DIGITAL ADAPTATION KIT FOR IMMUNIZATION - GHANA

GHANA HEALTH SERVICE

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Abbreviations

CCM	Cold Chain Manager	HCW	Health care worker
CHIM	Center for Health Information Management	HeFRA	Health Facilities Regulatory Agency
CHN	Community health nurse	HMIS	Health Management Information System
CHV	Community health volunteer	ICD	International Classification of Diseases
DAK	Digital Adaptation Kit	IIS	Immunization Information System
DHIMS	District Health Information Management System	LHIMS	Lightwave Health Information Management System
DIPC	Digital Innovation in Pandemic Control project	MFL	Master Facility List
DTDS	Digital tracking and decision support	MCH	Maternal and Child Health
EPI	Expanded Programme on Immunization	PPME	Policy, Planning, Monitoring, and Evaluation
GAVI	Global Alliance for Vaccines and Immunization	SSDM	Supplies, Stores, and Drugs Management Division
GHS	Ghana Health Service	WHO	World Health Organization
GHiLMIS	Ghana Integrated Logistics Management Information System		

Background

The World Health Organization (WHO) Digital Adaptation Kits (DAK) are intended as a tool to ensure that 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.

As the WHO Immunization DAK has not been published at the time of this project initiation, the project team has utilized the WHO DAK framework (format and structure) to develop a generic Digital Adaptation Kit (DAK) for Immunization based on the previous work of the Better Immunization Data (BID) initiative. The generic DAK contains the set of generic common requirements and is intended for use across the Digital Innovation in Pandemic Control (DIPC) programme where it will be localized for each different country context according to their specific needs.

This DAK focuses on immunization in the Ghana context and aims to provide a common language across various audiences–programme managers, software developers, and implementers of digital systems–to ensure a common understanding of the appropriate health information content within the immunization health programme area, as a mechanism to catalyse the effective use of these digital systems. The Ghana Digital Adaptation Kit for Immunization was adapted through engagements with the Policy, Planning, Monitoring and Evaluation (PPME) department and Ghana Health Service (GHS) Information Technology (IT) Unit and other key stakeholders, primarily through a four-day workshop in June 2023 followed by review and validation of the outputs of the workshop.

The key objectives of this DAK are to:

- 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.
- Enable health programme 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.
- Provide a starting point of the core data elements and decision-support logic that should be included within DTDS systems for immunization.

Information detailed in this DAK has been adapted from the generic workflow processes, data and decision-support algorithms, as derived from the DIPC project conducted by PATH and other related WHO documents

described below. In addition, this DAK describes linkages to related services for immunization, such as contact tracing, facility management of an infected patient, and considerations for community management. Note that this DAK is contextualized to the local Ghanian policies and requirements.

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. All information within this adaptation kit used a generic starting point that was then adapted according to the specific context, in this case Ghana.

Table 1: Eight components comprising the digital adaptation kit for immunization 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[1] *(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 programmes and interventions.	• List of related health interventions based on WHO's universal health coverage 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).
3	User scenarios	Narratives that describe how the different personas may interact with each other.	Contextualization - To understand how the system would be used	Example narrative of how the targeted personas may interact	Greater specification and details on the real needs of end

[1] 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
		The user scenarios are only illustrative and are intended to give an idea of a typical workflow.	and how it would fit into existing workflows.	with each other during a workflow.	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 programme area, such as registration, counselling, referrals[2] *(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 would fit into existing workflows and how best to design the system for that purpose.	• Overview matrix presenting the key processes for immunizations. • 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

[2] 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
					depending on the context.
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."[3] *(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 & 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.

