DIPC

Ghana Digital Adaptation Kit for Tuberculosis

Version 0.1

Digital Square at PATH
Digital Innovation in Pandemic Control (DIPC)

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Content

Versioning and governance

In Ghana, although the first version of this localized TB DAK was initially developed with support from the Digital DIPC project in 2025, governance responsibilities transitioned from November 2025 onwards to GHS. It is hoped that the GHS National TB Programme (NTP) will assume responsibility for maintaining and updating the TB DAK. As part of this governance structure, ideally reviews are conducted at a minimum annually, with the next review due in September 2026 if following an annual cadence. (If opting for semiannual updates, the next review would be due in March 2027).

Version #	Date (Month, Year)	Updated by (Organization[s])	Updated by (Name[s])	Description of changes
1.0	September 2025	GHS, GIZ, PATH	Linda Taylor, Gideon Sarpong	This was the first version published of the localized TB DAK.

Abbreviations

CHIM	Center for Health Information Management
CHN	Community Health Nurse
CHV	Community Health Volunteer
DAK	Digital Adaptation Kit
DHIMS	District Health Information Management System
DIPC	Digital Innovation in Pandemic Control Project
DOTS	Directly Observed Treatment, Short-Course
DTDS	Digital Tracking and Decision Support
GHS	Ghana Health Service
HCW	Health Care Worker
HeFRA	Health Facilities Regulatory Agency
HMIS	Health Management Information System
ICD	International Classification of Diseases
IGRA	Interferon-Gamma Release Assay
LTBI	Latent Tuberculosis Infection
MFL	Master Facility List
MCH	Maternal and Child Health
PPME	Policy, Planning, Monitoring, and Evaluation
NTP	National Tuberculosis Control Programme
NHIS	National Health Insurance Scheme (Nhis)
SOP	Standard Operating Procedure
TB	Tuberculosis
UCH	Universal Health Coverage
WHO	World Health Organization

Introduction

The World Health Organization (WHO) Digital Adaptation Kits (DAK) are intended as a tool to ensure the WHO guidelines are correctly interpreted and integrated into digital health systems, ensuring that care is provided in accordance with evidence-based guidelines. Each DAK focuses on a particular health domain - in this case tuberculosis (TB) - and provides a common language for program managers, clinicians, software developers, and digital health implementers. Its purpose is to ensure a shared understanding of the health information content required for the TB program, supporting the effective use of digital systems. Specifically, it defines the content requirements for a digital tracking and decision-support system used by primary health care workers for TB case management.

This document describes how the screening, diagnosis, and treatment of TB occurs in Ghana's public health sector, according to Ghana's local policies and program requirements; and also describes what data is collected and used in the existing digital system, the TB care eTracker, which is based on DHIS2.

Objectives

The key objectives of this DAK are to:

- Document the health content and functionality of the TB care eTracker using the WHO DAK framework, allowing for an initial high-level comparison of the existing system against the latest WHO TB DAK.
- Enable health program leads and digital health teams (including software developers) to have a joint understanding of the health content within the digital system, through a transparent mechanism to review the validity and accuracy of the health content.
- Ensure adherence to Ghana-specific public health and data use guidelines and facilitate consistency of the health content that is used to inform the development of a person-centered digital tracking and decision-support (DTDS) system.

Digital Square at PATH developed this document by reviewing publicly available documentation and testing the TB care eTracker module. Unlike the standard process, key stakeholders from the National TB Program, Ghana Health Service Policy, Planning, Monitoring and Evaluation (PPME) Division, and Information Communication Technology (ICT) unit, as well as end-user representatives, were not engaged through workshops, interviews, or focus group discussions due to resource constraints at the outset. However, instead Digital Square at PATH shared a more advanced version of the document with the National TB Program for input and feedback. As a result, this document should be considered a starting point and further adapted and expanded by Ghana Health Service to inform the development of a localized TB Digital Adaptation Kit (DAK) for Ghana.

Methodology

Information detailed in this DAK has been adapted from the generic workflow processes, data and decision-support algorithms, as derived from the **Digital adaptation kit for tuberculosis: operational requirements for implementing WHO recommendations in digital systems**[1] referred to hereafter as the WHO TB DAK.

This document has been adapted and contextualized to the local Ghanaian policies and requirements through a desk review of the following documents.

- The TB module within DHIS2 TB care eTracker system, using a test instance of the system provided by Health Information Systems Program (HISP) Ghana with dummy data.
- Ghana TB HIV Clinical Management Guidelines. (GHS/MOH, 2012).
- Guidelines for TB Preventive Therapy in Ghana. (MOH/GHS, 2018).
- Standard Operating Procedures for TB Case Detection for Ghana. (GHS, 2010).

Ghana's National TB Control Programme

The National Tuberculosis Control Programme (NTP) operates under the Disease Control and Prevention Department, which in turn falls within the Public Health Division of the Ghana Health Service (GHS), the primary implementing agency of the Ministry of Health (MOH). As the national authority on TB, the NTP is responsible for planning, coordinating, and managing TB control efforts across the country, overseeing activities from surveillance and diagnosis to treatment and monitoring, including oversight of logistics, laboratory services, and reporting systems. The National Tuberculosis Program (NTP) is based on the early implementation of the WHO-approved Directly Observed Treatment, Short-course (DOTS) strategy. This strategy emphasizes several key components: political commitment, using sputum smear microscopy for case detection, standardized treatment delivered under direct observation, a reliable drug supply, and a robust recording and reporting system. Despite these elements being in place, rural and peripheral areas still face challenges with diagnosis and referral. These issues are due to limited healthcare facility coverage and inadequate specimen transport systems, which prevent the timely identification and follow-up of suspected TB cases (GHS–Stop TB report, n.d.; GHRP-BMC, 2019). Treatment protocols follow WHO guidelines, with distinct intensive and continuation phases for new, retreatment, and pediatric cases. These treatments are provided through DOTS at health facilities, supported by strong national guidelines for drug-resistant TB that incorporate both clinical and bacteriological monitoring, including sputum smear/culture and drug-sensitivity testing when necessary (GHS–Stop TB report, n.d.).

[1]Digital adaptation kit for tuberculosis: operational requirements for implementing WHO recommendations in digital systems. Geneva: World Health Organization; 2024. Licence: CC BY-NC-SA 3.0 IGO

Procurement of TB medications, including fixed-dose combinations, is centralized through mechanisms like the Global Drug Facility, guided by annual quantification with multi-year forecasting to ensure supply chain continuity. Nevertheless, socioeconomic factors such as food insecurity, transport costs, and adverse drug effects significantly compromise treatment adherence, necessitating patient-centered and multisectoral support interventions (PMC study, n.d.; GHRP-BMC, 2019). To broaden service coverage and bridge access gaps, Ghana launched a Private–Public Mix (PPM) initiative in 2024, integrating free TB screening, diagnosis, and treatment into private healthcare facilities. This initiative, supported by training, GeneXpert deployment, and the engagement of community-based "TB Champions" for case finding and psychosocial support, delivered over 600 notified TB cases in its first year alone, signaling promising progress toward more inclusive TB care (WHO Africa, 2025).

Ghana's TB Health Information System

The GHS PPME Division, in close collaboration with the NTP, developed a client-centered individual case management record system to collect, manage and analyze case-based records for TB screening, TB care & Treatment, and TB DOTS. This system called **TB care eTracker** is built on DHIS2 Tracker and was initially developed as a web-based tool in 2014, with an Android tablet version rolled out to mitigate challenges like limited internet connectivity and device shortages. It is deployed primarily in district hospitals in areas with high TB disease burdens. It aims to provide frontline health workers with easy access to client information, even in offline mode, improving their efficiency and effectiveness in TB case management.

In addition to individual case-based tracking, Ghana's DHIS2 TB module includes aggregate reporting features, such as:

- Quarterly reports on TB case notifications (new, recurrent, re-registrations).
- Yearly reports on drug susceptibility testing (e.g., rifampicin, isoniazid, fluoroquinolones, bedaquiline, linezolid).
- Treatment outcomes by regimen type for drug-sensitive and drug-resistant cases.

The system also supports data quality dashboards that help program managers and facility staff monitor completeness and timeliness of TB notifications and outcomes, identify discrepancies, and support improvement efforts through subnational-level feedback and mentoring.

DAK components

This DAK comprises eight interlinked components (Table 1) as described in the WHO DAK framework: (1) health interventions and associated recommendations; (2) generic personas; (3) user scenarios; (4) generic business processes and workflows; (5) core data elements; (6) decision-support logic; (7) indicators and reporting requirements; and (8) high-level functional and non-functional requirements. The information in this DAK originated from the WHO's generic framework, which was then customized to the specific context of Ghana.

Table 1. Eight components comprising the digital adaptation kit for TB in Ghana.

	Component	Description	Purpose	Output/artifacts	Adaptation needed
1	**Health interventions and recommendations**	Overview of the health interventions and WHO recommendations included within this DAK. The list of health interventions is drawn from the universal health coverage (UHC) menu of interventions compiled by WHO[2](12).	**Setting the stage -** To understand how this DAK would be applied to a digital tracking and decision support system in the context of specific health programs and interventions.	• **List of related health interventions** based on WHO's UHC essential interventions. • **List of related WHO recommendations** based on guidelines and guidance documents.	Contextualization to reflect current or planned national policies.
2	**Generic personas**	Depiction of the end-users, supervisors, and related stakeholders who would be interacting with the digital system or involved in the care pathway.	**Contextualization -** To understand the wants, needs, and constraints of the end-users.	**Description, competencies, and essential interventions** performed by targeted personas.	• Greater specification and details on the end users based on real people (e.g., health workers) in a given context. • High-level information to describe the provider of the health service (e.g., the general background, roles and responsibilities, motivations, challenges, and environmental factors).

[2]UHC compendium: repository of interventions for universal health coverage. Geneva: World Health Organization; 2020 (https://www.who.int/universal-health-coverage/compendium/interventions-by-programme-area, accessed 17 December 2020).

	Component	Description	Purpose	Output/artifacts	Adaptation needed
3	**User scenarios**	Narratives that describe how the different personas may interact with each other. The user scenarios are only illustrative and are intended to give an idea of a typical workflow.	**Contextualization -** To understand how the system would be used and how it would fit into existing workflows.	Example **narrative** of how the targeted personas may interact with each other during a workflow.	Greater specification and details on the real needs of end users in a given context.
4	**Generic business processes and workflows**	A business process is a set of related activities or tasks performed together to achieve the objectives of the health program area, such as registration, counselling, referrals[3](1,16). Workflows are a visual representation of the progression of activities (tasks, decision points, interactions) that are performed within the business process (1,16).	**Contextualization and system design -** To understand how the system fits into existing workflows and how best to design the system for that purpose.	• Overview **matrix** presenting the **key processes** for TB. • **Workflows** for identified business processes with annotations.	Customization of the workflows that can include additional forks, alternative pathways, or entirely new workflows.
5	**Core data elements**	Data elements required throughout the different points of the workflow. These data elements are mapped to the International Classification of Diseases version 11 (ICD-11) codes and other established concept mapping standards to ensure the data dictionary is compatible with other digital systems.	**System design and interoperability** – To know which data elements need to be logged and how they map to other standard terminologies (e.g., ICD, Systematized Nomenclature of Medicine [SNOMED]) for interoperability with other standards-based systems.	• List of data elements. • Link to **data dictionary** with detailed data specifications in spreadsheet format (Web Annex A).	Translation of "data labels" into the local language and additional data elements created depending on the context.
6	**Decision-support logic**	Decision-support logic and algorithms to support appropriate service delivery in accordance with WHO clinical, public health, and data use guidelines.	**System design and adherence to recommended clinical practice** - To know what underlying logic needs to be coded into the system.	• List of decisions that need to be made throughout the encounter. • **Link to decision-support tables** in a spreadsheet format with inputs, outputs, and triggers for each decision logic (Web Annex B). • Scheduling logic for services (Web Annex B).	• Change of specific thresholds or triggers in a logic (IF/THEN) statement (e.g. BMI cut-off, age trigger for "youth friendly" services). • Additional decision-support logic formulas depending on the context.

[3]Collaborative Requirements Development Methodology (CRDM). In: Public Health Informatics Institute [website]. Decatur, GA.: The Task Force for Global Health; 2016 (https://www.phii.org/crdm/, accessed 11 February 2021).

	Component	Description	Purpose	Output/artifacts	Adaptation needed
7	**Indicators and performance metrics**	Core set of indicators that need to be aggregated for decision-making, performance metrics, and subnational and national reporting. These indicators and metrics are based on data that can feasibly be captured from a routine digital system, rather than survey-based tools.	System design and adherence to recommended health monitoring practices – To know what calculations and secondary data use are needed for the system, based on the principle of "collect once, use many." [4](9)	Indicators table with numerator and denominator of data elements for calculation, along with appropriate disaggregation.	• Changing calculation formulas of indicators. • Adding indicators. • Changing the definition of the primary data elements used to calculate the indicator based on data available.
8	**Functional and non-functional requirements**	List of core functions and capabilities the system must have to meet the end-users' needs and achieve tasks within the business process.	System design – To know what the system should be able to do.	Table of functional and non-functional requirements with the intended end-user of each requirement, as well as why that user needs that functionality in the system.	Adding or reducing functions and system capabilities based on budget and end-user needs and preferences.

How to use this document

Target audience

The primary target audience for this DAK are health program managers within MOH and GHS, who will be working with their digital or health information systems counterparts in determining the health data requirements for a TB DTDS system. The Health Program Manager is responsible for overseeing and monitoring the implementation of the clinical practices and policies for the health program area, in this case TB.

The DAK also equips individuals responsible for translating health-system processes and guidance documents into specification for digital systems with the necessary components to kick-start the process of developing, maintaining or updating/enhancing a DTDS system in a standards-compliant manner. These individuals are also known as Business Analysts. Business Analysts interface between health content experts and software development teams. Specifically, this DAK contains key outputs, such as the data dictionary and decision-support algorithms, to ensure the validity and consistency of the health content with the DTDS system.

Using this DAK requires a collaboration between Health Program Managers and counterparts in digital health and health information systems. Although each DAK focuses on a particular health program area (in this case TB), these assets are envisioned to be used in a modular format and link to other health program areas within primary health care settings, in an effort to support integration across services.

[4]Barton C, Kallem C, Van Dyke P, Mon D, Richesson R. Demonstrating "collect once, use many" – assimilating public health secondary data use requirements into an existing Domain Analysis Model. AMIA, 2011, 98–107.

Notation guidance

Throughout this DAK, there are identification (ID) numbers to simplify tracking and referencing of each of the components. Note that the DAK represents an overview across eight different components, and standard notation is recommended for the five components listed below to ensure linkages across these components. The comprehensive and complete outputs of the data dictionary is included in an appended spreadsheets. The notation guidance is as follows:

Component 4: Business processes and workflows

- Each workflow should have a **"Process name"** and a corresponding **letter.**
- Each workflow should also have a "Process ID" that should be structured as:
  - **Abbreviated health domain** (e.g., GIZPS)
  - **Corresponding letter for the process** (e.g., A)
- Each activity in the workflow should be numbered with an **"Activity ID"** structured as:
- **Process ID** from above + **Activity Number** (e.g., GIZPS.B7)

Component 5: Core data elements (data dictionary)

- Each data element should have a running number and a **"Data Element (DE) ID"** structured as:
  - **Abbreviated health domain** (e.g., GIZPS)
  - "DE"
  - **Sequential number of the data element** (e.g., GIZPS.DE.1, GIZPS.DE.2)

Component 6: Decision-support logic

- Each decision-support logic table should have a running number and a "Decision-support table (DT) ID" structured as:
  - **Abbreviated health domain** (e.g., GIZPS)
  - "DT"
  - **Sequential number of the decision-support table** (e.g., GIZPS.DT.1, GIZPS.DT.2)

Component 7: Indicators and performance metrics

- Each indicator should have an **"Indicator ID"** structured as:
  - **Abbreviated health domain** (e.g., GIZPS)
  - "IND"
  - **Sequential number of the indicator** (e.g., GIPZP/IND/1, GIPZP/IND/2)

Component 8: High-level system requirements

- Each functional requirement should have a "Functional requirement ID" structured as:
  - **Abbreviated health domain** (e.g., GIPZP)
  - "FXREQ"
  - **Sequential number of functional requirement** (e.g., GIPZP.FXREQ/1, GIPZP.FXREQ/2)
- Each non-functional requirement should have a **"Non-functional requirement ID"** structured as:
  - **Abbreviated health domain** (e.g., GIPZP)
  - "FXN"

Component 1: Health interventions and recommendations

Interventions referenced in this DAK based on WHO's Health Interventions for UHC and WHO TB guidelines and guidance documents, are the following.

Prevention by implementing:
- Bacillus Calmette–Guerin vaccination based on individual characteristics.
- Social protection and poverty alleviation measures and actions on determinants of TB.
- TB preventive treatment (TPT), preferably using shorter regimens.

Screening by means of:
- Active case-finding for TB among at-risk populations.
- Screening for TB among clinically at-risk groups and vulnerable.
- Populations to exclude active TB disease.

Case detection and diagnosis of TB by using:
- Targeted history and physical examination for TB.
- Laboratory work.
- Imaging studies.
- Diagnostic procedures.

Management of TB by means of:
- Non-pharmacological treatments
- Oral medications.
- Injectable agents.
- Procedures (including surgeries).
- Management of TB and comorbidities.
- Rehabilitation services.
- Treatment monitoring.

