) system.

Methods: In this study we: (a) conducted a desktop review to describe guidelines and standard operating procedures for DS-TB data management and flow; (b) implemented facility-based assessments at 13 health facilities to document the operationalisation of routine TB data in terms of data flow, access, usage, and quality; (c) assessed concordance between TB identification registers, TIER.Net, and webDHIS2 using Rapid Internal Performance Data Audit (RIPDA); and (d) conducted complementary key informant interviews with representatives at sub-district, district, provincial, and national levels to determine data flow processes, data access, usage, and needs.

Key Lessons:

- Despite efforts over time to integrate TB and HIV health information into the broader health information ecosystem (specifically DHIS2), TB programme data systems continue to reflect historical siloed approaches. This was evident in the standard operating procedure (SOP) documentation. The District Health Management Information System (DHMIS) policy and facility-level SOP do not fully integrate TB health information management and therefore do not fully reflect a harmonised framework for TB/HIV data within the broader primary healthcare data processes.
- In the SOPs guiding TB data management, the operational DS-TB data required for patient management via TIER.Net is not sufficiently distinct from the national reporting pathway via webDHIS. Disjointed data sources and capture points for DS-TB undermine the consistency and reliability of TB data, especially when consolidated into webDHIS.
- The location and number of paper-based TB Identification Registers (a key source document for DS-TB) in a facility directly affected the capturing, verification, and overall quality of DS-TB data into webDHIS. Facilities using a single, centralised register were more likely to demonstrate better data concordance across systems than facilities with multiple registers maintained in different sections.
- There was considerable variation in how DS-TB monthly data from TB Identification Registers were aggregated, verified, and captured into webDHIS, reflecting non-standard operating practices across facilities.

- Across multiple facilities, concerns about incomplete or outdated data in TIER.Net undermined its use for patient management, leading clinicians to develop unofficial workarounds to manage patient information, such as using A4 notebooks or 'Siponondos' to manually track patient care and continuing to rely on the phased-out TB Diary.
- Sub-district, district, provincial, and national stakeholders all called for access to nearer to real-time facility-level data to improve oversight, verify data, and respond to performance issues timeously. Reliance on monthly/quarterly TIER.Net dispatches and post-sign-off webDHIS data restricted timely intervention and limited participants' ability to influence patient management or correct data issues.
- Despite the availability of TB visualisations and reports in webDHIS, usage remains very low. Out of 3,973 active DHIS2 users, only 791 users (≈20%) accessed TB dashboards, generating 18,582 total views – an average of just 23 views per user. In contrast, across all programmes, users viewed reports 98 to 350 times per quarter, indicating that TB dashboards are used far less frequently.
- New EHR and Electronic Medical Record (EMR) Systems must balance national M&E and reporting requirements with real-time operational data needs at facility and (sub)district levels to adequately meet monitoring, evaluation, and reporting requirements, as well as operational monitoring needs, called for across health system levels.
- There were high levels of concordance between TIER.Net and DHIS2 for the quarterly DS-TB outcomes data. This indicated that the data transfer processes and the systems involved are functioning effectively, allowing for accurate reporting of DS-TB treatment outcomes and related indicators.
- There was significant variability in concordance with the monthly DS-TB data elements, which rely on paper-based or mixed (paper and electronic) data collection methods. Deviations ranged from material (>5% to 15%) to severe (>15%), indicating serious concerns regarding data integrity.
- Monthly DS-TB data elements, which rely on paper-based or mixed (paper and electronic) data collection methods, showed significant variability in congruency. Deviations ranged from material (>5% to 15%) to severe (>15%), indicating serious concerns regarding data integrity. Agreement between TIER.Net TB Identification Report and DHIS2 per data element was low across all facilities, with the 'under 5 years' data elements having the largest deviations.
- TB Identification Registers (key source document) are poorly completed ('test result' and 'treatment start date' were the most common incomplete fields), and the totals and summary pages were in most cases incomplete. None of the facilities showed full alignment between Registers and TIER.Net. In all but one facility, TIER.Net recorded more treatment initiations than were listed as testing positive for TB in the Registers. Across all facilities there were cases missed in both the Registers and TIER.Net, indicating substantial gaps in the DS-TB data pathway and potentially, patient management.
- All interview participants anticipated cuts in US government funding to negatively impact the TB programme and TB programme data, specifically mentioning TB data capturing, verification, and patient management.

Introduction

Tuberculosis (TB) remains a major public health challenge in South Africa. Tracking of routine TB data is essential for the effective management of TB and providing optimal TB care in South Africa.[1] Accurate and timely data allows the TB programme to monitor patients, allocate resources efficiently, and identify emerging needs. While efforts have been made to implement effective and user-friendly systems for the TB programme, there are several gaps in terms of our understanding of current data systems, including data quality, access across various platforms, and current and desired usage of TB data.[2]

The '*Data access, quality, and usage: Assessment of routine TB data (DAART-TB)*' project was developed in response to the request from the TB Think Tank (for the Department of Health) for an evaluation of current TB data access, quality, usage and flow across health system tiers in South Africa to inform the development of a new Electronic Medical Register (EMR) TB module.

The Desmond Tutu TB Centre (DTTC) at Stellenbosch University, in collaboration with the Health Information Systems Programme – South Africa (HISP-SA) and the TB Think Tank, led this project to assess TB data access, usage, and quality. Findings will inform the development and implementation of a revised EMR TB module. We draw on high-level perspectives from national, provincial, and (sub)district stakeholders, alongside frontline health staff experiences, to provide a comprehensive view of current systems and processes.

Current Context

Historically, the National TB Programme (NTP) in South Africa operated as a vertical, standalone programme supported by a central standardised recording system to monitor TB case rates and treatment outcomes. This system comprised paper-based registers at facility level. In 2005 an Electronic TB Register (ETR.Net) was added at sub-district, district, provincial and national level to capture and manage patient-level drug-susceptible TB (DS-TB) data separately from other health information systems. Since 2010, TIER.Net – a non-networked, facility-level electronic patient management and reporting system – has served as the primary monitoring platform for the national antiretroviral therapy (ART) programme. Over time, TIER.Net was incrementally expanded to incorporate additional HIV-related modules, including HIV testing, pre-ART data.

In 2014, the National Department of Health (NDOH) adopted a policy decision to integrate TB and HIV information systems at facility level into TIER.Net; ETR.Net was phased out. As a result, TIER.Net became the primary system for capturing patient-level TB/HIV information at facility level (Figure 1). Programme data are exported from TIER.Net and aggregated within the District Health Information System (DHIS2/webDHIS) to enable reporting from sub-district to national levels, aligned with the National Indicator Data Set (NIDS).[3] The NIDS is the foundational set of indicators defined by the NDOH (see Table 1). It outlines a 'minimum group of metrics that all public health facilities are required to

[1] Churchyard, G.J., Mametja, L.D., Mvusi, L., Ndjeka, N., Pillay, Y., Hesseling, A.C., Reid, A. and Babatunde, S., 2014. Tuberculosis control in South Africa: successes, challenges and recommendations: tuberculosis control-Progress towards the Millennium Development Goals. *South African Medical Journal*, *104*(3), pp.244-248.

[2] Murphy, J.P., Kgowedi, S., Coetzee, L., Maluleke, V., Letswalo, D., Mongwenyana, C., Subrayen, P., Charalambous, S., Mvusi, L., Dlamini, S. and Martinson, N., 2022. Assessment of facility-based tuberculosis data quality in an integrated HIV/TB database in three South African districts. *PLOS Global Public Health*, *2*(9), p.e0000312.

[3] A separate web-based programme for drug-resistant TB (DR-TB) known as EDRWeb was developed in parallel by the NTP to accommodate system changes required to support increased drug-sensitivity monitoring and support decentralisation of DR-TB care.

collect, use, and report on'.[4] NIDS informs the DHIS, supporting monitoring of national policies, priority health programs, and strategic goals across all system levels – facility, (sub)district, province, and national.

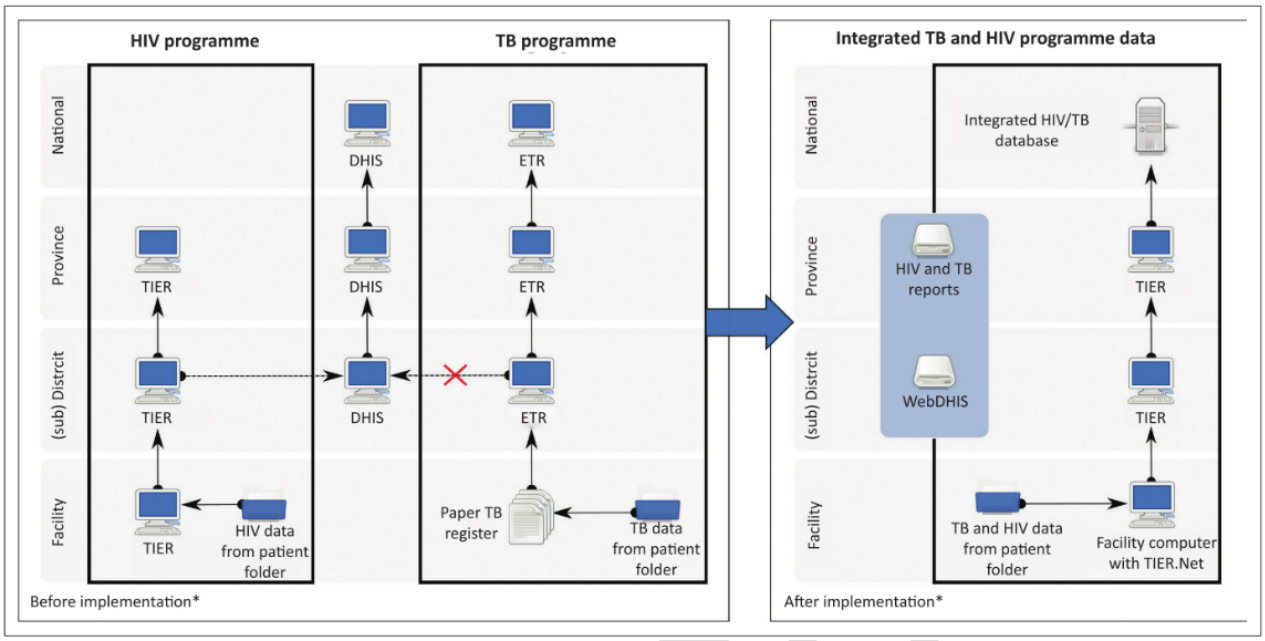


Figure 1. The data flow of TB and HIV programme data before and after the implementation of the TB module in TIER.Net

Source: Myburgh, H., Peters, R. P. H., Hurter, T., Grobbelaar, C. J., & Hoddinott, G. (2020). Transition to an in-facility electronic Tuberculosis register: Lessons from a South African pilot project. *Southern African Journal of HIV Medicine*, *21*(1), 1–7. https://doi.org/10.4102/sajhivmed.v21i1.1025.

The data flow of TB programme data before and after the implementation of the TB module in TIER.Net. Prior to implementation, the TB programme was supported by paper-based TB registers at facility-level and ETR.Net as a standalone system maintained on separate hardware with its own support structure. After implementation of the TB module in TIER.Net, TB programme data flow up through TIER.Net via dispatches, and aggregated TB programme data are available at all levels of the health system for querying and reporting (national through to facilities) through webDHIS (according to national reporting timelines).

The integration of the TB module into TIER.Net enhanced access to aggregated DS-TB data across health system tiers and streamlined programme NIDS reporting into webDHIS, the web-based interface of DHIS2. However, persistent system limitations, data quality issues, technological constraints, and integration challenges with other health information systems remain.[5] [6] Moreover, existing data and reporting frameworks have not kept pace with the

System / Tool	Data Type / Function
TIER.Net	Case-level DS-TB data (used to generate aggregate stats)
EDRWeb	Case-level DR-TB data (used similarly for aggregation)
webDHIS (DHIS2)	Aggregate DS/DR-TB indicators, aligned with NIDS
Paper Registers	Presumptive TB (screening to confirmed)

Table 1. Overview of systems and data type/function that enable NIDS reporting

[4] Barron, P., Day, C., Loveday, M., Monticelli, F. The District Health Barometer Year 1. January – December 2004. Durban: Health Systems Trust, 2005. https://www.hst.org.za/publications/District%20Health%20Barometers/DHB_Year1.pdf (Date accessed: 25 August 2025)

[5] Murphy, J., Kgowedi, S., Coetzee, L., et al. 2021. *Report: Review of the TB Module in TIER.Net in three South African Provinces*. Health Economics and Epidemiology Research Office (HE2RO), University of the Witwatersrand, Johannesburg, South Africa. Available at: https://tbthinktank.org/wp-content/uploads/2022/09/Final-Review-of-TB-Module-in-TIER.Net-HE2RO-31Mar2021-1.pdf (Date accessed: 25 August 2025)

[6] Stop TB Partnership. 2022. South Africa Country Report. Digital TB Surveillance System Assessment Report For 19 Global Fund TB Strategic Initiative (SI) Priority Countries. Geneva, Switzerland. Available at: https://www.stoptb.org/sites/default/files/imported/document/digital_tb_surveillance_system_assessment_report_global_report.pdf (Date accessed: 25 August 2025)

evolving needs of the TB programme, particularly considering rapid advancements in TB screening, prevention, diagnostics, and treatment.

Recognising these challenges, the NDOH decided to phase out TIER.Net and transition to a more integrated and modern Electronic Health Record (EHR) and Electronic Medical Record (EMR) system. This new system has the potential to transform how patient information is stored, accessed, and shared across the healthcare network, while better supporting the evolving requirements of TB and HIV programmes. This decision aligns with the broader goal of strengthening digital health infrastructure – a key component of the National Health Insurance (NHI) Act, signed into law in May 2024, which seeks to establish a single public health fund to provide universal health coverage in South Africa.

The implementation of a national EHR system is critical to the success of the NHI. It will enable real-time data sharing across public and private healthcare providers, support the strategic purchasing of healthcare services by the NHI Fund, and facilitate monitoring and evaluation of health outcomes to inform policy and resource allocation. Updating the EHR/EMR to capture and integrate TB programme data could significantly improve the accessibility, quality, and usability of TB data, thereby improving patient and programme management.

However, to ensure that TB data are effectively integrated into the new EHR/EMR, it is essential first to understand the unmet needs and limitations of current systems. This includes examining what TB data are accessed and used at each health system tier, the systems through which these data are obtained, their limitations, as well as identifying the data needs at each level that are not currently met. Multiple factors influence—and can potentially undermine—data access, quality, and use. These include available infrastructure, staff familiarity with and perceptions of the data systems, computer literacy, data flow and processes, and the availability and experience of personnel involved in data documentation and entry.[7,8,9] A thorough understanding of these constraints will inform how TB information should be structured and presented within the EHR to optimise both programme management and patient care.

Aim and objectives

Aim

To assess current routine TB data in terms of data access, data usage, and data quality.

Objectives

1. To describe current guidelines for DS-TB data management at national, provincial, (sub)district, and facility level;
2. To describe DS-TB data access, quality and usage, including barriers and facilitators in the current TB data systems at facility level, such as infrastructure, data collection and dataflow processes, staff experience and involvement in recording and reporting and inefficiencies in the system;

[7] Roomaney, R. A., Pillay-van Wyk, V., Awotiwon, O. F., Nicol, E., Joubert, J. D., Bradshaw, D., & Hanmer, L. A. 2017. Availability and quality of routine morbidity data: review of studies in South Africa. *Journal of the American Medical Informatics Association*, 24(e1), e194-e206.

[8] Jobson, G., Murphy, J., Van Huyssteen, M., Myburgh, H., Hurter, T., Grobbelaar, C. J., ... & Peters, R.P. 2018. Understanding health worker data use in a South African antiretroviral therapy register. *Tropical Medicine & International Health*, 23(11), 1207-1212.

[9] Moloko, S. M., & Ramukumba, M. M. (2022). Healthcare providers' views of factors influencing family planning data quality in Tshwane District, South Africa. *African Journal of Primary Health Care & Family Medicine*, 14(1), 1-10.

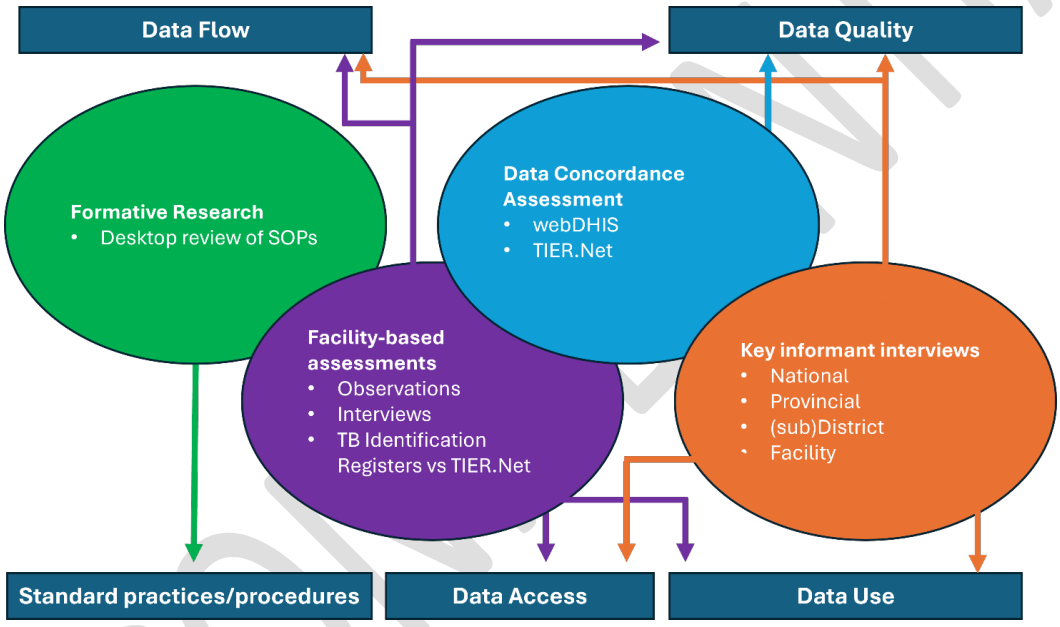
3. To evaluate concordance of aggregate-level data at facility and (sub)district levels and as it is exported from TIER.Net to webDHIS; and
4. To make recommendations for improving data access, quality, and usage of data to help inform the development of the proposed EHR.

Methods

Study design

The overall design is case descriptive of (a) the operationalisation of routine DS-TB data at health facilities in terms of data collection, flow, usage, and access, using interviews and observations of facility operations, (b) an assessment of data quality in the TB identification registers and TIER.Net to triangulate within each case (i.e. facility), and c) assessment of congruence between webDHIS and TIER.Net across selected facilities at facility and sub-district level, for select monthly and quarterly TB data elements. Figure 2 provides an overview of data collection activities, data sources, and relationships.

Figure 2. DAART-TB data collection activities and data sources



Setting

This study was undertaken in three high TB burden provinces: KwaZulu-Natal (KZN), Gauteng (GP), and Eastern Cape (EC). Facilities in these provinces face significant challenges with overcrowding and lack of resources, while managing high TB and HIV co-infection rates. In rural settings, limited healthcare infrastructure, including data connectivity issues, and fewer health facilities that are further apart, hinder TB care delivery. In urban settings, despite better healthcare infrastructure, issues with urban poverty, high population density, and large migrant (and mobile) populations, complicate TB management.[10] [11]

[10] Faye, L. M., Hosu, M. C., Iruedo, J., Vasaikar, S., Nokoyo, K. A., Tsuro, U., & Apalata, T. 2023. Treatment outcomes and associated factors among tuberculosis patients from selected rural eastern cape hospitals: An ambidirectional study. *Tropical Medicine and Infectious Disease*, 8(6), 315.

[11] Phafane, M. P., Ngozo, J., Radebe, Z., Lutge, E., & Ebonwu, J. 2024. Factors associated with mortality among laboratory-diagnosed drug-resistant tuberculosis patients on treatment, KwaZulu-Natal Province, 2017-2019. *The Pan African Medical Journal*, 47(181).

Sampling

Facilities

Across the three provinces, thirteen health facilities were purposively selected in consultation with the TB Think Tank and provincial TB managers, based on annual TB caseload, facility type (i.e., hospital, community health centre, clinic), and context (urban or rural). The aim was to achieve a diverse sample. Four facilities were selected from one health district in each province, KZN, GP, and EC, with an additional facility selected in the EC – Table 2.

Facility
Eastern Cape – Sarah Baartman District
ecFacility 1 – Clinic
ecFacility 2 – Community Health Centre
ecFacility 3 – Clinic
ecFacility 4 – Hospital
ecFacility 5 – Clinic
Gauteng – Tshwane District
gpFacility 1 – Hospital
gpFacility 2 – Clinic
gpFacility 3 – Community Health Centre
gpFacility 4 – Clinic
KwaZulu Natal – Ugu District
kznFacility 1 – Clinic
kznFacility 2 – Community Health Centre
kznFacility 3 – Clinic
kznFacility 4 – Hospital

Table 2. Health facilities selected for data collection in the Eastern Cape, Gauteng, and KwaZulu Natal provinces

Participants

Department of Health staff at national, provincial, district, and sub-district levels – identified through provincial and district managers and the National TB Cluster – were selected for in-depth interviews. District health directors sent an email to the identified potential participants to introduce the study and the researcher (HM) who would be conducting the interviews. Stakeholders included national, provincial, and (sub)district HAST (HIV/AIDS/STI/TB) coordinators and/or managers, as well as those involved in Health Information Systems (HIS), aiming for between 3-5 interviews per province.

Individuals were invited via email, which provided details about the project and the interview, as well as a copy of the informed consent form. Follow-up communications (emails, telephone calls, and messages) were sent to each individual and declines and non-responses recorded.

Data collection

Desktop Review

Prior to facility-based data collection and key informant interviews, we conducted a desktop review to assess availability of all guiding documents, standard operating procedures (SOPs), and official circulars relating to TB data. These documents were sourced through online platforms housing Department of Health policies, guidelines, and SOPs as well as through email communication with Strategic Health Information Managers.

Facility based data collection

Two research assistants spent approximately one week per facility (a month per province) (see Table 3) to conduct three types of activities (see Logic of data collection for DAART-TB project (Appendix A)): (a) semi-structured interviews with health facility staff; (b) facility-based observations of presumptive TB pathway, including TB screening, testing, and data flow; and (c) comparison of TB-positive cases in the TB identification registers (TB ID Registers) and TIER.Net. Research assistants had extensive experience in qualitative data collection, the South

Province	Dates
KwaZulu-Natal	11 Nov – 6 Dec 2024
Gauteng	17 Feb – 14 Mar 2025
Eastern Cape	05 – 29 May 2025

Table 3. Timeframe of facility-based data collection

African public healthcare system, and TB/HIV data management, and participated in project-specific training prior to the project's start.

At each facility research assistants liaised with facility managers to introduce the project and identify 3-5 health facility staff involved in recording, maintaining, and reporting routine TB health services data (including facility managers, TB/HIV nurses, and administrative clerks or data capturers responsible for DHIS and/or TIER.Net). Over the course of a week, the team observed key individuals to document processes in place for TB screening and testing, and TB data management processes. They made detailed notes on the use of paper-based and electronic registers, clinical stationery, staff responsibilities, and adherence to guidelines and SOPs, as well as noting barriers and facilitators relevant to DS-TB data management (see Appendix B).

Health facility staff were invited to participate in individual interviews at the health facility when convenient and at times that were least disruptive to health services. Research assistants used a study-specific discussion guide for the semi-structured interviews. These were based on previous research conducted by DTTC and were adapted for different staff cadres (See Appendix C). The interview guide included participatory research activities, such as mapping data flow from when clients with TB-like symptoms enter the clinic, to data entry on electronic registers, and upward data flow. Interviews were conducted either in English, or, where possible, in local languages (i.e., isiZulu, isiXhosa), and were audio recorded.

For the period October – December 2024, the team assessed agreement between the paper-based TB ID registers and TIER.Net at each facility, comparing clients tested positive for TB in the TB ID registers in this period with clients initiating TB treatment in TIER.Net. With this activity we aimed to ascertain linkage between the TB ID paper register and case-finding module in TIER.Net, how these are used at facility level to ensure TB notification, and to identify challenges and opportunities in their maintenance and use.

Key informant interviews

Interviews with national, provincial, and (sub)district DOH staff were conducted via telephone or through virtual platforms such as Microsoft Teams by an experienced qualitative researcher, using a study-specific discussion guide. The interview guide aimed to facilitate discussion on TB data quality, usage, and needs (see Appendix D).

Interviews were conducted in English or Afrikaans, audio recorded and were between 40 and 60 minutes in length. A total of 35 DOH representatives involved in TB, HAST, and HIS at (sub)district, provincial, and national levels of the health system were invited to participate in one-off interviews; 3 declined and 20 did not respond after repeated follow-up attempts. This

KwaZulu-Natal		n=4	
	TB	1	District level
	HAST	0	
	HIS	3	District and provincial level
Gauteng		n=3	
	TB	2	Sub-district and district level
	HAST	0	
	HIS	1	District level
Eastern Cape		n=3	
	TB	0	
	HAST	3	Sub-district and district level
	HIS	0	
National		n=2	
	TB	2	National
	HAST	0	
	HIS	0	

Acronyms: HIV/AIDS, STIs, and TB (HAST), Health Information Systems (HIS)

Table 4. Number of interviews with TB, HAST, and HIS representatives by province and health system tier (N=12)

resulted in 12 interviews, see Table 4.

DS-TB data concordance and usage assessment

The data concordance assessment aimed to assess concordance of monthly and quarterly DS-TB data element totals in TIER.Net and webDHIS at the selected facilities and in the same facilities at the subdistrict level, using a Rapid Internal Performance Data Audit (RIPDA) tool. The monthly and quarterly data elements relevant to the project (see Table 5) were collaboratively identified and agreed upon by the DTTC, HISP-SA, and the TB Think Tank. For monthly DS-TB data elements, the period of assessment is Q2-Q4 (Apr-Dec) 2024. For quarterly Treatment Start data elements, the period is Q2-Q4 (Apr-Dec) 2024. For quarterly HIV and ART data elements, the period is Q1-Q3 (Jan-Sep) 2024. For quarterly TB outcome data elements, the period of assessment is Q1-Q3 (Jan-Sep) of 2023, as outcome indicators are reported a year later.

	Grouping	Data elements
Presumptive DS-TB data elements	TB Monthly	Child under 5 years eligible for TB test
	TB Monthly	Client 5 years and older eligible for TB test
	TB Monthly	DS-TB bacteriologically confirmed 5 years and older
	TB Monthly	DS-TB Bacteriologically confirmed under 5 years
	TB Monthly	DS-TB clinically diagnosed 5 years and older
	TB Monthly	DS-TB clinically diagnosed under 5 years
	TB Monthly	DS-TB treatment start 5 years and older
	TB Monthly	DS-TB treatment start under 5 years
	TB Monthly	Screen for TB 5 years and older
	TB Monthly	Screen for TB under 5 years
	TB Monthly	TB contact 5 years and older
	TB Monthly	TB contact 5 years and older start on TB Preventive Therapy (TPT)
	TB Monthly	TB contact under 5 years
	TB Monthly	TB contact under 5 years started on TPT
	TB Monthly	TB test 5 years and older using TB Nucleic Acid Amplification Test (NAAT)
	TB Monthly	TB test under 5 years using TB Nucleic Acid Amplification Test (NAAT)
DS-TB outcome data elements	TIER Quarterly	New DS-TB client lost to follow-up
	TIER Quarterly	New DS-TB client start treatment
	TIER Quarterly	New DS-TB client successfully treated
	TIER Quarterly	New DS-TB client treatment failure
	TIER Quarterly	TB client known HIV positive
	TIER Quarterly	TB/HIV co-infected client on ART

Table 5. List of monthly and quarterly DS-TB data elements which are the focus of this assessment

We also conducted a usage assessment of DS-TB Quarterly data elements and indicators within DHIS2, between April 2024 and March 2025, focusing on user access to visualisations and dashboards across the three provinces.