[3] 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 the different components, while the comprehensive and complete outputs of each component (e.g., data dictionary) are included in appended spreadsheets. The notation guide 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 "**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**" that should be structured "**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**" that should be structured "**Abbreviated health domain**" (e.g. GIZPS)."**DE**". *"Sequential number of the data element" (e.g. GIZPS.B7.DE.1, GIZPS.B7.DE.2*

Component 6: Decision-support logic

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

Component 8: High-level system requirements

Each functional requirement should have a "**Functional requirement ID**" that should be structured "**Abbreviated health domain**" (e.g. GIZPS). "**FXREQ**". *"Sequential number of the functional requirement" (e.g. GIZPS.FXREQ.1, GIZPS.FXREQ.1)*

Each non-functional requirement should have a "**Non-functional requirement ID**" that should be structured "**Abbreviated health domain**" (e.g. GIZPS). "**NFXNREQ**". *"Sequential number of non-functional requirements" (e.g. GIZPS.NFXNREQ.1, GIZPS. NFXNREQ.2)*

How to use this document

Target audience

The primary target audience for this DAK is health programme managers within the ministry of health (MOH) and the Ghana Health Service (GHS), who will be working with their digital or health information systems counterparts in determining the health content requirements for an immunization DTDS system. The health programme manager is responsible for overseeing and monitoring the implementation of the clinical practices and policies for the health programme area, in this case immunization.

The DAK also equips individuals responsible for translating health-system processes and guidance documents for use within digital systems with the necessary components to kick-start the process of developing a DTDS system in a standards-compliant manner. These individuals are also known as business analysts who interface between health content experts and software development teams. Specifically, the adaptation kit 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.

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

Component 1: Health interventions and recommendations

Interventions referenced in this digital adaptation kit based on WHO's Universal Health Coverage List of Essential Interventions:

- General vaccine administration practices for all age groups, including children:
  - Counselling on the vaccine(s) to be administered.
  - Observe for any adverse event following immunization (AEFI).
  - Targeted history and physical examination for vaccination.
  - Follow-up visit(s).
- Vaccination based on individual characteristics. Vaccinations include:
  - Bacillus Calmette–Guérin (BCG)
  - Cholera
  - Diphtheria, Tetanus and Pertussis (DTP)-containing vaccines
  - *Haemophilus influenzae* type B
  - Hepatitis A
  - Hepatitis B
  - Human papillomavirus (HPV)
  - Measles
  - Meningococcal
  - Mumps
  - Polio
  - Pneumococcal conjugate
  - Rabies
  - Rotavirus
  - Rubella
  - Tick-borne encephalitis
  - Typhoid
  - Seasonal Influenza
  - Varicella
  - Yellow Fever

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 with visuals about users, so team members are designing for someone specific. The general personas in charge of the immunization processes are listed in Table 3 below.

Table 3: User personas in charge of immunization processes.

No.	Title	Description	Responsible
1	Client	A person who intends to receive vaccination services from the targeted health worker personas.	Vaccinated person, Patient, Infant, Baby.
2	Caregiver	This can be the mother, father, guardian, or caregiver of the child or infant.	Parent, Guardian.
3	Community Health Volunteer (CHV)	Community health volunteers provide health education, referrals, follow-up, primary preventive health care, and home visiting services to specific communities. They provide support and assistance to clients by reminding clients to take their vaccinations and reporting community births.	Community Health Worker (CHW)
4	Community Health Nurse (CHN) Midwife	Community Health Nurses facilitate education sessions, administer immunizations, provide counseling when needed, record stock movements, and compile/generate and approve facility reports.	Health Care Worker (HCW), Public Health Nurse, Vaccinator, Licensed Public Health Nurse
5	Disease Control Officer Technical officer Nutrition officer	Oversee immunization activities at regional, district, sub-district, community, and facility level. Management of vaccines logistics cold chain system, reporting, surveillance, supervision of immunization activities.	Disease Control Officers, District Directors, Public health nurses, Expanded Program on Immunization (EPI)
6	Deputy Director Public Health	Oversee health activities in the region including immunization.	Deputy Director in charge of public health in the region
7	Health Information Officer	Oversee data recording and reporting issues at regional, district, sub-district, community, and facility level.	Health Information Officer
8	National Vaccine Supply Chain Officer	Responsible for management of logistics, cold chain, and vaccines at the national level.	Data managers, cold chain managers, Logisticians, EPI Officer (Expanded Program on Immunization)
9	National staff	Responsible for developing annual and multi-annual plans; immunization communication and mobilization; management of logistics, the cold chain, and vaccines; monitoring, supervision, and evaluation of immunization services; and coordination of immunization activities at the national level.	Policy, Planning, Monitoring and Evaluation (PPME), Public Health, Supplies, Stores and Drugs Management Division (SSDM), EPI (Expanded Program on Immunization), Centre for Health Information Management (CHIM) and other Ghana Health Service (GHS) national staff.