Component 2: Personas

A user persona describes the general background, demographics, work environment, motivations, and key challenges for various country stakeholders that interact with the health information system. It is a method for enhancing engagement with stakeholders and building context for prototyping and implementation efforts. The purpose of creating user personas is to enable team members and stakeholders to better understand and relate to end-users. The general user personas involved in the TB processes are listed in Table 2 below.

For the TB health area, the primary personas for the digital client health record and decision-support system are physicians, nurses, and clinical officers, with physicians and nurses most commonly working together.

Table 2. User personas involved in TB processes.

No.	Title	Description	Different names (if relevant)
1	**Client**	A person who is given medical care, which may include TB prevention, screening, diagnosis, care or treatment services. Clients may be TB-confirmed, TB-presumptive or they may not know their TB status.	Patient, health service user, individual seeking care, person with TB
2	**At-risk group**	A member of an at-risk group is someone who manifests an increased risk of progression from TB infection to active TB disease, due to specific clinical conditions, social conditions or the activities this person performs. At risk groups also often have legal and social issues related to their behaviors that increase their vulnerability to TB. Key populations include: (1) people living with HIV; (2) contacts (household contacts or close contacts); (3) other people at risk.	Vulnerable groups
3	**Contact**	Any individual who has been exposed to a person with TB disease. There are two types of contacts. (1) Close contact, that is, a person who is not in the household but has shared an enclosed space, such as at a social gathering, workplace or facility, for extended periods during the day with the index patient during the three months before commencement of the current TB treatment episode. (2) Household contact, that is, a person who has shared the same enclosed living space as the index case (the initially identified person of any age with new or recurrent TB) for one or more nights or for frequent or extended daytime periods during the three months before the start of current treatment.	Close contact, household contact
4	**Doctor**	A legally qualified and licensed practitioner of medicine, concerned with maintaining or restoring human health through the study, diagnosis, and treatment of disease and injury, through the science of medicine and the applied practice of that science.	Physician, family doctor, general practitioner, medical doctor, specialist doctor (e.g., pediatrician, pulmonologist, psychiatrist), non-specialist doctor
5	**Nurse**	A graduate who has been legally authorized (registered) to practice after examination by a state board of nurse examiners or similar regulatory authority. Education includes three, four or more years in nursing school, and it leads to a university or postgraduate university degree, or the equivalent.	Registered nurse, nurse practitioner, clinical nurse specialist, advance practice nurse, practice nurse, licensed nurse, diploma nurse, nurse, nurse clinician, DOTS nurse
6	**Community health nurse (CHN)**	Community Health Nurses facilitate education sessions, administer treatment, provide counseling when needed, record stock movements, and compile/generate and approve facility reports.	Health care worker (HCW), public health nurse, licensed public health nurse
7	**Community health volunteer (CHV)**	Community health volunteers provide health education, referrals, follow-up, case management and primary preventive health care, and home visiting services to specific communities. They provide support and assistance to clients seeking TB-related services and their families in navigating the health and social services system.	Community health worker (CHW)
8	**Disease Control Officer Technical Officer**	Oversee TB activities at regional, district, sub-district, community, and facility level. Management of reporting, surveillance, supervision of TB activities.	Disease Control Officers, District Directors, Public Health Nurses, TB Program Officer

No.	Title	Description	Different names (if relevant)
9	**Deputy Director Public Health**	Oversee health activities in the region including TB.	Deputy Director in charge of public health in the region
10	**Health information officer**	Oversee data recording and reporting issues at regional, district, sub-district, community, and facility level. A manager supervising the monitoring system to track quality of care and data. This person provides a link between the health center and central level to ensure that patient monitoring needs are met (e.g., adequate staffing, tools and other resources) and implements changes to data standards or norms.	Health information officer
11	**National staff**	Responsible for developing annual and multi-annual plans; TB communication and mobilization; management of logistics, the cold chain, and vaccines; monitoring, supervision, and evaluation of TB services; and coordination of TB activities at the national level.	PPME , Public Health, Supplies, Stores and Drugs Management Division (SSDM), TB Programme, Centre for Health Information Management (CHIM) and other GHS national staff
12	**Data entry clerk**	An individual who helps to record, organize, store, compute and retrieve information, including patient records and registers. Clerks may also transcribe data, tally data, fill in routine reports and review the quality of data with others.	
13	**Registration clerk / medical office receptionist**	An individual responsible for receiving and welcoming visitors, guests or clients; making appointments for clients; dealing with telephone requests for information or appointments; directing clients to an appropriate location or person; supplying information pamphlets, brochures or forms.	
14	**Counsellor**	A person who provides counselling, therapy and mediation services to individuals, families, groups, and communities in response to social and personal difficulties. They assist clients to develop skills and access resources and support services needed to respond to issues arising from health problems and other personal, family, and social problems. They liaise with other social service agencies, educational institutions and health-care providers to advocate for client and community needs.	Psychotherapist, psychologist, social worker
15	**Laboratory technician**	A person who performs clinical tests on specimens of bodily fluids and tissues to get information about the health of a patient or cause of death. They use approved assays and operate equipment for analysis of biological material including sputum, stool, blood, urine, pleural fluid, cerebrospinal fluid, and respiratory samples.	Medical laboratory technician, pathology laboratory technician, medical laboratory assistant, pathology technician, Laboratory personnel, laboratory worker
16	**Pharmacist**	Pharmacists store, preserve, compound and dispense medicinal products. They counsel on the proper use and adverse effects of drugs and medicines following prescriptions issued by medical doctors and other health professionals. They contribute to researching, testing, preparing, prescribing and monitoring medicinal therapies for optimizing human health.	Chemist, clinical pharmacist, community pharmacist, hospital pharmacist, retail pharmacist, dispensing chemist

Additional considerations for at-risk individuals

Stigma and need for confidentiality between health provider and client

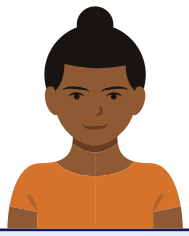
In many settings, TB status, HIV status, drug use and possession, and alcohol use are criminalized and associated with stigma and discrimination. Health providers must maintain confidentiality and understand that leaked information on personal identifiable information linked to these behaviors and clinical status raises the potential for negative consequences both to individuals and to service providers. As such, it is important to keep shared information confidential in keeping with the necessary public health functioning of a TB program or unit. Keeping people's TB status private will also help combat the stigma that is still associated with TB and help ensure the trust of patients and their communities.

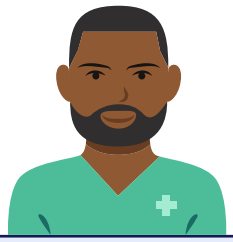
Data collection necessitates unique identifiers to protect patients' confidentiality

Because of these sensitivities, it is recommended that data collected on criminalized and stigmatized populations remain anonymous. TB prevention services can be provided effectively and efficiently, and individuals can be followed longitudinally using anonymous unique identification codes, without the collection of personally identifying information.

Only information that is clinically relevant should be included in clinical records where individuals are personally identified. Any data collection or data sharing scheme must have in place adequate safeguards to protect privacy and confidentiality, to minimize, mitigate or eliminate the risks of bias and stigma, and to ensure correct use by appropriate users.

Detailed personas

	**Betty, Community Health Volunteer who lives in a community**	
	Demographics	Betty is a 45-year-old woman living in a community in Ghana. She has 12 years of experience working in community health services, where she received training.
Responsibilities	• Community mobilization. • Community health education. • Clients follow up. • Client referrals. • TB, nutrition, HIV/AIDS. • Community services including family planning. • Provides community health services to people in catchment communities.	
Challenges	• Low awareness and demand for TB services among community members. • CHV may have limited knowledge on TB. • CHV may have inadequate tools and resources to support provision of services and follow-ups.	
Connectivity and eHealth	• Expected to have a personal mobile phone. • CHV may have challenges in accessing/paying for airtime/data for the mobile health applications used in the course of his/her work. • CHV may have challenges with charging their mobile devices. • Has limited access to connectivity.	

	**David, public health nurse who works in a district hospital**	
	Demographics	A dedicated and experienced licensed public health nurse with 10 years of valuable expertise in the healthcare field. At 38 years of age, he is passionate about providing compassionate and high-quality care to his clients. David is based at the district hospital in the Volta Region. His dedication to his profession is complemented by his personal life as a committed husband and father of two children.
Responsibilities	• Conduct TB services (e.g., prevention, screening, TB management). • Reporting. • Data entry. • Health education. • Provision of community health services. • Outpatient Department (OPD), In-Patient Department (IPD), Close to Community services (CTC).	
Challenges	• Work overload: multiple responsibilities resulting from not having enough staff at the district hospital. • Has limited access to connectivity.	
Connectivity and eHealth	• Expected to have a personal mobile phone. • District hospital has grid electricity power supply.	

	**Adowa, TB Officer in a district in Greater Accra Region**	
	Demographics	Adowa is in her late thirties, with eight years of working experience as a TB officer in a district in the Greater Accra Region.
Responsibilities	• Oversee 44 health facilities. • Ensure availability of accurate, complete, and updated information required for effective TB program in the district. • Draft monthly, quarterly, and final reports to other levels (e.g., regional and national). • Keep enough TB medicines in stock and store them properly at the district level. • Perform TB medicine stock audits in health facilities across the district. • Distribute and fill monthly electronic report forms in the national DHIMS system. • Participate in routine TB data verification. • Conduct training to HCWs on TB activities. • Support mapping of defaulters tracing in the district.	
Challenges	• TB medicine stockouts at the district hospital pharmacy. • Lack of transport. • No budget for airtime and data for mobile health applications used for work purposes. • Scarcity of data tools (e.g., tally, register booklets) at facility level. • Lack of a PC to use for work.	
Connectivity and eHealth	• Reliable power supply, good internet connection, access to tablets.	

Component 3: User scenarios

3.1 How to interpret user scenarios for functional requirements

User scenarios are helpful tools for understanding the context in which a digital tool would operate. They also provide insights into the key data elements that need to be recorded and accounted for in the database. Additionally, by illuminating the operational context, user scenarios help identify both functional and non-functional requirements that the system must address. For example, highlighted in **yellow** are some key data elements that need to be recorded and/or calculated. Highlighted in **blue** are some decision-support logic that can be automated in the system. Highlighted in **green** are some key functional and non-functional requirements that should be included in the system.

3.2 User scenarios for TB screening and TB preventive treatment

The following user scenarios describe both the current state (i.e., the way that CHVs currently work) and a possible future state where CHVs are able to use digital tools to better support their work.

3.2.1 Household contact: TB (TB) screening and infection testing - CURRENT STATE

Key personas	**Care giver (mother):** Mabel **Child:** Nana **Community Health Volunteer:** Betty
Betty is a CHV working for a health clinic. Today she is in the field, in a small village, to perform TB screening and TB infection testing on the household contacts of individuals with confirmed TB disease. Because there is a high HIV prevalence in the country, HIV testing is also offered. Betty is visiting the house of Mabel, a 41-year-old woman, who was recently diagnosed with pulmonary TB disease and who provided information about her household contacts. Mabel agreed in advance to receive the visit. Betty meets Nana, Mabel's son, and finds out that he is 21-years old. Betty asks the young man if he lives in the same house as Mabel. Nana confirms and explains that occasionally he goes outside of his town for several days because of his work, but most days he is living in the same house as his mother. Betty informs Nana about the purpose of the visit, the benefits and risks of the screening process, and the chosen screening algorithm and how TB is tested for. Betty highlights the importance of going to the hospital so that Nana can be screened and tested, because he is at high risk due to his mother's recently diagnosed TB status. Betty also explains how preventative treatment (TPT) can protect Nana. She also suggests that Nana should take an HIV test and explains the reason for the test (the high HIV prevalence), outlining that people living with HIV (PLHIV) are around 20 times more likely to develop TB disease than those without HIV infection. Betty refers Nana to the nearest hospital and also records this in her book so that she can provide reports to her supervisor. Betty asks if Nana has any other concerns or questions.	
Corresponding business processes (see Component 3)	This scenario refers to the following business processes: **A.** Registration **B.** Screening **F.** Referral

3.2.2 Household contact: : TB (TB) screening and infection testing FUTURE STATE

Key personas	**Care giver (mother):** Mabel **Child:** Nana **Community Health Volunteer:** Betty
Betty is a CHV working for a health clinic. Today she is in the field, in a small village, to perform TB screening and TB infection testing on the household contacts of individuals with confirmed TB disease. Because there is a high HIV prevalence in the country, HIV testing is also offered. She used her tablet to access the digital system and obtain the list of contacts to be visited, which were entered into the system by the nurse working in the health clinic. Betty is visiting the house of Mabel, a 41-year-old woman, who was recently diagnosed with pulmonary TB disease and who provided information about her household contacts. Mabel agreed in advance to receive the visit. Betty meets Nana, Mabel's son, and finds out that he is 21 years old. Using her tablet, Betty opens the application she is using for client management and contact tracing and **searches** using **Nana's first and last name,** but the app warns her that there is no internet connection; therefore, no results are returned. **The app then suggests to Betty that she should save Nana's data locally, temporarily, until the app goes back online. Once the app is connected to the internet, it will check whether a client** with **Nana's identifiers** exists on the system or not; based on the result, it will propose **creating a new client or updating an existing one,** matching Nana's data. After **entering into the system basic personal and demographic information** about Nana, **such as sex, and telephone number,** Betty asks the young man if he lives in the same house as Mabel. Nana confirms and explains that occasionally he goes outside of his town for several days because of his work, but most days he is living in the same house as his mother. As soon as the registration process finishes, Betty informs Nana about the purpose of the visit, the benefits and risks of the screening process, and the chosen screening algorithm and **the tuberculin skin test (TST) for TB infection.** Betty highlights the importance of a follow-up visit in 48–72 hours when the TST result shall be read. Betty also suggests that Nana should take an HIV test and explains the reason for the test (the high HIV prevalence), outlining that PLHIV are around 20 times more likely to develop TB disease than those without HIV infection. Betty asks the young man if he has any questions or concerns related to what was presented and asks for his verbal informed consent before starting the screening process. Next, Betty checks if Nana has any signs or symptoms suggestive of TB. Because none are present, Betty decides to administer a TST on site. Then, Betty informs Nana about the next steps, which consist of reading the TST result and performing a chest X-ray (CXR) at the clinic, followed by further diagnostic tests if the CXR looks abnormal. If the CXR does not present any abnormalities and the TST result is positive, then Nana will be evaluated for TPT eligibility. Betty briefly provides counselling on what TPT is and its benefits. The TST reading and CXR will be performed during the same visit to limit the inconvenience related to multiple visits to the clinic, such as time lost due to travel, financial expenses and delays in obtaining the test results. Because the TST should be read within a maximum of 72 hours from when it is administered, Nana agrees with Betty to **schedule a follow-up visit** at the clinic in 2 days' time. A rapid antibody HIV test is also administered because Nana has given his consent for this test to be carried out; this test is negative. Betty then asks Nana if he would like to receive the **referral letter** for the CXR via email, **using the email address provided during registration** (i.e., Nana could receive the referral letter immediately via email), instead of a **hard copy** at the end of the consultation. This could help with faster check-in at the clinic and avoid other inconveniences, such as losing it. Nana agrees. She also checks with Nana if he would like **to receive SMS (i.e., text message) reminders** for the next visits. As Nana agrees, Betty ticks the corresponding checkbox in the app, which indicates that the client has given the permission to receive this kind of notification. Betty asks if Nana has any other concerns or questions.	
Corresponding business processes (see Component 3)	This scenario refers to the following business processes: **A.** Registration **B.** Screening **E.** TPT **F.** Referral

3.2.3 User scenario for TPT assessment and counselling - CURRENT STATE

Key personas	**Client:** Nana **Receptionist:** Lerato **Nurse:** David
Nana presents to the health clinic for the referral visit as per Betty's instructions. He shows the receptionist at the registration desk the referral given to him by Betty. Lerato, the receptionist, checks if Nana has any appointment scheduled by searching the digital system using **Nana's national health ID.** As this is the first time that Nana has been to the hospital, he is not registered. Lerato asks for his information and registers him on the TB care eTracker system. Lerato tells Nana how to find the room where he should meet David, the nurse waiting for him. Nana makes his way to the consultation room, where David administers the TST test. After reading the TST, David tells Nana that the result is positive and sends Nana for a CXR. However, the CXR showed no abnormalities in the lungs. David then explains to Nana that the TB infection detected by the test does not mean that he has TB disease or that he is infectious, and that the best way to avoid developing TB disease would be by taking TPT. David provides further counselling on TPT, which includes the rationale for TPT and benefits to the individual, the household and the wider community. Nana also asks about medical conditions that would contraindicate TPT and discusses the potential risks of treatment. Nana shows interest in TPT, so David checks in the system **if the information provided during the previous encounters** would allow a complete TPT eligibility evaluation. This is not the case, so David starts asking Nana about his personal history, which may be relevant for TPT initiation, such as **allergy to TB drugs, previous TPT use, alcohol use, smoking and concurrent medication(s).** While registering the information on the system, David reassures Nana that all the information collected and his decision on whether to take TPT or not, will be kept confidential. The assessment reveals that the benefits of TPT outweigh the potential risk of acquiring TB or drug toxicity, so Nana decides to take TPT. After discussing the treatment regimen options, Nana and David decide to take a shorter rifAmacin-based TPT regimen because it is shorter and has fewer adverse side effects. David works out the medication dosage, provides medication for the next month and agrees with Nana to **schedule a follow-up visit in 1 month.** Before leaving the room, David makes sure that Nana knows how and who to contact in case of any signs or symptoms of adverse drug reactions or other TPT-related issues.	
Corresponding business processes (see Component 4)	This scenario refers to the following business processes: **A.** Registration **B.** Screening **E.** TPT

3.2.3 User scenario for active case-finding (ACF) campaign - FUTURE STATE

Key personas	**Nurse:** Azeeb **Data entry clerk:** Maira **Client:** Rohaan
Azeeb is a nurse working for a district health clinic in a large rural district. The clinic started an ACF campaign that focuses on TB detection so today Azeeb is in the field, together with his colleague Maira, on a mobile outreach screening campaign to a small mine in the district. Maira, the data entry clerk, invites the next man in the line to take a seat. His name is Rohaan, a 38-year-old man, who has worked in the mining sector for the last five years. Maira **registers Rohaan as a new client** because he was not yet registered in the electronic system. Once Rohaan is fully registered, he waits for the nurse to call him into the screening room. Azeeb invites Rohaan to the room and checks if he attended the group information session where the purpose of the ACT campaign, the benefits and risks of the screening process and the screening algorithm were presented. As Rohaan attended the session, Azeeb asks if he has any questions or concerns related to what was discussed. After obtaining Rohaan's verbal informed consent to start the screening process, Azeeb asks questions about any current TB symptoms and when it was the last time he had a CXR. As Rohaan has not had a CXR recently, Azeeb performs a CXR using a mobile X-ray device. The image shows no abnormal results. Rohaan does not manifest any TB symptoms; Azeeb tells him that he might be eligible for TPT, as someone who has been exposed to silica. After recording the screening results on his tablet, Azeeb offers Rohaan counselling on TPT.	