Data Analysis

We systematically reviewed policies and SOPs governing DS-TB health information and management focusing on identifying key facility-level contact points between clients and providers where health information is documented, the source registers and patient records used, and the pathways through which DS-TB data elements are captured and transferred into both electronic systems (TIER.Net, webDHIS) and paper-based records. Furthermore, we traced the flow of these data from facilities to sub-district, district, provincial, and national levels, allowing for a comprehensive understanding of the mechanisms that underpin routine DS-TB data reporting and the potential points where data quality or accessibility may be affected.

During the facility-based assessments, the field team held regular (daily/weekly) debriefs to review observations and interview findings, and to collaboratively construct DS-TB data flow diagrams for each facility, mapping the pathways for presumptive TB clients and DS-TB data. Facility profiles were compiled in tabular format, capturing key characteristics – including size, headcount, population served, location, services, infrastructure, and information systems – and detailing TB screening and testing practices. The summaries also documented data management and flow, including source registers and records, use of systems (electronic and paper-based), and data capture, verification, and reporting processes.

All in-depth interviews were transcribed verbatim and coded in ATLAS.ti using an initial codebook developed based on the study objectives. Additional codes were generated inductively from the data. The research team collaboratively refined the codebook through a consensus-driven process, and developed themes related to data access, usage, quality, and needs.

For both the quarterly and monthly data concordance assessment, the data from the TIER.Net reports, monthly data input (MDI) forms, and the reconciliation forms received from the provinces and data from the webDHIS report were captured in the DHIS2 RIPDA database. This data was downloaded into Excel spreadsheets and the deviation between the data in the TIER.Net system and the DHIS2 system was calculated using absolute values. For the usage assessment, the analysis involved custom Structured Query Language (SQL) views to extract usage data, focusing on various user levels (province, district, sub-district, facility). It excluded HISP user activity to avoid skewed results.

We triangulated all results to produce key findings and make recommendations on DS-TB data access, usage, and quality.

Ethics and research project approvals

This project was commissioned by the TB Think Tank, on behalf of the NDOH, with letters of support from the Director General and the director of the NTP. Ethics approval for the project was granted through Stellenbosch University's Health Research Ethics Committee (HREC) on 02 October 2024 (ethics approval number: N24/06/078).

Through the National Health Research Database (NHRD), we received approval from KwaZulu-Natal, Gauteng, and Eastern Cape research directorates to implement the project in their provinces. Additionally, we received approval letters from provincial and district health directors to approach selected facilities (Table 2) for data collection, and to invite selected TB/HIV and HIS managers and coordinators to interviews. Facility managers were contacted prior to commencing facility-based assessments to arrange introductions and access to facilities.

An informed consent process was followed with all participants prior to their participation in the study, and upon their agreement, participants were asked to sign an informed consent form. For health facility staff, written informed consent was requested. For national, provincial, district, and sub-district DOH participants, informed consent forms were signed using an electronic signature or alternatively, consent forms were printed, signed and scanned.

Approval for access to data from webDHIS and TIER.Net was provided through provincial directors of Strategic Information Management & Monitoring.

Results

This section presents key findings and recommendations for DS-TB health information management based on an assessment of:

1. Policies, guidelines, and standard operating procedures
2. Data pathway/flow
3. Data access
4. Data usage
5. Data quality

Policies, guidelines, and standard operating procedures (SOPs) informing DS-TB information management

We conducted a desk review and identified 8 documents released by the NDOH that inform current management of primary care health information and DS-TB data specifically – Table 6. We grouped and colour-coded these into three focus-areas to systematically and cumulatively map primary healthcare service organisation **(blue)**, routine health information for DHIS reporting **(pink)**, and routine DS-TB data management **(green)** onto each other.

Table 6. Documents guiding data management for the District Health Information System and TB/HIV programmes

Focus	Document title	Year published	Document URL*
1. Organisation of primary care services	Integrated Chronic Disease Management Manual	2014	Link
	Integrated Clinical Services Management (ICSM) Manual	2015	Link
	Ideal Clinic and Community Health Centre Manual	Apr 2024 (updated from 2016)	Link
2. District Health Management Information System (DHMIS)	District Health Management Information System (DHMIS) Policy	2011	Link
	DHMIS Standard Operating Procedures (SOPs) – Facility level	Dec 2016 (updated from 2012)	Link
3. TB/HIV data management	Integrated TB/HIV Data Management SOP, Part I: Facility Level	Apr 2019	Link
	Integrated TB/HIV Data Management SOP, Part II: (sub)District, Province, and National DOH	Oct 2019	Link
	TB Screening and Testing SOP	Jun 2022	Link

*Date accessed: 19 May 2025

The documents that relate to the **organisation of primary care services** provide a *blueprint of the key contact points* with clients *for service delivery* (Figure 3). These include client registration, vital sign station, consultation room/s, and medication room/pharmacy, before the client exits the facility. For those in the chronic stream (which includes HIV/TB), adherence clubs or central chronic medicines dispensing and distribution points may supplant other contact points as needed. These contact points are also points for *routine collection of patient and health information*, which is the topic of the second set of documents that detail the **District Health Information Management System** and the **facility-level SOP**. The documents shaded in **green** detail **management of patient-level and aggregate DS-TB data**, both for patient management and reporting (TIER.Net) and M&E and reporting on the NIDS (webDHIS) at facility and (sub)district levels.

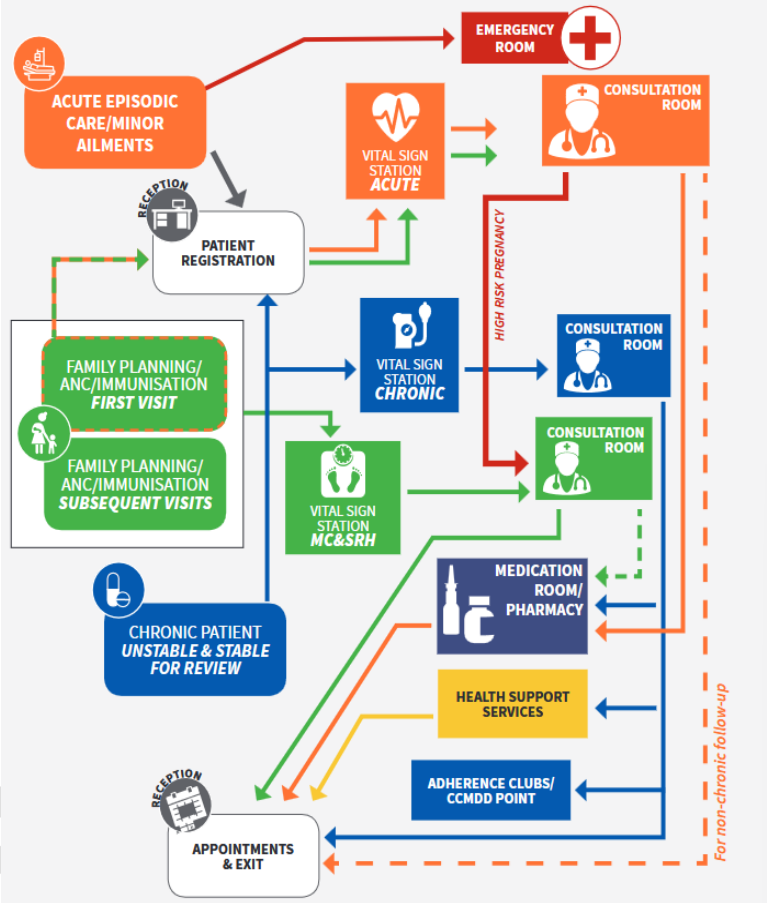


Figure 3. Process flow of clients based on streams of care detailing key contact points between health facility staff and clients

Source: Integrated Clinical Services Management (ICSM) Manual, 2015

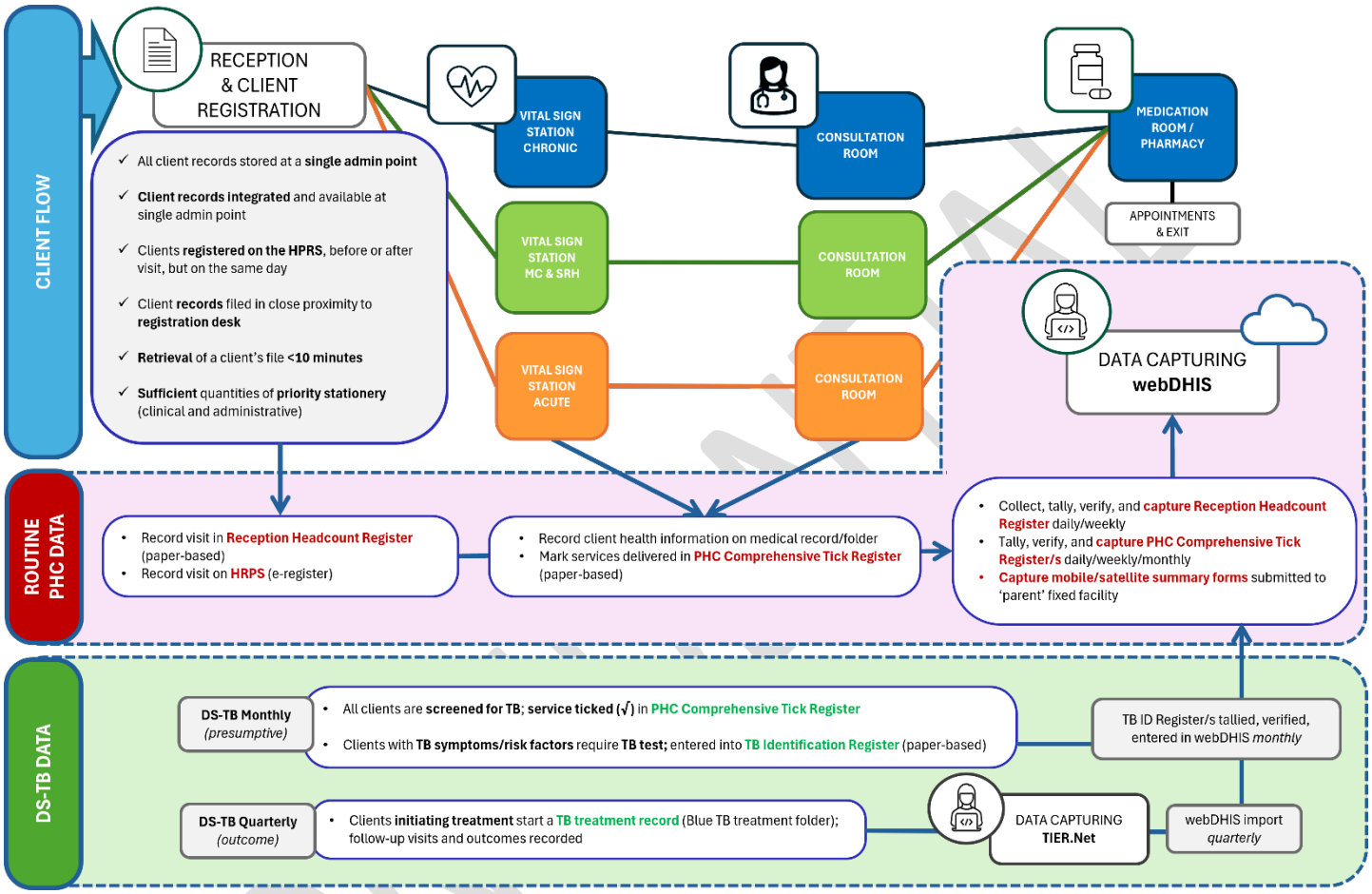
Figure 4 provides a simplified model of the contact points between primary care clients in different care streams (chronic (TB/HIV), mother and child & sexual reproductive health (MC & SRH), acute) and source registers for webDHIS reporting ('Routine PHC data', middle), including those for DS-TB ('DS-TB data', bottom).

These contact points include **reception and client registration**, where clients should be registered on the electronic Health Patient Registration System (HPRS), and their attendance recorded on **both the HPRS and paper-based Reception Headcount Register** with each visit. The reception area should also be the central location for storing, retrieving, and filing client folders. The **vital sign station and/or consultation room** is where clients are screened for infectious and non-communicable diseases and clinically evaluated or assessed. In primary care, all PHC services and screenings are recorded on the **PHC Comprehensive Tick Register**.[12] Client health information is recorded on the medical record/client folder – for TB, this is the TB treatment record. Both the **Reception Headcount Register and the PHC Comprehensive Tick Register/s should be tallied daily or weekly**, and verified by the operational manager, before being **captured into webDHIS** by designated data capturer/s.

[12] A PHC Comprehensive Tick Register is a standardised, paper-based register used to record specific health services provided for each client visit. It thereby serves to track attendances for specific conditions, services, and treatments, like maternal and child health, reproductive health, and disease-specific services. Aggregated data from the tick registers are verified and entered into webDHIS daily/weekly for monitoring and evaluating PHC delivery and for NIDS reporting.

DS-TB data sources for webDHIS (as shown in Figure 4, bottom) are incorporated **alongside routine PHC data** as per the Integrated TB/HIV Data Management SOP, 2019. DS-TB data elements are collected from **two source registers** (the PHC Comprehensive Tick Register and TB Identification (ID) Register/s,[13] for DS-TB monthly (*presumptive*) data elements) and the **TB treatment record** (the Blue TB treatment folder, for DS-TB quarterly (*outcomes*) data elements).

Figure 4. Conceptual model of contact points and source registers for PHC and DS-TB data for webDHIS reporting, as per the DHMIS Facility-level SOP (2012) and Integrated TB/HIV Data Management SOP (2019)



[13] The TB ID Register is a facility-level paper-based register used to record details of all individuals tested for TB, including patient demographics, testing dates, test types and results, and eligibility for treatment. It serves as the primary source document for tracking TB testing and treatment initiation and feeds into webDHIS through manual aggregation and capturing, as well as electronic systems such as TIER.Net for reporting and monitoring purposes.

Table 7. DS-TB data elements with source and method into TIER.Net and webDHIS indicated

	Grouping	Data elements	Data element source	Method into system	
				TIER.Net	webDHIS
Presumptive DS-TB data elements *(monthly)*	*DS-TB Monthly*	Screen for TB 5 years and older	**PHC Comprehensive Tick Register** (*aggregate*)	Screening data **not digitised** in TIER.Net	**Captured daily/weekly** after aggregation and verification, with other PHC data
		Screen for TB under 5 years			
		Child under 5 years eligible for TB test	**TB Identification Register/s** (*patient-line data and aggregate*)	Patient-line data captured **daily/weekly** into TIER.Net *(not all elements)*	Aggregated **monthly**, verified, transcribed onto a monthly data input (MDI) form,[1] and **entered into webDHIS**
		Client 5 years and older eligible for TB test			
		DS-TB bacteriologically confirmed 5 years and older			
		DS-TB Bacteriologically confirmed under 5 years			
		DS-TB clinically diagnosed 5 years and older			
		DS-TB clinically diagnosed under 5 years			
		DS-TB treatment start 5 years and older			
		DS-TB treatment start under 5 years			
		TB contact 5 years and older			
		TB contact 5 years and older start on TB Preventive Therapy (TPT)			
		TB contact under 5 years			
		TB contact under 5 years started on TPT			
		TB test 5 years and older using TB Nucleic Acid Amplification Test (NAAT)			
		TB test under 5 years using TB Nucleic Acid Amplification Test (NAAT)			
DS-TB outcome data elements *(quarterly)*	*DS-TB Quarterly*	New DS-TB client lost to follow-up	**TB treatment record** (Blue TB folder) (*patient-line data*)	**Daily data entry/capturing** into TIER.Net	**Quarterly** TIER.Net *export* and **webDHIS *import*** for DS-TB outcome data reporting[2]
		New DS-TB client start treatment			
		New DS-TB client successfully treated			
		New DS-TB client treatment failure			
		TB client known HIV positive			
		TB/HIV co-infected client on ART			

[1] See Appendix E for an example MDI form.

[2] Following the close of each quarter, a dispatch from TIER.Net is generated and submitted to (sub)District. The dispatch/es are consolidated into TIER.Net at (sub)district level to create a complete, up to date (sub)district database. From this, a TIER.Net export is created, and imported into webDHIS. If there is access to webDHIS at facility-level, the import into webDHIS occurs there and the TIER.Net dispatch is submitted to (sub)district level to update the TIER.Net system there. The dispatch from TIER.Net and the TIER.Net export includes all historical data up to the appropriate quarter, overriding all old cohort data. See Integrated TB/HIV Data Management

Table 7 details the **DS-TB monthly and quarterly data elements in the NIDS, each element's source, and their method into TIER.Net and/or webDHIS.** Both the TB ID Register/s and the patient TB treatment record are captured into TIER.Net on a daily/weekly basis to create an electronic platform with reports for patient management.

Figure 5 similarly illustrates **the pathway of monthly and quarterly DS-TB data elements into TIER.Net and webDHIS** but distinguishes between operational, patient management (TIER.Net) and reporting (webDHIS) purposes.

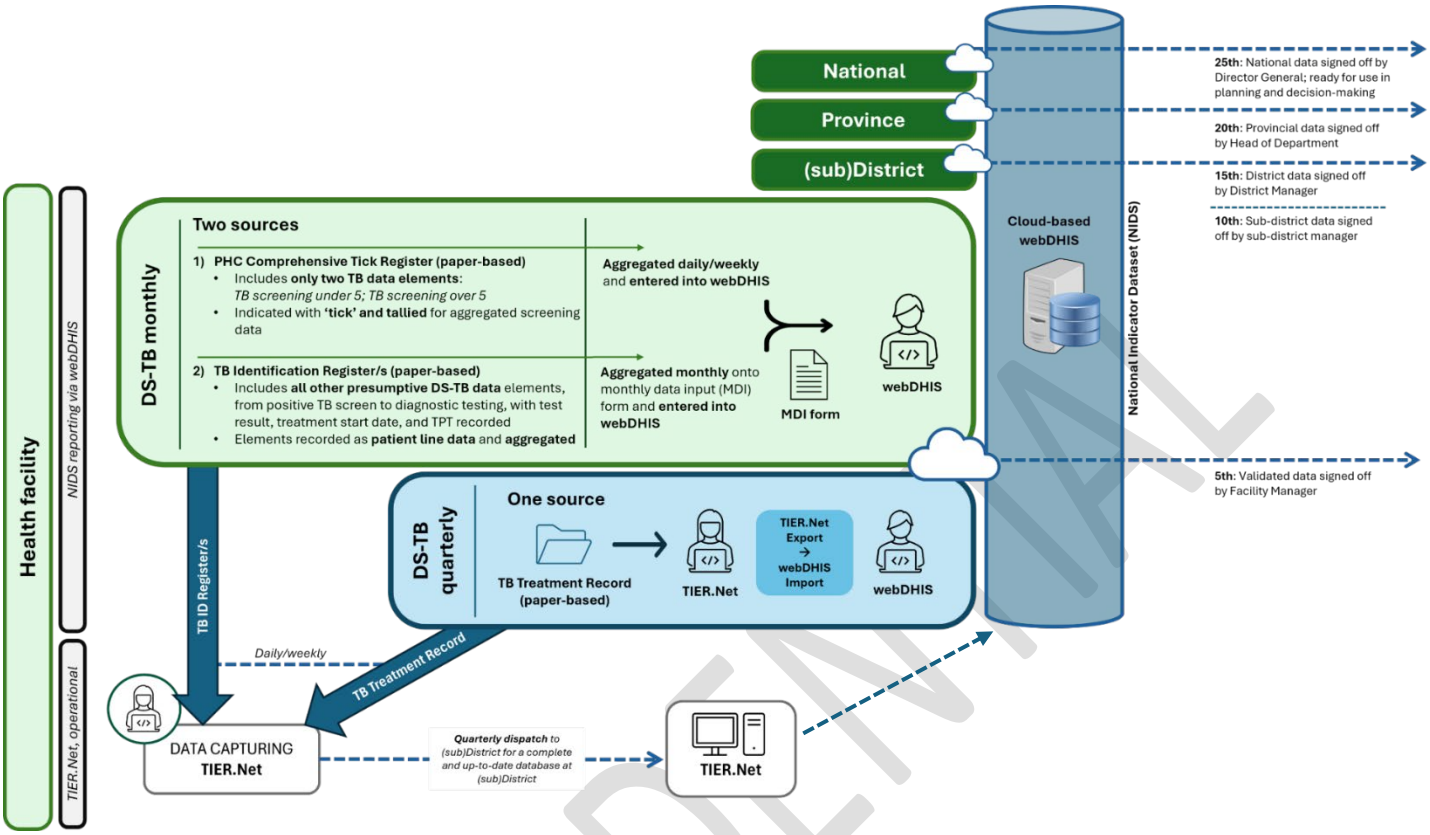


Figure 5. Process and source documents for reporting DS-TB monthly (presumptive) and quarterly (outcome) data elements into webDHIS, and TIER.Net as per the Integrated TB/HIV Data Management SOP, 2019

The figure illustrates the following:

- TB screening is ticked on the PHC Comprehensive Tick Register and not digitised in TIER.Net; aggregated totals are entered into webDHIS daily.
- Presumptive TB data, including TB testing and confirmed/diagnosed, is recorded in TB ID Register/s and captured into TIER.Net daily/weekly.
- By the 5th of each month, both TB screening and presumptive TB data (which make up monthly DS-TB data elements) must be aggregated from the PHC Tick Register and TB ID Registers and transcribed onto a monthly data summary or input form (MDI), to be captured into webDHIS following a verification process.
- The Blue TB folder or TB treatment record is the source for DS-TB outcome data elements (which make up quarterly DS-TB report). Folders must be captured onto TIER.Net daily.

Following the close of each quarter, a dispatch from TIER.Net is generated and submitted to (sub)District. The dispatch/es are consolidated into TIER.Net at (sub)district level to create a complete, up to date (sub)district database. From this, a TIER.Net export is created, and imported into webDHIS. If there is access to webDHIS at facility-level, the import into webDHIS occurs at facility-level and the TIER.Net dispatch is submitted to (sub)district level to update the TIER.Net system. The dispatch from TIER.Net and the TIER.Net export includes all historical data up to the appropriate quarter, overriding all old cohort data.

Key findings: policies, guidelines, and SOPs informing DS-TB information management

- Despite efforts over time to integrate TB and HIV data management systems into the broader health information ecosystem (specifically DHIS2), these programmes **continue to reflect historical siloed approaches**. This was evident in the SOP documentation. The DHMIS policy and SOP does not fully integrate TB/HIV processes and data management and therefore do not fully reflect a harmonised framework for TB/HIV data management within the broader primary healthcare data processes.
- The SOPs guiding both TB/HIV data and patient management was somewhat **unclear with the operational TB data needs for patient management via TIER.Net not sufficiently distinct from the national reporting pathway via webDHIS**. This could potentially lead to data quality issues. There are 'disjointed' data sources and capture points for DS-TB. For presumptive TB data (reported monthly), two data elements are sourced from the PHC tick register and other data elements are collected through the TB ID Register. Treatment outcome data (reported quarterly) is captured from the TB Treatment Record. These data sources are recorded and reported through different channels and timeframes, which can introduce variability in the data definitions and undermine the consistency and reliability of TB data, especially when consolidated into webDHIS.

Recommendations

1. Revise and align policies and SOPs to reflect integrated data management. Review and update DHMIS policy and SOPs to fully reflect the integrated nature of TB/HIV data management within PHC and webDHIS. Eliminate siloed references in existing documents and clearly define TB/HIV data as part of routine PHC service data, with unified reporting standards.

2. Map all TB and HIV data elements to their sources, tools, and reporting timelines in SOPs, distinguishing clearly between i) operational data used at facility level for patient management (e.g., TIER.Net) and ii) aggregate data used for reporting and surveillance (e.g., webDHIS).

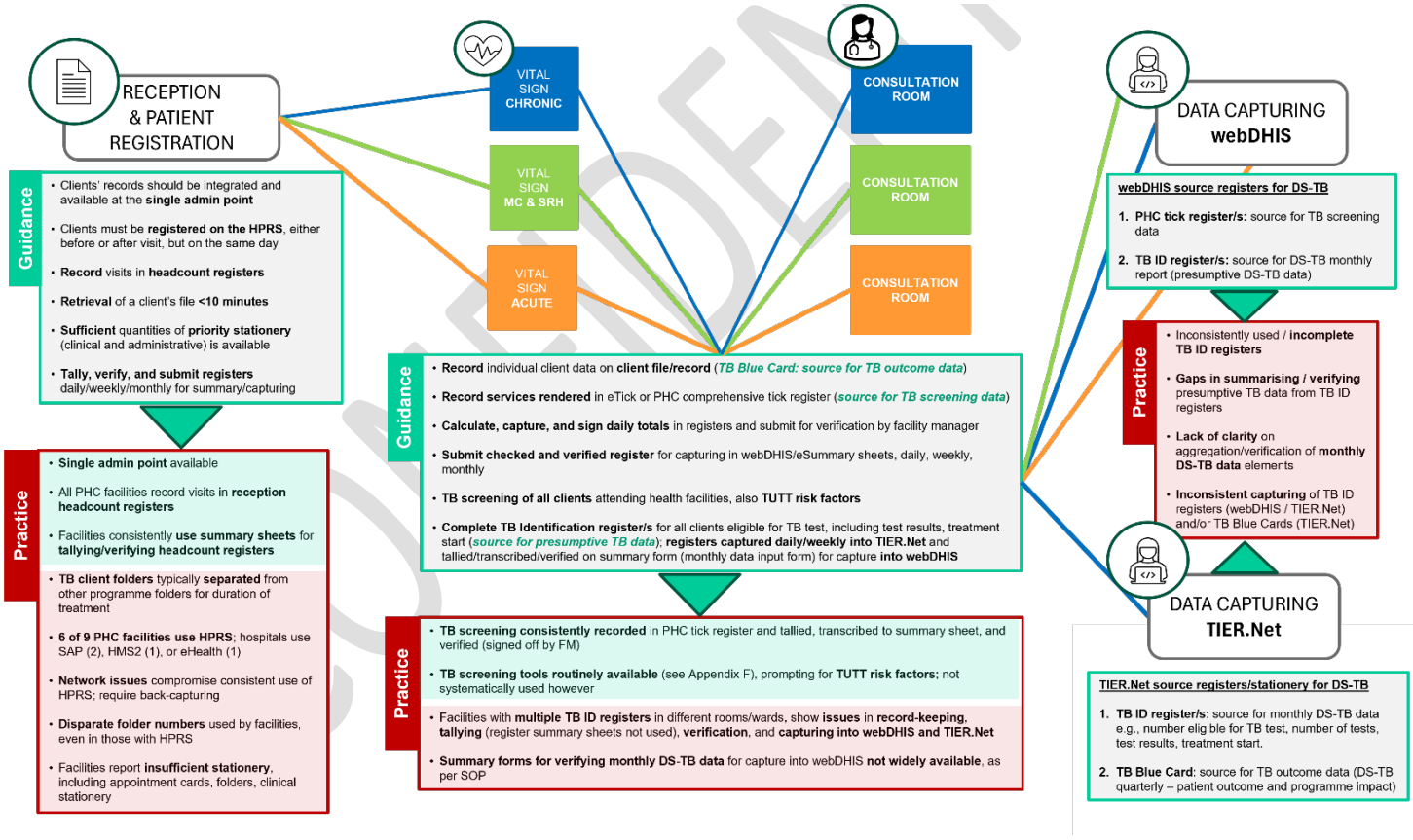
DS-TB data pathway in facilities in practice vs standard operating procedures

Working in 9 primary healthcare facilities and 4 hospitals we used facility-based assessments to map the flow of routine health information for DS-TB monthly and quarterly data elements relevant to the project (Table 5). We compared what we saw in facilities to what was documented in the SOP.