Detailed personas

	**Sena, Community Health Volunteer who lives in a community.**	
	Demographics	Sena 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. • Immunization, nutrition, HIV/AIDS. • Community services including family planning. • Provides community health services to people in catchment communities.	
Challenges	• Low awareness and demand for vaccines among community members. • CHV may have limited knowledge on immunization. • 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. • Has limited access to connectivity.	

	**David, Community Health Nurse who works in a Health Center**	
	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 in a community in a district in Bono Region, where he serves at the health center in the community. His dedication to his profession is complemented by his personal life as a committed husband and father of two children.
Responsibilities	• Maintain cold chain. • Conduct immunization services (Administer vaccines, Outreach). • 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 health center. • Manual reporting that involves tallying data and entering of data in the registers and compiling into a report that is captured in DHIMS is time consuming–up to 2 days a month. • Has limited access to connectivity.	
Connectivity and eHealth	• Expected to have a personalized mobile phone. • Facility has grid electricity power supply.	

	**Adowa, EPI Officer in a district in Greater Accra Region**	
	Demographics	Adowa is in her late thirties, with eight (8) years of working experience as an EPI officer in a district in Greater Accra Region.
Responsibilities	• Oversee 44 health facilities. • Ensure availability of accurate, complete, and updated information required for effective immunization and vaccination program in the district. • Undertake field visits for monitoring and supervision of vaccination activities to improve immunization coverage across the district. • Conduct disease surveillance at health posts and community level for vaccine preventable diseases. • Draft monthly, quarterly, and final reports to other levels, i.e., regional and national. • Maintain adequate vaccine stock and proper vaccine storage at the district level. • Perform vaccine stock and cold chain audits in health facilities across the district. • Distribute and fill monthly electronic report forms in the national DHIMS system. • Participate in routine immunization data verification. • Conduct training to health care workers on immunization activities. • Support mapping of defaulters tracing and zero doses of vaccines in district.	
Challenges	• Stockouts at the district vaccine store. • Lack of transport. • No budget for airtime and data for mobile health applications used for work purposes. • Scarcity of data tools (MCH, tally, register booklets) at facility level. • Lack of a PC to use for work.	
Connectivity and eHealth	• Reliable power supply, good internet connection, tablets.	

	**Kwaku, National Supply Chain Officer in EPI Logistics unit**	
	Demographics	Kwaku is a public health specialist in his mid-forties who has been working with the EPI in Logistics unit in GHS for over 10 years. With extensive experience in the public health domain and expertise in vaccine logistics, he plays a crucial role in ensuring the efficient ordering and distribution of vaccines and cold chain equipment. He has completed various online courses offered by reputable organizations like the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF).
Responsibilities	• Prepare procurement plan for cold chain equipment and vaccine. • Prepare training materials and facilitate training for vaccine supply chain and logistics officers at the subnational level. • Monitor performance of cold chain equipment.	
Challenges	• Increase demand of distributing cold chain equipment across the country. • Lack of visibility of performance of cold chain equipment especially for those that are not connected to the Remote Therapeutic Monitoring (RTM) devices. • Competing priorities at national level.	
Connectivity and eHealth	• Is computer literate. • Has access to reliable connectivity and power supply.	