Rohaan looks interested in getting TPT, so Azeeb continues with assessing his TPT eligibility. **The digital system helps Azeeb by offering examples of questions** he should ask related to Rohaan's personal and medication history, and social and financial status. Azeeb asks Rohaan if he would like to be called on his phone number, collected during the registration, to be told about the test result. As Rohaan has nothing against this, Azeeb **marks in the system that the client accepts to be contacted using this communication channel.** Rohaan schedules a visit to the clinic where Azeeb is working to be counselled further on TPT and decide on his preferred regimen.	
Corresponding business processes (see Component 4)	This scenario refers to the following business processes: **A.** Registration **B.** Screening **E.** TPT

3.3 User scenarios for TB diagnosis and treatment

3.3.1 Diagnosis of drug-susceptible extrapulmonary TB for an adult - CURRENT STATE

Key personas	**Client:** David **Receptionist:** Ama **Doctor:** Laura
David, a 39-year-old man, arrives at the reception desk of the local hospital. He has an appointment scheduled today. When Ama, the receptionist, asks for identification information, he shows his Ghana card ID. Ama is able to find David's record and verifies his personal information. After being checked in, David waits to be called into the consultation room. Abena, the family doctor, welcomes him. David underwent a series of examinations in the last few weeks, triggered by the appearance of an excrescence (i.e., an abnormal outgrowth, lump, or projection on a body or organ) in the neck area and general apathy. David took antibiotics, but the treatment did not help. This time Abena proposes TB investigations because the non-tender, enlarged cervical lymph node David has could be a sign of extrapulmonary TB. Abena starts by assessing the TB contact history. As far as he knows, David has not interacted with a person confirmed with TB, but a few months ago he returned from a 3-month work trip in a country with high TB burden. Abena also looks for signs and symptoms of pulmonary TB. No signs or symptoms of pulmonary TB are identified. Abena suggests that David should undergo diagnostic testing for TB, for both pulmonary and extrapulmonary TB, because, according toAbena, the two forms can coexist. David accepts, so he goes to the test room, accompanied by Emily, the nurse, where a sputum specimen is collected. This specimen will be used to test for pulmonary TB. A few hours are needed before getting the result of the test performed on the sputum, so Abena suggests communicating the result to David by calling him on the phone number shown on the digital system and scheduling an in-person visit once the extrapulmonary TB test result is ready. David thinks this is a good idea. Abena advises performing the test for extrapulmonary TB as soon as possible so that the diagnosis can be made based on the results of both tests. The following day Abena informs David that the result of the test is "MTBC detected, RIF resistance not detected, INH susceptible". Therefore, the diagnosis is extrapulmonary TB. Abena prescribes a 6-month regimen (2HRZ/4HR: 2 months of INH, RIF and pyrazinamide, followed by 4 months of INH and RIF). Because HIV, diabetes, smoking, alcohol consumption and mental disorders are factors associated with poorer TB treatment outcomes, Abena asks a series of questions, suggested by the system, to assess the presence of these comorbidities. Abena also performs, after obtaining David's consent, a rapid antibody HIV test that produces a negative result and collects a blood specimen that will be used to screen for diabetes. If diabetes or other comorbidities are identified, a referral to the nearest appropriate health service might be necessary for further management. Next, Abena uses the system to generate the follow-up visit schedule and links it to David's profile. According to the schedule, the first follow-up visit is due the following week to assess whether David tolerates the treatment, and to monitor adverse events and discuss the result of the diabetes screen. The next stop is the pharmacy, where David picks up the medication for the first week as prescribed by Abena.	
Corresponding business processes (see Component 4)	This scenario refers to the following business processes: **A.** Registration **D.** TB treatment

3.3.2 Adult with drug-susceptible TB (DS-TB) - CURRENT STATE

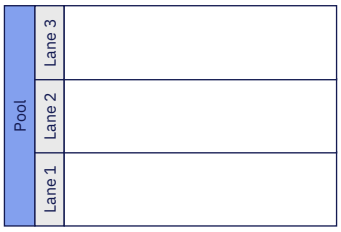
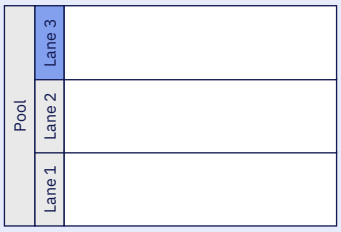
Key personas	**Client:** Amar **Nurse:** Aria
Amar is a 32-year-old man who lives in a poor rural community in an isolated area. One month ago, Amar was diagnosed with DS-TB and today he presents to the health-care facility for a follow-up visit. Amar had to take the bus because his village is 20 km away from the health centre. Aria, the nurse, welcomes Amar and invites him to the consultation room. The consultation starts with searching the system for Amar's record and to validate his details. The visit continues with the clinical assessment: the health worker checks for resolution or persistence of TB-related symptoms and for signs of medication side-effects. Amar's weight is also measured. The results reveal symptomatic improvement and a slight weight gain. Aria verifies if Amar took the drugs as prescribed. Amar tells her that he took the pills regularly. Aria continues with the assessment and counselling on treatment adherence. To make sure that the risk of financial hardship due to TB is minimized, the nurse provides information and education on available social protection services, such as nutritional support, employment guarantee, safe housing and poverty alleviation. At the end of the visit, Aria records the results of the examination performed on the system. She then checks the monitoring examination schedule to see when Amar should be scheduled for the next follow-up visit and what examinations should be performed at that time. Aria schedules the next visit in 1 month and provides a 1-month prescription. As smears and culture after the second month of treatment are necessary to monitor treatment response, Aria gives Amar a sputum container so that he can bring back a sputum sample at the next visit. Then, Aria gives Amar an appointment card detailing the date and time of the next follow-up visit.	
Corresponding business processes (see Component 4)	This scenario refers to the following business processes: **A.** Registration **C.** Diagnosis **D.** TB treatment **F.** Referral

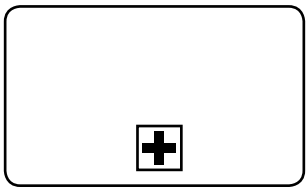
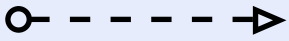
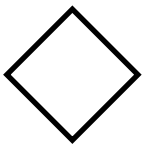
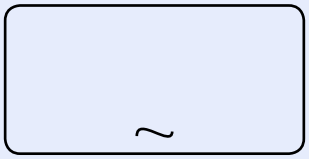
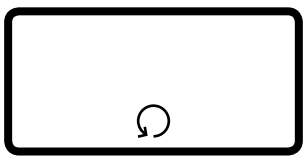
Component 4: Business process and workflows

A business process is a set of related activities or tasks performed together to achieve the objectives of the health programme area, such as registration, counselling and referrals. Workflows are a visual representation of the progression of activities (tasks, events, interactions) that are performed within the business process. The workflow provides a "story" for the business process being diagrammed and is used to enhance communication and collaboration among users, stakeholders and engineers.

This DAK focuses on the key business processes conducted by the personas (described in Component 2) as part of TB care service provision. These business processes are described in Table 3 below. For each of these business processes, the corresponding business processes, data elements and decision-support needs are detailed within the following sections of this document.

Table 3. Business process symbols used in workflows.

Symbol	Symbol name	Description
	**Pool**	A **pool** consists of multiple "swim lanes" that depict all the individuals or types of users that are involved in carrying out the business process or workflow. Diagrams should be clear, neat, and easy for all viewers to understand the relationship across the different swim lanes. For example, a pool would depict the business process of conducting an outreach activity, which involves multiple stakeholders represented by different lanes in that pool.
	**Swim lane**	Each individual or type of user is assigned to a **swim lane,** a designated area for noting the activities performed or expected by that specific actor. For example, a family planning health worker may have one swim lane; the supervisor would be in another swim lane; the clients would be classified in another swim lane. If the activities can be performed by either actor then those activities can be depicted overlapping the 2 relevant swim lanes.
	**Start event or trigger event**	The workflow diagram should contain both a **start** and an end **event,** defining the beginning and completion of the task, respectively.
	**End event**	There can be multiple **end events** depicted across multiple swim lanes in a business process diagram. However, for diagram clarity, there should only be one end event per swim lane.
	**Activity, process, step or task**	Each **activity** should start with a verb, e.g., "Register client", "Calculate risk". Between the start and end of a task, there should be a series of activities noting the successive actions performed by the actor for that swim lane. There can also be subprocesses of each activity.

Symbol	Symbol name	Description
	**Activity with subprocess**	This denotes an activity that has a much longer subprocess to be detailed in another diagram. If the diagram starts to become too complex and unhelpful, the subprocess symbol should be used to reference another process depicted on another page.
	**Activity with business rule**	This denotes a decision-making activity that requires the business rule, or decision-support logic, to be detailed in a decision-support table. This means that the logic described in the decision-support table will come into play during this activity as outlined in the business process. This is usually reserved for complex decisions.
	**Sequence flow**	This denotes the flow direction from one process to the next. The end event should not have any output arrows. All symbols (except start event) may have an unlimited number of input arrows. All symbols (except end event and gateway) should have one and only one output arrow, leading to a new symbol, looping back to a previously used symbol or to the end event symbol. Connecting arrows should not intersect (cross) each other.
	**Message flow**	This denotes the flow of data or information from one process to another. This is usually used when data are shared across swim lanes or stakeholder groups.
	**Gateway**	This symbol is used to depict a fork, or decision point, in the workflow, which may be a simple binary (e.g., yes/no) filter with two corresponding output arrows, or a different set of outputs. There should only be two different outputs that originate from the decision point. If you find yourself needing more than two "output" or sequence flow arrows, you most likely are trying to depict "decision-support logic" or a "business rule". This should be depicted as an "Activity with business rule" (above) instead.
	**Throw – Link**	The "Throw – Link" serves as the start an off-page connector. It is the end of the process when there is no more room on your page for that workflow. It is the end of a process on your current page or the end of a subprocess that is part of a larger process. There will need to be a "Catch – Link" that follows the "Throw – Link".
	**Catch – Link**	The "Catch – Link" serves as the end an off-page connector. It is the start of the new process on a different page from the "Throw – Link" or the start of a subprocess that is part of a larger process. There needs to be a "Throw – Link" that is aligned to the "Catch – Link".
	**Ad hoc subprocess**	An ad hoc subprocess can contain multiple tasks. One or more tasks in this shape should be performed, and they can be performed in any order. However, not all of these activities need to be finished before moving on to the next activity.
	**Loop activity**	This loop activity or loop task symbolizes an activity or task that is repeated until it no longer needs to be repeated. For example, vaccine administration can happen as many times as the number of vaccines that need to be given.

Overview of Ghana's main TB business processes

This section illustrates the workflows of the identified processes, within the Ghana context, using standardized notations for business process mapping.

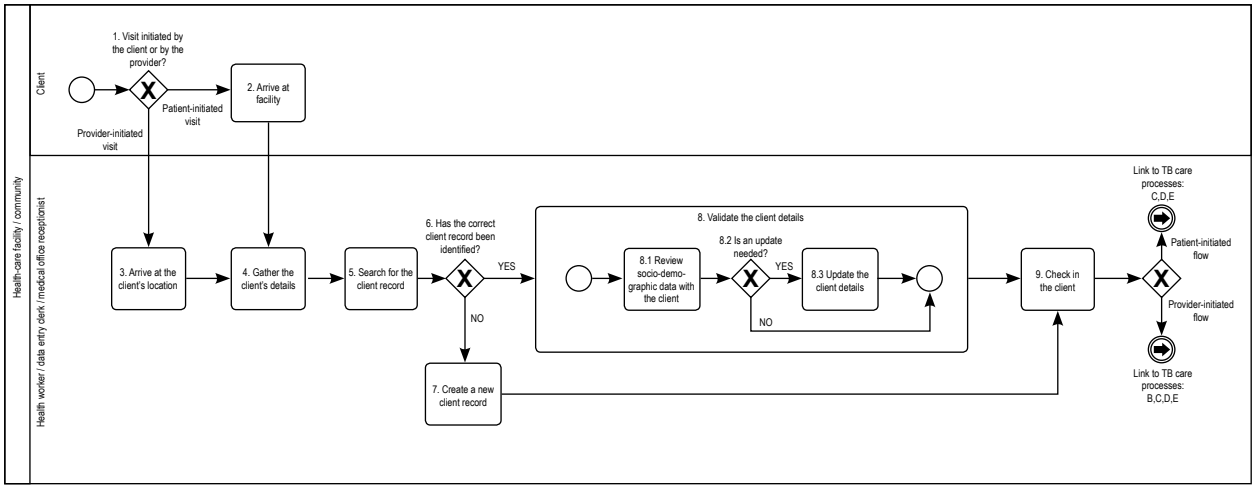
Table 4. TB business processes in Ghana.

No.	Process name	Process ID	Personas	Objectives	Task set
	Title	ID used to reference this process throughout the DAK	Individuals interacting to complete the process	A concrete statement describing what the process seeks to achieve	The general set of activities performed within the process
A	**Registration**	TB.A	Client (TB-confirmed, TB-presumptive or unknown TB status) Contact, Data entry clerk, receptionist or Health worker	To identify and register or update the client's personal details so that they can benefit from TB related services.	Starting point: The client arrives at the facility and checks in with the clerk, receptionist or health worker. Alternatively, the health worker makes contact with the client at his/her location (home, workplace, detention place). • Search for client record • Review and update client record • Create a new client record
B	**Screening**	TB.B	• Client • Contact • Health worker (physician, nurse or community health worker)	To reach people who are not reached by the patient-initiated pathway and to detect TB disease early, thereby improving outcomes for individuals and reducing transmission and incidence at the population level.	Starting point: The client or contact has been registered and called in for screening activities. TB screening can happen alongside other health services (e.g., HIV testing, nutrition counselling, child immunizations). • Provide pre-screening information • Assess medical history and risk factors • Screen for TB using a screening algorithm
C	**Diagnosis**	TB.C	• Client • Health worker • Laboratory technician	To determine TB status in clients by performing bacteriological and clinical investigations.	Starting point: The client has been screened positive (provider initiated pathway) or the client is seeking care at the health-care facility (patient-initiated pathway) and further investigation is needed to confirm or rule out TB disease. At this stage, for patients with confirmed TB, drug susceptibility testing (DST) will be performed. • Clinically evaluate the client • Collect specimens • Perform initial diagnosis tests using a diagnosis algorithm • Perform follow-on testing for evaluation of resistance to anti-TB drugs • Interpret and review results • Take diagnostic decision

No.	Process name	Process ID	Personas	Objectives	Task set
D	**TB Treatment**	TB.D	• Client • Health worker • Pharmacist	To initiate the appropriate TB treatment and perform necessary follow-up examinations to ensure that the correct treatment is followed, and that the patient adheres to it.	Starting point: The client has been diagnosed with TB disease. • Perform additional clinical examinations: evaluate risk for drug–drug interactions, assess for comorbidities, consider corticosteroid use, perform baseline evaluations • Determine treatment regimen and dosage • Develop monitoring examinations schedule • Initiate treatment and discuss treatment adherence • Monitor treatment considering the monitoring examinations schedule • Report treatment outcome
E	**TPT**	TB.E	• Client • Health worker • Pharmacist	To identify clients eligible for TPT, select the appropriate TB preventive treatment regimen for each client and ensure treatment adherence.	Starting point: The client has been screened negative for TB or TB disease has been ruled out after TB diagnosis activities. • Provide TPT counselling • Test for TB infection • Perform TPT eligibility evaluation • Determine TPT regimen and dosage • Develop TPT adherence plan • Report TPT completion
F	**Referral**	TB.E	• Client • Health worker	To provide timely and appropriate referrals to another health-care facility that can provide services unavailable within this facility.	Starting point: The clinician determines client needs for services that are not available at this facility. • Determine whether it is an emergency referral • Discuss referral locations • Contact destination facility • Provide information to destination facility • Discuss any questions with the client
G	**Aggregate reporting and data use**	TB.G	• Health worker • District health information officer	To aggregate client-level data into validated, aggregate reports, use the data and submit reports at the facility level.	Starting point: Time for periodic (usually monthly) reporting. • Check data quality • Correct fixable errors • Generate and review aggregate reports • Submit for approval • Provide feedback and any changes required

TB.A Business process for registration

Objective: To identify and register or update the client's personal details so that they can benefit from TB-related services.