Figure 6 (below) depicts what we found when we assessed the concordance between the SOP (guidance) and what is happening in practice. We have mapped our findings to show practices that are concordant with the SOP (in green) and non-concordant (in red) at different areas of the facility; i) reception and patient registration area, ii) consultation rooms, and iii) data capturing into Tier.Net and WebDHIS.

Overall, there was some concordance between the SOP and practice in the facility, in the reception and patient registration areas and in the consultation rooms. However, there were several practices that did not follow the SOP guidance, most notably during data capturing into TIER.Net and webDHIS. A key finding was the variability in the aggregation and verification of DS-TB monthly data elements, potentially due to systematic sources of error.

Figure 6. Key contact points and source registers/stationery, as per facility-level SOPs, with points of divergence indicated



Key findings: DS-TB data pathway in practice

1. **Facility administration and client registration systems**
    a. All facilities followed the SOP of having one administration point for patient registration and data entry.
    b. Six of the nine PHC facilities actively used the Health Patient Registration System (HPRS) and the paper-based Reception Headcount Register as per SOP – a duplicate effort. The

three remaining PHC facilities relied on alternative systems: one used the paper-based Reception Headcount Register only, one used the Hospital Management System (HMS2), one used the SAP system (commonly used in hospitals). The four hospitals used different systems depending on the province: HMS2 (EC), SAP (GP), or eHealth (KZN).

2. **Network reliability and its effect on service delivery**
    a. Most PHC facilities reported frequent or daily network outages, which disrupted access to HPRS.
    b. These interruptions delayed client registration and limited the ability to retrieve patient folders efficiently, contributing to longer waiting times and administrative backlogs.
    c. Best practice: ecFacility 3's fully electronic system. This clinic in EC demonstrated how a reliable network and fully electronic data system improve efficiency. The facility used HMS2 exclusively, with computers in all consultation rooms. In addition to the headcount register, HMS2 replaced the paper-based PHC Comprehensive Tick Register. This integration streamlined data recording, tallying, and verification.
3. **TB ID Registers and their impact on DS-TB data quality**
    a. The location and number of paper-based TB ID Registers in a facility directly affected the capturing, verification, and overall quality of DS-TB data.
    b. Facilities using a single, centralised TB ID register were more likely to demonstrate better data concordance across systems than facilities with multiple registers maintained in different sections/rooms. There was higher agreement between TB ID registers and TIER.Net and greater consistency between webDHIS and TIER.Net.
4. **Non-standardised aggregation and verification practices of monthly DS-TB data**
    a. There was considerable variation in how DS-TB monthly data from TB ID registers were aggregated, verified, and captured into webDHIS. These inconsistencies reflect non-standard operating practices across facilities, as described in Box 1 (p. 23).
5. **Limited trust in TIER.Net data and reliance on workarounds**
    a. Across multiple facilities, concerns about incomplete or outdated data in TIER.Net undermined its use for patient management.
    b. As a result, some clinicians developed unofficial workarounds to manage patient information, such as using A4 notebooks or 'Siponondos' to manually track patient care and continuing to rely on the phased-out TB Diary. These manual tools were used to list TB-positive clients and record details like treatment initiation, appointment dates, and tests conducted, leading to duplication of data management efforts. Unlike the TB ID Registers, which capture both positive and negative test results, these informal methods focused exclusively on documenting TB-positive clients and managing their care.

Recommendations

1. Standardise and streamline patient registration systems

a. Adopt a single, standardised patient registration platform across facilities wherever possible, prioritising integration between HPRS, HMS2, and TIER.Net.
b. Phase out duplicate paper registers at facilities where electronic systems are functional and reliable.
c. Establish provincial guidelines clarifying the primary system for PHCs and hospitals and develop job aids to support adherence.

2. **Improve network infrastructure to ensure reliable data access**
    a. Invest in network upgrades and stable connectivity for facilities, prioritising those with higher patient volumes.
    b. Introduce offline data capture functionality within key systems like HPRS to prevent workflow disruption during outages.
3. **Promote fully electronic, integrated data systems**
    a. Prioritise transitioning facilities towards fully electronic systems for both patient registration and clinical data capture.
    b. Use the ecFacility 3's fully electronic system as a case study to develop a scalable implementation plan, including infrastructure requirements, workstation setup, and staff training.
4. **Centralise TB ID Registers to improve data quality**
    a. Standardise the use of one centralised TB ID register per facility wherever possible.
    b. Clearly define where the register should be located (e.g., TB room or central station) and ensure all screening points refer TB-positive clients to this register.
    c. Provide training and job aids for staff on maintaining a single, complete, and accurate TB register.
5. **Standardise aggregation and verification processes**
    a. Develop a national TB data verification SOP, detailing the step-by-step process for: aggregating TB data from source registers, verifying totals before submission, reconciling discrepancies between webDHIS and TIER.Net.
    b. Introduce monthly data review meetings within facilities, where TB focal points verify accuracy and resolve inconsistencies collaboratively.
    c. Incorporate automated data quality dashboards into webDHIS to flag discrepancies in real-time.
6. **Build confidence in TIER.Net as a reliable patient management tool**
    a. Audit and clean up TIER.Net data regularly to improve completeness and reliability.
    b. Provide hands-on training for clinicians on using TIER.Net for patient follow-up and clinical decision-making.
    c. Develop a TB data feedback loop: Share regular reports comparing TIER.Net outputs with facility registers, highlight progress and areas needing improvement.
7. **Strengthen capacity-building and technical support**
    a. Conduct refresher trainings for data capturers, clinicians, and TB focal points on correct use of TIER.Net and TB ID registers.
    b. Provide mentorship and on-site support for high-burden facilities struggling with TB data quality.
    c. Develop a helpdesk (provincial or district level) for resolving system errors, connectivity issues, and data-related queries quickly.
    d. Document and disseminate case studies on successful integration models, network upgrades, and data quality interventions.

8. **Create a data use culture**
    a. Establish a provincial TB data quality learning network where facilities can share solutions and innovations.
    b. Encourage facilities to use their own data to give staff an opportunity to see whether the data captured is a true reflection of their work.
    c. Introduce data review meetings at facility level to verify DS-TB data before submission.

Box 1. Variability in aggregating DS-TB monthly data elements and verification processes

Box 1 –

During our assessments we could not find definitive answers on how monthly DS-TB data elements were aggregated and verified from TB ID registers, and captured into webDHIS, despite our observations and interviews with diverse facility staff. The answers below illustrate the challenges posed towards finding definitive answers to these questions.

1. **How are monthly DS-TB data elements tallied/aggregated from the TB ID registers?** Who is responsible for tallying them? When/how often? What forms are the totals written/recorded on? Where are these forms filed/kept at facility level?
2. **Please describe the data verification process for monthly DS-TB data elements, before capture into webDHIS.** Who is involved in the verification of DS-TB monthly data elements? What does this process look like? Which registers are involved/compared? Who signs off on the data?

Example answers:

'Every month, as per the DHIS requirement, I generate the HIV and TB **monthly reports from TIER.net and feed them into the DHIS system**...I feed the figures that I get from TIER into DHIS as per indicators given on DHIS. There are **no paper tools that I receive from TB** [to capture into webDHIS]. **They just give me the figures** that I feed on the DHIS system, **on any piece of paper that I can discard after getting**.' - Data capturer, GP

'On a weekly basis, the **TB focal point totalises** the numbers from all the TB ID registers used in the hospital and **transcribes them into a reporting tool devised at the facility**, which she uses to report to the facility manager. This tool includes folder numbers, date of screening, wards where the client tested, as well as a summary of the ID registers. **The hospital developed an A4 exercise book in which to record the dates when TB ID registers were collected** from a ward for capturing on TIER.Net.' – Data capturer, GP

'**We don't do tally sheets at all**; it was a district decision to cut out transferring the data from the register to the tally sheet – because people can't copy directly. [I think] it is a great idea. On a daily basis, we have a laptop and a router, the CHC is huge, so they take the **laptop and router to each section** and sit here in the office, and the clinicians come one by one with the [PHC tick] register, HTS (HIV Testing Services) register, and TB ID register, and **capture it on the day**. On a weekly basis, just to trick the clinicians into making sure their files are filled in, we go through it with them, we verify the ages, we have a summary sheet, and it has day 1 to 31...So we do daily, weekly, monthly. **The OM will do this entire process at the end of the month for TB, HTS, and the [PHC] tick register**.' – Facility Information Officer, KZN

'The data capturer captures what is in the TB ID register into TIER.Net – all those patients who tested positive, who have TB NAAT. **At the end of the month, TIER will generate a monthly report (the TB ID report), and we will confirm that monthly report with the TB ID register**... Data verification is done by all the PNs

Data access

Access to DS-TB data across health system levels reflected differences in available information systems, usage, permissions, and responsibilities. At facility level, systems capture **patient-level TB data** used primarily for **operational and patient management purposes** and these data are **aggregated** for **reporting into webDHIS**. Higher levels access **aggregated programme data** for **monitoring and planning**. webDHIS was available at all the health system tiers. Participants explained that the process for acquiring credentials for webDHIS was simple, although regular log-in was required to keep the credentials active.[14] As a result, some participants – particularly at sub-district level – had expired credentials at the time of interview, and they reported relying on data clerks to access data.

Table 8 summarises which systems are typically accessible at each level, the types of TB data available, primary users, and observed and reported facilitators and barriers to access.

Table 8. Data access and facilitators and barriers by health system level

Health System Level	Systems Accessible	Types of TB Data Available	Primary Users & Purpose	Facilitators and barriers to access
Facility	- **TB ID Registers** (TB case identification register) - **Blue TB folders** (TB treatment records) - **NHLS Web Portal** (lab results) - **TIER.Net** (patient management system) - **webDHIS** (routine aggregated reporting)	- Paper-based **patient line data** in **TB ID registers** and **Blue TB folders** (TB treatment records) - Paper and electronic **lab results** (patient-level) - **Digitised patient line data** in TIER.Net - **Aggregated data elements** in webDHIS	Nurses, data capturers – used for **patient management**, compiling line lists, monthly reports, and quarterly reporting to webDHIS	• **Limited** TIER.Net/webDHIS **access** beyond clerks • **Poor maintenance of source registers**, especially TB ID registers • **Inconsistent data capturing** from patient records • Frequent **network disruptions**
(sub)District	- **TIER.Net** (read-only or local dispatches) - **webDHIS** (routine aggregated reporting) - **NHLS** dashboards	- **Patient line data in TIER.Net** for all facilities in (sub)district (not 'live') -**Aggregated DS-TB data** via webDHIS	(sub)District programme managers, HAST/TB Coordinators, M&E officers	• Some managers, coordinators **have no or expired credentials** • **Laptops underpowered** to run TIER.Net with multiple dispatches • **Reliance on clerks** for data access, slowing queries
Provincial	- **webDHIS** (provincial dashboards) - **NHLS** dashboards	**Aggregated DS-TB data** via webDHIS	Health Information Management	• **Limited to** interrogate/query **aggregate data**
National	- **webDHIS** (national dashboards)	**Aggregated DS-TB data** via webDHIS	Health Information Management, TB Programme managers	• **Limited to** interrogate/query **aggregate data**

All non-facility-based participants, from (sub)district to national participants saw the benefit of access to 'live' facility-level data. They explained that being able to see real-time data would improve oversight of facility performance, support needs, and facilitate early intervention. This was opposed to receiving TIER.Net dispatches periodically (at sub-district level) and for provincial and national participants,

[14] webDHIS logins are active for 90 days. Users receive a reminder email 14 days before their credentials expire to reset their passwords, with daily follow up reminders to avoid deactivation.

seeing those data only upon sign-off in webDHIS. Participants explained benefits and limitations of the systems, their access, and needs:

> 'TIER.NET is designed that you can only view it at that facility, unlike DHIS, where I can sit at the district office and view [aggregated] DHIS data and then be able to contact the facility. **If we have access to TIER.NET data from the facility, I think it could [improve oversight and verification].** It's only when [the facility sends] dispatches where you can access their data. The fact that TIER is not a live system, that is the main problem.' District coordinator, KZN

> 'We [as Health Information Management] have access to all the data… because on a monthly basis we **share data** with … all the programme managers at the provincial level. And also, as the DHIS policy says, we need to **give feedback to the district and facilities**. We sit and do quality checks, do outlier reports, do validation rules, do follow up analysis, check if the data is correct, and then send it back to them for them to look at their data and make corrections if need be.'
> *Interviewer: Do you have **access to line data**?*
> 'No, we can't because … at the provincial level we don't have a big computer data warehouse where we can access TIER.Net.'
> *Interviewer: Is that something you would like to have access to?*
> 'Definitely, because we have a mandate, when you're looking at our SOPs, it tells us that **we need to run quality checks at the provincial level**. So **we are limited** because it's only done at the facility level. So even us here should run that line list, to check those follow ups. **We rely on facilities to do them**, and then you see an outcome only when we upload it on WebDHIS.' Province (HIS), KZN

> 'This moment DHIS is what I've got access to… I would like to see my facilities, how they are performing**… if we can have access to [facility-level] data…to see what is happening on [TIER.Net] itself**…It can be anonymized so that we see what is a recorded on Facility A… **Because if it goes to DHIS, there's nothing much I can do**… If they say hospital so and so are not initiating patients on TB and then the data that we use is DHIS, I would have not seen the data before to check what is happening.' NDOH TB stakeholder

Participants shared how limited access to facility-level data, combined with delays in accessing data through webDHIS (due to the monthly reporting cycle), constrained them to act on the information in real time—whether for data quality improvements or patient management, depending on their role in the health system. From the above excerpts, both participants share the view that increased access would hold important benefits for data quality and the programme overall – a sentiment that was shared by all the participants interviewed. In view of this, participants across all levels, from sub-district to national, **stressed the urgent need for integrated, interoperable systems** that enable client tracing across facilities and provinces, and included integration with NHLS.

Excerpts from interviews with district and national level stakeholders further highlight the inefficiencies and complexity caused by the current use of multiple, standalone systems, while underscoring the potential, advantages, and added value that a single, integrated system could bring to the health system and service delivery:

> 'We have DHIS and TIER…We also have HPRS, which is our headcount electronic register, which is different from TIER, which is different from DHIS. But **if we could have one integrated software** we can access [everything at a single point], meaning, if we're doing **data verification**, for example, before you say a client is a defaulter, you can check the HPRS. Didn't this client come to the facility, you know? And also, you can check to SYNC, which is a CCMDD tool. Maybe the client came, probably went to SYNC. Meaning, this client was attended, but probably it was a missing from our side of capturing. Probably the file was not captured in TIER. So, meaning, [now] **you're checking on**

these three different systems. Because if you could have one integrated system, I think it would make our life much, much, much better.' District coordinator, KZN

'It is good that we integrate so that we **develop a comprehensive system**...But the challenge is to put everything that we want as a TB programme in that main stationary, because **TB has some nitty gritty** that that you need to cater for... But I think it can work that they use one clinical stationery and one system [across programmes]. If everything is catered for then we can work with [that] instead of having our **own system or our own stationeries**.' NDOH TB stakeholder

Key findings: data access

- **Need for real-time facility-level data**
  a. Sub-district, district, provincial, and national participants stressed the value of 'live' access to TIER.Net data to improve oversight, verify data, and respond to performance issues in real time.
- **Data delays limits action**
  a. Reliance on monthly/quarterly TIER.Net dispatches and post-sign-off DHIS data restricts timely intervention and limits participants' ability to influence patient management or correct data issues.
- **Fragmented systems hinder visibility**
  a. Participants highlighted frustration with having to consult multiple systems to track patients or verify data.
- **Call for integrated, interoperable platforms**
  a. There was a strong demand for a single, integrated system that enables cross-facility client tracing, synchronises NHLS results, and streamlines reporting and verification.

Recommendations

1. **Enable real-time access to facility-level data**
   a. Provide sub-district, district, provincial, and national stakeholders with secure, role-based access to facility-level TIER.Net data to support timely oversight, verification, and intervention.
   b. Develop user-friendly dashboards or digital portals that display real-time aggregate-level indicators to enable sub-district, district, and provincial managers to monitor programme performance effectively.
2. **Reduce data access delays**
   a. Minimise reliance on periodic TIER.Net dispatches and post-sign-off webDHIS reporting by implementing more frequent or automated synchronisation of facility data to central repositories, enabling near-real-time access and updates.
3. **Integrate fragmented information systems**
   a. Prioritise the development of an interoperable platform that links TIER.Net with webDHIS, HPRS, NHLS, and other key systems.
   b. Allow cross-checking of patient information, reducing duplication and gaps in TB case reporting and treatment monitoring.
4. **Strengthen patient tracing capabilities**
   a. Enable a consolidated, integrated interface where users can track clients across facilities and provinces and cross-verify with NHLS results.
   b. Support better management of 'missed' patients by flagging discrepancies between systems in real time.
5. **Build user capacity and standardise access**

a. Expand system credentials beyond data/admin clerks to include relevant programme managers, coordinators, and data users across levels.
b. Provide targeted training to ensure stakeholders can interpret, query, and act on facility-level TB data effectively.

Data use

We evaluated data use through facility-based assessments, key informant interviews, and a DHIS2/webDHIS TB data usage analysis. Table 9 provides an overview of data use at each health system tier and barriers and facilitators to optimal use.

Table 9. Overview of data use and barriers and facilitators

Health system level	Systems / Registers accessible	Data use	Facilitators and barriers to data use
Facility	- TB ID Registers - NHLS Web Portal - TIER.Net - webDHIS	**Patient management:** - Paper-based **patient folder/Blue TB treatment record** - Paper-based **TB ID register** for patient management and DS-TB monthly reporting - **Digitised patient line data in TIER.Net** to generate patient line lists, appointment lists, reports - **Paper and electronic lab results** to check and capture test results in TB ID registers, patient folders, and TIER.Net, potential for secondary capturing **Reporting:** - Paper-based **TB ID register** for DS-TB monthly reporting - **Patient folder**/treatment record digitised in TIER.Net and exported to webDHIS for **quarterly reporting**	-**Electronic systems** primarily accessible to clerks -**Insufficient capturing/completion** of source documents -**Secondary data capturing** can cause data errors -**Distrust of data in TIER.Net** leads to **use of TB Diaries or 'Siponono's'** to track care of TB positive patients -**TB ID Registers record positive and negative TB tests**, which does not facilitate management of TB positive cases -**Network issues** = offline systems
Sub-district	- **TIER.Net** (read-only or local dispatches) - **webDHIS** (aggregated) - **NHLS** dashboards	- webDHIS for reporting, TIER.Net for data interrogation, facility and patient management - **Monitor** facility **performance** - Conduct **data verification** and **quality checks** - **Track** screening, testing, treatment initiation (**care cascade**)	-Access to **delayed/out-of-date data** - **TIER.Net credentials**, and/or **expired webDHIS credentials**
	Illustrative quotes: *'I don't really use DHIS because that's what they pull from TIER. **TIER is more relevant**, because that which DHIS gives us, by the time I get to the facility, TIER data has changed again, **because they capture on a daily basis**... If I can have more regular updated information that's live for the facilities, it would assist me to assist them to manage their patients better.' Sub-district, EC* *'[The systems] are working well, but it **depends if everything is captured in TIER.Net** [which is a gap]. **We check TIER to make sure that everything that needs to be captured is captured**... When you go for [a facility] support visit **you go to TIER** [and] do the line listing. Then you will check if there's any patient waiting for TB treatment. What happened to the patient? If the patient is not there, was a tracing done? Things like those.' Sub-district, GP*		
District	- **TIER.Net** (read-only or local dispatches) - **webDHIS** - **NHLS**	- **Oversee** sub-district **performance** - Conduct **data verification** and **quality checks** - **Track** screening, testing, treatment initiation (**care cascade**) - Report to provincial level	Similarly to sub-district level participants: -Access to **delayed/out-of-date data** - **TIER.Net credentials**, and/or **expired webDHIS credentials**
	Illustrative quotes: *'I use both DHIS and TIER.Net because if there's something that I don't understand, I need to go back to TIER and check. Also, **DHIS will not tell me the number of clients who are not initiated or who are waiting to be initiated**. Hence, TIER, because it's patient-based, it can tell me. Because, for example, when I'm validating my data, I will check **how many clients were screened, how many were identified, how many were tested, how many were initiated**.' District, KZN* *'I usually use **DHIS** when it's time **for reporting**. But **when you want to see what is the problem...**it is **best to use TIER**, because TIER shows you what the facility is really doing and how are they capturing their data. Even when we want to **check patient management**, it is better with TIER. DHIS gives us numbers only.' District, GP*		

Province	- **webDHIS** (provincial dashboards) - **NHLS**	- Monitor **programme performance** - Conduct **trend analyses**	-**Integrated TB data into webDHIS** has **allowed interrogation** of TB data during **performance reviews** - **Limitations to data interrogation/support** given only aggregate webDHIS data (no TIER.Net data access)
	Illustrative quotes: *'The fact that TB data were integrated with TIER.Net, with HIV, has helped to have a more transparent view. In our performance review, TB indicators are a standing agenda item. So now they're being discussed widely by all stakeholders. You know, quarterly performance review.' Province, KZN*		
National	- **webDHIS**	- **Monitor** national **TB trends and targets** - Inform **policy and guideline** development - Allocate **funding and resources** - **Report** to international stakeholders (WHO, donors)	- **Limitations to data interrogation/support** given only aggregate webDHIS data (no TIER.Net data access)
	Illustrative quotes: *'Data is very important for our programme. It helps us helps us with policy decision-making. It helps us with implementation of various other guidelines.' - NDOH TB stakeholder*		

While coordinators and managers highlighted the need for a real-time, networked system to improve patient care and programme management, the existing visualisations and reports available in webDHIS remained significantly under-utilised. In a DHIS2 usage report (Appendix H) access to DS-TB visualisations and dashboards across KZN, GP, and EC from April 2024 to March 2025, revealed large gaps in TB data use.

Out of 3,973 active DHIS2 users, only 791 (≈20%) accessed TB visualisations, generating 18,582 total views – an average of just 23 views per user. User access by job function indicated that data capturers accessed reports the most, followed by users with a Monitoring and Evaluation (M&E) function, followed by Information Managers, Facility Managers and Programme managers, while clinicians, Subdistrict Managers and District Managers were far fewer in number, and their usage low. Use of DHIS2 TB dashboards also varied widely across provinces. KZN had the highest engagement (27.2% of users accessed reports), while EC had the lowest (8.2%).

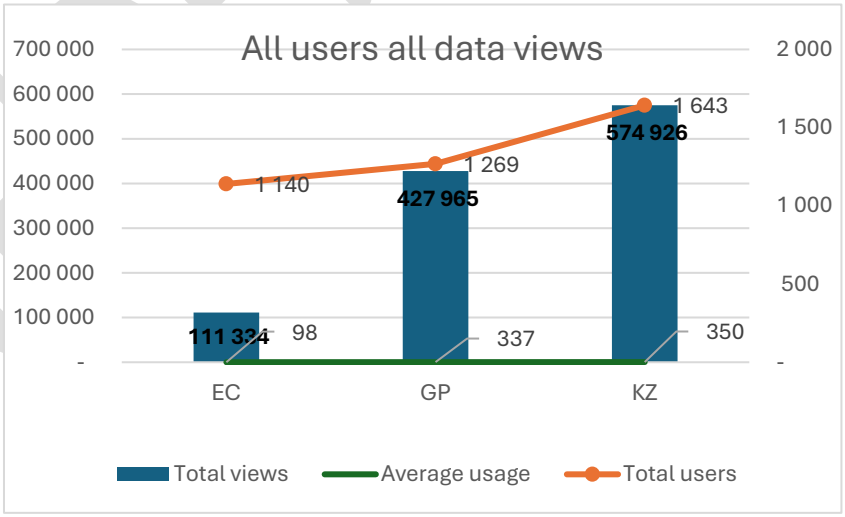


Figure 7. All users all DHIS2 data views across programmes

Compared to other programmes, TB reports are used far less frequently. Later analyses of the same quarters showed only marginal changes in active user numbers, but when looking at overall DHIS2 usage (Figure 7), users viewed reports across all programmes between 98 and 350 times per quarter on average. This indicates that TB reports in DHIS2 are perceived as less useful than those for other programmes.

A key reason lies in the mismatch between **M&E reporting requirements** and **operational reporting needs**:

- Due to the data flow processes of HIV and TB data from TIER.Net to webDHIS, there is an increasing discrepancy between the reported values in webDHIS and TIER.Net as a quarter

progresses. These differences between reported values in the two systems make it **difficult for users to rely on DHIS data for programme management**, reducing the efficiency and timeliness of data use for decision-making.

- DHIS dashboards may not be optimally configured for use in provinces. As a result, users frequently **export data from DHIS into provincial data warehouses** and tools such as **Excel, Power BI, or Tableau** to refresh custom dashboards that are more aligned with their needs. This practice bypasses DHIS visualisations entirely, meaning that usage metrics captured via SQL views, as in this report, **do not fully reflect actual data engagement**.
- A **moratorium on further TIER.Net development** means that the **NIDS 2023 indicators are not fully included in webDHIS exports**. Because these indicators are necessary for reporting on all required TB and HIV outcomes, many users continue to rely on **TIER.Net reports rather than DHIS2 dashboards**. This contributes to lower perceived usefulness and under-utilisation of DHIS for routine reporting and operational decision-making.

Overall, the findings underscore an **urgent need for a fundamental redesign of current information systems** to ensure they meet the **full spectrum of user needs**—from facility to provincial and national levels. Systems cannot remain primarily geared toward **high-level reporting**; they must deliver **real-time, actionable data and visualisations** that enable frontline users to **monitor programme performance, identify gaps in patient management, and respond quickly to service delivery challenges**. Without addressing these systemic shortcomings, TB programme oversight, patient outcomes, and resource allocation will remain compromised.

Key findings: data usage

1. **Data capturing and reporting challenges**
    a. In about one-third of facilities, data capturing processes were significantly constrained due to:
        i. Too few data capturers relative to workload
        ii. Lower prioritisation of TB data compared to HIV and PHC data
        iii. Complexity of TB data entry, including diagnostic codes and test types.
        iv. These challenges led to incomplete and delayed data entry, undermining confidence in TIER.Net and the perceived usability of electronic data for patient management and follow-up.
2. **Reliance on unofficial workarounds**
    a. Where TIER.Net data were considered unreliable, staff developed unofficial patient-tracking tools, such as A4 notebooks ('Siponongos') and the phased-out TB Diary.
    b. These tools were used to manually manage patient care, including recording: positive TB test results, treatment initiation dates, appointment return dates, follow-up test results.
3. **Limited use of TIER.Net for patient management**
    a. Appointment lists and patient line reports generated from TIER.Net were not considered reliable by many clinicians.
    b. As a result, electronic TB data in TIER.Net were in some cases under-utilised for clinical decision-making and follow-up, encouraging reliance on manual tracking systems.
4. **Under-utilisation of DHIS2 TB dashboards**

a. Despite the availability of TB visualisations and reports in webDHIS, usage remains very low. Out of 3,973 active DHIS2 users, only 791 users (≈20%) accessed TB dashboards, generating 18,582 total views – an average of just 23 views per user.
b. In contrast, across all programmes, users viewed reports 98 to 350 times per quarter, indicating that TB dashboards are used far less frequently.