Component 3: User scenarios

How to interpret user scenarios for functional requirements

User scenarios are helpful tools not only to better understand the context in which a digital tool would operate, but also for some insights into what key data elements would need to be recorded and accounted for in the database. Additionally, the context in which the tool would operate, illuminated by the user scenarios, provides insight into some functional and non-functional requirements that the system would also need. 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.

User scenario for routine vaccination clinic

Key personas	• Care giver (mother): Mabel • Child: Nana Ama • Community Health Nurse: Betty

Mabel is 21 years old and Nana Ama, her first baby, is 10 weeks old. Mabel completed primary school and has basic literacy. Her husband attended secondary school for three years, but he did not finish. They all live in a two-room house with intermittent electricity in a village near Mankranso.

Nana Ama was born at home. Although Nana Ama's birth was not registered (and she does not have a birth certificate), the clinic assigned an ID to Nana Ama when Mabel took her in for her first round of immunizations shortly after her birth. It takes Mabel just over an hour to walk to the Mankranso clinic from her home. Mabel enjoys going to the clinic as it is a chance to talk to other new mothers and she gets helpful information from the nurse about keeping her baby healthy.

Betty is a nurse working in the Mankranso clinic. She has 12 years of experience, and she has a diploma in nursing. Betty is in charge of the delivery of scheduled vaccines as part of the "under 5 program" at her clinic. Two other nurses also work in this clinic. The clinic operates 3 days a week in the morning. The clinic sees babies for screening and monitoring to identify any children who are at risk and may require further intervention early on to prevent issues. She also provides some preventative care such as vaccines and other supplements. Betty also spends time during each clinic doing health teaching about various child health topics.

Mabel and Nana Ama arrive at the clinic just after 9 a.m., and there are already 5 other moms with their babies. When it is Mabel's turn, she goes to the table where Betty is sitting, and hands her Nana Ama's paper vaccination card (or home-based record) which she received when Nana Ama attended her first clinic visit when she was registered. It contains Nana Ama's name, date of birth, a record of each vaccine given, as well as her weight at that visit. Betty uses the ID on the top of the card to look up Nana Ama's record on her tablet. She finds the record and can see in the system that Nana Ama is due for 4 vaccines at this time. Betty weighs Nana Ama using the scale set up beside the desk, and she records her weight on both the paper card and in the immunization information system (IIS) application on her tablet. She tells Mabel that Nana Ama is gaining weight well, and they briefly discuss some questions Mabel has about breast feeding.

Betty takes the appropriate vaccines out of the small cooler box beside her table. Betty had filled the cooler box earlier that morning based on what she would typically need based on an average clinic day. She has access to more vaccines, but they are in the fridge in the storage room. She prepares each vaccine, making sure that it is not expired and that the small symbol on the vial indicates it is safe to give. Betty gives each vaccine (starting with the ones given by mouth, then the injections) to Nana Ama. While Mabel comforts Nana Ama, Betty records the vaccines given in the application on the tablet, as well as on Nana Ama's home-based record. She also tells Mabel when to bring Nana Ama back for her next vaccines, and she also writes this on Nana Ama's home-based record. She also advises Mabel on what to do if Nana Ama develops a fever or some other symptom following vaccination. Since the clinic operates every weekday morning, Mabel understands that while she should try to come on the date given, it is not an actual appointment, just a guideline to come within a day or two of that date. Betty also informs her that they have a new system that can send an SMS reminder when Nana Ama is due for a vaccine to her phone if she would like. Mabel

agrees that she would like this reminder and Betty confirms her phone number in the system and checks the box indicating she would like to receive these notifications.	
Corresponding business processes (see Component 3)	This scenario refers to the following business processes: C. Client Reminder E. Register Client F. Query Client Record G. Administer Vaccine

User scenario for defaulter tracing

Key personas	• Community Health Nurse: Betty • Community Health Volunteer: Gloria