Registration business process notes and annotations

Registration may be conducted as a stand-alone process by a data entry clerk or administrative person ahead of the encounter in which TB-specific services (screening, diagnosis, treatment) are offered or it may be conducted directly by the health worker as part of the overall encounter. These activities can be performed either in the healthcare facility or in the community (e.g., client's home, workplace), depending on where the encounter takes place.

1. **Was the visit initiated by the client or by the provider?**
   Depending on the reasons that triggered the encounter, the starting activity is represented either by
   - client's arrival at the health-care facility (i.e., patient-initiated)
     - Client's arrival at the health-care facility could also happen as part of a provider-initiated pathway (e.g., client referred for additional screening activities, PLHIV screened for TB by the health worker in the HIV clinic).

   or
   - by the health worker's arrival at the client's location (i.e, provider initiated).
   - The provider-initiated TB screening pathway systematically targets people at high risk of exposure to or of developing TB disease and screens them by assessing symptoms, using tests, examinations or other procedures to identify those who might have TB, following up with a diagnostic test and additional clinical assessments to make a definite diagnosis.

2. **Client arrives at facility**
   The client arrives at the healthcare facility and notifies the outpatient department, where staff provide further guidance. The client may already be registered at the facility for another service, such as HIV or diabetes care.

3. **Arrive at the client's location**
   The health worker arrives at the client's location.

4. **Gather the client's details**
   - **4.1.** Ask the client whether they have previously been issued with a unique identifier (like a National ID called the Ghana Card), client registration number, National Health Insurance number (NHIS).
   - **4.2.** Does the client have a card, number or barcode?
   - **4.3.** Does the client say they are a returning or referred client?
   - **4.4.** If a referral, check for the referral slip or data from the community.
     Determine whether the client is new to the healthcare facility or health post.
   - **4.5.** For returning clients, details will be retrieved from the registry of clients in the paper-based filing system or in the TB care eTracker system.

5. **Search for the client record**
   Search for the client's records either in the paper-based filing system or in the TB care eTracker system using their name, unique identifier.

6. **Has the correct client record been identified?**
   If multiple records are found for the client, consider merging or deleting duplicate records, according to the Health Management Information System (HMIS) guidelines or Standard Operating Procedures (SOPs).
   If multiple records are found where the same episode of TB disease in a given has been recorded more than once in the system, consider removing these duplicate records according to the HMIS guidelines or SOPs. Any duplicate records of the same episode of TB should be removed (de-notify duplicate case) to avoid over reporting.

7. **Create a new client record**
   Issue a unique identifier if used and possible at the facility.
   In the TB careTB care eTracker system, issue the client with the system-generated Client Registration Number
   Where there is a paper-based system, ...

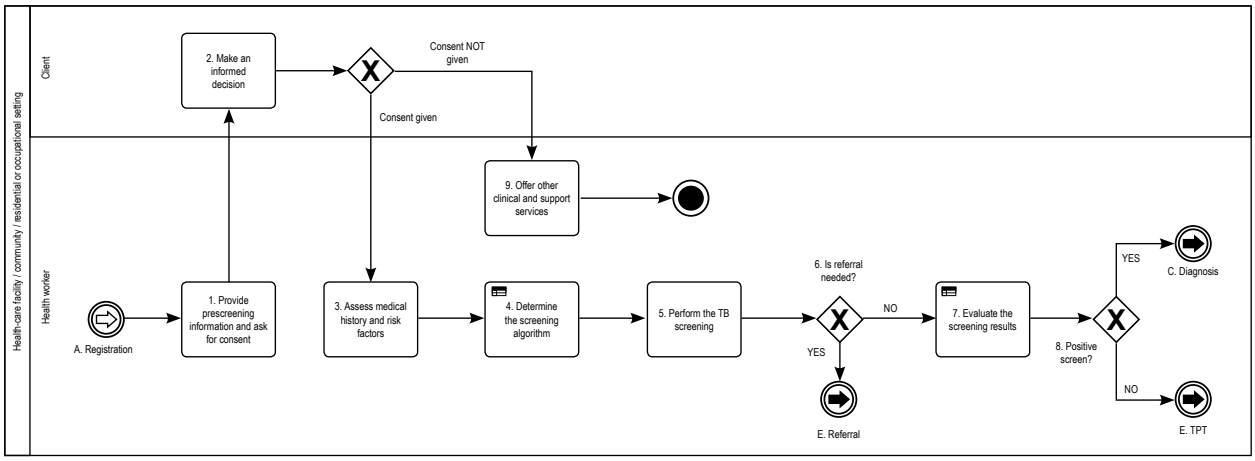
8. **Validate the client details**
   Review and update the client record.
   - **8.1.** Review the sociodemographic data with the client.
     Review the client's non-clinical information, that is, name, address, contact information, occupation, education level, etc.
   - **8.2.** Is an update needed?
     Has the client moved? Have they changed their contact information or has any other sociodemographic information changed?
   - **8.3.** Update the client details.
     The client can provide updated information if they have moved or changed their details recently.
   - **8.4.** Record the client's updated details in the paper registry or in the TB careTB care eTracker system.

   NOTE: This activity could also happen during other TB-specific processes, for example, screening, diagnosis, TB treatment, TPT.

9. **Complete the client check-in**
   Add the client to the relevant queue for TB-related services.
   - **9.1.** In case of patient-initiated flow, new clients will be redirected to "C. Diagnosis" while existing clients could continue the workflow with any of "C. Diagnosis", "D. TB treatment" or "E. TPT business processes".
   - **9.2.** For new clients following a provider-initiated flow, the workflow continues with "B. Screening" while existing ones might be redirected to any of "B. Screening", "C. Diagnosis", "D. TB treatment" or "E. TPT business processes".

TB.B Business process for TB screening

Objective: The primary goal of TB screening is to reach people who are not reached by the patient-initiated pathway and to detect TB disease early, thereby improving outcomes for individuals and reducing transmission and incidence at the population level. Secondary goals of TB screening are to: (1) rule out TB disease to identify people who are eligible for TPT; (2) identify people who are at particularly high risk of developing TB disease and thus may require repeated screening, such as people with an abnormal CXR (e.g., fibrotic lesion) that is compatible with TB but who were not diagnosed with TB disease at the time of screening, people living with HIV, health workers and prisoners; and (3) better characterize TB risk factors by combining screening for TB with screening for TB risk factors (such as HIV, diabetes mellitus, chronic obstructive pulmonary disease, undernutrition or smoking) to map individual or community-level risk factors and socioeconomic determinants that should be addressed to prevent the disease more effectively. This may be an additional objective in settings where information about the prevalence and distribution of TB risk factors is lacking.



Screening business process notes and annotations

According to national guidelines:
The community health worker (CHW) in the field must:

- Conduct TB screening of all contacts of TB smear positive clients in the community
- Record and report all those screened
- Refer all TB suspects to a health facility for a sputum smear examination

The health worker in the OPD waiting room or consulting rooms must:

- Perform screening and register all suspect clients in the cough register or OPD register
- Ensure those who have been coughing for > 2 weeks are referred for a sputum smear examination
- Request sputum smear examination through filling in a sputum request form. Ensure it is completely filled in with a traceable address.

The health worker in the ART clinic must:

- Administer TB questionnaire and the screening algorithm to all adults and adolescents with HIV at least twice a year for individual client
- Record and report all those screened for TB and referred for TB diagnosis treatment
- Screen all children with contact with TB pulmonary patients
- Record and report all those children screened for TB and referred for TB diagnosis treatment or TPT

1. Provide pre-screening information and ask for consent

- The health worker presents the potential risks and benefits of the screening procedure and familiarizes the client with the screening tools and procedure.
- TB screening should follow established ethical principles for screening for infectious diseases, including obtaining voluntary informed consent before proceeding with screening. Informed consent refers to the process of engaging patients in the delivery of health services by giving them sufficient and relevant information to enable them to make decisions for themselves.

2. **Make an informed decision**
   - The client makes an informed decision regarding the acceptance and continuation of the process.
   - Consent given by the client includes agreement to follow various TB screening tests and evaluations
   - Patients who refuse to consent should be counselled about the risks to both themselves and the community.

3. **Assess medical history and risk factors**
   - Discuss medical history with the client and review available records. Examples of history may include other diagnoses and medications.
   - Capture information related to the client's socioeconomic risk factors (e.g., homelessness), recent interactions with individuals with confirmed TB and other health-related risk factors for TB, such as:
     - Smoking
     - Diabetes
     - Harmful use of alcohol
     - Malnourished
     - Hiv infection
     - Undernutrition

4. **Determine the screening algorithm**
   There are screening algorithms for the general population and high risk groups.
   For details of the algorithms and SOPs for screening and diagnosis for different categories of clients, please see Component 6. Decision Support Logic.

5. **Perform the TB screening**
   - The health worker performs a TB screening according to the screening algorithm selected. There are screening algorithms for the general population and high risk groups.

6. **Is referral needed?**
   - When at least one method part of the screening algorithm is not available in the location (due to lack of skills or tools), a referral is needed to complete the screening activity.
   - A referral can also be issued when risk factors requiring close clinical management are identified to ensure that the patient receives the care they need.

   NOTE: Referrals are managed through manual processes and paper-based tools currently, with no electronic referrals generated in the eTB care eTracker system currently.

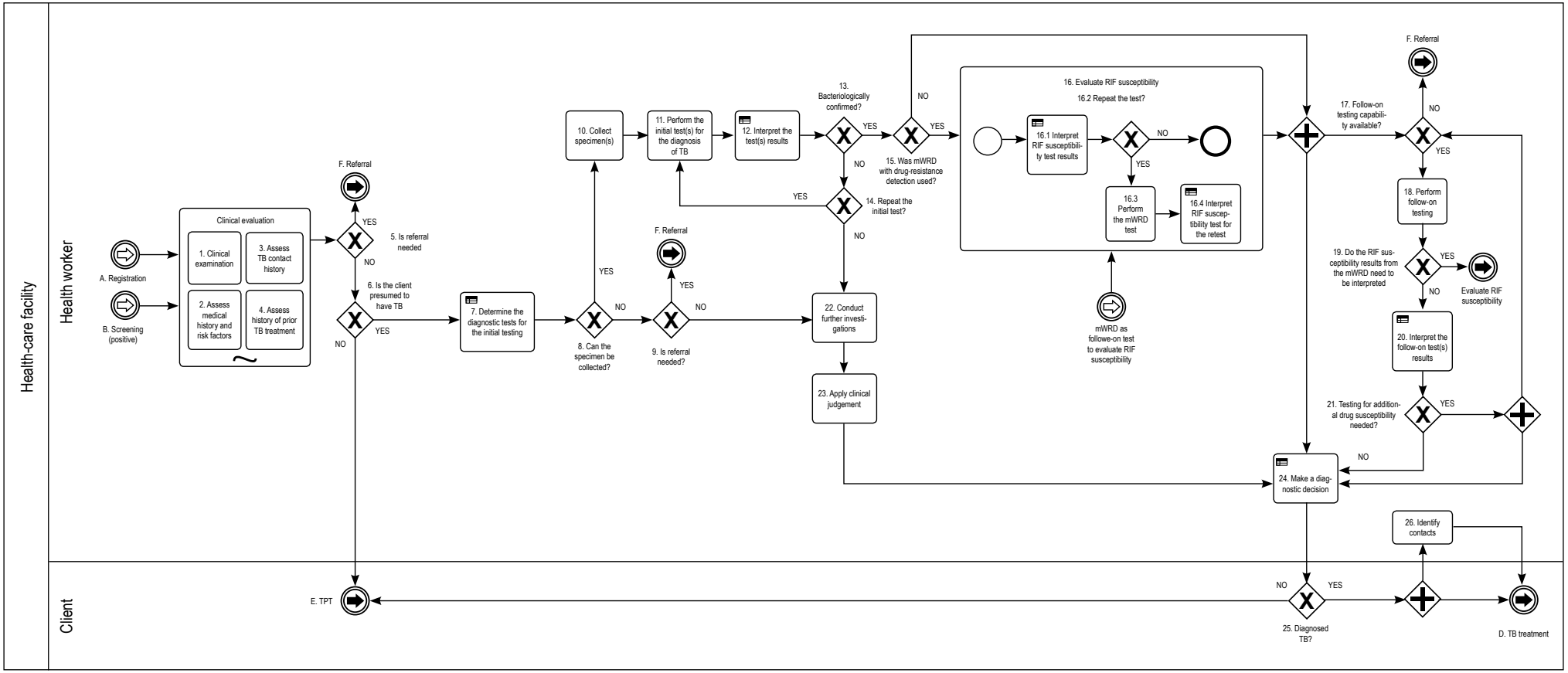
7. **Evaluate the screening results**
   - Once the results of the screening evaluations or the test part of the screening algorithm are available, the health worker can interpret them and decide what could be the next actions to take: refer for diagnostic evaluation or assess for TPT.

8. **Screen result**
   - A positive or abnormal result in screening tests is an indication for referral towards a diagnostic evaluation.
   - In case of a negative screen result, the process will continue with TPT process, according to the existing national policy. Please see Component 6 Decision Support Logic for more details.

9. **Offer other clinical and support services**
   - The health worker might offer other relevant clinical and support services to the client if the client does not give their consent for proceeding with TB screening.

TB.C Business process for diagnosis

Objective: To determine TB status in clients, by performing bacteriological and clinical investigations, starting TB treatment or TPT based on the results of the investigations. For details of the algorithms and SOPs for screening and diagnosis for different categories of clients, please see Component 6. Decision Support Logic.



Diagnosis business process notes and annotations

1. **Carry out clinical examination**
   - A clinical evaluation is usually required before performing tests that would provide a bacteriological confirmation of the disease. Usually, a decision to undertake a diagnostic work-up of an individual for TB begins with assessing the symptoms and signs of TB disease. In addition, a variety of non-specific signs are also evaluated to identify the features that raise clinical suspicion: vital signs, signs of respiratory distress, signs of advanced HIV disease, seriously ill PLHIV based on four danger signs (respiratory rate of more than 30 breaths per minute, temperature of more than 39°C, heart rate of more than 120 beats per minute and unable to walk unaided), CD4 cell count, and so on.

2. **Assess medical history and risk factors**
   - Discuss medical history with the client and review the available records. Examples of history may include other diagnoses and medications.
   - Capture information related to the client's occupation, socioeconomic risk factors and other health-related risk factors for TB, such as:
     - Smoking
     - Diabetes
     - Harmful use of alcohol
     - Malnourished
     - Hiv infection
     - Undernutrition
   - For clients evaluated for TB disease, with unknown HIV status, HIV testing should be performed in accordance with national guidelines. See Component 6 Decision Support Logic for more details.

3. **Assess TB contact history**
   - Close contact with a source case with TB often involves sharing a living, learning or working space with them. Contact may also occur with a source case from outside the household (e.g., a neighbour, caregiver or relative) with whom the client has had frequent contact.

4. **Assess history of prior treatment**
   - Previous TB treatment shall be discussed.

5. **Is referral needed?**
   - If, during the evaluation for TB disease, signs are identified requiring urgent medical care (e.g., gastrointestinal, circulatory, respiratory, neurological), a referral to the first referral level of care as per national guidelines, shall be considered. See Component 6 Decision Support Logic for more details.

6. **Is the client presumed to have TB?**
   - Depending on the findings of the initial clinical evaluation, the health worker decides whether the client should be further evaluated for TB disease or whether a TPT eligibility evaluation should be performed. This does not mean that every client evaluated as not being "presumptive TB" will get a TPT. The evaluation for TPT will be performed according to the "E.TPT" workflow.

7. **Determine the diagnostic tests for the initial testing**
   - The health worker selects a diagnosis algorithm and the diagnosis tests to be used depending on HIV status, the age of the client and other criteria. When selecting the diagnosis algorithm, it is important to consider the findings of the client's clinical evaluation and the characteristics of the population to which the client belongs. See Component 6 Decision Support Logic for more details.
   - Decision logic: Component 6. Decision Support Logic.

8. **Can the specimen be collected?**
   - In some cases, the specimen cannot be collected. Examples of such cases are: the client cannot produce the specimen (e.g., children who cannot produce sputum), the health worker lacks the necessary skills or tools to collect the specimen, or the client refuses the intervention.

9. **Is referral needed?**
   - A referral to another facility may be needed if the specimen cannot be collected. The client might resume the workflow, with the appropriate activity, if they come back to the facility that issued the referral to continue the process (e.g., the client was referred to a secondary-level health-care facility for specimen collection and diagnostic test execution and they come back to the original facility for the interpretation of the test results and eventually for treatment initiation). Otherwise, the TB care process will be continued at the referral facility.

10. Collect specimen(s)

- The decision on which type of specimen should be collected depends on the type of TB being evaluated (pulmonary or extrapulmonary), the tests intended to be used, age and other criteria. See Component 6 Decision Support Logic for more details.

11. Perform the initial test(s) for the diagnosis of TB

- At this step, the diagnostic test(s) is/are performed according to the corresponding test procedure.

12. Interpret the test(s) results

- The test(s) results are interpreted according to the diagnosis algorithm selected to determine if TB disease is confirmed bacteriologically.
- Decision logic: See Component 6 Decision Support Logic for more details.

13. Is the TB bacteriologically confirmed?

- When bacteriological confirmation cannot be obtained (negative test results), the recommendations could consist of repeating the test(s) and/or perform further investigations.

14. Repeat the initial test

- When the diagnosis test gives an inconclusive result, such as "error", "invalid", "no result" or a negative result, the health worker might decide to repeat the test, using any portion of the sample remaining after the first test or by collecting a fresh specimen. The result of the second test is usually the result that is considered for clinical decisions.