5. **Misalignment between M&E and operational reporting needs**
    a. TB dashboards in DHIS2 are designed primarily for M&E reporting, where TB treatment outcomes are reported 12 months after case finding.
    b. Programme managers, however, require operational data within 6–9 months to close cases without outcomes.
    c. This misalignment significantly reduces the perceived relevance of TB dashboards for day-to-day programme management.
6. **Provincial variations in dashboard engagement**
    a. KZN had the highest dashboard usage (27.2% of users accessed reports).
    b. EC had the lowest engagement (8.2%), with GP falling between these extremes.
    c. This variation suggests differences in data culture, user capacity, and system integration across provinces.
7. **Preference for alternative reporting tools**
    a. Many users prefer exporting data into tools such as Excel and Power BI, rather than interacting directly with DHIS2 dashboards.
    b. Some users also rely on TIER.Net reports instead of webDHIS due to reporting delays, as webDHIS aligns with monthly M&E timelines rather than the near-real-time needs of operational TB management.
8. **Need for system redesign to meet multi-level user needs**
    a. Systems must balance national M&E and reporting requirements with real-time operational data needs at facility and district levels. These serve different but complementary purposes:
        i. **Monitoring, Evaluation, and Reporting requirements:** These are primarily focused on formal reporting to meet national and programmatic requirements. The emphasis is on data completeness. For example, when TB treatment outcomes are reported, all relevant outcomes must be captured and reflected in the report. TIER.Net fulfils this requirement by exporting data to webDHIS and including treatment outcomes one year after the treatment start date, ensuring full reporting compliance.
        ii. **Operational Monitoring needs:** These support real-time patient management and assist health workers and managers in ensuring that patients receive appropriate care. The focus is on timely access to interim data to monitor progress and address gaps. For example, when patients complete treatment after 6 or 9 months, facilities need access to reports within these timeframes to:
            1. Finalise data capturing,
            2. Identify patients who have not completed treatment, and
            3. Conduct follow-up to prevent treatment default.
    b. In essence, while national M&E systems require **complete, retrospective data** for reporting, facility and district teams require **timely, operational data** to support patient care and programme performance

Recommendations

1. **Improve data quality and timeliness**
    a. Increase staffing or redistribute data-capturing responsibilities to ensure TB data are entered promptly and accurately.
    b. Simplify TB data entry processes, including diagnostic codes and test types, to reduce errors and workload burdens.
    c. Implement routine data quality checks and validation procedures to identify and correct gaps early.
2. **Reduce reliance on manual workarounds**
    a. Phase out unofficial tracking tools (A4 notebooks, TB Diary) by providing digital alternatives that are easy to use and trustworthy.
3. **Prioritise TB within facility data workflows**
    a. Integrate TB data capturing and verification into routine facility workflows alongside HIV and PHC data, ensuring adequate attention and resources.
    b. Establish clear SOPs for TB data management, including responsibilities, timelines, and escalation procedures for missing or inconsistent data.
4. **Redesign TB information systems**
    a. To meet multi-level user needs by integrating real-time data, interactive visualisations, and operational reporting tools.
    b. Systems must support both national M&E requirements and facility- and district-level decision-making, enabling users to track programme performance, manage patients effectively, and respond rapidly to service delivery gaps.
    c. Prioritising usability, timeliness, and alignment with operational workflows is critical to improving TB outcomes and strengthening overall health system performance.

Data quality

To determine data quality, we *firstly* assessed the concordance between TIER.Net and DHIS2. RIPDA was used to assess concordance of monthly and quarterly DS-TB data element totals in TIER.Net and webDHIS at the selected facilities. *Secondly*, we compared the TB ID Registers with TIER.Net at facilities. *Thirdly*, we used our qualitative data to contextualise the quantitative assessments.

Concordance between TIER.Net and DHIS2

Process: Quarterly Data Elements and Indicators

Reports on the TB data in the TIER.Net databases were received from the relevant sub-districts and facilities in the EC and KZN provinces (see Table 10). The Quarterly Data Elements and Indicator data from GP were not available to us at the time for analysis.

Table 10. DS-TB data reports in TIER.Net per quarter, KZN and EC

		2023				2024			
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
TB outcome report	New DS-TB client lost to follow-up	✓	✓	✓					
	New DS-TB client successfully treated	✓	✓	✓					
	New DS-TB client treatment failure.	✓	✓	✓					
TB&HIV	TB client known HIV positive					✓	✓	✓	✓
	TB/HIV co-infected client on ART					✓	✓	✓	✓
Rx	New DS-TB client start treatment						✓	✓	✓

The reports were drawn on the same day from the TIER.Net databases at the sub-district and facility for each of the facilities. This was to ensure that any updates the facility might have made would not reflect on the sub-district database as we wanted to determine if there were significant differences between the data captured in real time at the facilities, and that which was imported into the sub-district databases. For this reason, data from GP remains excluded from our analysis.

A report for the same periods and data elements was drawn from the national DHIS2 database. The latest export reflecting in the DHIS2 was in April 2025.

Process: Monthly Data Elements

For the data quality assessment for monthly data elements, we analysed data from all 3 provinces. For this assessment, only the data elements that reflected on the TIER.Net TB Identification Report were used to analyse the data.[15] These data elements were:

- DS-TB Bacteriologically confirmed under 5 years
- DS-TB bacteriologically confirmed 5 years and older
- DS-TB clinically diagnosed 5 years and older

[15] We only received Monthly Data Input (MDI) forms for the full assessment period from one clinic in the Eastern Cape. Another clinic had only the MDI form for June 2024 available. Two others (a hospital and day hospital) supplied reconciliation forms generated from their databases. We were able to capture most of the data elements not sourced from the TIER.Net TB Identification Report from these reports. For both the quarterly and monthly data, the data from the TIER.Net reports, the MDIs and the reconciliation forms received from the provinces and the data from the DHIS2 report were captured in the DHIS2 RIPDA database. This data was downloaded into Excel spreadsheets and the deviation between the data in the TIER.Net system and the DHIS2 system was calculated using absolute values.

- DS-TB clinically diagnosed under 5 years
- DS-TB treatment start 5 years and older
- DS-TB treatment start under 5 years
- TB contact under 5 years
- TB contact under 5 years start on TPT

Deviations were graded according to severity:

0% to 5% - Not material (used green font)

>5% to 15% - Material (used amber font)

>15% - Severe deviation (used red font)

Results of analysis

For the deviation between source documents and DHIS2, we calculated the absolute deviation between the two numbers. Where aggregations of months, data elements, or facilities was done the absolute deviation for each was summed and then the % deviation was calculated dividing the absolute deviation by the source documentation data received from the facilities, instead of merely dividing the sum of the DHIS2 figure with the sum of the source figure. This was to ensure that in aggregating the data the errors would not be cancelled out by the source figures sometimes being lower than the DHIS2 figures.

Quarterly DS-TB Data Elements and Indicators

For both EC and KZN there were no discrepancies between the data from the TIER.Net databases at the sub-district and the facility, nor were there discrepancies between TIER.Net and DHIS2 for the outcome and the HIV/TB data elements. The tables below reflect the findings regarding discrepancies between the 2 databases for the treatment initiation data element.

The deviations reflected in the tables are most likely due to updates to the data in TIER.Net after the import to DHIS2 was done in April 2025. The updates will only reflect in DHIS2 when the next import is done in the first week of July 2025. The practice is to import the export files from the TIER.Net databases during the 1st week of the quarter following the most recently completed quarter.

Table 12. Treatment initiation per data element for sub-district/facility vs DHIS2, EC

Data Element Name	Deviation for Q2 to Q4 2024			
	TIER	DHIS	Abs Dev	% Dev
New DS-TB client start treatment	153	152	1	1%

Table 11. Treatment initiation per data element for sub-district/facility vs DHIS2, KZN

Data Element Name	Deviation for Q2 to Q4 2024			
	TIER	DHIS	Abs Dev	% Dev
New DS-TB client start treatment	581	586	5	1%

Table 13. Treatment initiation per facility for sub-district / facility vs DHIS2, EC

	Deviation for Q2 to Q4 2024			
Facility Name	**TIER**	**DHIS**	**Abs Dev**	**% Dev**
ecFacility 1 (clinic)	32	32	0	0%
ecFacility 2 (CHC)	16	16	0	0%
ecFacility 3 (clinic)	41	41	0	0%
ecFacility 4 (hospital)	0	0	0	0%
ecFacility 5 (clinic)	64	63	1	2%
Eastern Cape	**153**	**152**	**1**	**1%**

Table 14. Treatment initiation per facility for sub-district / facility vs DHIS2, KZN

	Deviation for Q2 to Q4 2024			
Facility Name	**TIER**	**DHIS**	**Abs Dev**	**% Dev**
kznFacility 1 (clinic)	7	7	0	0%
kznFacility 2 (CHC)	209	213	4	2%
kznFacility 3 (clinic)	52	52	0	0%
kznFacility 4 (hospital)	313	314	1	0.3%
KwaZulu Natal	**581**	**586**	**5**	**1%**

Monthly DS-TB Data Elements

The deviation shown in the tables is not the difference in the values for the two systems, but the sum of the deviations across all the months assessed. The deviation is divided by the TIER.Net value to get the percentage deviation as the TIER.Net system is taken as the source. For the tables 'Per data Element aggregated for the facilities' and 'Overall DS-TB monthly data per facility' the absolute deviation is used to avoid negative and positive deviations cancelling each other out, creating an artificially positive result for the facility. The tables 'Percentage deviation for EC Per Data Element per facility' reflect where the DHIS value is higher than the TIER.Net value.

Eastern Cape: comparison between the TIER.Net TB Identification report and DHIS2 (Monthly Data Elements)

The table below shows that the deviation between the data elements on the TIER.Net TB Identification report and those captured in DHIS2 is material. When aggregated across all facilities, none of the deviations fall within the acceptable limit of less than 5%. This may be due to the facilities using a different source document for capturing the data in DHIS2, but this would need to be verified. For each indicator, the 'under 5' age group has a larger deviation compared to '5 years and older.'

Table 15. EC Per Data Element aggregated for the facilities

EC Per Data Element aggregated for the facilities	Overall			
	TIER	DHIS	Dev	% Dev
DS-TB bacteriologically confirmed 5 years and older	583	546	37	6%
DS-TB Bacteriologically confirmed under 5 years	4	3	1	25%
DS-TB clinically diagnosed 5 years and older	70	65	11	16%
DS-TB clinically diagnosed under 5 years	10	5	5	50%
DS-TB treatment start 5 years and older	575	539	38	7%
DS-TB treatment start under 5 years	9	6	3	33%
TB contact under 5 years	137	115	52	38%
TB contact under 5 years start on TPT	38	55	21	55%

Table 16 shows the deviation of the aggregation of the data elements between the two databases per facility. Table 17 shows that ecFacility 1 (clinic) has acceptable concordance for all except one data element. Four of the facilities have higher values in DHIS2 than in the TIER.Net TB Identification report for TB contact under 5 years start on TPT – this would indicate that they most likely use other source documents for this data element. ecFacility 5 (clinic) has significant deviations across all data elements. For seven of these, the values in the TIER.Net TB Identification report are higher than in DHIS indicating that the facility uses alternative source documents to capture in DHIS. Table 15 shows the aggregation of all the data for the data elements assessed per facility in TIER.Net and DHIS2. The main contributors to the high deviation between the source documents and DHIS2 are ecFacility 4 (hospital) and ecFacility 5 (clinic). Although Table 16 shows deviations for some data elements for ecFacility 1 (clinic) and ecFacility 2 (CHC), Table 17 shows that overall there is good concordance between the TB Identification Report From TIER.Net and DHIS suggesting the use of TB Identification Report from TIER.Net as the source for these data elements. It also suggests that there is greater concordance between their TB ID registers and TIER.Net, which would improve the quality of the TB ID report generated in TIER.Net. This has been corroborated in the facility-based assessments, which showed use of a centralised TB ID register, use and maintenance of these registers according to the TB data management SOP, capture of these registers into TIER.Net, and use of standardised data input forms to aggregate and verify monthly DS-TB data elements prior to capture into DHIS2.

Table 16. Percentage deviation for EC Per Data Element per facility

% Deviation of DHIS relative to Tier across data elements	ecFacility 1 (clinic)	ecFacility 2 (CHC)	ecFacility 3 (clinic)	ecFacility 4 (hosp)	ecFacility 5 (clinic)
DS-TB bacteriologically confirmed 5 years and older	5%	2%	0%	0%	14%
DS-TB Bacteriologically confirmed under 5 years	0%	0%	0%	0%	100%
DS-TB clinically diagnosed 5 years and older	0%	-200%	0%	-33%	34%
DS-TB clinically diagnosed under 5 years	0%	0%	0%	100%	67%
DS-TB treatment start 5 years and older	0%	-4%	-1%	0%	19%
DS-TB treatment start under 5 years	0%	0%	0%	0%	75%
TB contact under 5 years	0%	12%	42%	-92%	57%
TB contact under 5 years start on TPT	-100%	-12%	-20%	0%	-900%

Table 17. Overall DS-TB monthly data per facility, EC

Overall per facility	TIER	DHIS	Dev	% Dev
ecFacility 1 (clinic)	275	270	13	5%
ecFacility 2 (CHC)	201	201	4	2%
ecFacility 3 (clinic)	389	374	27	7%
ecFacility 4 (hosp)	52	74	22	42%
ecFacility 5 (clinic)	492	396	100	20%
Eastern Cape	**1409**	**1315**	**166**	**12%**

Gauteng: comparison between the TIER.Net TB Identification report and DHIS2 (Monthly Data Elements)

As with Eastern Cape, the deviations per data element are all material with the 'under 5 age group' showing larger deviations than the older age group.

Table 18. GP Per Data Element aggregated for the facilities

GP Per Data Element aggregated for the facilities	Overall			
	TIER	DHIS	Dev	% Dev
DS-TB bacteriologically confirmed 5 years and older	342	368	44	13%
DS-TB Bacteriologically confirmed under 5 years	1	1	2	200%
DS-TB clinically diagnosed 5 years and older	415	447	58	14%
DS-TB clinically diagnosed under 5 years	11	9	4	36%
DS-TB treatment start 5 years and older	680	769	105	15%
DS-TB treatment start under 5 years	9	9	4	44%
TB contact under 5 years	163	95	84	52%
TB contact under 5 years start on TPT	2	26	24	1200%

gpFacility 1 (hospital) shows acceptable concordance for all data elements except the TB contact under 5 years. This results in a material discrepancy for the facility when the data elements are aggregated as shown in Table 18. All the facilities have major discrepancies for TB contact under 5 years. The data suggests that they all use the TIER.Net TB Identification report as the source for DS-TB Bacteriologically confirmed under 5 years and DS-TB start under 5 years. There are significant deviations for most of the data elements at gpFacility 2 (clinic), gpFacility 4 (hospital) and gpFacility3 (CHC) (Table 19, Table 20).

Table 19. Percentage deviation for GP Per Data Element per facility

% Deviation of DHIS relative to Tier across data elements	gpFacility 1 (hospital)	gpFacility 2 (clinic)	gpFacility 3 (CHC)	gpFacility 4 (hospital)
DS-TB bacteriologically confirmed 5 years and older	5%	9%	1%	-109%

DS-TB Bacteriologically confirmed under 5 years	0%	0%	0%	0%
DS-TB clinically diagnosed 5 years and older	-1%	45%	19%	-97%
DS-TB clinically diagnosed under 5 years	0%	100%	17%	0%
DS-TB treatment start 5 years and older	0%	23%	11%	-208%
DS-TB treatment start under 5 years	0%	0%	0%	0%
TB contact under 5 years	98%	-225%	-80%	80%
TB contact under 5 years start on TPT	0%	-100%	-600%	-100%

Table 20. Overall DS-TB monthly data per facility, GP

	Overall			
GP - Overall per facility	**TIER**	**DHIS**	**Dev**	**% Dev**
gpFacility 1 (hospital)	674	562	112	17%
gpFacility 2 (clinic)	202	176	54	27%
gpFacility 3 (CHC)	562	561	61	11%
gpFacility 4 (hospital)	185	425	240	130%
Gauteng	**1623**	**1724**	**201**	12%

KwaZulu-Natal: comparison between the TIER.Net TB Identification report and DHIS2 (Monthly Data Elements)

In KwaZulu Natal, DS-TB treatment start 5 years and older has an acceptable level of deviation (5%). The same pattern emerges, as in the other provinces, with the under 5 age category having larger deviations than the older age group, except for DS-TB Bacteriologically confirmed (note only 1 patient) (Table 21). The most likely cause is the use of a different source to capture the data in DHIS2.

Table 21. KZN Per Data Element aggregated for the facilities

KZ Per Data Element aggregated for the facilities	**Overall**			
	TIER	**DHIS**	**Dev**	**% Dev**
DS-TB bacteriologically confirmed 5 years and older	319	267	62	19%
DS-TB Bacteriologically confirmed under 5 years	1	1	0	0%
DS-TB clinically diagnosed 5 years and older	411	411	26	6%
DS-TB clinically diagnosed under 5 years	14	17	7	50%
DS-TB treatment start 5 years and older	656	661	31	5%
DS-TB treatment start under 5 years	12	18	8	67%
TB contact under 5 years	65	83	38	58%
TB contact under 5 years start on TPT	9	63	54	600%

Overall, there were material deviations at all the facilities with kznFacility 1 (clinic) having the highest (Table 22, Table 23). TB contact under 5 years shows poor concordance across all the facilities, with only kznFacility 4 (hospital) showing no deviation for the under 5 contacts started on TPT.

Table 22. Percentage deviation for KZN Per Data Element per facility

% Deviation of DHIS relative to Tier across data elements	kznFacility 1 (clinic)	kznFacility 2 (CHC)	kznFacility 3 (clinic)	kznFacility 4 (hospital)
DS-TB bacteriologically confirmed 5 years and older	38%	26%	-8%	6%
DS-TB Bacteriologically confirmed under 5 years	0%	0%	0%	0%
DS-TB clinically diagnosed 5 years and older	0%	-8%	75%	0%
DS-TB clinically diagnosed under 5 years	0%	0%	-100%	-18%
DS-TB treatment start 5 years and older	29%	10%	5%	-11%
DS-TB treatment start under 5 years	0%	0%	-100%	-63%
TB contact under 5 years	78%	-95%	67%	100%
TB contact under 5 years start on TPT	-100%	-567%	-100%	0%

Table 23. Overall DS-TB monthly data per facility, KZN

	Overall			
KZ - Overall per facility	**TIER**	**DHIS**	**Dev**	**% Dev**
kznFacility 1 (clinic)	24	14	12	50%
kznFacility 2 (CHC)	653	714	105	16%
kznFacility 3 (clinic)	128	121	11	9%
kznFacility 4 (hospital)	723	752	53	7%
KZN	**1528**	**1601**	**181**	**12%**

Summary of the deviation between TIER.Net TB Identification Report and DHIS2 per data element across all facilities assessed

When analysing the data across all the assessed facilities, the under 5 years data elements show the most significant deviations (Table 24). The value in DHIS2 is significantly higher which would indicate that the values are derived from another source.

Table 24. Summary of the deviation between TIER.Net TB Identification Report and DHIS2 per data element across all facilities assessed

Data Element	TIER	DHIS	Dev	% Dev
DS-TB bacteriologically confirmed 5 years and older	1244	1181	143	11%
DS-TB Bacteriologically confirmed under 5 years	6	557	47	783%
DS-TB clinically diagnosed 5 years and older	896	15	9	1%
DS-TB clinically diagnosed under 5 years	35	923	95	271%
DS-TB treatment start 5 years and older	1911	789	113	6%
DS-TB treatment start under 5 years	30	742	76	253%
TB contact under 5 years	365	119	95	26%
TB contact under 5 years start on TPT	49	207	94	192%

Summary of the deviation between TIER.Net TB Identification report and DHIS2 per facility

Of the 4 Gauteng facilities, 3 showed deviations greater than 15%, with gpFacility 4 (hospital) having the least concordant data overall. Two of the 4 KwaZulu-Natal facilities showed deviations greater than 15%, and kznFacility 1 (clinic) had the 2nd least concordant data of all the assessed facilities. Two of the 5 Eastern Cape facilities also showed high deviations, but the other 3 Eastern Cape facilities had the most concordant data overall, with ecFacility 1 (clinic) and ecFacility 2 (CHC) showing deviations within the acceptable range (Table 25).

Table 25. Summary of the deviation between TIER.Net TB Identification report and DHIS2 per facility

	TIER	DHIS	Dev	% Dev
ecFacility 1 (clinic)	275	270	13	5%
ecFacility 2 (CHC)	201	201	4	2%
ecFacility 3 (clinic)	389	374	27	7%
ecFacility 4 (hospital)	52	74	22	42%
ecFacility 5 (clinic)	492	396	100	20%
gpFacility 1 (hospital)	674	562	112	17%
gpFacility 2 (clinic)	202	176	54	27%
gpFacility 3 (CHC)	562	561	61	11%
gpFacility 4 (clinic)	185	425	240	130%
kznFacility 1 (clinic)	24	14	12	50%
kznFacility 2 (CHC)	653	714	105	16%
kznFacility 3 (clinic)	128	121	11	9%
kznFacility 4 (hospital)	723	752	53	7%

Comparison between the source MDI forms/reconciliation reports and DHIS2 from the four facilities in EC that provided them

In four facilities in EC, the source MDI and reconciliation reports were available. The comparison presented here focuses on the data elements not reflected in the TIER.Net TB Identification report. Table 26 shows for which months the MDI form was available for analysis. Table 27 below aggregates the data from the four facilities and where there were gaps in the data for a given facility, the facility was excluded from the aggregation.

Table 26. Availability of MDI forms for analysis

Facility	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ecFacility 1 (clinic)	✓	✓	✓	✓	✓	✓	✓	✓	✓
ecFacility 2 (CHC)	✓	✓	X	✓	✓	✓	✓	✓	✓
ecFacility 4 (hospital)	✓	✓	✓	✓	✓	✓	✓	✓	✓
ecFacility 5 (clinic)	X	X	✓	X	X	X	X	X	X

The TB screening data shows no deviations which would suggest that this data source is used to capture the data in DHIS2. In general, the deviations between DHIS2 and these source documents are less significant than those between the TIER.Net TB Identification Report and DHIS2. This would suggest that these source documents may also be used to capture the DHIS2 data elements that were compared with the TIER.Net TB Identification report above.

Table 27. Comparison between the MDI forms/reconciliation reports and DHIS2 from the four facilities in the EC that provided them

	Overall			
Data Element	MDI	DHIS	Dev	% Dev
TB test under 5 years using TB Nucleic Acid Amplification Test (NAAT)	97	73	24	25%
TB contact 5 years and older	493	535	-42	-9%
TB contact 5 years and older start on TPT	237	256	-19	-8%
Client 5 years and older eligible for TB test	1998	2101	-103	-5%
Child under 5 years eligible for TB test	78	74	4	5%
TB test 5 years and older using TB Nucleic Acid Amplification Test (NAAT)	2003	2088	-85	-4%
Screen for TB symptoms 5 years and older	57793	57793	0	0%
Screen for TB symptoms under 5 years	10353	10353	0	0%

Comparison of TB Identification Register/s with TIER.Net

We compared the number of clients with a TB positive test result in the TB ID register/s with the number of clients started on TB treatment in TIER.Net per facility, for the period: Oct to Dec 2024 in the Gauteng and Eastern Cape provinces. KwaZulu-Natal was excluded as this activity was added after we had left KZN. The aim of this assessment was to evaluate linkage between the TB ID Register/s and TIER.Net and to identify challenges and opportunities in their maintenance and use. Agreement between these two data sources indicate potential gaps in the pathway of presumptive TB clients from positive screen to TB testing, and treatment initiation (with capture on TIER.Net for continued management).

Table 28 shows the number of TB ID registers in use at each facility, the aggregated number of TB positive cases in the TB ID registers per facility, the number recorded in TIER.Net as starting TB treatment, along with the number of matched cases in the TB ID register/s and TIER.Net. We furthermore identify where discrepancies lay, with the TB ID Registers and/or with TIER.Net.

We found that most of the PHC facilities had 1 or 2 TB ID Registers in use. Three GP facilities had the highest number of registers in use, with 3, 5, and 9 for gpFacility 4 (hospital), gpFacility 3 (CHC), and gpFacility 1 (hospital) respectively.

None of the facilities showed full alignment between TB ID Registers and TIER.Net. In all but one facility, TIER.Net recorded more treatment initiations than were listed as testing positive for TB in the TB ID Registers. Across all facilities there were cases missed in both the Registers and TIER.Net. These findings corroborate findings from the facility observations and key informant interviews that TB ID Registers were not consistently used when clients tested for TB, especially in facilities with many registers (see for example gpFacility 3 (CHC) and gpFacility 1 (hospital) in Table 28) and that all Registers were not systematically captured into TIER.Net. The particularly low percentage match (11%) for gpFacility 4 (hospital) is due to the three TB ID Registers poor capture into TIER.Net. None of the clients recorded in the 'ward round' register (n=43) – a register used across multiple wards – were entered into TIER.Net, and the register located in the TB ward itself had 6 of its 8 client records not captured into TIER.Net.

Table 28. Comparison of number of clients with a positive TB test in the TB ID register/s with clients started on treatment in TIER.Net, by facility, for the period: Oct–Dec 2024

Facility	No. of TB ID Registers in use*	No. of TB positive cases in TB ID register	No. started on TB treatment in TIER.Net	Matched cases: TB ID Register, TIER.Net (n=)	Matched cases: TB ID Register, TIER.Net (%)**
gpFacility 1 (hospital)	9	99	90	65	52%
gpFacility 2 (clinic)	2	33	33	19	40%
gpFacility 3 (CHC)	5	84	107	82	75%
gpFacility 4 (hospital)	3	64	17	8	11%
ecFacility 1 (clinic)	2	31	44	30	67%
ecFacility 2 (CHC)	1	22	31	16	43%
ecFacility 3 (clinic)	2	39	56	28	42%
ecFacility 5 (clinic)	1	64	104	38	29%

*at time of evaluation

** calculated as a Match Rate

We identified the following consistent gaps across facilities:

- **TB ID Registers are not optimally completed**
  - 'Test result' and 'treatment start date' were the most common incomplete fields, and 'treatment start date' more so than 'test result'. In a few cases facility-based Registers contained no further information other than the client's personal details and details of their screening, with no indication that a TB test was conducted.
  - The 'Totals' row at the bottom of each Register's page was inconsistently completed, and in most cases not at all. The same held true for the 'Summary sheet' at the end of the Register, which is meant to be verified by the relevant clinicians (e.g., TB nurse), used to populate the Monthly Data Input (MDI) form with the DS-TB monthly data elements totals, verified by the operational manager, and captured into webDHIS.
  - The TB ID Registers used for Community Outreach most often had no treatment start dates recorded, likely due to clients being referred to facilities to start treatment.
  - In a hospital, the TB ID Register used in Casualty had no test results or treatment start dates recorded for clients.
  - We found cases of duplicate clients in the TB ID Registers, with the same client recorded in more than one TB ID Register at the facility. This was the case in facilities with more than one TB ID Register, in which a client was entered onto the TB ID Register in one ward and also referred for testing to the TB ward or room.
- **Significant inconsistencies between TB ID Register/s and TIER.Net**
  - There were numerous TB patients in the ID register, but who were not found in TIER.Net.
  - There were also numerous TB patients recorded in TIER.Net, but who were not recorded in the ID register.
  - Clients who had treatment start dates in the TB ID Register, but Transferred Out to another facility, were frequently not found in TIER.Net; in one case a death noted on the Register was not recorded in TIER.Net.