As the nurse responsible for the under 5-clinic in Mankranso, Betty has an estimate for the number of children that live in the area of her clinic that she needs to ensure are vaccinated. This number is estimated based on the population her clinic serves, as it is the only clinic in the area. Betty works closely with Gloria, a community health worker to find and encourage caregivers to bring their children to the clinic for vaccinations. Gloria lives in the village and is the wife of the school's headmaster. She is well respected in the community, and she has been a community health worker for the past 10 years. While she is not paid for this work, she is happy to know she is helping her community raise healthy children. She is responsible for both children and pregnant women, and she regularly councils them to ensure they attend clinics and get the care they need in a timely manner. Gloria has completed secondary school, and her training for this role has been both on the job, as well as some workshops that are held a few times a year.

At the clinic, Betty registers each child that came for their first vaccines into an electronic immunization registry (EIR) or immunization information system (E-Tracker), that has been implemented to replace the large paper ledger book. The child's name, sex, date of birth, parents' name, and some other identifying information was entered into the IIS system, and the IIS noted each vaccine that needs to be given. Betty enters the date each vaccine was given in the appropriate place during the visit in which it was done. Since this new IIS system was introduced, Betty no longer needs to add the same information into a large paper ledger book.

Now with an IIS in place, Betty no longer takes several hours each week to determine which children need to be followed up with by reviewing her paper ledger each week and calculating overdue status based on dates logged. Betty can see on her tablet the list of children who are overdue or late for their vaccines based on the vaccine schedules determined by national policies and their relevant contact information she may need for follow-up (e.g., caregivers' name and contact info). This list is also sent to Gloria via an SMS message once a week for her to help with follow up. At the clinic they have just started using the system to automatically send an SMS message to the caregiver to remind them when their child is due to come for the next vaccine. Betty is hopeful that this will help reduce the number of children who are brought in late for their vaccines.

Corresponding business processes (see Component 3)	This scenario refers to the following business processes: B. Plan Service Delivery C. Client Reminder D. Defaulter Tracing E. Register Client J. Report Generation

User scenario for catchup campaign

Key personas	District EPI Officer: Alfred
Alfred is the district EPI Officerr, he is 35 years old and has a university degree in management. He has been the EPI Officer for his district for the last 6 years. Alfred is responsible for planning, supporting all of the facilities in his district to manage their immunization programs, supervising and conducting reviews of data on immunization programs in the district. He closely monitors the monthly reports that each facility sends and looks for potential issues that may require his attention, such as inaccurate data on the reports, situations where the overall vaccine coverage in a facility may be lower than their targets, or if they have had times where they have stock out of a vaccine. Alfred is also responsible for keeping track of target population of children in his district and a sketch map of where that population is found. Alfred's district, like the rest of the regions, has had significant challenges due to the COVID-19 pandemic. Clinics have often been closed or reduced the hours they were giving routine vaccinations. Many parents also did not bring their children for their routine vaccinations even when the clinics were open for fear of contracting COVID-19. As a result, Alfred has noticed their coverage rates for most vaccines are much lower. After the epidemiological situation of COVID-19 changed, most clinics are now back to operating normally, but there are many children who are overdue for their vaccines. Last month, during a workshop, Alfred and his other EPI Officer colleagues were informed that they should plan for some local catch-up campaigns as part of a coordinated national plan to address this issue. Alfred and his team have conducted these catchup clinics previously, typically one or two times a year during Child Health Week events or Immunization Days. Since this campaign will be larger due to the number of overdue vaccines, the national EPI program is working with other partners to offer additional support. Alfred has the responsibility to review and customise plans made by the national government for the campaign in his region, review budgets and supervise the implementation of the campaign. Alfred works closely with stakeholders (coordination) and the community (communication) to implement the district's immunization plans.	
Corresponding business processes (see Component 3)	This scenario refers to the following business processes: B. Plan Service Delivery J. Report Generation

Component 4: Business process and workflows

A business process, or process, is a set of related activities or tasks performed together to achieve the objectives of the health programme area, such as registration, counselling, or referrals. Workflows are a visual representation of the progression of activities (tasks, events, interactions) that are performed within the business process[4]. 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 key business processes that are part of routine immunizations programmes and mass immunization campaigns. The most significant difference with campaigns is in the planning phase (process B. Service Plan Delivery). The rest of the workflows, most importantly process G. Administer Vaccine (which drives most of the decision logic to vaccinate versus not vaccinate) is the same regardless of whether it is part of the routine immunization programme or a mass immunization campaign.