WHO GUIDANCE - TO BE VALIDATED BY GHS:

15. Was mWRD with drug-resistance detection used?

- When a molecular WHO-recommended rapid diagnostic test (mWRD) test with drug-resistance detection is used and the result confirms the presence of Mycobacterium TB, RIF susceptibility evaluation will be performed.
- If a conventional diagnosis test or a WRD without drug-resistance detection was used and indicates bacteriological confirmation, the flow continues directly with diagnostic decision and follow-on testing in parallel.

For example: TB was bacteriologically confirmed by lateral flow urine lipoarabinomannan assay (LF-LAM) as the initial diagnostic test; the health worker establishes the TB diagnosis result "diagnosed TB" and initiates TB treatment immediately; an mWRD test is performed in parallel with the purpose of assessing RIF susceptibility.

16. Evaluate RIF susceptibility

- If testing was done with an mWRD test capable of detecting RIF resistance, the health worker needs to interpret the results of the RIF susceptibility test and decide on the next steps accordingly.

16.1. Interpret RIF susceptibility test results.
The health worker interprets the RIF susceptibility test results.

16.2. Repeat the test?
Repeating the mWRD test is recommended in some cases, for example, when the RIF result is indeterminate and false RIF resistance is suspected. When there is no need to repeat the test, the subprocess ends and the workflow continues in parallel with follow-on testing and diagnostic decision-taking (e.g., when the mWRD test indicates "MTB detected, RIF resistance NOT detected", the health worker establishes the TB diagnosis result "diagnosed TB" and initiates TB treatment with a first-line regimen; drug susceptibility testing [DST] for isoniazid [INH] is performed in parallel).

16.3. Perform the mWRD test
The health worker repeats the mWRD test. Probe binding delay and samples with a low bacillary load have been associated with increased false resistance or an "RIF indeterminate" result. A fresh specimen should be used to repeat the test

16.4. Interpret RIF susceptibility test results for the retest
The results of the second test are analysed and a decision regarding treatment initiation and the next steps is made. The subprocess ends and the workflow continues in parallel with follow-on testing and diagnostic decision-taking.

17. Availability of follow-on testing capability

- If the follow-on testing capability for resistance to additional anti-TB drugs is missing at the current facility, the client needs to be referred to another facility. The flow might be resumed, with the appropriate activity, at the original facility if the client returns for the interpretation of the results and treatment initiation or treatment adjustments. Otherwise, the TB care process will be continued at the referral facility.

18. Perform follow-on testing

- Follow-on testing is used once TB disease is confirmed, with the goal of identifying resistance to TB drugs. If the results are inconclusive, such as "error", "invalid", "no result", or a negative result is recorded, the health worker might decide to repeat the test. A new specimen might be needed for follow-on testing.

19. Do the RIF susceptibility results from the mWRD need to be interpreted?

- When the goal of the follow-on test is to assess for RIF resistance using an mWRD diagnostic test (e.g., TB was bacteriologically confirmed by "microscopy – sputum" used as the initial diagnostic test, followed by a (follow-on) mWRD test with the purpose of confirming or excluding RIF resistance), the flow will continue with the subprocess "16. Evaluate RIF susceptibility", otherwise the flow will continue with interpretation of the follow-on test results.

20. Interpret the follow-on test(s) results

- The results of the follow-on testing are interpreted and further used for treatment adjustments, if needed.

21. Testing for additional drug susceptibility

- The health worker may recommend conducting further DST in line with the available test results. If this is necessary, the activities of "perform follow-on testing" and "interpret follow-on test results" will be repeated while concurrently modifying TB treatment, if deemed necessary.

22. Conduct further investigations

- When a diagnostic test cannot be performed or the test(s) is/are performed but the result is inconclusive or negative, the health worker should conduct additional investigations. Among such investigations could be a chest X-ray (e.g., in case of a negative mWRD test or when the client cannot produce the specimen[s] necessary for bacteriological confirmation), analysis of the clinical response after treatment with antimicrobial agents or conducting additional testing (e.g., additional mWRD testing or culture in case of symptomatic persons with negative results for the initial diagnostic tests).

23. Apply clinical judgement

- The health worker assesses all the information available before making a diagnostic decision.

24. Make a diagnostic decision

- Clinical decisions should be made based on clinical judgement, the results of available laboratory tests or the results of further investigations (or both).
- Currently, there are algorithms in the TB guidelines regarding making diagnostic decisions for children (<10 years old); therefore, the decision logic mentioned below refers to children younger than 10 years.

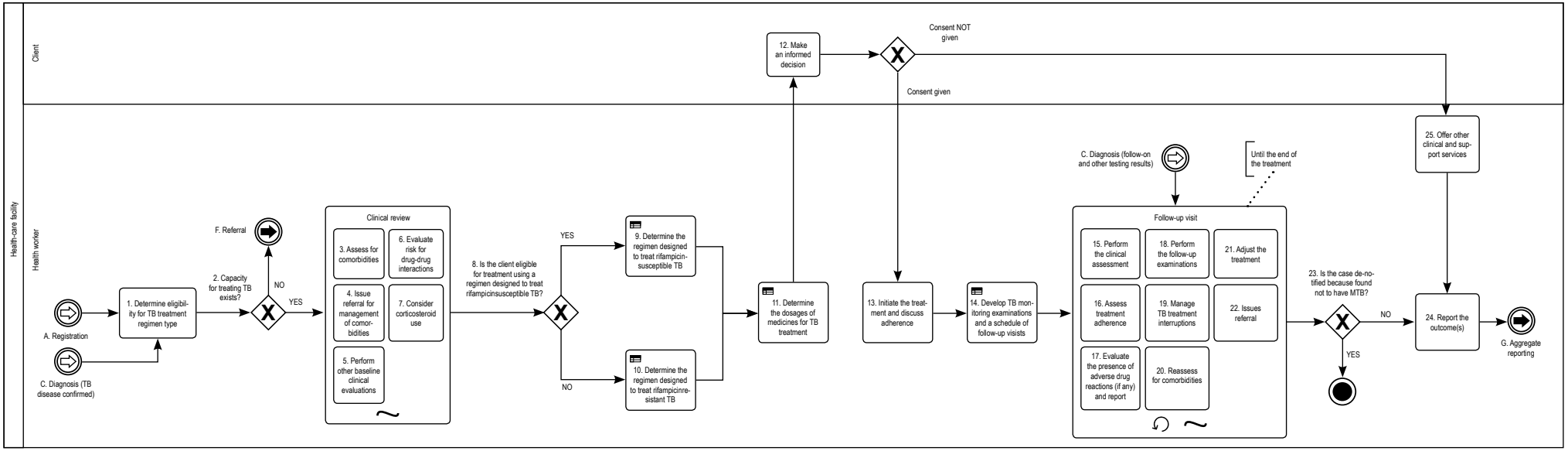
25. When TB is diagnosed, follow the appropriate course of action

- Clients diagnosed with TB will need TB treatment whereas clients in whom TB disease was ruled out can be evaluated for TPT.

26. Identify contacts

- Once a client is diagnosed with TB, it is important to identify their contacts as soon as possible to conduct screening activities on people recently exposed to TB with a high risk of developing the disease.

TB.D Business process for TB treatment



TB treatment business process notes and annotations

1. **Determine eligibility for TB treatment regimen type**
   - The health worker determines whether the client is eligible based on laboratory results and previous clinical evaluation, for a regimen designed to treat rifampicin (RIF)-susceptible TB or if a regimen for TB resistant to RIF is more appropriate.

2. **Confirm capacity to treat TB**
   - When treatment cannot be started or continued in the current facility (e.g., lack of skills, knowledge, stock of medicines), a referral is issued to transfer the patient to a new treatment facility.

3. **Assess for comorbidities**
   - There are some comorbidities and risk factors that increase the risk of poor TB treatment outcomes, or further transmission, which may require close clinical management. The assessment of comorbidities and risk factors (e.g., diabetes, disorders due to alcohol or drug use, HIV, smoking, undernutrition, coronavirus disease 2019, mental disorders, viral hepatitis) as part of the baseline clinical review is also important to determine additional needs for co-management, to correctly interpret adverse drug reactions, if such reactions are identified during or after the treatment ends, and for providing advice and counselling as necessary.

4. **Issue referral for management of comorbidities**
   - Beyond the impact on TB, collaborative action on TB and comorbidities may also improve efficiency of resource use, reduce health-care visits, address fragmentation in health systems and improve health outcomes. Therefore, the health worker must ensure that once a comorbidity or impairment is identified, the patient receives the care they need, preferably at the same place or via referral to an appropriate health service in case of need. This may include referral to mental health or substance use services, preventive and rehabilitation services, and social protection services to improve the health and social outcomes of people with TB.

5. **Perform other baseline clinical evaluations**
   - TB treatment poses special issues in some subgroups of patients (pregnant women, people aged over 65 years, those with chronic kidney or liver disease). For patients belonging to these subgroups, a set of baseline examinations (clinical, electrocardiography, laboratory evaluations) are recommended before starting TB treatment.

6. **Evaluate drug–drug interactions**
   - For patients taking other medicines (older people, people with comorbidities), interaction between the drugs taken as part of the TB treatment regimen and other drugs taken by the patient must be evaluated.

7. **Consider corticosteroid use**
   - Treatment with corticosteroids is recommended for tuberculous meningitis and tuberculous pericarditis because the benefits outweigh the potential harms of corticosteroid therapy.

8. **Is the client eligible for treatment using a regimen designed to treat rifampicin-susceptible TB?**

9. **Determine the regimen designed to treat rifampicin-susceptible TB**
   - The health worker selects the most appropriate regimen designed for rifampicin-susceptible TB based on specific considerations, such as age, HIV status, site of TB disease, severity of the disease, previous TB treatment and DST results.

10. **Determine the regimen designed to treat rifampicin-resistant TB**
    - The health worker selects the most appropriate regimen designed for TB resistant to rifampicin based on specific considerations, such as age, DST results, eligibility criteria for the drug-resistant tuberculosis (DR-TB) regimens, pregnancy status, severity of the disease. » The inability to undertake DST routinely for all patients despite all possible efforts should not be a barrier to starting patients on a potentially life-saving DR-TB regimen; however, treatment should always be considered in a context of the potential risk of prescribing ineffective treatment and amplifying drug resistance, with a subsequent decrease in the likelihood of treatment effectiveness.

11. **Determine the dosages of medicines for TB treatment**
    - The health worker determines the dosage for the medicine part of the treatment regimen, based on age and weight band.

12. **Make an informed decision**
    - All treatment delivered should align with Ghana standards, including obtaining informed consent where necessary.
    - Patients who refuse to consent to TB treatment should be counselled about the risks to both themselves and the community.

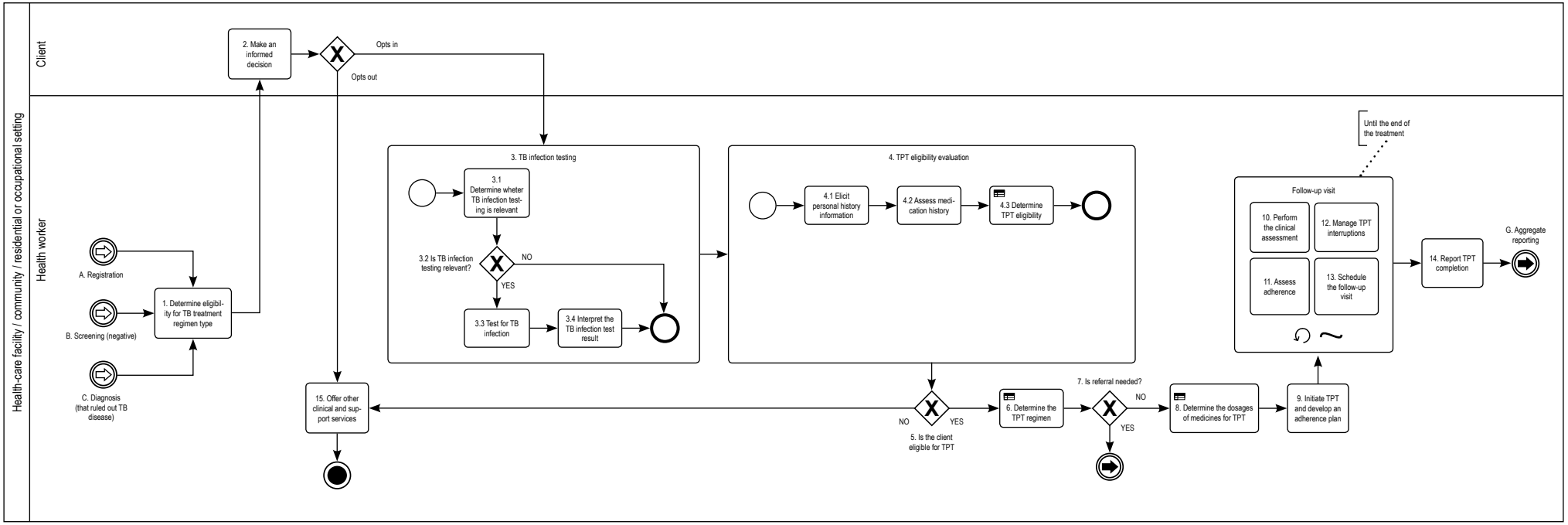
13. **Initiate the treatment and discuss adherence**
    - Once the appropriate treatment regimen is identified, the correct medicine dosages are determined and the consent from the patient (parent or legal guardian in case of children or adolescents) is obtained, treatment can be initiated.
    - The health worker should undertake the relevant measures to support adherence and ensure favourable treatment outcomes, such as considering directly observed treatment.

14. **Develop TB monitoring examinations and a schedule of follow-up visits**
    - Patients should undergo appropriate evaluation at baseline, as well as during and after treatment. This should include necessary clinical evaluations (e.g., laboratory tests, electrocardiography), and bacteriological and radiological examinations.
    - Clinical visits should coincide with bacteriological and clinical laboratory examination schedules, to limit time and transportation constraints for the patient.

15. **Perform the clinical assessment**
    - Clinical assessment should focus on monitoring response to treatment and addressing common symptoms associated with TB treatment and long-term antibiotic use, with the goal of supporting adherence. Persistent fever, weight loss or recurrence of any of the classic symptoms of TB should prompt investigation for possible treatment failure, undetected resistance to one or more drugs in the current treatment regimen or untreated comorbidities.

TB.E Business process for TPT

Objective: To identify clients eligible for TPT, select the appropriate TB preventive treatment regimen for each client and ensure treatment adherence.



TPT Business process notes and annotations

1. Offer TB prevention counselling

- Provide information on TB infection, the rationale for TPT and the benefits from completing the course to the individual, the household and the wider community. Mention possible adverse effects and the likelihood of their manifestation. Educate the client regarding the risk of not taking the TPT. Inform the client about the TPT short regimens that can be completed in 4–12 weeks, unlike the treatment of TB disease, which lasts 6 months or longer.

2. Make an informed decision

- Explicit consent is generally required for TPT since the subject does not pose an immediate risk to others and the potential benefits are highly context-specific and may be outweighed by risk of harm for some individuals. Whether this is documented in writing or not depends on local practice.
- Informed consent requires effective and adequate communication of the possible uncertainties, as well as prospects of risk reduction (often uncertain due to risk of reinfection).
- Consent given by the client includes agreement to follow various tests as part of TPT evaluation and to follow treatment if indicated.

- Patients who refuse to consent should be counselled about the risks to both themselves and the community.

3. Conduct TB infection testing

- Just as excluding TB disease is a critical step before starting TPT, confirming TB infection before starting TPT may increase the certainty that individuals targeted for TPT would benefit from it.

3.1. Determine whether TB infection testing is relevant. The decision on whether to test for TB infection before TPT is influenced by the expected prevalence of TB infection in the at-risk population, risk of progression to TB disease and the risk of harms due to unnecessary TPT.

3.2. Is TB infection testing relevant?
Some risk groups, such as PLHIV who are on antiretroviral therapy (ART), benefit from TPT regardless of whether they test positive or negative for TB infection. Similarly, children under 5 years who are contacts of a patient with bacteriologically confirmed TB have a high risk of TB and would benefit from TPT regardless of the test result. Therefore, TB infection testing is not relevant in such cases and the recommendation is to consider TPT.

3.3. Test for TB infection

3.4. Interpret the TB infection test result
Once the test result is available, a health worker with the appropriate level of knowledge will interpret it. Older contacts and other risk groups who test positive are likely to benefit more than those with a negative test.

4. Evaluate TPT eligibility

- Once TB disease is ruled out, and the decision to consider TPT is made, baseline assessment to determine the eligibility of an individual for TPT should be undertaken. The baseline assessment includes personal and medication history and investigations as per national guidelines.

4.1. Elicit personal history information
Information relevant for TPT initiation and continuation should be asked, such as allergy to TB drugs, previous intake of TPT, alcohol use, smoking, concurrent medication, contacts with drug-resistant TB and potential contraindications to TPT.

4.2. Assess medication history
Elicit medication history to guide the choice of TPT regimen. Certain drug classes, for example, antiretroviral (ARV) drugs, opioids and antimalarials, often affect TPT.

4.3. Determine TPT eligibility
Based on the information gathered in the previous steps, a decision will be made on whether the TPT benefits outweigh the risks.

5. Is the client eligible for TPT?

- If the decision in step 4 is that TPT is beneficial, the health worker will proceed with discussing the treatment regimen.
- The health worker might offer other relevant clinical and support services if the client is not eligible for TPT.