Qualitative exploration of data quality

We drew on facility-based assessments and key informant interviews to explore experiences and perceptions of DS-TB data quality. This included comparison of clients identified as testing positive for TB in the TB ID registers against those captured on TIER.Net as having started TB treatment in the period: Oct to Dec 2024. These results serve to qualify and contextualise the concordance assessment of TIER.Net and webDHIS.

Below we discuss persistent issues identified at facility-level with regards to 1) non or variable adherence to TB data SOPs, 2) TB data capturing, and 3) substandard and inconsistent TB data verification which affect data quality.

Variable adherence to TB data standard operating procedures

Our **facility-based assessments** showed TB screening data elements captured in the PHC comprehensive tick registers were consistently recorded and captured into webDHIS daily/weekly. The location and number of TB ID registers impacted capturing, verification, and quality of DS-TB data. In most cases, availability and maintenance of a centralised TB ID register improved the DS-TB monthly source data and verification processes, as was the case in ecFacility 1 (clinic).

The source registers from which monthly DS-TB data elements should be aggregated/totalled and verified before being captured into webDHIS are the PHC comprehensive tick register, which includes

two TB screening data elements (for under and over 5s), and the TB Identification Register/s, which includes all presumptive TB data.

The process is as follows, providing data in the form of a TB cascade which becomes the basis for data verification and validation at facility and (sub)district levels:

1. All clients should be screened for TB (TB symptom and TB risk factors, including TUTT criteria) with each facility visit, and this service documented with a tick on the PHC Comprehensive Tick Register. The register records screened for TB and does not differentiate between symptoms/TUTT risk factors.
2. All clients who are eligible for a TB test (screened with one or more TB symptoms or risk factors including TUTT) should be recorded in the TB ID register.
3. All clients' test results (negative and positive) should be recorded in the TB ID register.
4. All clients with a positive TB test should have a TB treatment start date recorded in the TB ID register.

Across the three provinces, (sub)district participants, whose primary responsibility lay with ensuring compliance with HAST and TB guidelines and SOPs at facility-level, reported variable and inconsistent use and completion of the TB ID registers, which are the basis for monthly DS-TB data elements captured into webDHIS and aligned with the NIDS, evidenced in these excerpts from interviews.

> 'TIER.Net has the TB module where **they need to capture this TB case identification register daily on the system** and monthly they just do the summary sheet where the **summary sheet will feed DHIS**. So **that process is not 100% done**, especially on the high impact facilities. The hospital data I can say is not the true reflection because they are not feeding [using/completing] the TB case identification registers.' – District, GP

> 'We are discouraging the use of any stationery that is outside the prescribed stationery, like **those A4 books that they [facility staff] are using**. Reason being, the source documents that we are using to capture on TIER.NET, it's a TB ID register and the client folder. Those are just the prescribed documents. **The minute you are having other sources, we find gaps in the recording in the prescribed registers**. So that is why we always discourage that because we need the recording to be complete in the prescribed stationery for accurate capturing to happen.' – District, KZN

Some participants also referred to the issue of ownership for TB data at facility level and how this influenced adherence to guidelines and SOPs, as well as the maintenance of TB-related stationery and registers. The routine shifting of staff to different programmes and sections affected the consistency with which source registers were maintained. All interview participants also expressed serious concern about the impacts of US funding cuts on the quality of TB data on three fronts: data capturing, data verification, and patient management.

Gaps in TB data capturing

Participants emphasised the importance of consistent, timely, and accurate data capturing at facility-level, explaining that once data are reported upwards, there is limited scope for corrections, i.e., data can only be corrected at facility level. They shared persistent issues with facility-level data capturing, which included incomplete source TB ID registers as reported above, the use of multiple and variably maintained TB ID registers at a single facility, power differentials between data capturers and clinicians which made it difficult for data capturers to hold clinicians accountable for maintaining source

registers, limited investment into human resources for data capturing, and less of a focus on TB data capturing (as compared to HIV). A district-level manager explained:

> *'You will find that the **summary on the TB ID register is not filled** and then the data capturers will now be **tempted to generate a TIER.Net report and populate DHIS**. Now you're **having TIER.NET as a source for DHIS**. So that means whatever errors or gaps that happened when the DC was capturing on TIER.Net, it will be translated directly to DHIS as they are. Unlike when somebody is going to capture from the TB ID register summary.' – District, KZN.*

Substandard and inconsistent TB data verification practices at facility level

Participants at (sub)district level shared that TB data were not consistently verified before capture into webDHIS. The inconsistent use and maintenance of source registers (i.e., TB ID registers), as well as inconsistent processes for aggregating/totalling the TB ID registers contributed to errors and inconsistencies in upwards data streams.

> *'Our **facilities don't do data verifications**. And because of that, sometimes when the data comes to us, we do validations of the data, and we send it back to them to do the corrections. But then the data's already at the provincial office because it's on DHIS. So, **it's not a true reflection**, but it's not the fault of province or district level, it is mainly at the facility where we don't verify the data prior sending to the next level.' Sub-district manager, EC*

> *'**Data verification** by the facility managers is **not consistent**. That is when you find outliers. And when you go back and check, you find that the compiler of the register is the clinician. But there is **no signature of the second person who verified** that this is the correct information that should be fed into the facility's data system. So, it's usually data verification.' District manager, KZN*

> *'[Facilities] don't capture on time, they **don't actually verify** their data. Then obviously we'll end up with that data, which will have a lot of **gaps or duplicates**.' TB programme, NDOH*

At (sub)district level, managers and coordinators used data from webDHIS to identify errors or outliers (according to the TB cascade presented earlier). These data were also used to identify (or triage) facilities requiring intervention and supportive supervision based on performance.

Perceived impact of recent changes in US funding on the TB programme and TB programme data

All interview participants anticipated cuts in US government funding to negatively impact the TB programme and TB programme data, specifically mentioning the data capturing, verification, and patient management. There was some nuance based on the type of support provided by local implementing partners in each setting, see Table 29 below.

Table 29. Perceived impact of recent changes in US funding on the TB programme and TB programme data – illustrative excerpts from interviews

Topic	Illustrative excerpts from interviews
Data capturing	'**Most of our data capturers that was capturing on TIER, they were from our partners**. The facilities don't have staff …At the CHC they initiate about 20 plus patients on TB treatment per month. So during that time it was difficult because there was **no one to capture**. There was only one data capturer from the Department [of Health] and they could not have managed. We had piles and piles of files that were just waiting to be captured.' Sub-district, GP
Data verification	'[We are impacted], especially when it comes to TB data. Because when we had our supporting partner Aurum, they had **data quality officers** where they would go out to the clinics and go and **verify the data** with the Sisters on a regular basis. With me being the only one in the sub-district between 26 clinics, 10 hospitals, it becomes [impossible] for me to do that. We have only 2 supervisors in our sub-district as well. When we lost Aurum due to the funding that was stopped it did create the **gap for supervision and support and also for quality data**. We really were negatively affected when Aurum withdrew from [the] district.' Sub-district, EC

	'We're ready for a really severe impact on the TB programme. Because they [the implementing partners] were **our eyes- direct eyes- in the facilities** and they will see the **gaps** immediately and highlight them to us so that we go and **support the facilities**.' District, GP
Patient management	'In our sub-district, they did not assist so much with data capturing, because data capturers are provincially employed. But they did **help us to look at our data, that our patients are traced**. The NGO provided Community Health Workers mostly, so tracing patients is going to be a problem, and **it will influence our outcomes**. You can't trace everyone who defaults.' Sub-district, EC

Key findings: data quality

1. **There were high levels of concordance between TIER.Net and DHIS2 for the quarterly DS-TB outcomes data.**
    a. This indicated that the data transfer processes and the systems involved are functioning effectively, allowing for accurate reporting of DS-TB treatment outcomes and related indicators.
    b. We did not assess the quality of data in TIER.Net in this evaluation, and we do not know the quality of the quarterly data, only that TIER.Net data are pulled into webDHIS properly.
2. **There was significant variability in concordance with the monthly DS-TB data elements**, which rely on paper-based or mixed (paper and electronic) data collection methods.
    a. Deviations ranged from material (>5% to 15%) to severe (>15%), indicating serious concerns regarding data integrity.
    b. This inconsistency may stem from several factors:

        - Data entry errors: The reliance on manual data entry in paper-based systems increases the likelihood of human error. Inaccuracies during data transcription from paper to electronic formats leads to discrepancies.

        - Documentation gaps: Inconsistent use, maintenance, and verification of TB ID registers for capture into webDHIS, especially where multiple TB ID registers were in use. In facilities with a centralised TB ID register, these processes were more consistent.

        - Lack of standardised input forms and processes: Facilities frequently deviated from the SOPs that guide DS-TB data management at facility level, including the use of standardised data input forms for aggregating and verifying monthly DS-TB data elements prior to capture into webDHIS. This variability in processes for aggregating data from source TB ID Register/s negatively impacted agreement in the data in TB ID Registers, TIER.Net, and webDHIS.

        - Data entry gaps and delays: Significant data entry challenges were found with the maintenance of routine DS-TB data in TIER.Net, related to limited data capturing capacity and prioritisation of HIV and other programme data over TB. leading to distrust of the accuracy and timeliness of the data. which led to the development and use of unofficial TB 'Siponongos' with which clinicians could track client treatment journeys manually. In this way, the TIER.Net system which is meant to facilitate patient management, was not used for its purpose and clinicians found workarounds to meet their data needs.

        - Inadequate training: Staff are not adequately trained in data collection protocols and the importance of accurate reporting. This lack of understanding leads to

limited ownership and prioritisation of TB data at facility-level and inconsistent data capturing, aggregation, verification, and reporting.

- Communication barriers: Ineffective communication between facilities and sub-districts regarding data discrepancies prevents timely identification and resolution of issues.

3. **There was significantly more discordance in the monthly data elements for the under 5 age group compared to the ≥5 years age group.**
    a. This is likely due to smaller numbers of patients in this age category
4. **TB ID Registers (key source document) are not optimally completed**.
5. **Cuts in US government funding** were expected to negatively impact TB data capturing, verification, and patient management.

Recommendations

1. **Revisit standardised data collection**
    a. Review the SOP to assess where revisions are needed to clarify tools and processes for data collection.
2. **Enhance training**
    a. Provide regular training for healthcare workers on proper data entry and the importance of accurate reporting.
    b. Ensure that all staff are familiar with the data elements and their definitions.
3. **Improve source documentation**
    a. Ensure that all facilities maintain complete and accurate source documents, such as TB identification registers and Monthly Data Input (MDI) forms, to support data verification processes.
4. **Regular audits**
    a. Conduct periodic audits of data quality and concordance between TIER.Net and DHIS2 to identify and address discrepancies in real-time.
5. **Timely data updates**
    a. Streamline the process for updating data in both TIER.Net and DHIS2 to ensure that changes in one system are reflected in the other promptly. Consider more frequent data imports to DHIS2.
6. **Facilitate communication**
    a. Enhance communication between facilities and sub-districts to clarify data discrepancies when they arise.
    b. Use the data flow feedback loop for addressing issues identified during audits. The RIPDA audit tool can be used to provide feedback on discordant data and develop an improvement plan
7. **Utilise technology**
    a. Explore the use of data management tools and software that can automate data reconciliation processes and flag inconsistencies for further review. An example would be to enhance RIPDA to the comparison and validation of data between webDHIS and TIER.Net (EMR system). Here's how this can be achieved:

    Steps to Automate Data Reconciliation

1. *Data Integration*: Use ETL (Extract, Transform, Load) tools to gather data from various sources (e.g., databases, APIs, spreadsheets). Ensure data is standardized in format for easier comparison.
2. *Data Comparison:* Implement scripts or software that automatically compare datasets based on predefined criteria (e.g., matching IDs, transaction amounts). Use SQL queries or Python scripts with libraries like Pandas to perform these comparisons.
3. *Flagging Inconsistencies:* Set up rules to identify discrepancies (e.g., mismatched records, missing entries). Use conditional logic to flag these inconsistencies. This can involve sending alerts via email or logging them in a dashboard.
4. *Reporting:* Generate automated reports summarizing the reconciliation status, highlighting inconsistencies for further review. Use visualization tools to present the data in an easily digestible format.

8. **Engage stakeholders**
    a. Involve stakeholders, including healthcare workers and data managers in discussions about data usage and reporting needs to better align systems with practical requirements.
9. **Document best practices**
    a. Document and share best practices from facilities with low deviation rates to encourage replication of successful strategies in other areas.
10. **Advocate for diversified and sustainable funding streams to safeguard TB data capturing, verification, and patient management processes**
    a. This may include engaging provincial and national health departments to allocate contingency budgets, strengthening partnerships with alternative donors, and optimising existing resources through integration of systems and task-sharing to minimise the impact of reduced US government funding.

Discussion and recommendations for impact

Over the past two decades, DS-TB information management in South Africa has undergone major shifts – from a fully paper-based, nurse-managed system which required laborious manual aggregation, to electronic platforms (ETR.Net, later integrated into TIER.Net) that expanded access and decentralised data entry to clerks and capturers. These reforms brought TB closer to the digitised, integrated models pioneered by the HIV/ART programme, improving accessibility across health system levels.

Yet, these gains remain constrained. The system has evolved within rigid structures that limit space to design a fit-for-purpose DS-TB information system. Instead of streamlined, patient-centred, and efficient processes, facilities contend with multiple registers, duplicative entries, and complex workflows that drain time and still fail to generate reliable data. Our assessment revealed persistent gaps between what the system provides and what users need across all health system levels.

Moreover, the current approach as set out in SOPs is onerous, inefficient, lacks clarity, and ultimately places unreasonable expectations and demands on facility-level staff to implement, setting them up for failure. Minor fixes – like retraining staff to manage unwieldy registers and duplicative SOPs – cannot solve the problem. What is needed is decisive simplification: cutting unnecessary registers, reducing duplication, and radically streamlining data collection, verification, and reporting. Without this, DS-TB data will remain fragmented and untrustworthy, undermining data use for patient management and national reporting.

As South Africa prepares for NHI and an integrated EHR/EMR, the country faces a critical choice: to take the opportunity to purposefully redesign the DS-TB data systems with a vision for the future, or to continue to elaborate on and manoeuvre within the constraints of the current inherited, unfit-for-purpose systems.

We make the following recommendations for design of a simpler, efficient, fit-for-purpose system.

Recommendations for impact	Aspect/s addressed
Discontinue the TB Identification Register and Monthly Data Input forms in favour of a digitised system for data collection and management. The current monthly DS-TB recording and reporting processes are overly complex, burdensome for facilities, and yield unreliable data. Digitising these could simplify data collation. Screening elements already flow reliably from the PHC Comprehensive Tick Register to webDHIS and should remain. By contrast, TB ID Registers are poorly maintained, inconsistently captured into webDHIS and TIER.Net, and serve no purpose beyond reporting – making them a major source of missed or inaccurate data. In practice, clinicians must first record patient details at testing, then manually update results once received – often across multiple registers, kept by different staff in different parts of the facility. This duplication is inefficient and unreliable. We therefore recommend that TB ID Registers and their associated MDI forms be discontinued. Presumptive DS-TB data elements should be reviewed, with only essential fields retained. DS-TB testing data should be automatically fed into a digitised register from the NHLS. Facility staff should capture only non-automated information, in real time, reducing duplication and freeing time for patient care.	Data quality

Automate patient tracking and linkage to care The DS-TB health information system should be designed to automatically update with NHLS results and allow reports at facility-level to flag patients with positive test results who remain unlinked to care (i.e. generate a TB treatment action list). An integrated, interoperable system across facilities should indicate if and where treatment initiation has occurred. Treatment initiation should be captured in real-time to reduce the need for follow-up. Facilities should only be required to act on cases that remain unlinked to care. Clear responsibilities for follow-up must be defined across facilities to prevent overburdening frontline staff.	Data access, usage, quality
Digitise/implement an electronic treatment record for TB to strengthen patient management and reporting on treatment outcomes Clinicians need a simple tool to track treatment initiation, return visits, sputums due, and outcomes. Current systems are undermined by too few clerks, low prioritisation of TB data, and incomplete stationery, forcing reliance on paper-based workarounds. A real-time, clinician-entered TB EMR (on a tablet for example) would eliminate secondary data capturing, improve accuracy, and generate reliable reports and line lists for patient management. Built to interoperate with NHLS, the system should automatically update with lab results, ensuring timely sputum monitoring and reducing administrative burden.	Data access, usage, quality
Implement health information systems with processes that enable access to real-time data. Managers and coordinators across health information management and HAST/TB consistently emphasised the critical need for real-time, facility-level data to support patient management and validate reporting. Outdated, periodic data dispatches obscure visibility, delay intervention, and shift an unreasonable burden onto facilities to 'get everything right.' It is therefore essential to design and implement systems that provide real-time access at the facility level. This requires minimising reliance on monthly DS-TB dispatches and post-sign-off webDHIS reporting, and instead enabling automated, frequent synchronisation of facility data with central repositories. Ideally, a fully networked system should allow data to be viewed seamlessly from any tier of the health system, ensuring oversight, accountability, and timely action.	Data access, usage, quality
Build user capacity and standardise access to digital systems in use across staff cadres Data access controls should be improved to ensure that staff responsible for data have reliable credentials and system access. Expand system credentials beyond data/admin clerks to include relevant programme managers, coordinators, and data users across levels to avoid sharing of credentials. Provide targeted training to ensure stakeholders can interpret, query, and act on facility-level TB data effectively. Establish a helpdesk (provincial or district level) for resolving system errors, connectivity issues, and data-related queries quickly.	Data access, usage, quality
Revise and align DHMIS policy and SOPs to reflect integrated data management Following development of simplified, streamlined processes for DS-TB data management at facility-level, review and update DHMIS policy and SOPs to fully reflect the integrated nature of TB/HIV data management within primary care and webDHIS. Eliminate siloed references in existing documents and clearly define TB/HIV data as part of routine primary healthcare service data, with unified reporting standards.	Data quality

Together, these recommendations aim to transform the DS-TB information system from a cumbersome, duplicative, and error-prone set of registers into a streamlined, digital, real-time platform

that better supports facility-level users and national reporting. By discontinuing redundant paper registers and forms, automating data flows (especially lab results), and implementing clinician-entered electronic treatment records, the system would reduce duplication, delays, and errors. Real-time access and automated synchronisation across health system tiers would enable clinicians and managers to see current, accurate data, improving both decision-making and accountability. Expanding access and training for all staff cadres, plus aligning SOPs and policy to the new simplified workflows, would increase capacity, clarify responsibilities, and reduce the burden on facility staff. Altogether, this redesign would enhance data quality (accuracy, completeness, consistency), increase data usage (for patient care, follow-up, and treatment outcomes), and ensure data access when and where needed, thereby better meeting what users at all levels have expressed they require

Strengths and limitations

This analysis has several strengths that enhance the relevance and credibility of its findings. First, we triangulated multiple data sources—facility-based assessments, in-depth interviews, and data concordance assessments—to develop a contextualised understanding of data flow, access, use, and quality across varied settings. This multi-method approach ensured that the analysis was comprehensive and not reliant on a single perspective. Second, provinces, districts, and facilities were purposively selected to represent a range of contexts. Data were collected from three provinces with the highest reported TB burdens in South Africa, making them critical for understanding TB data management practices. Within these provinces, facilities were chosen to reflect diversity in size, type, patient volume, and services offered. Third, in-depth interviews were conducted with stakeholders across multiple levels of the health system, including facility, district, provincial, and national representatives involved in TB programme management and TB data. This allowed for a nuanced understanding of programme implementation from different vantage points. Finally, the same team of trained research assistants conducted data collection across all sites, ensuring consistency in approach. Their direct involvement in both data collection and analysis contributed to generating context-rich insights.

However, several limitations should be considered when interpreting the findings. First, the 13 participating facilities were clustered within one district per province. While purposively selected to capture variation, the findings may not be generalisable to all settings. In the EC an additional facility was added at the request of the Think Tank as no DS-TB cases were reported at that facility int eh previous year. We therefore did a rapid, one-day assessment of key data processes at this facility. At all other facilities data collection occurred over the course of a week as per the protocol. Second, the data reflect a specific period of collection (one month per province between November 2024 and May 2025) and may not fully capture evolving practices in TB data management. Third, uptake of key informant interviews was limited, with only 12 interviews completed (34% of those contacted). Participant representation was skewed towards sub-district and district coordinators and managers (HAST, TB, and HIS), with fewer participants at provincial and national levels, and uneven distribution across the three provinces.[16] Lastly, the data quality assessment excluded quarterly data for GP as they were unable to provide this data after numerous requests. For the monthly DS-TB data assessments, it was not possible to compare source documents (the MDI forms) for all facilities with webDHIS, as specified in SOPs, as these source documents were not consistently available. In most of these analyses we therefore compared the TIER.Net TB Identification Report with webDHIS.

[16] For example, only KwaZulu-Natal included provincial-level participants.

Dissemination plan

As part of the dissemination plan, an anonymised summary technical report will be shared electronically with the national, provincial, and (sub)district stakeholders through whom approval for this project was obtained. In addition, site-specific summary reports will be provided to each of the 13 participating facilities via their facility managers. These reports will present the key findings from the assessment and include recommendations aimed at improving TB data access, use, and quality. The full anonymised technical report will also be made available to these stakeholders and facilities.

Findings and recommendations will further be shared with the TB Think Tank and representatives from the National Department of Health through a written report and a formal presentation. To extend the reach of the work, the research team, together with the TB Think Tank, will prepare a manuscript for submission to a peer-reviewed journal and will present the findings at relevant academic and public health conferences.

Acknowledgements

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Appendix A. Logic of data collection for DAART-TB project

DAART-TB: Logic of data collection tools (facility observations and interview guides) Nov 2024

...the consistency of facility-based TIER files up the chain and to DHIS (data integrity).	• How source documents are captured into the TIER.Net system. • And identify potential gaps in capturing paper-based data into the electronic system.	<u>TB clinicians, clerks, FM:</u> • About TB data management at facility level. • How are patient data captured into TIER.Net - from patient folders, paper TB registers, other sources? By whom? How regularly? What are the challenges/gaps in this process? What are the things that work well in this process? • How are TB data reported? What reports are drawn, from which systems/sources? By whom/whose responsibility? How regularly? For what purpose/use? • How are TB data reported to sub-district level? What does this process look like? When does this happen? Who is involved and how? What is the perceived quality/accuracy of the data reported? • What are the gaps/challenges in this exporting/reporting process? What works well? What needs to change? What needs to stay the same? <u>SD/district/provincial TB managers and information managers:</u> • Their perceptions and experiences of the consistency of TB data across different health systems levels and systems. • What are the reasons for consistencies/inconsistencies? • What are key considerations/factors at each health systems level? What are their suggestions for maintenance/improvement of TB data.
...current data usage (which indicators are used, granularity, how often) and for what purpose, as well as actual needs in terms of data and data extracts.	• Different TB data sources/tools, e.g., TB patient folders, TB notification register, TB paper registers, TIER.Net system, other TB data systems. • Where are these kept/available, e.g., which rooms, where are computers with these systems and how many. • Who/which staff has access to the systems? How accessible are they and to/by whom? • What tasks/actions are the different systems used for and how are different staff involved?	<u>TB clinicians, clerks, FM:</u> • Purpose of different data sources/systems/tools • What kind of data is available in each (e.g., patient line data, aggregate data, indicators)? • How often are the data from these sources/systems/tools used? By whom? • What specifically is used from each? E.g., which indicators, reports, details, etc.? • Which TB data and systems/tools are used commonly/every day? • Which TB data and systems/tools are used less commonly (e.g., weekly/monthly)?

	• What does using them involve (e.g., logging onto a computer, writing with a pen in a register, looking details up in a paper register)? • How often do they use the systems and for which tasks/actions? • Which data sources and data are commonly used and by whom? • Which data sources and data are less commonly/frequently used (e.g., weekly/monthly), and by whom? • What are facilitators to data usage? What are barriers to TB data usage?	• Which data/information/reports/indicators are the most useful? • Are there TB data that would be useful that you currently don't have access to? • Where are current gaps in the use of the TB data that are recorded/collected? What are your needs in terms of TB data and data extracts/reports? <u>SD/district/provincial TB managers and information managers:</u> • Purpose of different data sources/systems/tools at their level • What kind of data is available in each (e.g., patient line data, aggregate data, indicators)? • How often are the data from these sources/systems/tools used? By whom? • What specifically is used from each system/tool? E.g., which indicators, reports, details, etc.? • How are these indicators/reports used? • Which TB data and systems/tools are used commonly/every day? • Which TB data and systems/tools are used less commonly (e.g., weekly/monthly)? • Which data/information/reports/indicators are the most useful? • Are there TB data that would be useful that you currently don't have access to? • Where are current gaps in the use of the TB data that are recorded/collected? What are your needs in terms of TB data and data extracts/reports?
...how data is processed, reviewed, approved, used and submitted in upwards data flow through DHIS and TIER.Net		<u>TB clinicians, clerks, FM:</u> • Preparation of TB data exports. • Which systems/tools are involved? • What does this process look like? Who is involved (e.g., facility staff, sub-district/district staff), when does this happen? • Who reviews and approves the exports? • What are past or potential challenges in this process? • What works well in this process? <u>SD/district/provincial TB managers and information managers:</u>

		• Oversight of TB data at their level • Who is involved, when, and how frequently does this happen? • Who reviews and approves the exports? • Integration of different systems (TIER and DHIS). • How are TB data received/retrieved from the level below? How are TB data submitted to the next level upwards? • What are past, current, or potential challenges in this process? • What works well in this process?
…how NHLS alert lists are received from NICD and dispatched and actioned	• If the NHLS alert lists are received. • Where are they captured and by whom. • Communication around the NHLS alert lists. • What systems are involved. • Compare NHLS alert lists with TIER.Net and TB case notifications (will need access to these data sources).	<u>TB clinicians, clerks, FM:</u> • If their facility receives NHLS alert lists (if not, how so? What do they receive from the lab? What are the gaps?) • If yes, how they are received (by whom), how often, and what happens after they are received. Consistency of receiving these lists. • How are different actors responsible (e.g., capturing them and where?)? • How are the lists actioned? Who is involved in actioning them? • How are paper and electronic systems involved? • What are gaps/challenges in the system/process? What works well in the system/process? <u>SD/district/provincial TB managers and information managers:</u> • Is the SD or District NHLS Xpert alert received weekly? • How are they shared with facilities? • Who follows up on treatment initiation?

Appendix B. Observation guide for facility-based observations

Title of research project:

Data access, quality, and usage: assessment of routine TB data (DAART-TB)

Facility observation guide

Purpose of the guide: DAART-TB is an assessment of TB data access, quality, and usage in three provinces (KZN, GP, and EC). The project aims to identify gaps and challenges in TB data flow at different health systems levels and to make recommendations for improvement.