These business processes are described in Table 4. 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.

[4] 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).

Overview of Ghana immunization business processes

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

Table 4: Immunization business processes in Ghana.

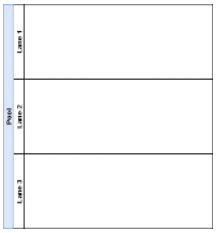
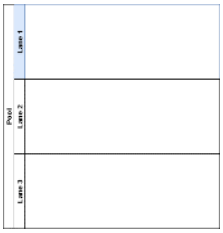
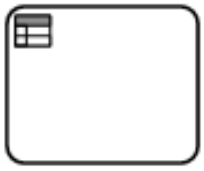
No.	Process name	Process ID	Personas	Objectives	Task set
	Title	ID used to reference this process throughout the DAK	Individuals interacting to complete the process	A concrete statement describing what the process seeks to achieve	The general set of activities performed within the process
A	Generate reminders	GIZPS.A	• Client (Parent/ Caregiver) • HCW/ Facility Staff • CHV	To communicate to the parent/caregiver if a child is due now, due on a future date, or past due date for immunization.	*Starting point: HCW checks if client is due for immunization.* • Check list of clients due for immunization using the child health and nutrition register (CHN Register). • Confirm clinic/ outreach dates through home visits by CH volunteers and phone calls. • Send reminder message to client via the CH volunteers and community information systems (CICs) • Receive message reminder (client/ CHV/HCW). Messages should be voice recorded in a local language.
B	Immunization follow-up	GIZPS.B	HCW/ Facility Staff	To identify children who are due to come for vaccination, missed their follow-up dates, and are now past due.	*Starting point: HCW checks register and determines if immunizations were missed.* Review planned immunization list and determine if some were missed, using the child health nutrition register, the child health record booklet and/or, where available, via E-Tracker. • HCW is always to be present during the child welfare clinic (CWC) sessions. • HCW must ensure every child is vaccinated. • The record must be captured in the child health record booklet and child health nutrition register and E-Tracker. Follow up is done through home visits using defaulter tracing register and school health services to trace defaulters (for second year of life (2YL) children.
C	Create newborn record	GIZPS.C	HCW/Facility Staff	To create an initial client/patient record following the birth of a newborn.	*Starting point: HCW registers birth of newborn Birth in facility/ Mother brings newborn to facility immediately after birth.* The HCW registers the child by adding an entry to the CHN Register and to the MCH Booklet (if available) and/or the immunization card, using a red pen to indicate this is a new registration. Blue pen is used to record continuing services. The Serial No is not unique (written in pencil). The (manual) Registration No is a sequential number unique within the facility + year e.g., 001/2023. If IIS (E-tracker or LHIMS) is in use, then the HCW registers the child by adding a new electronic record:

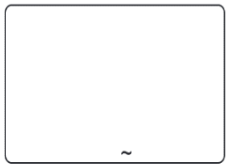
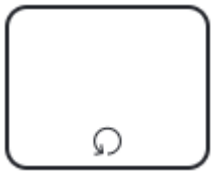
					• Search if record already exists. • Create a new record. • Update/ edit/ add to existing record. *Birth in community* The first time the newborn is seen at the clinic/facility the HCW registers the child by adding an entry to the CHN Register and to the MCH Booklet (if available) and/or the immunization card. (See details above) NOTE: The child's birth is also registered as part of the civil registration process, but this may happen weeks or months after the birth.
D	Register facilities	GIZPS.D	HCW/ Facility Staff, IIS System administrator	To be able to identify the facility where services are delivered. To enroll facilities into the IIS for vaccine reporting and reconcile the IIS facility list with the National Master Facility List (NMFL).	*Starting point: HCW in facilities without an IIS.* • The HCW records the name of the facility in the MCH Booklet. *Starting point: IIS staff receives new facility information.* • Validate against the list of facilities within the IIS. • Create/ update IIS facility record. • If new, generate unique IIS facility identification code. NOTE: Public health immunization clinics may also take place at a private health facility site.
E	Plan service delivery	GIZPS.E	HCW/Facility Staff	To prepare for an immunization clinic, either at the facility, static site, or done on an outreach basis.	*Starting point: HCW wants to prepare for an immunization clinic or outreach.* • Review CHN register data before the next appointment session to determine estimates of vaccines and vaccine consumables (syringes, cotton pads, ice packs, AEFI forms, etc.) needed. *Forecast based on the age of children according to age i.e. 0-11 months, 12-23 months, 24-59 months.* This takes place at least 2 days in a month due to the monthly schedule. • Check vaccine stock levels. • If needed (according to minimum stock level) then place a requisition/order for vaccine stock required. Record vaccine stock taken out of stores in preparation for the clinic/outreach in the vaccine ledger book.
F	Register client	GIZPS.F	HCW	To start and contribute to the clients' lifelong vaccine record.	*Starting point: HCW wants to register new client* Community Health Nurse, Public Health Nurse or Disease Control Officer usually performs this role. All information is entered manually in Maternal and Child Health booklet and the Child Health and Nutrition Register (see details in C: Register Newborn). *Starting point: HCW wants to register client information into the digital IIS health record.* • Search the client record to see if it already exists. • If exists, update client health record. If not, create new client record.

G	Query client record	GIZPS.G	HCW	To correctly locate or identify a client's immunization record as well as review and update a client's record to provide a client's complete immunization history.	*Starting point: Client/patient immunization visit.* ● Search for the client. ● Determine if there is an exact match, or partial matches. Use additional search criteria to establish an exact match.
H	Administer vaccine	GIZPS.H	HCW	To determine what vaccines a client needs, administer and record the relevant necessary data either in the IIS and/or on the appropriate paper records.	*Starting point: Patient presents for vaccination.* ● View the client record and determine which vaccine should be given, as well as any contraindications (e.g. allergy to egg). ● Check the vaccine and its label (e.g., expiry date, VVM, color, etc.). ● Prepare and administer the vaccine. ● Safely dispose syringe etc. ● Record appropriate data. ● Monitor for adverse event: if adverse event occurs, treat, record, report, and refer as appropriate. ● Schedule client's next visit. *Manual process: The MCH booklet contains vaccination information, and the completed booklet serves as documentation of being vaccinated. A certificate is provided when the child is fully vaccinated.* *IIS process: No digital certificate is generated.*
I	De-duplication of client patient records	GIZPS.I	HCW	To identify duplicate client records and consolidate them into one most accurate/suitable (best) record.	*IIS ONLY* *Starting point: Identify duplicate patient records and flag for evaluation.* ● Identify/flag duplicate records for evaluation. ● Produce a list of duplicate records and review them. ● Determine if these are in fact duplicate records. ● Link or merge as appropriate or mark as not duplicate. ● Generate report to show the resolution. *DHIMS: can deduplicate facility records.* *E-Tracker: can deduplicate for individual records.*
J	De-duplication of vaccine events	GIZPS.J	HCW	To identify duplicate vaccination events within a client record and update into one event.	*IIS ONLY* *Starting point: Identify duplicate vaccine events and flag for evaluation.* ● Identify potential duplicate events. ● Determine if these are in fact duplicate events. ● Update record appropriately. (Link or merge if a duplicate or mark as not duplicate). ● Generate report to show the resolution. NOTE: *In E-Tracker, data validation means this is unlikely but may be some edge cases where duplicate events are captured.*