6. Determine the TPT regimen

- When choosing a regimen, the caregiver and the person taking the treatment should consider the circumstances under which TPT would be given to increase the likelihood of it being completed. The choice may also depend on the availability of resources, fixed-dose combinations, child-friendly formulations, concomitant medication (such as ARV drugs, oral contraception), as well as acceptability.

7. Is referral needed?

- In some cases, the client might prefer to start TPT in another health-care facility, for example, closer to their house. In those cases, the client might need a referral.
- If the treatment medication is not available at the health-care facility, the client will be referred to another clinic or to the pharmacy to get the necessary medication.

8. Determine the dosages of medicines for TPT

- The health worker determines the dosages of medicines for TPT based on the client's age and weight.

9. Initiate TPT and develop an adherence plan

- TPT is initiated.
- An adherence plan is developed.

10. Perform the clinical assessment.
Clinical assessments should focus on monitoring response to treatment, presence of adverse drug reactions and common symptoms associated with TB treatment and long-term antibiotic use, with the goal of supporting adherence.

- Persistent fever, weight loss or recurrence of any of the classic symptoms of TB should prompt investigation for possible treatment failure, undetected resistance to one or more drugs in the current treatment regimen, or untreated comorbidities.

- Overall, the occurrence of serious adverse events leading to death or requiring withdrawal of TPT is rare. However, it is critical to identify any sign of drug toxicity early on and manage it vigorously.

11. Assess adherence

- Adherence to treatment is a complex behaviour that is influenced by many factors, such as personal motivation, beliefs about health, risks and benefits from treatment, comorbidities, competing demands that conflict with the taking of medicine, family environment, complexity of the drug regimen, drug toxicity, trust and relationship with the health provider. The health worker needs to reinforce supportive educational messages at each contact during treatment.

12. Manage TPT interruptions.

- Any interruptions in treatment should be discussed with the person on treatment and their treatment supporter, and interventions to address problems in adherence should be instituted.

13. Schedule the follow-up visit

- The next visit is scheduled depending on the treatment regimen, clinical condition and client's availability. The visit could take place either at the health-care facility or in the community, or at the client's location.

14. Report TPT completion

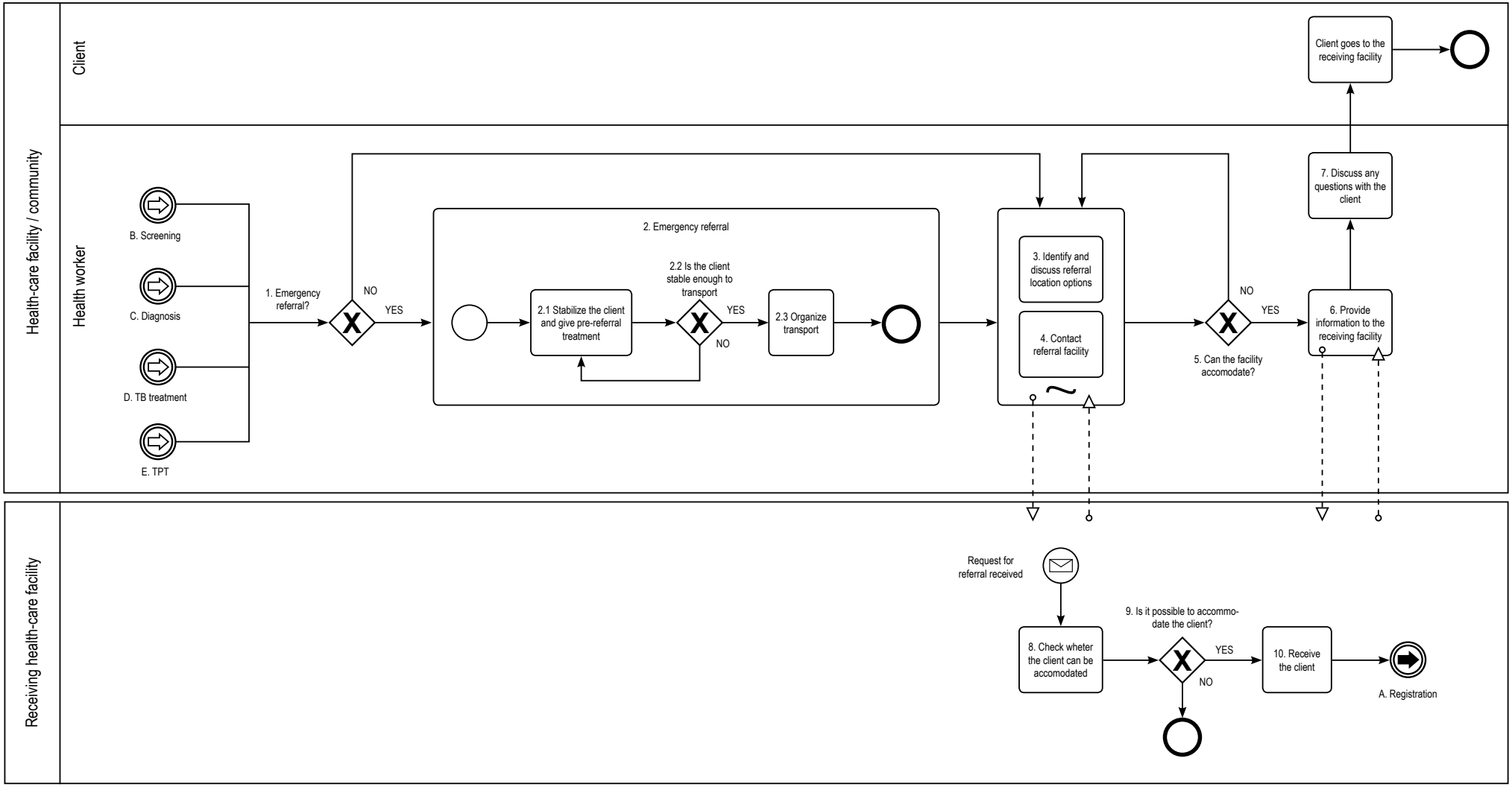
- It is important to monitor and report TPT completion both for individual care and programme management.

15. Offer other clinical and support services

- The health worker might offer other relevant clinical and support services to the client if the TPT is not accepted, the client is not eligible or TPT is not recommended.

TB.F Business process for referrals

Objective: To provide timely and appropriate referrals to another healthcare facility that can provide services unavailable within this facility or community.



Referrals business process notes and annotations

Examples of reasons for referral include:

- The health worker cannot provide the service because of a lack of training and skills.
- The facility does not have the supplies needed to provide the service.
- The facility cannot perform the service for other reasons.
- There is an emergency and the client needs immediate referral.

1. Refer the client in an emergency?

- If the client needs immediate referral due to an emergency situation, bypass standard referral steps.
- In an emergency, a referral can be made at any time, including during diagnosis and treatment encounters.

2. Manage emergency referral

2.1. Stabilize the client and give pre-referral treatment The client is assumed to need emergency referral if their condition requires immediate medical attention. Stabilize the client's condition and provide any necessary treatment.

2.2. Is the client stable enough to transport? Once the client is stable enough to transport, immediately organize it. If the client is still not stable, provide pre-referral treatment for stabilization.

2.3. Organize transport For emergency referrals, the health-care facility usually arranges for an ambulance or other vehicle.

3. Identify and discuss referral location options

- In discussion with the client and their relatives, decide where the client will be referred to. Discussions include:
  - how to get to the referral facility, including location and transportation options;
  - who to see and what is likely to happen;
  - whether to follow up on return.

4. Contact referral facility

- Health workers should contact the referral facility to determine whether that facility can accommodate such a referral.

5. Can the facility accommodate?

- Check whether facility can accommodate the client and provide the services needed.
- If the facility can accommodate the client, move on to step 6.
- Otherwise, find a different facility that is able to accommodate the client.
- A system can be set up to catalogue referral facilities, and what type of referral needs they can handle to accommodate a referral.

6. Provide information to the receiving facility.

- Make an appointment, if needed.
- If not an emergency referral, the client or family arranges transport.
- For emergency referrals, the health-care facility arranges transport, usually by phoning the district for an ambulance or other vehicle, and informing the receiving facility that the emergency client is on the way.
- Fill out a referral form, which can include notification of the referral destination.
- Provide the necessary clinical, sociodemographic and identity information to the referral facility.

7. Discuss any questions with the client

- Discuss any of the client's questions or concerns.

8. Check whether the client can be accommodated

- The receiving facility evaluates the needs and assesses whether the client can receive the services needed.

9. Is it possible to accommodate the client?

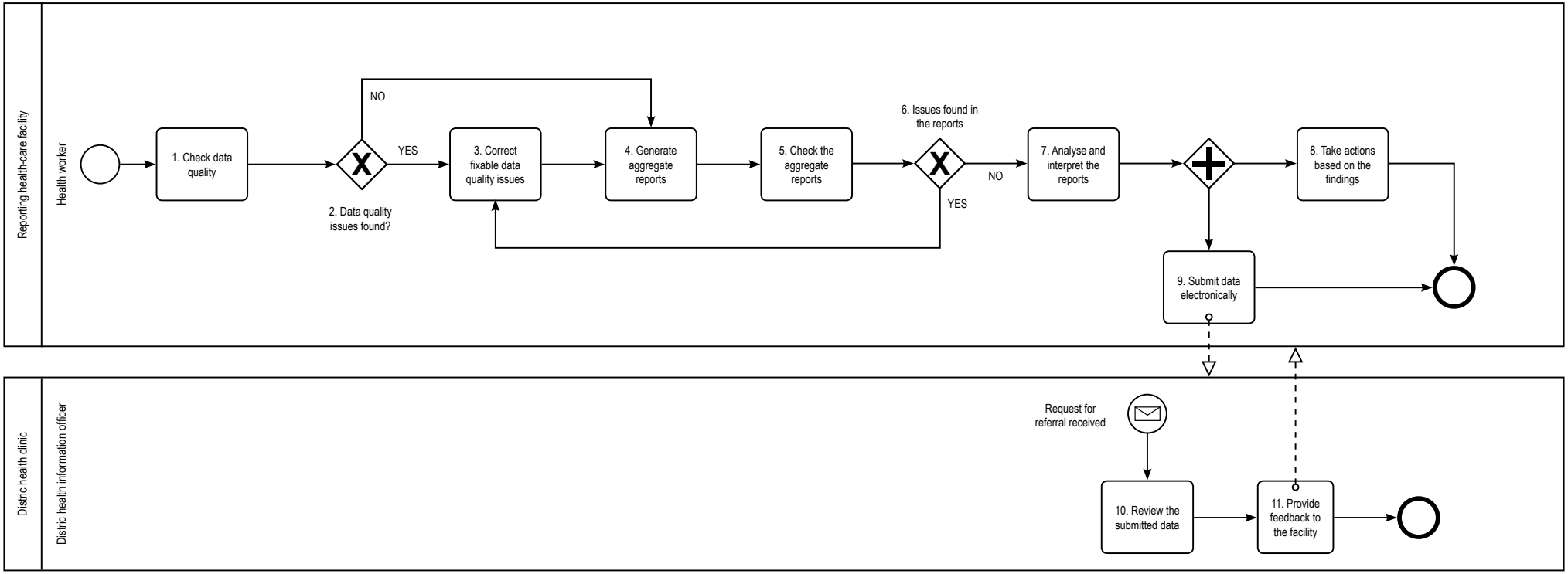
- If the receiving facility cannot accommodate the client, it will inform the source facility. If accommodation for the client is possible, move on to step 10.

10. Receive the client

- The receiving facility receives the client, along with all the necessary clinical, sociodemographic and identification information, and provides the services.

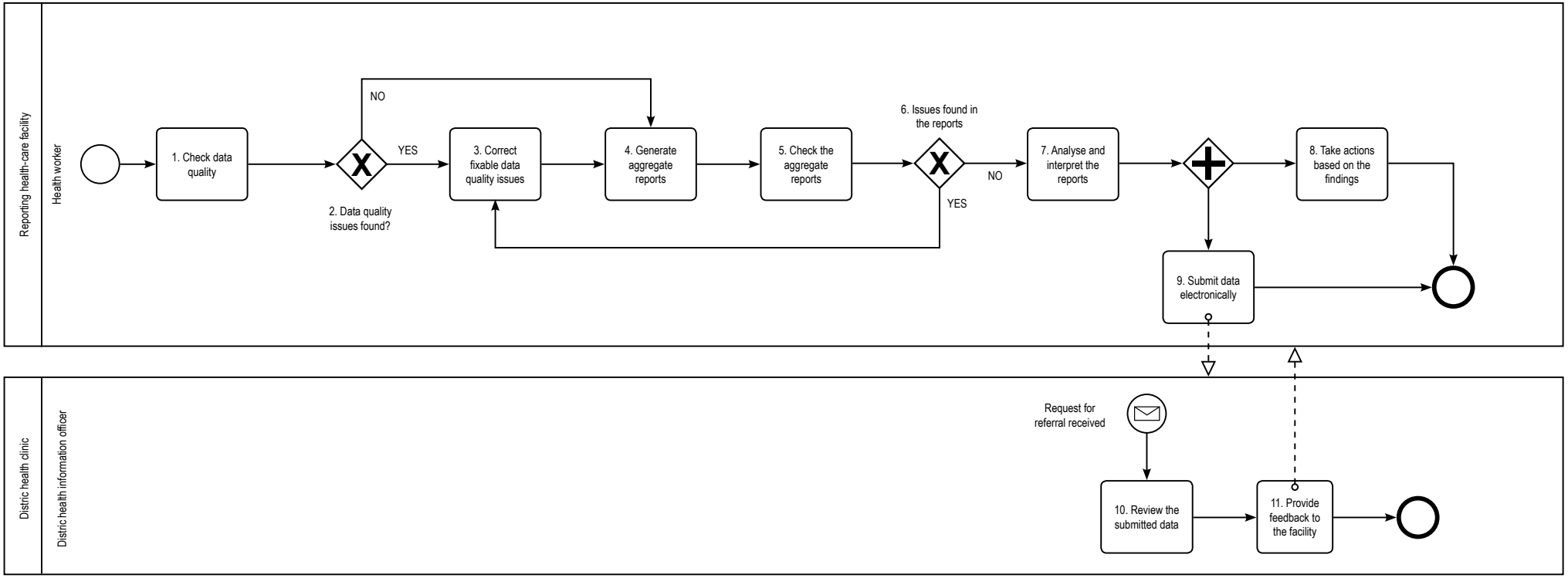
TB. G. Business process for aggregate reporting and data use

Objective: To aggregate client-level data into validated, aggregate reports, use the data and submit reports



Aggregate reporting and data use business process notes and annotations

National, digital, case-based surveillance systems for TB have several advantages compared with the more traditional paper-based aggregated systems, such as reduction in the recording and reporting workload of frontline workers, better data quality, faster access to data at all levels, more flexible data analysis and enhanced use of data through record linkage between databases.



1. Check data quality

- Health-care facility data are reviewed for accuracy, validity and completeness.
- This can be supported through automated checks in a digital system.

2. Were data quality issues found?

3. Correct fixable data quality issues

- Where possible, inaccurate, invalid or incomplete data should be checked against source records and corrected according to the national standard operating procedures (SOPs).
- It is also possible for the same episode of TB disease in a given individual to be recorded multiple times in the system. Any duplicate records of the same episode of TB must be removed (de-notify duplicate case[s]) to avoid overreporting.

4. Generate aggregate reports

- The health worker generates aggregate reports of predefined indicators aligned with national monitoring and evaluation guidelines.
- This can be automated in the TB care eTracker Module for those facilities where it is in use.

5. Check the aggregate reports

- Check for any potential remaining data quality issues such as implausible values or outputs.

6. Were issues found in the reports?

- If so, return to step 3.

7. Analyse and interpret the reports

- The analyses and interpretation of the reports should identify opportunities to improve the performance of the health-care facility, such as tracing

missing data or contacting patients who have not attended a clinic.
- Data analysis and interpretation can be done regularly and should not be limited to the reporting schedule.

8. Take actions based on the findings
- Findings from the reports can inform corrective actions.

9. Submit data electronically
- This is automated in the TB care eTracker Module. District-level, provincial-level and national level ministry of health are able to access data directly for reporting purposes.

10. Review the submitted data
- The district health office reviews the quality of the submitted data.

11. Provide feedback to the facility
- The focal person at the district level will provide feedback to the facility. If data quality issues are identified, the facility may be required to restart the process and resubmit the reports.

Component 5: Core data elements

This section outlines the minimum set of data corresponding to different points of the workflow within the identified business processes. **This data set lists the data elements recorded within the TB care eTracker module that are relevant for TB service delivery and executing decision-support logic, as well as for populating indicators and performance metrics.** Although this section provides a high-level overview of the data elements, a more complete data dictionary in spreadsheet form detailing the input options, format, and mappings to the WHO TB DAK data elements is available in **Annex A: TB Ghana Data Elements Mapped to WHO TB DAK Data Elements.**

NOTE: The 'Data Element ID' column lists the corresponding ID from the WHO TB DAK. If the field is blank, it means no matching data element is defined in the WHO TB DAK.

Inclusion of a data element in the table does not imply that it must be collected. Some elements are calculated automatically, while others depend on specific conditions—for example, test results are only entered if a test has been performed.