This observation guide is intended to focus facility-level observations towards understanding TB data systems and flows. Researcher/s must consult this guide daily and ensure that, for each facility, all observations listed in the guide are sufficiently covered over the course of weeklong data collection. Together with the study team, researcher/s will use these data to develop facility profiles and draw comparisons between field sites.

Form of data recording: 1) *in-situ* notes of observations on the listed observation foci, handwritten as separate field notes, 2) daily/weekly online debriefs with study team, 3) observational field notes typed up into a 'facility profile' template in MS Word.

Expected time needed per use: daily, for the duration of time spent at the facility.

Instructions: use the below questions and prompts to guide observations of TB data access, quality, use, and flows at facility level. Some of the information required will need input from facility managers and/or TB clinicians, clerks.

All handwritten field notes must contain the following: Name of researcher, Facility name, Date, Time observation started, Time observation finished.

1) **Details of health facility**

→ Layout: size, building structure (include facility map as part of observations)

→ Location: surrounding area; population

→ Number of staff members / number of patients (headcount)

→ Years in operation

→ Length of time delivering TB services

→ TB staff component

→ Length of time using electronic TB data systems

2) **TB services**

→ Is there a designated TB area at this facility? TB sputum booth?

→ Describe the space, i.e., is there a designated waiting area, consultation rooms, reception/space for folders?

→ What are the different entry points for clients to be screened for TB? What is the process for when a client has TB symptoms? Where would they go first, second, and so on, until they are tested for TB? What would happen at each step, i.e., which staff would help them, and which documents/registers/tools would be involved?

3) **Health information and TB data systems/tools**

→ List all the TB data sources, systems, registers, and tools available at this facility.

- Patient folders
- TB 'suspect' / identification register (paper-based)
- TB treatment register (paper-based)
- TB notification register
- TIER.Net
- Other TB registers/systems/tools
- Other non-TB specific electronic systems

→ Where are these kept/available at the facility, e.g., which rooms/spaces, number of computers with TIER.Net and other electronic systems?

→ Which staff has access to/use which TB data sources, systems, registers, and tools? Note any limitations to access.

→ How the different sources/systems/tools flow into each other (the TB data flow), e.g., first, second, third, and so on. What is the pathway they follow with each other?

→ What tasks/actions are the TB data sources, systems, registers, and tools used for and how are different staff involved (who does what)? Note if there is any specialisation around input, access, and use of TB health information?

→ What are common/everyday tasks? What are less common/infrequent tasks (e.g., weekly/monthly)?

→ Can you identify staff who take on leadership roles with regards to specific registers/system/tools?

→ What works well in the current practices? What gaps and challenges can you note?

4) **TB data use and maintenance**

→ How are the different TB data sources, systems, registers, and tools part of different staff's daily activities?

→ What does using the different TB data systems involve (be specific, e.g., logging onto a computer and looking up..., writing [x] information with a pen in a [y] register, looking [x] details up on [y] paper/electronic register)?

→ How often are the different TB data and systems used and for which tasks/actions?

- Which data sources and data are commonly used and by whom?
- Which data sources and data are less commonly/frequently used (e.g., weekly/monthly), and by whom? (e.g., compiling reports/exports)
- How are source documents/folders/data captured onto TIER.Net? By whom? When? Any potential gaps in this process?

→ Are NHLS alert lists received?

- When/how often? By whom, and in which format?
- How are they captured and by whom? Which systems are involved?
- How are they actioned/communicated about?

→ What are facilitators to data usage and maintenance? What are barriers to data usage and maintenance?

5) **Availability of resources (equipment, time, space)**

→ How many computers are available at this facility and where are they located?

→ Accessibility of computer/s; who/which staff member/s uses/accesses them?

→ Working condition of hardware and software

→ Time available for TB data systems/tools

→ Space requirements – impact of TB data systems on facility space

→ What activity/ies are the computer/s mostly used for?

→ Which staff are responsible for maintaining electronic systems, or entering data into computer software? Describe this data pathway and process, who are involved, and when and how often data are captured.

6) **The everyday and the extraordinary**

→ Daily rituals and duties around TB data.

→ TB data flow – how does TB data pass/travel through the facility?

→ Uncommon behaviours, practices, interactions, occurrences around TB data, systems, and tools.

Appendix C. Discussion guide for semi-structured interviews at facility level

Title of research project:

Data access, quality, and usage: assessment of routine TB data (DAART-TB)

Discussion guide for health staff

Purpose of the guide: DAART-TB is an assessment of current TB data access, quality, and usage in three provinces (KZN, GP, and EC). The project aims to identify gaps and challenges in TB data flow at different health systems levels and to make recommendations for improvement.

This discussion guide is to be used with health staff at facility level, which includes facility managers, TB clinicians (doctors and nurses), and data clerks. The guide covers 4 topic areas through which to explore the participant's background and work experience, the current TB data sources, systems, and tools available at their facility, as well as practices around the use of these systems and tools for TB data maintenance and reporting. The guide should be used flexibly to facilitate discussions with participants.

Form of data recording: (1) Audio recording (2) Notes of key points per topic area handwritten as separate field notes.

Expected time needed per use: 30-60 minutes

Instructions: Use the below questions and prompts to engage the participant in conversation after following the informed consent process.

Preamble (to be read by research assistant):

Today is the _____/____/_____ (**insert date dd/mm/yy**). This is a discussion with health staff for the DAART-TB project.

Thank you for your time. These discussions are for the DAART-TB study which aims to understand TB data access, quality, and usage and your experience of TB data systems. This discussion guide is organised into 4 topic areas which includes questions about your personal background and work experience, current TB data sources, flows, and practices, as well as TB data access, quality and usage. Everything we talk about today will remain anonymous. We will summarise the perspectives of all the interviews we conduct across the three provinces, to learn more about TB data systems and may share de-identified quotes in a report or publication. These reports will not include any names or other personal information.

I want to remind you that there are no right or wrong answers — you're the expert, and I am happy to be learning from you and your experience to improve the use of these systems. Do you have any questions before we begin?

Topic area 1: About the participant and their work experience *This topic area is about getting to know the participant and understanding their role and involvement in the TB programme/service.*	The first few questions are about understanding your role and involvement in the TB programme and service, and how this relates to TB data specifically. **Age? Man/woman?** *(researcher to note this)* **Please briefly tell me about your work role in this health facility.** What is your current position/job title? **How are you involved in TB?** What are your key duties/tasks/oversights related to TB? **Please tell me how you are involved in TB data and TB health information.** What are your key duties/tasks/oversights related to TB data management? - How long have you been working with TB data (this can include capturing, reporting, management in general)? - Please tell me about some of the **changes** you have seen in how TB data are managed. How have you experienced these changes? - What do you think of how TB data are managed? How does management of TB data compare to that of other programmes (e.g., HIV)? - What do you think works well in the current system/processes? What, in your experience, are key gaps and challenges in how TB data are managed?
Topic area 2: TB data sources, flows, responsibilities, and practices *This topic area is about understanding different TB data sources, TB data flow, and practices and responsibilities at each step.*	**Please start by telling me about the different TB data sources, registers, systems, and tools available at this facility** *(Interviewer to write down all the data sources and systems on notes pages. Probe about paper and electronic data sources, registers, and systems, e.g., patient folder, TB notification registers, TB treatment registers, electronic systems (e.g., Primary Care system, TIER.Net, EDR Web, other?))* **Please tell me where these records/systems/tools are used/kept.** - *(Interviewer to probe on all the sources/tools, i.e., patient folders, TB notification register, TB treatment register, electronic systems and computer availability/access, other electronic or paper-based systems).* - **Who has access to or uses these records/systems/tools, and how are they responsible for updating/maintaining them?** *(probe on patient records/systems/tools and staff responsible for using or maintaining them)* **Please tell me how these different TB data sources, systems, and tools flow into each other, i.e., how the data from one source is captured/reported into another.** *(Allow the participant to explain how the patient folder/record, TB notification register, treatment register, TIER.Net, and other systems inform each other – how data between these moves into/from each other)* **I would now like to use an example of TB data flow in the facility from the time a patient with TB symptoms enters the facility, to the time that TB data are captured into TIER.Net. I will draw a figure to map the data flow, the sources, registers, and systems involved at each step, as well as the persons responsible at each step, and the timing of actions** *(researcher to*

	draw the data flow on a piece of paper and make notes of actions at each step, persons responsible). • Please tell me what happens when a person with TB symptoms presents at the facility. Where/how is data recorded? Into what? Whose responsibility is this? • What happens next? Where does the person go? Who would help them? What data source/s are involved? *(probe: paper vs electronic)* Who is responsible for this step? *(repeat until data entered into TIER.Net)* • What aspects of this process are easy? What aspects are difficult? Please provide examples.
Topic area 3: TB data usage, purpose, and needs	**Please tell me about the purpose of the different data sources/systems/tools you've mentioned, i.e., what they are used for at the facility.** • How do you understand the purpose of 1) the patient folder, 2) TB notification register, 3) TB treatment register, 4) electronic systems (e.g., TIER.Net, other), 5) any other paper-based registers mentioned? • Which of these TB data sources/systems/tools do you use most commonly/every day? Why? What do you use it/them for? • Which of these TB data sources/systems/tools do you use the least (e.g., weekly/monthly)? Why? What do you use it/them for? • Which data/information/reports/indicators do you find most useful to you in your work? What are your **needs in terms of TB data and data extracts/reports?** • **Are there TB data/systems/tools that you would find useful, but that you don't have access to currently?** Please tell me about that/them. What do you think are current gaps in the use of the TB data that are recorded/collected? • **Are there any data that are collected on paper that cannot be entered electronically into TIER.Net?** (wait for the participant to answer, then you can also probe if needed: e.g., side effects, new treatment regimens, TB Preventive Therapy information) **In your experience, what is the QUALITY of the TB data collected at your facility?** • What do you think **affects** quality of TB data at your facility? What do you think **causes gaps/challenges** in TB data quality? **Do you receive NHLS alert lists at your facility, i.e., lists compiled by the NHLS of patients who tested positive for TB?**

	• **If NO**, what is the reason for not receiving them? Please tell me about what you do receive from the lab (*probe: what do you receive? Who receives it? What happens to the results? Where are they captured? By whom?)* ○ Please tell me what works well with this process. What are some of the gaps/challenges you experience? • **If YES**, how are the alert lists received (by whom)? How often are they received? What happens after they are received, e.g., where are they captured/consolidated? • How are the NHLS alert lists implemented? Who is involved in actioning them? • How are paper and electronic systems involved? • What are gaps/challenges in the system/process? What works well in the system/process?

Topic area 4: Consistency of facility-based TB data and entry into TIER.Net	**I now want to ask you specifically about TIER.Net and reporting TB data to other health systems levels.**
	
	• **Please tell me how patient-level data are captured into TIER.Net.**
	  - What source documents are used? (e.g., patient folders, paper TB registers, other sources?)
	  - Who is responsible for maintaining TIER.Net?
	  - What is the process for capturing data into TIER.Net?
	  - How regularly are data captured?
	  - What are the challenges/gaps in this process? What are the things that work well in this process?
	
	• **How are TB data reported to sub-district/district level?**
	  - What does this process look like? What systems/tools are involved? *(probe: preparation of TB data exports? Who reviews and approves the exports?)*
	  - When/how regularly does this happen? Who is involved and how? How do you perceive the quality/accuracy of the data reported?
	  - What are the gaps/challenges in this exporting/reporting process? What works well? What needs to change? What needs to stay the same?

Closing	Is there anything that you would like to share before we end off? Thank you for your time today, we appreciate your participation in the study and for sharing openly about your experiences.

Appendix D. Discussion guide for semi-structured interviews with key stakeholders

Title of research project:

Data access, quality, and usage: assessment of routine TB data (DAART-TB)

Discussion guide for (sub)district and provincial-level staff

Purpose of the guide: DAART-TB is an assessment of current TB data access, quality, and usage in three provinces (KZN, GP, and EC). The project aims to identify gaps and challenges in TB data flow at different health systems levels and to make recommendations for improvement, specifically aimed at implementation of an electronic medical register/record system.

This discussion guide is to be used with TB and health information managers at different tiers of the health system (i.e., sub-district, district, provincial, and national levels). The guide covers 3 topic areas through which to explore the participant's background and work experience, experiences of current TB data management, including data sources, systems, and tools, as well as TB data quality. The guide should be used flexibly to facilitate discussions with participants.

Form of data recording: (1) Audio recording (2) Notes of key points per topic area handwritten as separate field notes.

Expected time needed per use: 30-40 minutes

Instructions: Use the below questions and prompts to engage the participant in conversation after following the informed consent process.

Preamble (to be read by research assistant):

Today is the _____/____/_____ (**insert date dd/mm/yy**). This is a discussion with health staff for the DAART-TB project.

Thank you for your time. These discussions are for the DAART-TB study which aims to understand TB data access, quality, and usage and your experience of TB data systems. This discussion guide is organised into 4 topic areas which includes questions about your personal background and work experience, current TB data sources, flows, and practices, as well as TB data access, quality and usage. Everything we talk about today will remain anonymous. We will summarise the perspectives of all the interviews we conduct across the three provinces and nationally, to learn more about TB data systems and may share de-identified quotes in a report or publication. These reports will not include any names or other personal information.

I want to remind you that there are no right or wrong answers — you're the expert, and I am happy to be learning from you and your experience to improve the use of these systems. Do you have any questions before we begin?

Topic area 1: About the participant and their work experience *This topic area is about getting to know the participant and understanding their role and involvement in the TB programme and information.*	The first few questions are about understanding your role and involvement in the TB programme and service, and how this relates to TB data specifically. **Please tell me how you are involved in the TB programme and TB data.** - How **long** have you been working in the TB programme/data? - What are your **key duties/tasks/oversights** related to the TB programme/TB data? - What do you **enjoy** about your work/role? What are some things you find **challenging**?
Topic area 2: TB data management and use *This topic area is about understanding different TB data sources, TB data flow at each tier.*	**Please tell me about some of the *changes* you have seen in how TB data are managed.** *Probe*: changes in TB data flows? Systems? Registers? Reporting? - How have you **experienced these changes**? Probe: What have been good changes/advantages? What have been disadvantages? - Probe: Do you have your own username and password, or do you share with a colleague. - How friendly is the process for obtaining a username and password? Barrier experienced? **Please tell me about TB data management at your level** (i.e., SD, district, province, national). - **What are the key data** sources/register/systems/tools currently being used? - *Probe*: paper and electronic data sources, registers, and systems, e.g., patient folder, TB notification registers, TB treatment registers, electronic systems (e.g., TIER.Net, DHIS, EDR Web, other?) - **What are [insert system/register/tool] they used for?** - *Probe*: patient management, programme management, reporting? - **Which do you find most useful?** Which system/register/tool do you use most often? What for and why? What indicators do you focus on? - **How well is the current system (TIER/DHIS) meeting the needs of staff at different health system tiers?** - **How well do the current systems/processes serve *your* needs? Are the current systems/processes fit for purpose?** - **How would you rate the current system? [1 to 5, where 1 equals not meeting needs at all, and 5 equals meeting all of the needs]** - *Probe*: in terms of **access** to the data needed to do your job well? In terms of how data are **presented** (e.g., patient line data vs aggregate data, indicators, reports available) - Are there any data/indicators/reports/systems/tools that you **don't have access to** currently, that you wish you did/that would be useful to you? Please explain.

	Are there any data that are collected on paper that are not entered electronically into TIER.Net? - - *(wait for the participant to answer, then probe if needed*: e.g., screening, TUTT, side effects / adverse events, new treatment regimens, TB Preventive Therapy, TB care cascade, post TB) - How would having these data be valuable to you in your work? - what changes would you like to make to TIER, if any? **If you could imagine/design a system for TB data management, what would it look like?** What would it be able to do/functionality? What data would you ideally want to see/have? What level of data (aggregate vs patient level)?
Topic area 3: TB data quality and integrity	**In your experience, what is the QUALITY of TB programme data? What are the gaps? Please explain.** • What do you think **affects** quality of TB data at your facility? What do you think **causes gaps/challenges** in TB data quality? • Comment on **congruence** between DHIS and TIER.Net? • when you see data being presented by National, are you satisfied that this is an adequate reflection of the data at provincial level? Explain. • **Please tell me about reporting between health system tiers.** - What does this process look like? What systems/tools are involved? (probe: preparation of TB data exports? Who reviews and approves the exports?) - Timing of reports/dispatches/exports? - What are the gaps/challenges in this exporting/reporting process? What works well? What needs to change? What needs to stay the same? - How would you rate your trust in the quality of the data [1 – 5, where 1 equals do not trust at all, and 5 equals trust completely] **Please tell me about NHLS alert lists and how this functions.** - How are alert lists received (by whom)? How often are they received? What happens after they are received, e.g., where are they captured/consolidated? - How are the NHLS alert lists implemented? Who is involved in actioning them? - How are paper and electronic systems involved? - What are gaps/challenges in the system/process? What works well in the system/process? Do you anticipate data problems ito capturing/data? verification/quality/supervision/QC now with termination of US TB/HIV funding. What do you think the impact would be (scale 1 – 5, where 1 equals no impact and 5 equals severe impact)
Closing	Is there anything that you would like to share before we end off? Thank you for your time today, we appreciate your participation in the study.

Appendix E. Monthly Data Input Form example, with DS-TB data elements (pages 3 and 5) and data quality check (page 5) indicated

DEPARTMENT OF HEALTH MONTHLY INPUT FORM

(This form must be completed by the facility manager.) (SUB DISTRICT MUST RECEIVE COPY)

FACILITY: [redacted] PERIOD: OCTOBER 2024

COMPLETED BY: [redacted] MPLETED ON: 04/11/2024.

CONTACT NO.:

POPULATE FIELD NEXT TO ELEMENT WITH "N" IF SERVICE IS NOT RENDERED BY FACILITY AND A ZERO (0), IF NO PATIENTS WERE SEEN EVEN THOUGH THE SERVICE WAS OFFERED.

Data Element	Value	Comment
NIDS 2023 HEADCOUNT REGISTER/HPRS (MONTHLY)		
PHC headcount 10-19 years		
PHC headcount 20 years and older		
PHC headcount 5-9 years		
PHC headcount under 5 years		
CCMDD		
CCMDD - new enrolment		
CCMDD - renewal		
CCMDD client collecting medicine parcel from contracted external PuPs		
CHILD AND NUTRITION		
Infant exclusively breastfed at DTaP-IPV-Hib-HBV (Hexavalent) 3rd dose	19	
Child under 5 years on food supplimentation new	5	
Diarrhoea with dehydration new in child under 5 years	0	
Pneumonia new in child under 5 years	0	
Deworming dose 12-59 months	86	
Vitamin A dose 12-59 months	86	
Moderate acute malnutrition in child under 5 years new	5	
Severe acute malnutrition new in child under 5 years	0	(OBESE/overweight)
COMMUNICABLE DISEASES		
Bilharzia new case reported	0	
Malaria new case reported	0	
EPI		
BCG dose	0	
DTaP-IPV-Hib-HBV (Hexavalent) 1st dose	21	
DTap-IPV-Hib-HBV (Hexavalent) 2nd dose	20	
DTaP-IPV-Hib-HBV (Hexavalent) 3rd dose	19	
DTaP-IPV-Hib-HBV (Hexavalent) 4th dose	11	
Measles 1st dose	17	
Measles 2nd dose	18+1=19	
OPV 0 dose under 1 year	0	
OPV 1st dose under 1 year	21	
PCV 1st dose under 1 year	21	
PCV 2nd dose under 1 year	19	
PCV 3rd dose under 1 year	14	
Immunised fully under 1 year new	14	
RV 1st dose under 1 year	21	
RV 2nd dose under 1 year	19	
Td dose at 6 years	5	
Td dose at 12 years	0	
EYE CARE		
Spectacles required by child - total	0	
Spectacles issued to child - total	0	
Spectacles required by and adult - total	0	
Spectacles issued to an adult - total	0	

Page 1 of 5

Data Element	Value	Comment
HIV		
HIV new positive eligible for TPT	9	
HIV new positive eligible client initiated on TPT	3	
CD4 done on newly diagnosed HIV client	14	
HIV test 25-59 months	0	
HIV positive 25-59 months	0	
HIV test 5-14 years (excl ANC)	1	
HIV positive 5-14 years (excl ANC)	0	
HIV test 15-24 years male	13	
HIV positive 15-24 years male	01	
HIV test 15-24 years female (excl ANC)	22	
HIV positive 15-24 years female (excl ANC)	0	
HIV test 25-49 years (excl ANC)	58	
HIV positive 25-49 years (excl ANC)	8	
HIV test 50 years and older	8	
HIV positive 50 years and older	3	
HIV test around 18 months	5	
HIV test positive around 18 months	0	
New sexual assault case HIV negative issued with Post Exposure Prophylaxis	0	
New sexual assault case seen at health facility	0	
Person exposed to HIV who tested negative and was issued with Post Exposure Prophylaxis	0	
HIV positive screened for TB	14	
MANAGEMENT PHC		
PHC client seen by professional nurse	1831	+21 = 1852
PHC client seen by doctor (public + sessional)	59	
MATERNAL AND NEONATAL		
Antenatal 1st visit before 20 weeks	2H1 = 22	
Antenatal 1st visit 20 weeks or later	3	
Antenatal already on ART at 1st visit	8	
Antenatal known HIV positive but NOT on ART at 1st visit	0	
Antenatal HIV 1st test	17	
Antenatal HIV 1st test positive	1	
Antenatal clients HIV re-test	20	
Antenatal HIV re-test positive	0	
Born alive before arrival at facility	0	
Infant PCR test at birth	0	
Infant PCR test positive at birth	0	
Infant PCR test around 6 months	2	
Infant PCR test positive around 6 months	0	
Infant PCR test around 10 weeks	14	
Infant PCR test positive around 10 weeks	0	
Mother postnatal visit within 6 days after delivery	20	
Maternal death in facility	0	
MENTAL HEALTH		
Client under 18 years seen for suicide attempt	0	
Client 18 years and older seen for suicide attempt	0	
Mental health visit under 18 years	0	
Mental health visit 18 years and older	13	
PHC client treated for mental disorder new	0.	

Data Element	Value	Comment
NON-COMMUNICABLE DISEASES		
Client 18-44 years screened for diabetes	1096	
diabetes		
Client 45 years and older screened for diabetes	359	
diabetes		
Diabetes client 18-44 years new	0	
Diabetes client 45 years and older new	0	
Client 18-44 years screened for hypertension	1069	
Client 18-44 years screened for hypertension and requiring/referred for treatment for hypertension	01	
Client 45 years and older screened for hypertension	205	
Client 45 years and older screened for hypertension and requiring/referred for treatment for hypertension	02	
Hypertension client 18-44 years new	01	
Hypertension client 45 years and older new	02	
ORAL HEALTH		
Dental headcount - total	0	
Number of primary schools and early childhood centers visited as part of the oral health preventive services programme	0	
Client treated with emergency endodontics	0	
Tooth extration	0	
Tooth fissure sealant 1st or 2nd permanent molar (child)	0	
Tooth restoration	0	
REHABILITATION		
Hearing aid required child 0 - 18 years	0	
Hearing aid issued child 0 - 18 years	0	
Hearing aid required adult 19 years and older	0	
Hearing aid issued adult 19 years and older	0	
Wheelchair required child 0 - 18 years	0	
Wheelchair issued child 0 - 18 years	0	
Wheelchair required adult 19 years and older	0	
Wheelchair issued adult 19 years and older	0	
STI		
Antenatal client 1st visit - syphilis test	25	
Antenatal client 3rd trimester visit - syphilis test	0	
Antenatal client syphilis 1st test positive	0	
Antenatal client syphilis re-test positive	0	
Male screened for STI	328	
Male urethritis syndrome treated - new episode	27 29	
Antenatal client syphilis positive - BPG Dose 1	0	
TB MONTHLY		
Screen for TB symptoms under 5 years	360	
Screen for TB symptoms 5 years and older	1607	
VIRAL HEPATITIS		
Antenatal client tested for HBsAg	25	
Antenatal client vaccinated with HepB vaccine	0	
Antenatal client with HBsAg positive result	0	

Data Element	Value	Comment
WOMENS HEALTH		
Cervical cancer screening in HIV positive women 20 years and older	01	
Cervical cancer screening in non-HIV woman 30-50 years	4	
IUCD inserted	0	
Medroxyprogesterone injection	251	
Norethisterone enanthate injection	72	
Oral pill cycle	27	
Sub-dermal implant inserted	01	
NIDS 2023 PHC OTHER (MONTHLY)		
ART MONTHLY		
ART adult naive start ART in month	16	
ART adult remain on ART end of period	1024	
ART child under 15 years naive start ART in month	0	
ART child under 15 years remain on ART end of period	28	
HIV		
Antenatal client started on PrEP	03	
HIV positive known but NOT on ART	0	
Male circumcision performed by medical professional in the traditional sector (10-14 years)	0	
Male circumcision performed by medical professional in the traditional sector (15 years and older)	0	
Medical male circumcision 10-14 years	0	
Medical male circumcision 10-14 years at health care facility	0	
Medical male circumcision 15 years and older	0	
Medical male circumcision 15 years and older at health care facility	0	
Start PrEP	0	
Total remaining on PrEP	0	
Total antenatal client remaining on PrEP	0	
MANAGEMENT PHC		
PHC professional nurse clinical work days	44+11 =55	
PHC public/sessional doctor clinical work days	3	
MATERNAL AND NEONATAL		
Antenatal start on ART	01	
QUALITY		
Complaint resolved	0	
Complaint resolved within 25 working days	0	
Complaints received	0	
Patient Safety Incident case closed	0	
Patient Safety Incident case closed within 60 days	0	
Patient Safety Incident case reported	0	
Severity assessment code 1 incident reported	0	
Severity assessment code 1 incidents reported within 24 hours	0	

Data Element	Value	Comment
TB MONTHLY		
Child under 5 years eligible for TB test	0	
Client 5 years and older eligible for TB test	115	
DS-TB bacteriologically confirmed 5 years and older	14+2=16	
DS-TB Bacteriologically confirmed under 5 years	0	
DS-TB clinically diagnosed 5 years and older	0	
DS-TB clinically diagnosed under 5 years	0	
Clients 5 years and older who were started on DS-TB treatment	11+2=13	(1 Died)
DS-TB treatment start under 5 years	0	
RR-TB bacteriologically confirmed	01	
TB contact 5 years and older	37	
TB contact 5 years and older start on TPT	10+38	Outreach
TB contact under 5 years	0	
TB contact under 5 years start on TPT	0	
TB test 5 years and older using GeneXpert	115+8=123	
TB test under 5 years using GeneXpert	0	
WOMEN'S HEALTH		
Termination of pregnancy 0-12 weeks	0	
Termination of pregnancy 10-14 years	0	
Termination of pregnancy 13-20 weeks	0	
Termination of pregnancy 15-19 years	0	
Termination of pregnancy 20 years and older	0	

DATA QUALITY CHECK

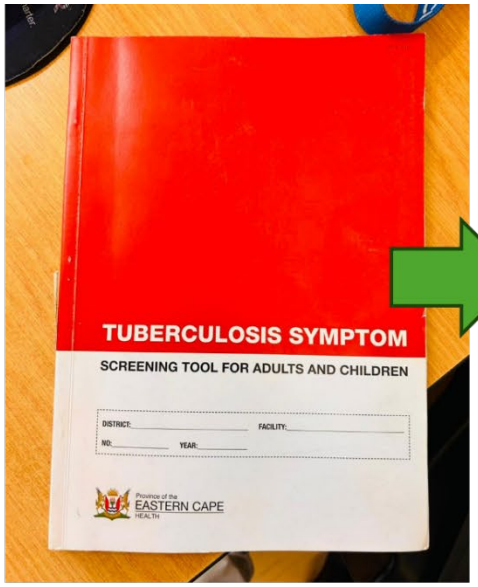
All fields completed: (YES) / NO (If NO please provide a reason)