Activity ID Activity name	Data element WHO ID	Data element name	Description and definition
TB.A Client registration	TB.A4.DE.4	Date of Registration	The date and time of the client's encounter with the health system
	TB.A4.DE.3	Client Registration Number	Unique ID of the client moving through the health system. It can be based on a national unique ID, a national health ID, biometrics, a system-generated unique ID or something else
	TB.A4.DE.3	National ID (Ghana Card)	Unique ID of the client moving through the health system. It can be based on a national unique ID, a national health ID, biometrics, a system-generated unique ID or something else
	TB.A4.DE.3	NHIS Number	Unique ID of the client moving through the health system. It can be based on a national unique ID, a national health ID, biometrics, a system-generated unique ID or something else
	TB.A4.DE.1	First Name	Client's first name
		Middle Name	Client's middle name
	TB.A4.DE.2	Last Name	Client's family name or last name
	TB.A7.DE.17	GEN - Sex	Sex of the client
		Educational Status	Educational status of the client
		Marital Status	Marital status of the client
	TB.A7.DE.23	Mobile Phone	Can be a landline or a mobile phone number
		Occupation	Occupation of the client
		Name and address of Treatment supporter	Name and address of the person providing treatment support to the client
		Treatment supporter phone	Phone number of the person providing treatment support to the client

Activity ID / Activity name	Data element WHO ID	Data element name	Description and definition
TB.B TB screening		Date of TB Screening *	Date that the client was screened for TB
		Organisation unit	Name of the facility where the client encounter occurred
		Is Client An Existing Active TB Case?	
		Was Client referred?	
		Who referred the client?	Source of the referral : Facility based screening, civil society organization, Non-governmental organizations, TB champion, Healthcare worker, Community Health Officers, Other (specify)
		Was Symptoms Based Screening done? *	
		Screening site	Place where the screening took place
		Date of screening	Date that the client was screened for TB
	TB.Comm. DE.57	Type of screening	Type of screening determined by the screening site : Household contact, community, General OPD, ANC or Reproductive health, Female ward, Male ward, Diabetic clinic, HIV/ART clinic, Paediatric ward, Others (specify)
	TB.Comm. DE.58	Cough	Current cough
	TB.Comm. DE.61	Weight loss	Weight loss
	TB.Comm. DE.62	Night sweats	Night sweats
	TB.Comm. DE.60	Fever	Fever of 39 °C or higher
	TB.Comm. DE.65	Chest Pains	Chest pain
		Contact of PTB Patient	Contact of a Presumed TB patient
	TB.Comm. DE.113	X-Ray	Was an X-Ray done?
		Is x-ray result suggestive of active TB?	X-Ray outcome
		Date of x-ray	Date the client underwent the x-ray
		Active TB testing requested?	
	TB.Comm. DE.68	TB Screening outcome	Outcome of the TB screening automatically determined based on the answers to the symptoms. If any of the screening symptoms = YES then = Presumed TB Case
		Screening-related comment	Additional notes field
	TB.F6.DE.1	Transferred to (Owned by)	Name of the health facility that the client was transferred to
		Request Date *	Date that the lab test was requested
		Type of Laboratory Request	Type of Lab requested : Initial laboratory test / Followup laboratory Test

Activity ID / Activity name	Data element WHO ID	Data element name	Description and definition
		Type of Laboratory Test	Lab test requested: Sputum smear micoscopy , Xpert MTB/ RIF Ultra , Xpert MTB/XDR
	TB.Comm. DE.86	Date of Specimen Collection	The date when the test sample was collected from the client
	TB.Comm. DE.73	Sample Type	The type of sample collected from the client
	TB.Comm. DE.74	Sputum	Sputum was collected from the client
	TB.Comm. DE.75	Gastric Lavage	Gastric aspirates collected from the client
	TB.Comm. DE.77	Stool	Stool was collected from the client
	TB.Comm. DE.85	Others (specify)	Another type of sample was collected from the client
		Sample ID	ID of the sample/specimen
		Date of Xpert MTB/ RIF Ultra Test	Date that the Xpert MTB/RIF Ultra test was performed
		Xpert MTB/RIF Ultra - MTB Results	Result of the Xpert MTB/RIF Ultra test
		MTB Result Interpretation	Interpretation of the Xpert MTB/RIF Ultra test
		Date sample was received at testing laboratory	Date sample/specimen was received at testing laboratory
		Sample status	Status of the sample/specimen: Sample received/ sample lost
		Sample quality	Quality of the sample/specimen: Good (accepted for processing) / Poor (not accepted for processing)
		Microscopy result	Result of the microscopy: Positive (scanty), positive _+, positive ++, positive +++, negative
		Date of microscopy	Date of the microscopy
		Active TB results	Result: Positive, Negative, Unknown
		Notes	Additional notes
		Others (specify)	Another type of sample was collected from the client
		Sample ID	ID of the sample/specimen
TB.C Diagnosis	TB.Comm. DE.101	Report date * (TB Diagnosis DATE)	
	TB.C4.DE.1	History of previous treatment *	New, Relapse, Treatment after failure, Treatment after loss to follow up , other previously treated, Unknown
	TB.Comm. DE.23	Risk factors	
		Smoking	No, Unknown Yes
		Diabetes	No, Unknown Yes
		Harmful use of alcohol	No, Unknown Yes
		Malnourished	No, Unknown Yes
	TB.C2.DE.1	HIV infection	No, Unknown Yes
		ART started	No, Unknown Yes

Activity ID / Activity name	Data element WHO ID	Data element name	Description and definition
		Diagnostic decision: Is this a TB diagnosis? Do you want to notify the case? *	Yes, No
		Confirmation method	Means by which the diagnosis was confirmed: Clinically diagnosed / Bacteriologically confirmed
		Site of disease *	Anatomical site of TB disease : Pulmonary, extra-pulmonary, Pulmonary and extra-pulmonary, Unknown
		Date of diagnosis *	Date of the TB diagnosis
		Date of notification *	Date the notification was made
		Household contacts	Number of people (excluding the index case) living in the same household
		Notes	Additional notes
TB.D TB Treatment		TB drug resistance type classification	TB drug resistance type classification
	TB.Comm. DE.1	Height (in CM)	The client's height in centimetres
	TB.Comm. DE.3	Weight (KG)	The client's current weight in kilograms
	TB.Comm. DE.8	Body Mass Index (BMI)	BMI for adults and adolescents
	TB.Comm. DE.5	MUAC for Children (in CM)	The client's current mid-upper arm circumference in millimetres
	TB.D1.DE.1	Treatment regimen	Indicates for which regimen the client is eligible, based on the diagnosis: First-line , second-line
	TB.D1.DE.2	First line Regimen - child	First line regimen for a child
			Dropdown options for this field (from national guidelines)
			1-RHZ 75/50/150 - e 100mg-Child-4-7Kg
			2-RHZ 75/50/150 - e 100mg-Child-8-11Kg
			3-RHZ 75/50/150 - e 100mg-Child-12-15Kg
			4-RHZ 75/50/150 - e 100mg-Child-16-24Kg
			2-RHZE 150/75/400/275mg-Child-25+ Kg
			1-RHZ 75/50/150-Child-4-7Kg
			2-RHZ 75/50/150-Child-8-11Kg
			3-RHZ 75/50/150-Child-12-15Kg
			4-RHZ 75/50/150-Child-16-24Kg
			2-RH 150/75-Child-25+ Kg
		First-line treatment start date	The date when the client started the anti-TB treatment regimen or restarted TB treatment. This is needed to determine when the treatment outcomes of 'cured', or 'treatment completed' can be assigned
		Second-line treatment start date	The date when the client started the anti-TB treatment regimen or restarted TB treatment. This is needed to determine when the treatment outcomes of 'cured', or 'treatment completed' can be assigned

Activity ID / Activity name	Data element WHO ID	Data element name	Description and definition
		Treatment initiation delay (days)	Number of days delay between diagnosis and treatment initiation
		TB Treatment end date	Date at which the client's TB treatment outcome was determined
		De-notify the case	Indicate whether to de-notify the case or not
		Treatment outcome delay (weeks)	
	TB.D24.DE.1	Treatment outcome	Indicates client's treatment outcome: Cured/completed/ failed/died/lost to follow-up/Not evaluated
TB.E TPT	TB.E4.7.DE.2	TPT Eligibility Date	Date when determination of the client's eligibility for TPT was made
	TB.E4.7.DE.1	TPT eligible?	Client is eligible for TPT according to national guidelines
		Started on TPT?	Was the client initiated on TPT
		TPT Start date	Date that client was initiated on TPT
	TB.E6.DE.1	Preventive TB treatment (TPT	TPT regimen is proposed to the client or taken by the client
	TB.E6.DE.2		The client follows a 6-month regimen of daily isoniazid
	TB.E6.DE.3		The client follows a 9-month regimen of daily isoniazid
	TB.E6.DE.4		The client follows a 3-month regimen of weekly rifapentine plus isoniazid
	TB.E6.DE.5		The client follows a 3-month regimen of daily isoniazid plus rifampicin
	TB.E6.DE.6		The client follows a 4-month regimen of daily rifampicin alone
	TB.E6.DE.7		The client follows a 1-month regimen of daily rifapentine plus isoniazid
	TB.E6.DE.8		The client follows a 6-month regimen of daily levofloxacin (preventive treatment for MDR-TB)
		TPT related comment	Additional notes
		Notes	Additional notes
		TPT Completion date	Date that TPT was completed
		TPT Outcome	Outcome of TPT
		Reason for ending TPT episode	Reason that the TPT was stopped
		Months between expected and actual outcome date (months)	Months between expected and actual outcome date (months)

Component 6: Decision support logic

The decision-support logic component of the DAK provides the decision logics and algorithms, and the scheduling of services, in accordance with Ghana national guidelines.

6.1 Overview

Table 10. provides an overview of the decision-support tables and algorithms for the different TB module business processes.

Activity name and ID	Decision support ID	Decision support table description	Reference
Screening and Diagnosis	TB.B4.DT1	Diagnosis of TB in a suspected TB case	Standard Operating Procedures for TB case detection for Ghana
	TB.B4.DT2	SOPs for Screening and Diagnosing of TB in Adults and Adolescents living with HIV	The Ghana TB HIV Clinical Management Guidelines
	TB.B4.DT3	SOPs for Screening and Diagnosing TB in children living with HIV	
	TB.B4.DT4	SOPs for Screening and Diagnosing TB in HIV-negative Children < 5 years who are household contacts of people with PTB.	
	TB.B4.DT5	SOPs for Screening and Diagnosing TB in HIV negative children ≥ 5years and who are household contacts of people with TB and other at risk populations**	

6.2 Decision support narrative guidelines

TB.B4.DT3 - SOPs for screening and diagnosing TB in children living with HIV.
A child visits the facility (Pediatric clinic, ART Center, TB Center, and or ART /TB Collaborative center). Screen child using TB symptom screening tool including history of contact with TB patient or patient with chronic cough.

- For a ”yes” response to any of the signs and symptoms (i.e., cough of any duration, night sweat, chest pains, weight loss, fever, history of contact with TB patient or patient with chronic cough) do chest Xray or consider referral for a GeneXpert.
  - If MTB is detected.
    - Initiate anti TB therapy if Rifampicin is sensitive.
    - If Rifampicin resistant, refer to regional MDR TB.
  - For a child who tests negative for MTB.
    - Do a chest x-ray if available in the facility.
      - If chest X-ray is abnormal, refer the child to a TB expert for further evaluation.
      - If chest X-ray is normal, initiate the child on PTP.
    - If chest X-ray is not available refer for further evaluation***
      - *** Further evaluation-to be done by persons with higher expertise, physicians, paediatricians, MO.

For those who have no signs and symptoms after applying the symptoms screening tool.

- Do a chest x-ray if available.
  - If chest X-ray is normal, initiate the child on TPT.
  - If chest x-ray is abnormal, refer the child for a GeneXpert test.
  - If MTB is detected.
    - Initiate anti TB therapy if Rifampicin is sensitive.
    - If Rifampicin resistant, refer to regional MDR TB.
  - For a child who tests negative for MTB refer the child to a TB expert for further evaluation.
- If chest x-ray is not available.
  - Initiate the child on TPT.

TB.B4.DT4 - SOPs for screening and diagnosing TB in HIV-negative Children less than 5 years of age who are household contacts of people with PTB.

- Screen child using TB symptom screening
- If a “yes” response to any of the symptoms (ie cough of any duration, night sweat, chest pains, weight loss, fever, history of contact with TB patient or patient with chronic cough) should be referred for a chest Xray and or GeneXpert test.
  - If MTB is detected.
  - Initiate anti TB therapy if Rifampicin is sensitive.
    - If the child is Rifampicin resistant, refer to regional MDR TB.
  - For a child who tests negative for MTB.
  - Do a chest x-ray if available in the facility.
    - If chest X-ray is abnormal, refer the child to a TB expert for further evaluation.
    - If chest X-ray is normal, initiate the child on TPT.

- For those who have no signs and symptoms after applying the symptoms screening tool.
  - Do a chest x-ray if available.
    - If chest X-ray is normal, initiate the child on TPT.
    - If chest x-ray is abnormal, refer the child for a GeneXpert test.
    - If MTB is detected.
      - Initiate anti TB therapy if Rifampicin is sensitive.
      - If the child is Rifampicin resistant, conduct a culture and DST and per the results initiate MDR.
    - For a child who tests negative for MTB refer the child to a TB expert for further evaluation.
  - If chest x-ray is not available.

- Initiate the child on TPT.

TB.B4.DT5 - SOPs for screening and diagnosing TB in HIV negative children greater than 5 years of age and who are household contacts of people with TB and other at risk populations**

- Screen individuals from the risk group for symptoms of TB (e.g., cough of any duration, haemoptysis, night sweats, chest pains, weight loss, fever and shortness of breath).
  - If “yes” to any of the symptoms above.
    - Refer for further evaluation.
  - If “no” to any of the symptoms above.
    - Perform either the TST or the Interferon-Gamma Release Assay (IGRA) to screen for TB infection.
      - If positive to IGRA or TST, order a chest x-ray.
        - If chest x-ray is abnormal, refer for further evaluation.
          - Note: Further evaluation should be conducted by professionals with specialized expertise in TB and HIV—such as physicians, pediatricians, medical officers (MO), or designated TB/HIV personnel.
        - If chest x-ray is normal, initiate TPT.

Component 7: Indicators and performance metrics

This section outlines the indicators and performance metrics relevant to the Ghana context. These metrics are derived from core data elements identified in Component 5. The tables below present a minimum set of indicators that can be aggregated to support decision-making, monitor performance, and inform both subnational and national reporting. These indicators are based on data collected through routine, individual-level health systems. These indicators may be aggregated automatically from the digital tracking tool to populate the DHIMS (DHIS2), which is the national HMIS.

7.1 Case detection indicators

Monitoring and evaluation of TB case detection activities will be integrated into the NTP monitoring and evaluation and supervision plan. Monitoring will be conducted at all levels, starting at the health facility level, to district, regional and national level. Monitoring will be conducted monthly at the health facility level, quarterly at the district and regional levels, and annually at the national level.

7.1.1 National Level

Indicator	Source	Frequency	Monitoring tool
Proportion of health facility with TB case detection plan per regions	Health facility plan	Biannual	Supervision checklist / report
Rate of increase of TB notification per region	TB Register	Quarterly	Notification reports
Rate of increase of TB case detection in Ghana	WHO estimates	Annual	WHO report

7.1.2 Regional/district level

Indicator	Source	Frequency	Monitoring tool
Number and proportion of health facilities conducted TB case detection assessment	Assessment	Baseline	Supervision reports
Number and proportion of health facility with TB case detection plan	Health facility plan	Quarterly	Supervision reports
Number and proportion of health facility with functional TB team	TB Team meeting report / plan of action	Quarterly	Supervision reports
Rate of increase of TB case notification per district and region	Quarterly TB case notification reports	Quarterly	Notification reports

7.1.3 Health facility level

Indicator	Source	Frequency	Monitoring tool
Number of TB team meetings	Meeting reports	Monthly	TB team quarterly reports
Gaps and challenges of TB case detection identified	Baseline assessment checklist	Baseline	Assessment report
Presence of SOPs for TB case detection in all designated / important departments	SOPs supervision checklist	Monthly	TB team quarterly reports
Presence and use of TB algorithms, wall posters and screening tools	SOPs supervision checklist	Monthly	TB team quarterly reports
Availability of updated TB case detection plan of action	Plan of action	Quarterly	TB team quarterly reports
Rate of TB suspects identified	Hospital records / TB suspect register	Quarterly	TB Suspect quarterly report
Rate of TB suspects notified among suspects	Hospital records / Lab register / TB suspect register vs TB register	Quarterly	TB Suspect quarterly report

7.1.4 TB Suspects indicators

Indicator	Source	Frequency	Monitoring tool
Rate of TB suspects identified = Number of TB suspects identified / x100		Quarterly	Hospital records / HIMS records
Rate of TB suspects examined= Number of TBS examined X 100 / Number of TBS identified		Quarterly	Hospital records / HIMS records / TB suspect register
Rate of TB suspects examined= SS+ positive rate Number of TBS examined SS+ X 100 / Number of TBS examined		Quarterly	Hospital records / HIMS records /TB suspect TB register vs. Lab register
Average of sputum samples = Number of sputum samples in all TBS examined / Number of TBS examined		Quarterly	Lab register

7.2 TPT indicators

Surveillance of TPT implementation will be conducted using the indicators listed below. District health coordinators—covering TB, HIV, or TB/HIV collaborative programmes—will submit data on a monthly and quarterly basis to both district and national management teams. These reports will include, but are not limited to, the national indicator set.