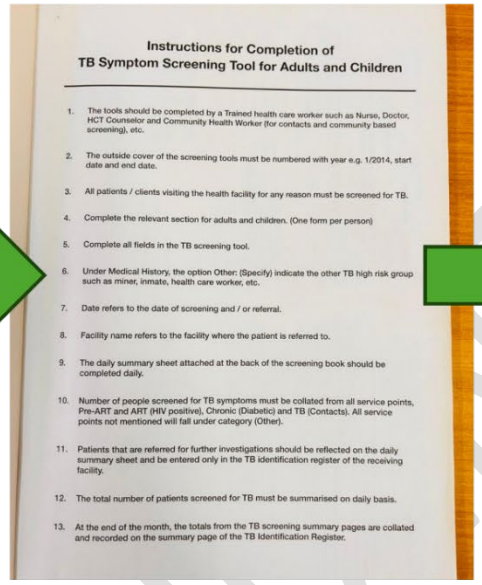
Reason: [redacted]

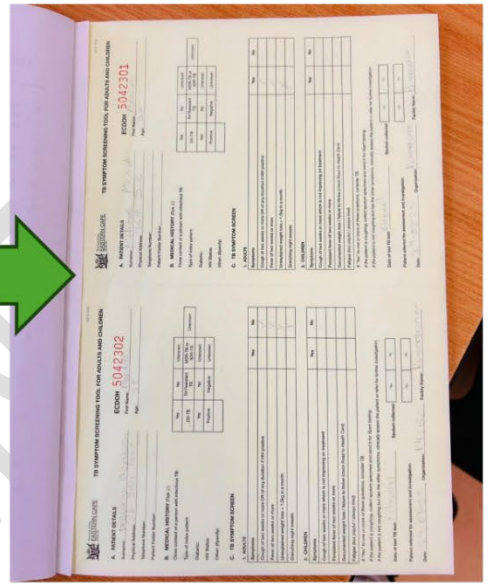
Signature: [redacted] 2024

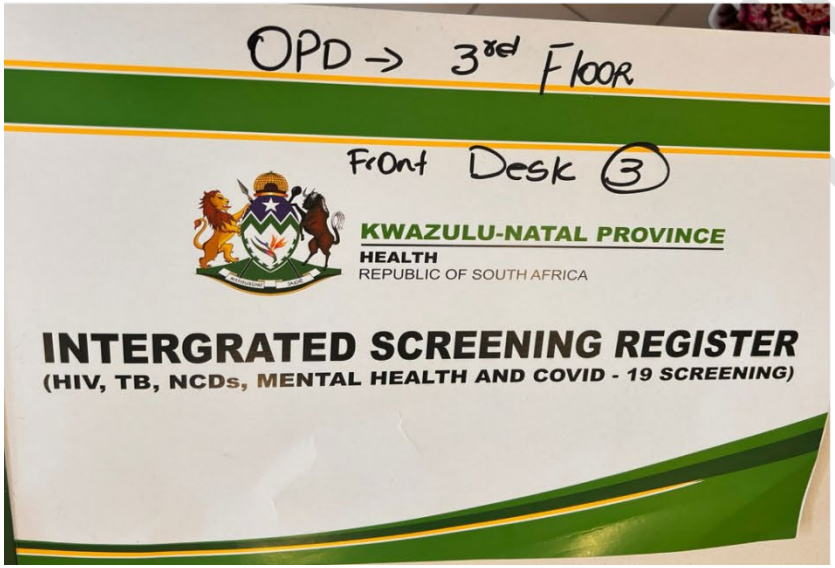
DHIS2 Version 2.30

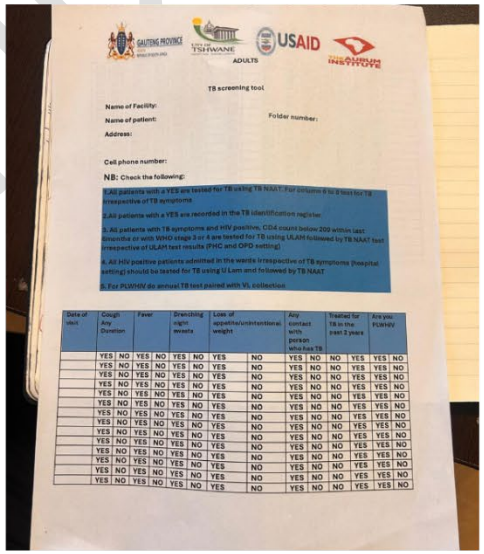
Appendix F. Examples of TB screening tools used at facilities, with TUTT risk factors

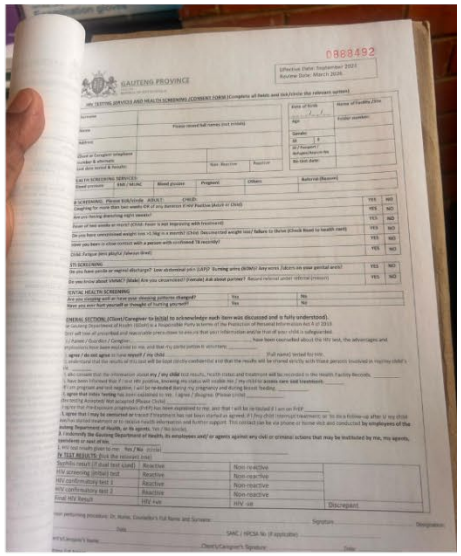




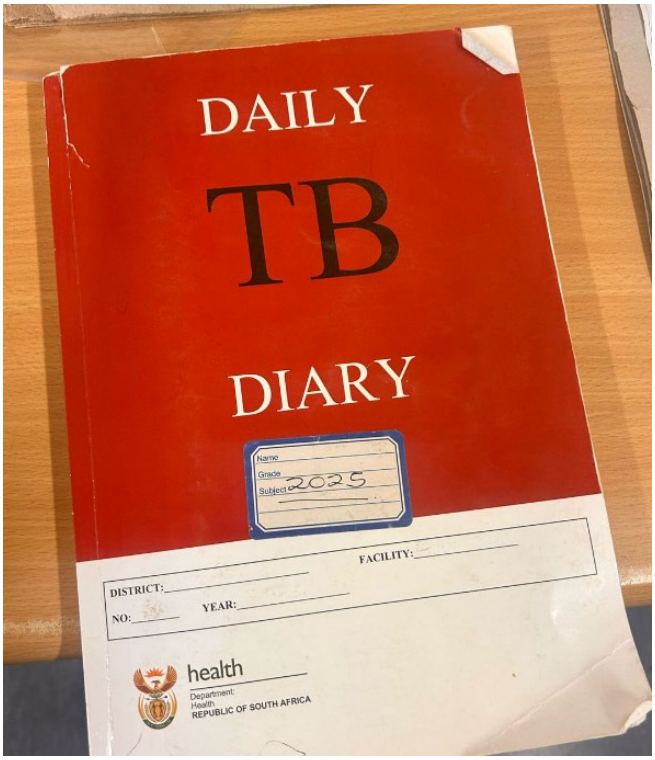








Appendix G. Examples of phased-out DS-TB patient and data management tools



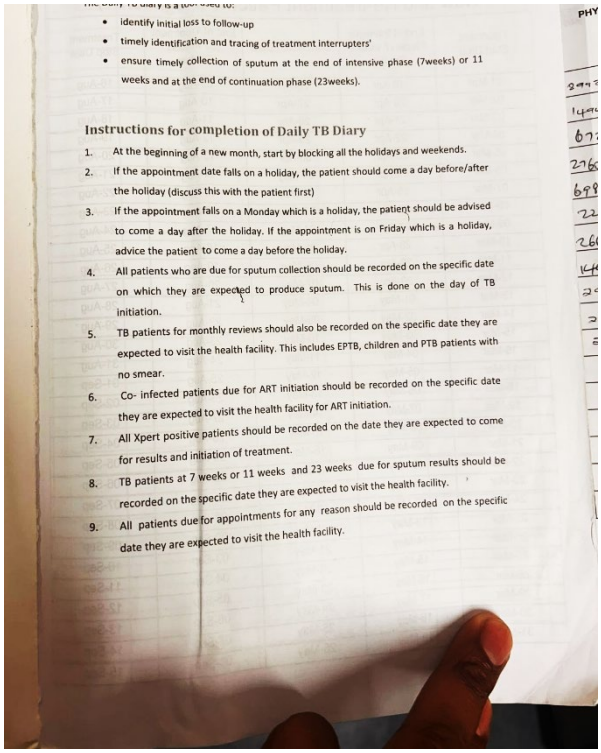


Figure 1. Daily TB Diary

Figure 2. Brown phased-out TB Register

Examples of phased out TB data and patient management tools.

Figure 1 shows the Daily TB Diary with instructions, previously used for patient management

Figure 2 shows the brown TB register, which was in use prior to the updated yellow TB ID register (also pictured)

Appendix H. DHIS2 data visualisation and usage report

health
Department:
Health
REPUBLIC OF SOUTH AFRICA

DHIS2 DATA USAGE REPORT: TB QUARTERLY DATA

Project Manager	Report prepared by:
Jenni Brown	Elmarie Claasen
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Abbreviations

Abbreviation	Name
ART	Antiretroviral Therapy
DHIS2	District Health Information System version 2
EC/ec	Eastern Cape
GP/gp	Gauteng
HISP	Health Information Systems Programme
HIV	Human Immunodeficiency Virus
KZN/kz	KwaZulu Natal
L2	Province level
L3	District level
L4	Subdistrict level
L5	Facility level
M&E	Monitoring and Evaluation
NDOH	National Department of Health
Q	Quarter
SOP	Standard Operating Procedure
SQL	Structured Query Language
TB	Tuberculosis
TIER.Net	Three Interlinked Electronic Registers
webDHIS	web-based DHIS also called DHIS2

Scope of the report

This report presents a usage analysis of TB Quarterly data in the District Health Information System version 2 (DHIS2). The focus is on use of both visualisations and dashboards accessed between Quarter Q2-2024 (April 2024) and Q1-2025 (March 2025) across all users in the Eastern Cape (EC), KwaZulu-Natal (KZN), and Gauteng (GP) provinces, and across selected users at provincial, (sub)district, and facility level included in the DAART-TB project – see Table 1.

Methodology

Data use analysis focused on users accessing visualisations and dashboards which contain any of the TB Quarterly Data Elements and Indicators that are part of the National Indicator Dataset (NIDS) 2023 Dataset – see Table 2.

Usage data was extracted from DHIS2 using custom Structured Query Language (SQL) views, which pulls the data use activity of users and where they are allocated. All Health Information Systems Programme (HISP) user activity is excluded from the data use analysis since HISP use to set up visualisations and analyse data completeness may skew the data. Even though HISP users are included in the annexure on user counts their usage is not included.

Following quite low usage analysis, three separate districts in Eastern Cape were contacted to sense-check/confirm the TIER.Net and DHIS export processes and timelines, as well as data usage practices.

Table 1. Facilities, (sub)districts, and provinces included in the DHIS2 usage analysis

Facilities	Subdistricts	Districts
kzFacility 3 (clinic)	kz Ray Nkonyeni Local Municipality	KZN Ugu District
kzFacility 2 (CHC)		
kzFacility 1 (clinic)	kz Umzumbe Local Municipality	
kzFacility 4 (hospital)	kz Umdoni Local Municipality	
gpFacility 1 (CHC)	gp Tshwane 6 Health sub-District	GP Tshwane District
gpFacility 2 (clinic)	gp Tshwane 3 Health sub-District	
gpFacility 4 (hospital)		
gpFacility 1 (hospital)		
ecFacility 1 (clinic)	ec Sundays River Valley Local Municipality	EC Sarah Baartman District
ecFacility 2 (CHC)	ec Dr Beyers Naudé Local Municipality	
ecFacility 3 (clinic)	ec Kouga Local Municipality	
ecFacility 4 (hospital)		
ecFacility 5 (clinic)		

Table 2. TB Quarterly Data Elements and Indicators included in usage analysis

Data Element Name	Indicator Name
All DS-TB treatment start	All DS-TB client treatment success rate
New DS-TB client start treatment	All DS-TB client lost to follow-up rate
Retreatment DS-TB client start	All DS-TB client death rate
Relapse DS-TB client start treatment	TB/HIV co-infected client on ART rate
All DS-TB client successfully completed treatment	
New DS-TB client successfully treated	
Relapse DS-TB client successfully treated	
Retreatment DS-TB client successfully treated	
All DS-TB client lost to follow-up	
New DS-TB client lost to follow-up	
Relapse DS-TB client lost to follow-up	
Retreatment DS-TB client lost to follow-up	
All DS-TB client death	
New DS-TB client death	
Relapse DS-TB client death	
Retreatment DS-TB client death	
All DS-TB clients treatment failure	
New DS-TB client treatment failure	
Relapse DS-TB client treatment failure	
Retreatment DS-TB client treatment failure	
TB client known HIV positive	
TB/HIV co-infected client on ART	

Findings

Analysis of data use for TB Quarterly Data Elements and Indicators: All users in EC, GP and KZN

We analysed use of TB Quarterly data elements and indicators (Table 2) for all users at facility, (sub)district, and provincial levels, by the level at which they are allocated in DHIS and excluding all HISP-SA staff. User levels represent the following:

a. Level 2 = Province
b. Level 3 = District
c. Level 4 = Sub-district
d. Level 5 = Facility

Annexures 1 to 8 depict the data analysis in detail. Overall in the 3 provinces; EC, GP and KZN, there are 3,973 active users (users who were active in the past 90 days). Over the period of 4 quarters (Q2 2024-Q1 2025), 791 (19,9%) users accessed the TB visualisations or dashboards. These users accessed 18,582 views of which

2,151 were intentional dashboard clicks (opening a dashboard to access multiple visualisations on it) and 16,284 were exploring (opening) a specific visualisation in the visualisation app with TB Quarterly data. The number of users by level is Province (level 2) 50, District (level 3) 147, Sub-district (level 4) 143 and Facility (level 5) 452.

The average rounded number of views per user is 23 with three of those dashboard views and 20 intentional visualisation views. However, individual users' access differs significantly from only 2 views at all of the levels, while the highest views are 143 (L2), 361(L3), 342 (L4) and 429 (L5). In terms of the period when views were accessed, there is a decline over the course of the 4 quarters. Although Q1 2025 is not yet finalised, it should be considered that importing of TB data occurs at the beginning of a quarter and, therefore, by the 2nd month of a quarter, one would have expected analysis of imported data to have occurred.

User access by job function indicates that data capturers access the reports the most, followed by users with a Monitoring and Evaluation (M&E) function, followed by Information Managers, Facility Managers and Programme managers, while Clinicians, Subdistrict Managers and District Managers are far fewer in number, and their usage are very low as well.

Comparing the three provinces against each other, the following observations can be made:

Table 3: Comparative analysis of overall TB usage

Item	EC	GP	KZN
No of users	1116	1253	1605
No of facilities	967	539	966
No (%) of users accessed reports	132 (8,2%)	222 (17,7%)	437 (27,2%)
No of reports accessed	2398	5385	9410
No of times dashboards accessed	431	482	1238
No of times visualisations accessed	1967	4903	9358
Average user views	18	24	22
Highest user views	189	354	429
Lowest user views	1	1	1

Analysis of data use for TB Quarterly Data elements and Indicators: Users in selected facilities and (sub)districts included in the DAART-TB project

Analysis of facility and subdistrict users included in the project showed similar low usage trends. The facilities and subdistricts showed a total of 75 active users (accessed DHIS within the last 90 days) and 21 (28%) of those accessed reports from Q2-2024 to Q1-2025. These users accessed 1,152 views of which 18 were intentional dashboard clicks and 1,134 were exploring (opening) a specific visualisation with TB Quarterly data. The number of users who accessed reports by level is Sub-district (level 4) 13 and Facility (level 5) 8.

The average rounded number of views per user is 55 with 1 of those dashboard views and 54 intentional visualisation views. Overall this is more than double the number of views compared to the overall usage across these provinces but as will become evident most of the increased impact is from KZN. Individual users' access differs significantly from only 1 view at the subdistrict and facility level while the highest views are 385 (L4) and 89 (L5). In terms of the period when views were accessed, there is a decline from Q2 to Q3 2024 but after that it is fairly stable.

User access by job function indicates that data capturers access the reports the most, followed by users with a Monitoring and Evaluation (M&E) function, followed by Information Managers, Facility Managers and Programme managers, while clinicians, Subdistrict Managers and District Managers are far fewer in number, and their usage is very low as well.

Comparing the three provinces against each other the following observations can be made:

Table 4: Comparison of TB usage at selected facilities per province

Item	EC	GP	KZN
No of users	36	16	23
Facilities assessed	5	4	4
No (%) of users accessed reports	7 (28%)	3 (19,4%)	11 (47,8%)
No of reports accessed	146	4	1002
Average user views	18	1	91
Highest user views	131	2	385
Lowest user views	1	1	2

The sampled KZN facility users access the system more than those in other provinces, and in GP, DHIS reports were not accessed even once per quarter.

District Processes clarified in terms of TIER.Net to DHIS exports and data usage

The low usage observed prompted the investigator to clarify the processes followed and since permission in GP ands KZN were still pending only EC districts were contacted. From three Districts in the EC, the following information was obtained:

District 1:

- **Monthly** TIER.Net Dispatches are obtained from Health Facilities to the Subdistrict level and imported into the 2 separate Subdistrict TIER.Net computers.
- The district uses reports from these 2 TIER.Net systems to analyse TB and ART data.
- The district used to upload dispatch files to a provincial server. It currently uploads them **quarterly** to the NDOH upload server.
- The district also imports the data into the DHIS from an export generated from the same dispatch file they are uploading to NDOH, but they do not import the monthly data in between.
- The district does not have access to the reports in the Health Information Centre; therefore, use TIER.Net reports.

District 2:

- The district regularly receives TIER.Net dispatch files on a weekly basis, but at least once a month. They import these files into TIER.Net at the subdistrict level and simultaneously transfer this data into the DHIS.
- The district report that they use DHIS for their reporting requirements.
- The district uploads TIER.Net dispatch files to the NDOH server on a quarterly basis only.

- This district is part of the study group however data use does not reflect major data use in DHIS thus the information obtained needs to be verified with the official interviews conducted.

District 3:

- The district receives monthly TIER.Net dispatch files from Subdistricts in accordance with the monthly data flow. They upload these dispatch files quarterly to the NDOH upload server.
- The district only loads quarterly data into the DHIS.
- The district uses DHIS for reporting.

From the process descriptions above, all three districts should have consistent data in their TIER dispatch files sent to NDOH for the Health Information Centre and the Provincial DHIS in the month when the quarterly report is sent. Still, District 1 is using TIER.Net data for their reporting throughout the quarter because that is more updated than DHIS2, and District 2 is updating DHIS in the interim months, which would create a discrepancy between DHIS and TIER.Net data. District 3 appears to follow the laid-out processes from verbal clarifications on the supposed process, and their data should be consistent.

From the small sample of districts examined here, the process appears to have inconsistencies, which could be further exacerbated in other districts across the country.

Discussion

The above analysis prompts questions about the drastically limited DHIS data use. There could be several reasons for this low data use in DHIS:

- Due to the data flow processes of HIV and TB data from TIER.Net to webDHIS, there is an increasing discrepancy between the reported values in DHIS and TIER.Net as a quarter progresses, which does not facilitate efficient data use. This report will outline the reasons for these discrepancies and offer suggestions on resolving this issue.
- DHIS dashboards may not be optimally configured for efficient data use in Provinces, so there is the tendency to fall back to other methods of data use. It is known that several provinces extract data from DHIS and import the data into data warehouses, which they established in the province using tools such as Excel, PowerBI or Tableau to refresh custom dashboards which they use more frequently. The data extraction process means that users do not visualise data directly in DHIS which the SQL views used to quantify data use in this report would have picked up.
- Due to a moratorium on further TIER.Net development all NIDS 2023 indicators are not included in the export to DHIS which may contribute to users preferring to use TIER.Net reporting to meet the requirement to report on all indicators.
- Insights gathered from the three EC districts, illustrate different needs:
    - A Monitoring and Evaluation and Reporting need which is mostly for formal reporting and in this case the requirement is that data should be complete. For example, when TB Outcomes are reported, all the outcomes should be captured already and included in the report. The TIER.Net export to DHIS includes outcomes after 1 year of treatment start date and fulfills this need.
    - An Operational Monitoring need which helps health workers and managers ensure that patients receive the care they need and ensuring that the data is captured correctly to finalise the reporting. For example, when patients complete their treatment after 6 or 9 months, the operational need is to see a report for 6 months or 9 months after treatment start date and to finalise all capturing or follow up on possible outstanding patients to ensure they do not default from treatment.

DHIS can fulfil the M&E need above but currently only TIER.Net is fulfilling the Operational reporting needs of users thus the low DHIS2 data usage described in this report.

Dataflow

TIER.Net has been a distributed system (not web-based) in health facilities and installed in MS Access since its inception. South Africa implemented DHIS2 or webDHIS as a web-based system since April 2017.

TIER.Net is updated daily by data capturers who enter information from patients' clinical records. After each quarter, all dispatches are sent to the Subdistrict office, where they are imported into a Subdistrict TIER database. The Subdistrict then conducts completeness and version checks on the data. Following these checks, the DHIS export process generates two separate files: one for Antiretroviral Therapy (ART) and another for Tuberculosis (TB). These files are subsequently imported into webDHIS; specifically, the ART file is uploaded to the Quarterly ART DHIS instance, while the TB file is imported into the Provincial DHIS instance by the Subdistrict Information Officer.

The data flow between TIER.NET and webDHIS is outlined in an NDOH procedure quoted below:

Timelines for reporting quarterly TIER data

Each cohort is reported three months after the close of a quarter. This allows all activities to be completed, such as confirming outcomes and capturing laboratory results.

Reporting Quarter	Reporting date to Subdistrict (Timelines are aligned with the DHMIS policy)	Subdistrict Import into DHIS by:
January – March	5th July	10th July
April – June	5th October	10th October
July-September	5th January	10th January
October-December	5th April	10th April

It should be stressed that the Standard Operating Procedure (SOP) indicates that dispatches and imports into DHIS should only be made once per quarter at the above frequency according to the standardised dataflow timelines.

Figure 1 (NIDS Data Flow NDOH) below illustrates the data flow from the Facility to the National level, including the proposed timelines for the NDOH Health Information Centre (data lake). Please note that this is based on the assumption that TB and ART data would flow from DHIS into the Data Lake.

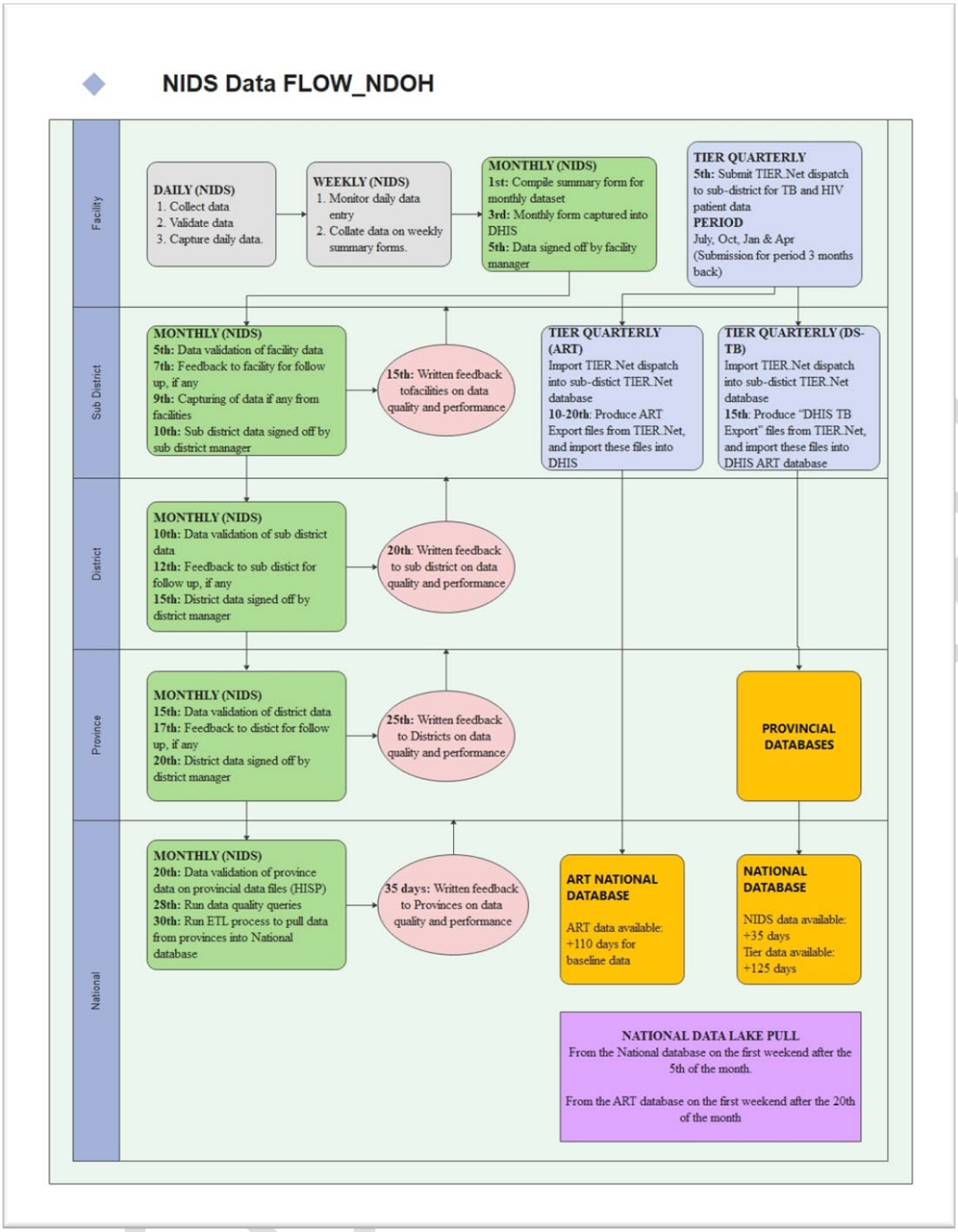


Figure 1. NIDS data flow

Data Congruency

The Rapid internal Performance Data Audit (RIPDA) instance has been utilised in South Africa to confirm data consistency between data sources such as registers and the DHIS reporting system. For ART and TB data, it has been used to verify the consistency of data between DHIS and TIER.Net. The procedure for this consistency test involves performing a TIER.Net export into DHIS, followed by a RIPDA assessment from the export file generated from the dispatch file from TIER.Net. As long as they use that same export file to compare the data with DHIS during the quarter being assessed, the data has been shown to be 100% consistent.

However, since TIER.Net would be updated daily from patient files, it stands to reason that as soon as more data is captured in TIER.Net the two systems would be misaligned until a next export is made. The discrepancies would also escalate in severity as the quarter progresses away from the last imported date.

Data consistency is foundational to effective data management, driving accuracy, trust, and operational success within organisations.

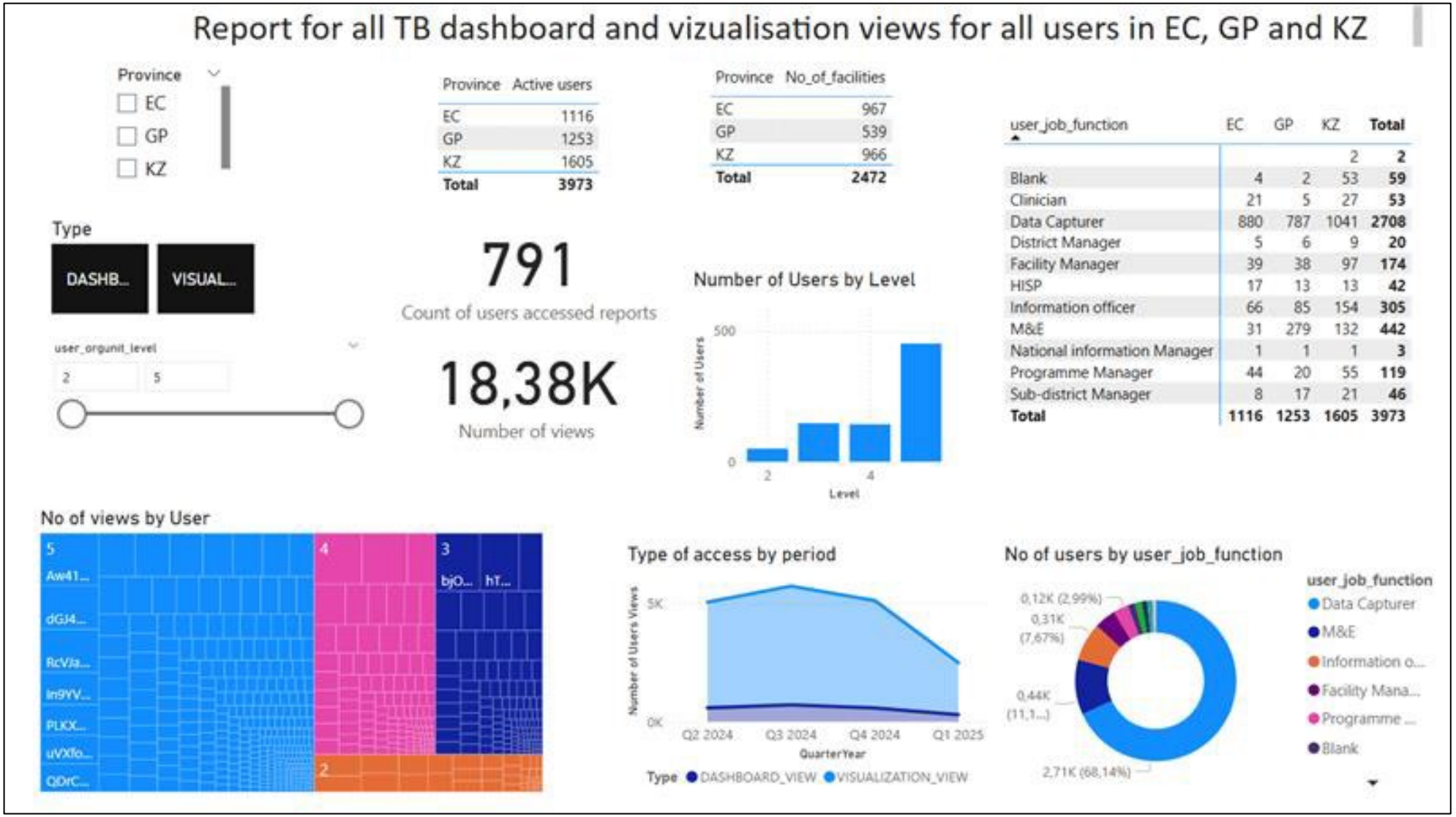
Recommendations

1. **Distinguish between different reporting needs:** Ensure that both M&E reporting needs and Operational reporting needs are covered through focus group discussions.
2. **User Feedback**: Conduct focus group discussions to understand user needs and improve report/dashboard configurations.
3. **Data Synchronization**: Establish more regular data exchanges between TIER.Net and DHIS2 to improve data consistency and relevance.
4. **User Training**: Enhance training for users on DHIS2 functionalities to increase engagement.

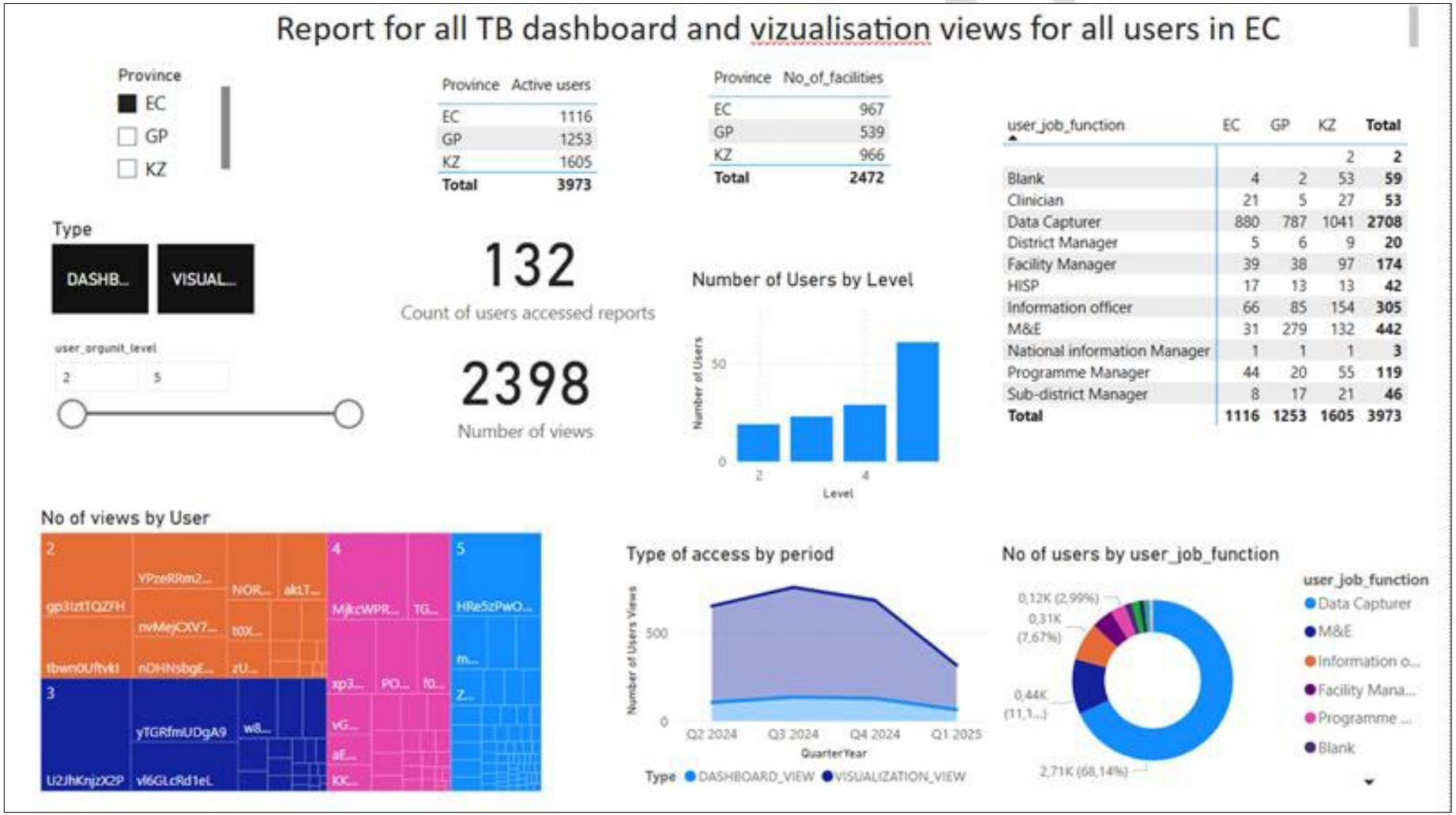
Conclusion

The report identifies significant gaps in the utilisation of TB data within DHIS2, highlighting the need for improved systems, user engagement, and data management practices to enhance TB program effectiveness.

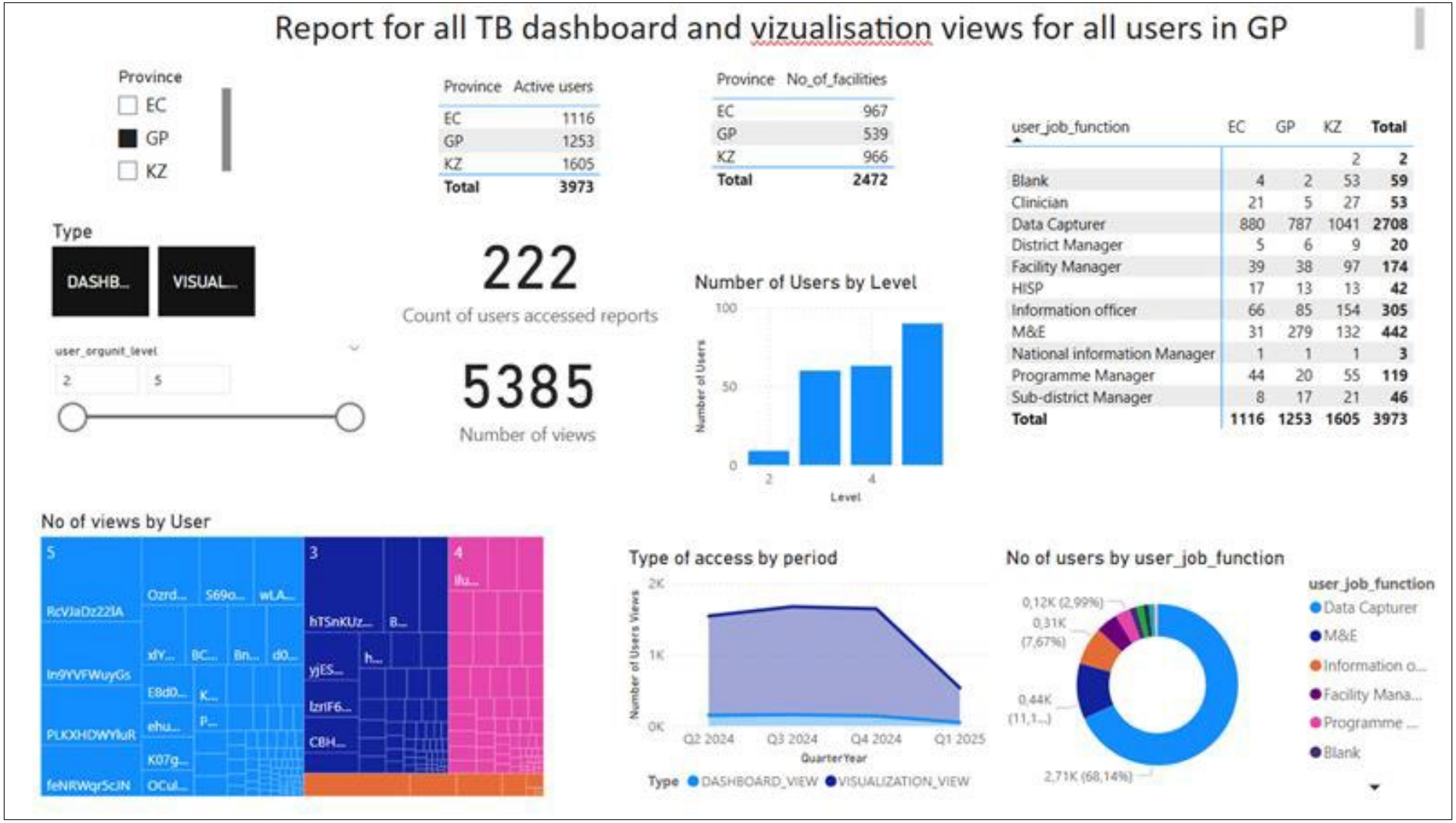
Annexure 1: Analysis for all Users (EC, GP, and KZN)



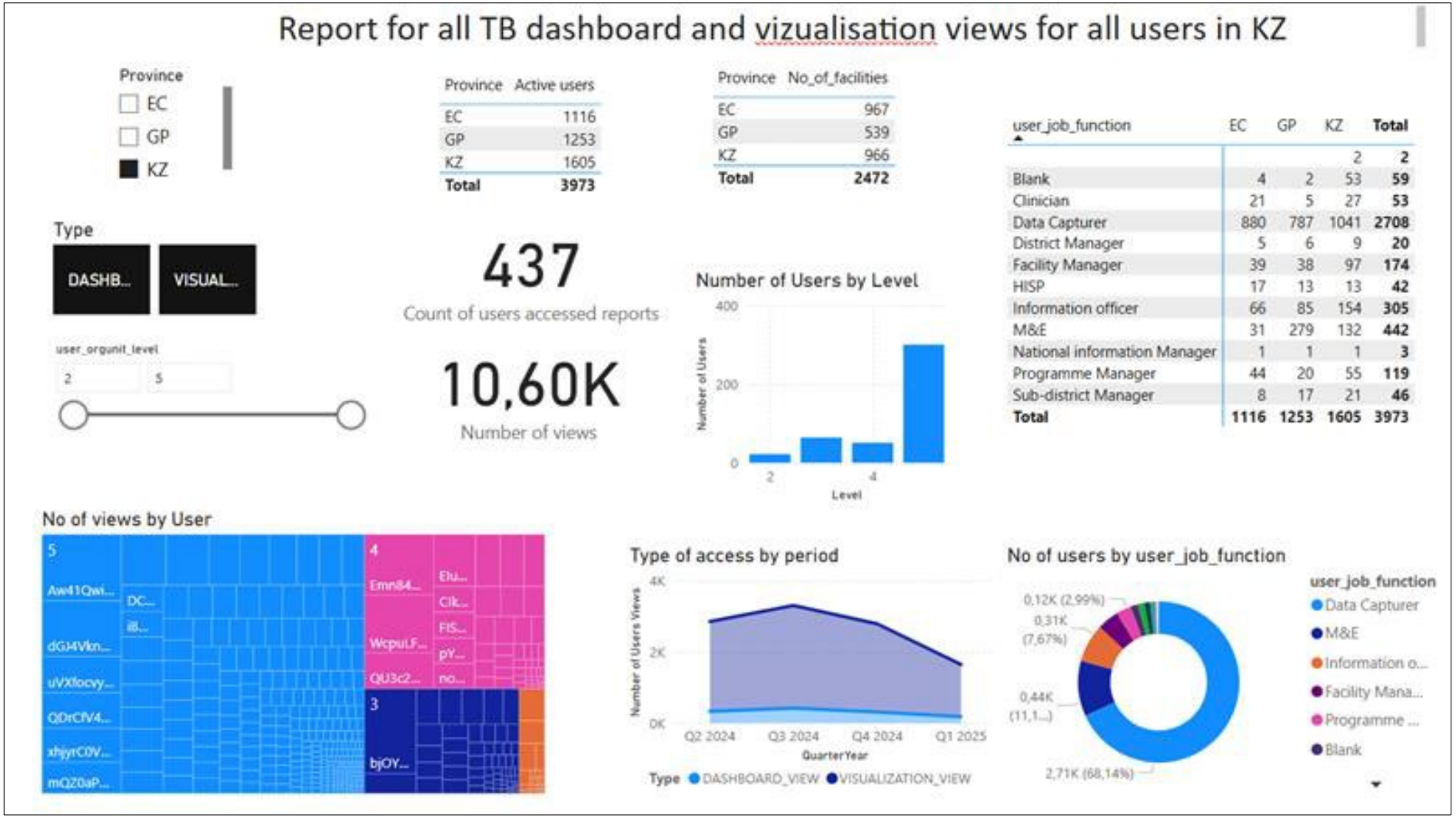
Annexure 2: Analysis for all users (EC)



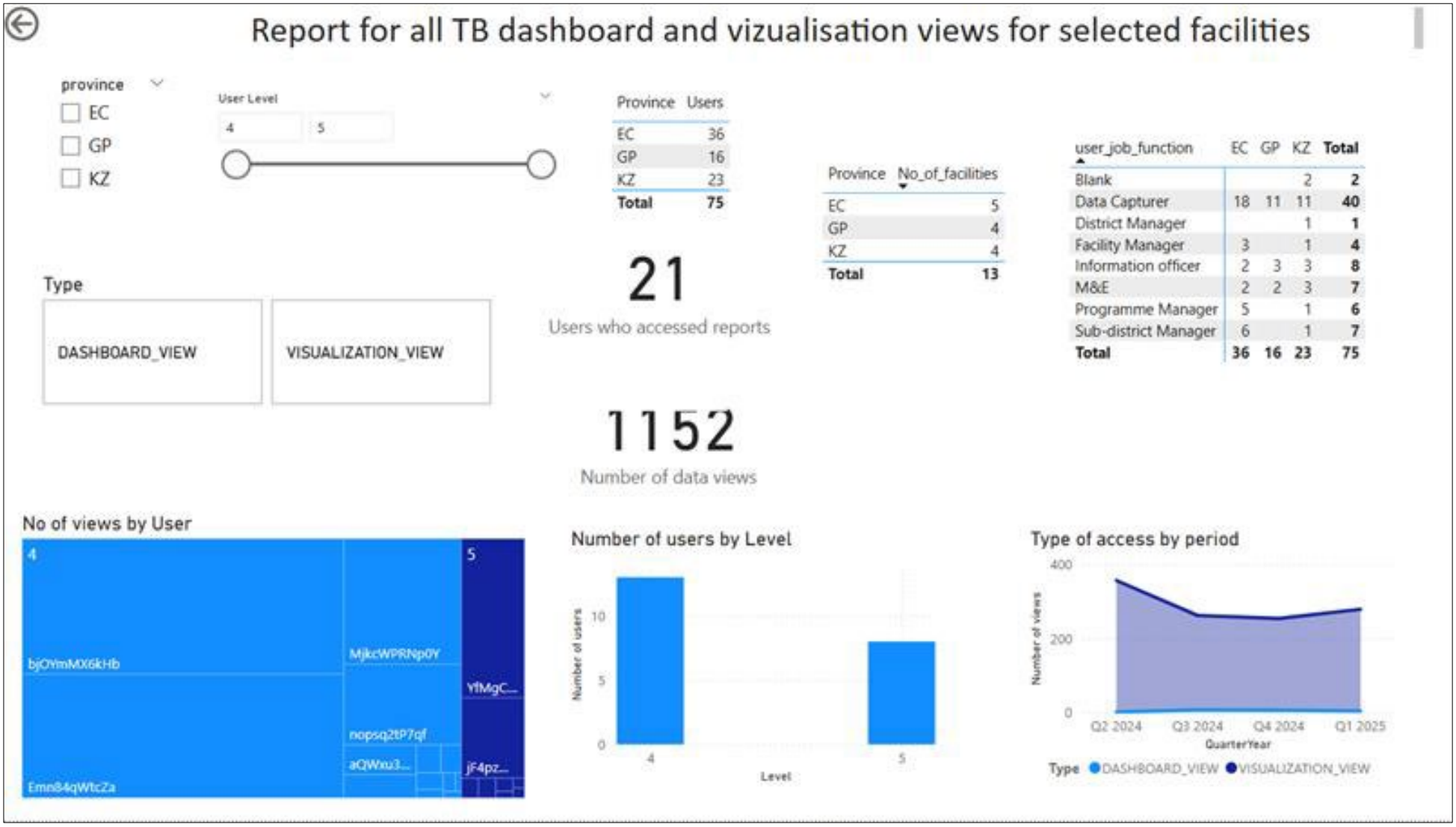
Annexure 3: Analysis for all users (GP)



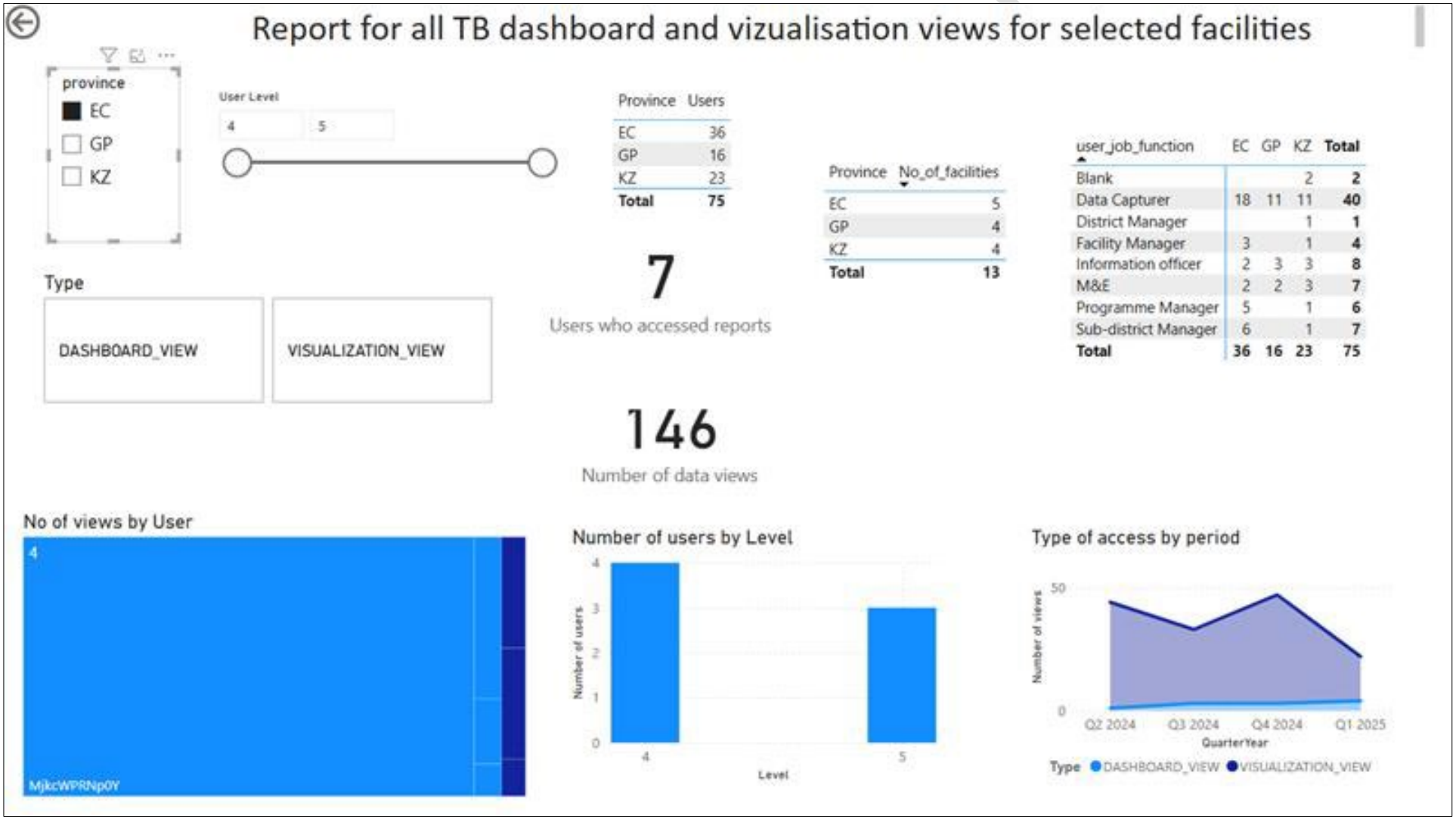
Annexure 4: Analysis for all users (KZN)



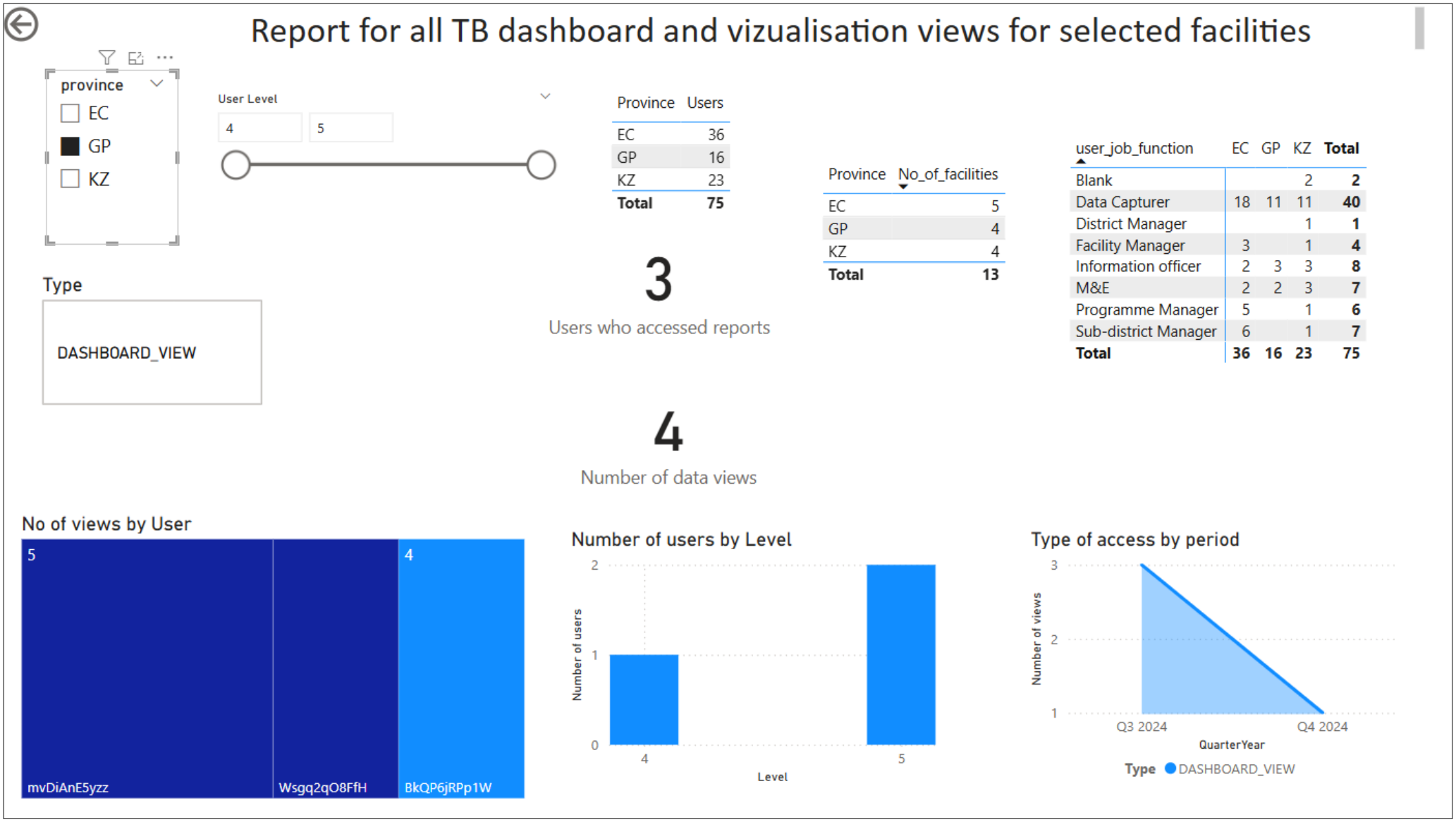
Annexure 5: Users included in selected provinces, (sub)districts, and facilities



Annexure 6: Users included in selected (sub)districts and facilities, EC



Annexure 7: Users included in selected (sub)districts and facilities, GP



Annexure 8: Users included in selected (sub)districts and facilities, KZN