Indicator	Numerator	Denominator	Purpose	Source
Number of PLHIV newly enrolled in HIV care	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary form for ART
Number of PLHIV screened for TB	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary screening tool
Number of PLHIV newly enrolled in HIV care screened for TB	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary screening tool
Number of PLHIV newly enrolled who are eligible for TPT	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary screening tool
Number of PLHIV newly enrolled in HIV care started on TPT	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary form for ART
Total number of PLHIV newly enrolled who received and completed TPT				
Proportion of PLHIV newly enrolled in HIV care screened for TB	Number of PLHIV newly enrolled in HIV care screened for TB	Number of PLHIV newly enrolled in HIV care	Measure the capacity of the programme to detect active TB among PLHIV	DHIMS
Proportion of PLHIV newly enrolled who are eligible and received TPT	Number of PLHIV newly enrolled who are eligible and received TPT	Number of PLHIV newly enrolled who are eligible for TPT	Measure the capacity of the programme to initiate TPT among PLHIV	DHIMS
Treatment completion rate	Total number of PLHIV newly enrolled who received and completed TPT	Total number of PLHIV newly enrolled who were imitated on TPT 9 months ago		
Total number of children under 5 who are household contacts of PTB cases screened	N/A	N/A	To help with projections and forecasting of commodity needs	Monthly summary screening tool
Total number of children under 5 who are household contacts of PTB cases	N/A	N/A	To help with projections and forecasting of commodity needs	
Total number of children under 5 who were eligible and received TPT	N/A	N/A	To help with projections and forecasting of commodity needs	
Total number of children under 5 who were eligible for TPT	N/A	N/A	To help with projections and forecasting of commodity needs	
Total number of children under 5 who are household contacts of PTB cases who were screened	Total number of children under 5 who are household contacts of PTB cases who were screened	Total number of children under 5 who are household contacts of PTB cases	Measure the capacity of the programme to detect active TB among children <5 who are household contacts of PTB cases	DHIMS

Indicator	Numerator	Denominator	Purpose	Source
Proportion of children under 5 who are household contacts of PTB cases who were eligible and received TPT	Total number of children under 5 who were eligible and received TPT	Total number of children under 5 who were eligible for TPT	Measure the capacity of the programme to initiate TPT among children <5 who are household contacts of PTB cases	DHIMS
Total number of children under 5 who received and completed TPT	N/A	N/A		
Treatment completion rate	Total number of children under 5 who received and completed TPT	Total number of children under 5 who were imitated on TPT 9 months ago		
Total number of eligible individuals in at risk populations tested for Latent Tuberculosis Infection (LTBI)	N/A	N/A	To help with projections and forecasting of commodity needs	
Total number of eligible individuals in at risk populations tested for LTBI and received TPT	N/A	N/A	To help with projections and forecasting of commodity needs	
Proportion of eligible individuals in at-risk populations tested for LTBI and received TPT	Total number of eligible individuals in at risk populations tested for LTBI and received TPT	Total number of eligible individuals in at risk populations tested for LTBI	Measure the capacity of the programme to detect active TB among eligible individuals in at risk populations	
Proportion of eligible individuals in at- risk populations tested for LTBI and received TPT and completed the TPT	Total number of eligible individuals in at-risk populations tested for LTBI and received TPT and completed the TPT			

Source. Guidelines for TB Preventive Therapy in Ghana - May 2018

Component 8: Functional and non-functional requirements

This section provides an overview of the high-level functional and non-functional requirements that are needed for the Ghana TB digital health information system.

Functional requirements describe the capabilities the system must have in order to meet the end-users' needs and achieve tasks within the business process. Non-functional requirements provide the general attributes and features of the digital system to ensure usability and overcome technical and physical constraints. Examples of non-functional requirements include ability to work offline, multiple language settings, and password protection.

Functional requirements

Requirement ID#	Activity ID and description	As a ...	I want ...	So that ...
TB.A REGISTER CLIENT				
TB.FXNREQ.001	TB.A5. Search for the client record	Health worker or data entry clerk or medical office receptionist	To search to see whether client is already in the system (using a combination of unique identifiers and demographic characteristics)	I can check whether this is a new or existing client
TB.FXNREQ.007	TB.A7. Create a new client record	Health worker or data entry clerk or medical office receptionist	To be able to enter identification information	I can enter new client information
TB.FXNREQ.012	TB.A8. Validate the client details	Health worker or data entry clerk or medical office receptionist	To display client information for validation (and be able to edit it)	I can ensure information has been checked before submission
TB.FXNREQ.016	TB.A8. Validate the client details	Health worker or data entry clerk or medical office receptionist	To be able to confirm the client's identity	I can be sure it is the right person
TB.FXNREQ.020	TB.A9. Check in the client	Health worker or data entry clerk or medical office receptionist	Provide a list or roster of all clients due to arrive	I know which clients to follow up or are due for services
TB. B SCREENING				
TB.FXNREQ.021	TB.B1. Provide pre-screening information and ask for consent	Health worker (e.g., nurse)	To have available general pre-screening information about potential risks and benefits, screening tools and procedure to share with clients during counselling activities	I can better answer the client's questions and better prepare them for screening activities
TB.FXNREQ.023	TB.B3. Assess medical history and risk factors	Health worker (e.g., nurse)	To be able to capture or update client information related to medical history and risk factors for TB	I make sure that new relevant information is not missed

Requirement ID#	Activity ID and description	As a ...	I want ...	So that ...
TB.FXNREQ.024	TB.B4. Determine the screening algorithm	Health worker (e.g., nurse)	To have available general information about screening algorithms	I have a quick reference to help me choose the most appropriate screening algorithm for a client or group of clients
TB.FXNREQ.025	TB.B5. Perform the TB screening	Health worker (e.g., nurse)		
TB.C DIAGNOSIS				
TB.FXNREQ.026	TB.C1. Carry out clinical examination	Health worker (e.g., nurse)	The system to use the data entered for a client to generate statistics, graphs, pop-ups (on demand or ad hoc)	I can take better clinical decisions
TB.FXNREQ.027	TB.C2. Assess medical history and risk factors	Health worker (e.g., nurse)	To be able to route the consultation via different health workers and save in the system the information already entered to the consultation even if the consultation is not yet complete, enabling other health workers to see the information already entered and to be able to add or edit information as it becomes available	I do not have to start a new consultation for every health worker that the client is involved with
TB.FXNREQ.028	TB.C4 Assess history of prior TB treatment	Health worker (e.g., nurse)	To be able to check client's medical history	I can use this information for investigations or treatment recommendations
TB.FXNREQ.029	TB.C12. Interpret test(s) results TB.C20. Interpret the follow-on test(s) results	Health worker (e.g., nurse)	The system to record diagnosis test results from laboratories or other test centres	I can take the appropriate actions more quickly
TB. D TB TREATMENT				
TB.FXNREQ.030	TB.D9. Determine the regimen designed to treat rifampicin-susceptible TB TB.D10. Determine the regimen designed to treat rifampicin-resistant TB	Health worker (e.g. nurse)	The system to propose TB treatment regimens based on predefined criteria and on the information available in the system	It helps me selecting the appropriate treatment regimen for the client
TB.FXNREQ.032	TB.D13. Initiate the treatment and discuss adherence	Health worker (e.g., nurse)	The system to automatically calculate the expected TB treatment completion date	I do not have to calculate this myself
TB.FXNREQ.033	TB.D14. Develop monitoring examinations and a schedule of follow-up visits	Health worker (e.g., nurse)	To have the system automatically calculate a date when the client should return for care, based on treatment regimen, clinical condition and monitoring examinations	I do not have to calculate this myself

Requirement ID#	Activity ID and description	As a ...	I want ...	So that ...
TB.FXNREQ.035	TB.D19. Manage TB treatment interruptions	Health worker (e.g., nurse)	The system to be able to exchange information with digital adherence technologies to automatically record and calculate information related to treatment progress or interruptions	I do not have to calculate this myself and fill in the information manually
TB.FXNREQ.036	TB.D24. Report the outcome(s)	Health worker (e.g., nurse)	The system to trigger an alert to assign treatment outcome in case the expected TB treatment completion date is reached and there is no treatment outcome assigned	Alignment between the number of cases notified and number of treatment outcome cohort (all notified cases have assigned treatment outcomes) is ensured
TB.E: TPT				
TB.FXNREQ.037	TB.E1. Offer TB prevention counselling	Health worker (e.g. nurse)	To be prompted to provide counselling on TPT	I can ensure that the client is educated on TPT before offering any TPT-related service
TB.FXNREQ.038	TB.E2. Make an informed decision	Health information officer	The system to prompt the health worker to get informed consent from the client before proceeding with the TPT evaluation	I can ensure that client rights are protected
TB.FXNREQ.040	TB.E4.7. Determine TPT eligibility	Health worker (e.g., nurse)	To have questions that guide me in TPT eligibility assessment	I can better evaluate client TPT eligibility
TB.FXNREQ.041	TB.E4.7. Determine TPT eligibility	Health worker (e.g., nurse)	To be able to use my clinical judgement when deciding if a client is eligible or not for TPT and enter the decision in the system	I do not prevent clients from taking TPT when they are eligible with clinical judgement (e.g., when the benefits of TPT outweighs the risks)
TB.FXNREQ.042	TB.E9. Initiate TPT and develop an adherence plan	Health worker (e.g., nurse)	To have available general information about TPT adherence	I can better prepare the TPT adherence plan
TB.F: REFERRALS				
TB.FXNREQ.044	TB.F2.1. Stabilize the client and give pre-referral treatment	Health worker (e.g., nurse)	To be able to bypass the standard flow at any point if danger signs are present or emergency care is needed; urgent cases should be flagged and seen promptly	The client can be referred, if needed
TB.FXNREQ.045	TB.F3. Identify and discuss referral location options	Health worker (e.g., nurse)	To be able to find out in the system where the required service may be available	I can refer my client to another facility to receive the appropriate services
TB.FXNREQ.046	TB.F4. Contact referral facility	Health worker (e.g., nurse)	To be able to send a referral request to a health centre	I can refer my client for them to receive the appropriate services

Requirement ID#	Activity ID and description	As a ...	I want ...	So that ...
TB.FXNREQ.047	TB.F4. Contact referral facility	Health worker (e.g., nurse)	To have a list of the contact information for referral facilities	I can easily contact the facility when making the referral arrangements
TB.FXNREQ.048	TB.F6. Provide information to the receiving facility	Health worker (e.g., nurse)	To indicate in the system the referral reason	I can identify ways to improve the TB care process at my healthcare facility
TB.FXNREQ.049	TB.F6. Provide information to the receiving facility	Health worker (e.g., nurse)	To share the client's health records with the referral facility	They can provide the care my client needs
TB.FXNREQ.050	TB.F8. Check whether the client can be accommodated	Health worker (e.g., nurse)	To be able to check if the supplies and skills needed to accommodate a referred client are available at my facility	I can validate to the referring facility (or directly to the client) where the client can be accommodated
TB.G: AGGREGATE REPORTING AND DATA USE				
TB.FXNREQ.052	TB.G4. Generate aggregate reports	Health worker or data entry clerk	To produce a range of prepared reports	I do not need to create the reports manually for reporting purposes
TB.FXNREQ.053	TB.G7. Analyse and interpret the reports	Health worker (e.g., nurse)	To view a range of standardized visualizations (e.g., charts, tables, maps)	I am able to use data collected at the facility for service delivery and informing programmatic actions with the aim of improving the quality of care for clients with TB.

Non-functional requirements

Requirement ID#	Category	Non-functional requirement
TB.NFXNREQ.001	Security – confidentiality	Provide password-protected access for authorized users
TB.NFXNREQ.002	Security – confidentiality	Provide a means to ensure confidentiality and privacy of personal health information
TB.NFXNREQ.003	Security – confidentiality	Provide the ability for allowed users to view confidential data
TB.NFXNREQ.007	Security – confidentiality	Provide encrypted communication between components
TB.NFXNREQ.008	Security – confidentiality	Provide secure data transmission methods to prevent others from seeing data sent from one computer to another by using data encryption and private networks across public networks
TB.NFXNREQ.010	Security – authentication	Adhere to complex password requirements

Requirement ID#	Category	Non-functional requirement
TB.NFXNREQ.014	Security – authentication	Lock a user out after a specified number of wrong password attempts
TB.NFXNREQ.015	Security – authentication	Notify a user if their account is locked due to wrong password attempts
TB.NFXNREQ.016	Security – authentication	Provide role-based access to the system: users of the system get access on a need-to-know and need-to-use basis
TB.NFXNREQ.017	Security – audit trail and logs	Log system logins and logouts
TB.NFXNREQ.018	Security – audit trail and logs	Record all authentication violations
TB.NFXNREQ.013	Security – authentication	Reset a user's password in a secure manner
TB.NFXNREQ.024	Security – audit trail and logs	Log all data and system errors
TB.NFXNREQ.026	Security – user management	Provide ability to create roles with associated permission. Provide the ability to create, edit and void user records and link them with one or more roles to enable role-based access.
TB.NFXNREQ.027	Security – user management	Allow roles to be associated with specific geographical areas or health-care facilities
TB.NFXNREQ.028	Security – user management	Allow cascading user management and assignment of roles
TB.NFXNREQ.033	Security – user management	Support definitions of unlimited roles and assigned levels of access, viewing, entry, editing and auditing
TB.NFXNREQ.034	System requirements – general	Provide a unique version number for each revision
TB.NFXNREQ.035	System requirements – general	Enable earlier versions of a record to be recoverable
TB.NFXNREQ.042	System requirements – general	Show the number of records that are not yet synchronized
TB.NFXNREQ.043	System requirements – general	Have the ability to easily back up information
TB.NFXNREQ.044	System requirements – general	Warn user if no valid back-up for more than a predefined number of days
TB.NFXNREQ.045	System requirements – general	Must have the ability to store images and other unstructured data
TB.NFXNREQ.046	System requirements – scalability	Scalable to accommodate new demands
TB.NFXNREQ.047	System requirements – scalability	Be able to accommodate at least [x number of]a healthcare facilities
TB.NFXNREQ.048	System requirements – scalability	Be able to accommodate at least [x number of]a concurrent users
TB.NFXNREQ.049	System requirements – usability	Be user-friendly for people with low computer literacy
TB.NFXNREQ.057	System requirements – usability	Provide guidance to users to better support clinical guidelines and best clinical practices
TB.NFXNREQ.058	System requirements – usability	Be reliable and robust (minimize the number of system crashes)
TB.NFXNREQ.059	System requirements – usability	Adjust display to fit small screens (e.g., mobile phones)
TB.NFXNREQ.060	System requirements – configuration	Configure the system centrally
TB.NFXNREQ.061	System requirements – configuration	Configure business rules in line with guidelines and standard operating procedures
TB.NFXNREQ.062	System requirements – configuration	Configure error messages
TB.NFXNREQ.063	System requirements – configuration	Configure workflows and business rules to accommodate differences between facilities

Requirement ID#	Category	Non-functional requirement
TB.NFXNREQ.064	System requirements – interoperability	Communicate with external systems through mediators
TB.NFXNREQ.065	System requirements – interoperability	Provide access to data through application programming interfaces
TB.NFXNREQ.066	System requirements – interoperability	Be interoperable with external systems through mediators
TB.NFXNREQ.068	System requirements – interoperability	Exchange data with other approved systems

Glossary

Business process	A set of related activities or tasks performed together to achieve the objectives of the health programme area, such as registration, counselling, referrals (1,16).
Clinic	The setting where health workers are administering services that include TB screening, care and treatment.
Data dictionary	A centralized repository of information about the data elements that contains their definition, relationships, origin, usage, and type of data. For this digital adaptation kit, the data dictionary is provided as a spreadsheet.
Data element	A unit of data that has specific and precise meaning.
Decision-support logic	A set of decision rules for standard and exceptional cases that is separate from the business process. This would help reduce the complexity of the business process depiction without losing the detail necessary for coding the rules required for system functionality.
Decision support (for health workers)	Digitized job aids that combine an individual's health information with the health worker's knowledge and clinical protocols to assist health workers in making diagnosis and treatment decisions.
Decision-support table	Semi-structured way to depict each discrete decision that will need to be embedded in the system. Depending on the complexity of the clinical guidelines, there will likely be multiple decision-support tables.
Digital health	The systematic application of information and communications technologies, computer science and data to support informed decision-making by individuals, the health-care workforce and health systems, to strengthen resilience to disease and improve health and wellness.
Digital tracking	The use of a digitized record to capture and store clients' health information to enable follow-up of their health status and services received. This may include digital forms of paper-based registers and case management logs within specific target populations, as well as electronic medical records linked to uniquely identified individuals.
Functional requirement	Capabilities that the system must have in order to meet the end-users' needs and achieve tasks within the business process.
Health information system (HIS)	A system that integrates data collection, processing, reporting and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services (38).
Health management information system	An information system specifically designed to assist in the management and planning of health programmes, as opposed to delivery of care (38).
Interoperability	The ability of different applications to access, exchange, integrate and use data in a coordinated manner through the use of shared application interfaces and standards, within and across organizational, regional and national boundaries, to provide timely and seamless portability of information and optimize health outcomes.
Non-functional requirement	General attributes and features of the digital system to ensure usability and overcome technical and physical constraints. Examples of non-functional requirements include ability to work offline, multiple language settings, and password protection.
Persona	A generic aggregate description of a person involved in or benefiting from a health programme.
Standard	In software, a standard is a specification used in digital application development that has been established, approved, and published by an authoritative organization. These rules allow information to be shared and processed in a uniform, consistent manner independent of a particular application.
Task	A specific action in a business process.
Terminologies	For clinical care, terminologies are structured vocabularies covering health-related concepts, such as diseases, diagnoses, laboratory tests and treatments, to enable the storage, analysis and exchange of data in a consistent and standard way (39,40).
Workflow	A visual representation of the progression of activities (tasks, events, decision points) in a logical flow illustrating the interactions within the business process (16).

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