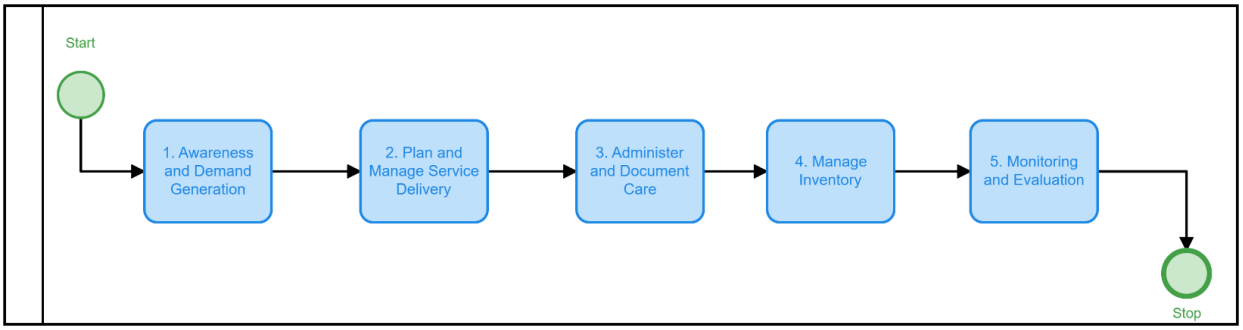
K	Manage cold chain inventory	GIZPS.K	Cold chain managers (CCM)/ logistician	To plan for equipment distribution at national level and ship to regions.	*Starting point: Cold chain managers makes a plan for equipment distribution.* ● Access cold chain equipment situation or take cold chain equipment inventory. ● Prepare and submit equipment distribution plan. Receive shipment and update maintenance report.
L	Manage arrivals of vaccine and related supplies (stock)	GIZPS.L	Manufacturing facility attendant, Freight forwarder, National warehouse store manager	To manage the arrival of vaccines to the national warehouse.	*Starting point: The manufacturing facility pack the vaccines for shipment to the national warehouse.* ● Receive, inspect, and clear the shipment and update shipping form. ● Report any damaged shipment. ● Fill and submit vaccine arrival report.
M	Distribute supplies to region	GIZPS.M	Regional store manager	To issue a requisition to the regional store for vaccine stock.	*Starting point: The regional store manager estimates the vaccine stock needed for the region.* ● Estimate vaccines required. ● Issue a requisition for vaccine stock to the regional store. ● Inspect stock delivery and record receipt. ● Update stock ledger. ● Notify requisition and receipt of stock to regional levels.
N	Distribute supplies to district/ health center	GIZPS.N	District store attendant, Health centre store attendant	To submit usage on hand to the region store and receive vaccine stock.	*Starting point: The health facility store attendant prepares a vaccine usage report.* ● Prepare and submit vaccine usage report. ● Record receipt of stock. ● Record issues of stock. Update health facility stock ledger.
O	Manage Inventory	GIZPS.O	CCM within facility	To receive stock and dispense/issue requests for stock in the vaccine store.	*Starting point: The cold chain manager receives vaccines at the district store.* ● Update ledger with received stock. ● Record loss and adjustments. ● Issue requisition. Notify and report on expiry.
P	Generate reports	GIZPS.P	HCW, DIVO, RIVO, Authorized system user	The objective is to provide the ability to access and analyze data to improve immunization program decision making. This business process outlines the general steps to generate a variety of reports that are routinely needed by DIVO, RIVO, providers, and other partners.	*Starting point: Time for periodic (monthly, quarterly, semi-annually, annual, and ad-hoc) reporting.* • Check data quality. • Correct fixable errors. • Generate and review aggregate reports. Provide feedback on any issues encountered during the process.

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.
	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.

Symbol	Symbol name	Description
	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 for 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.

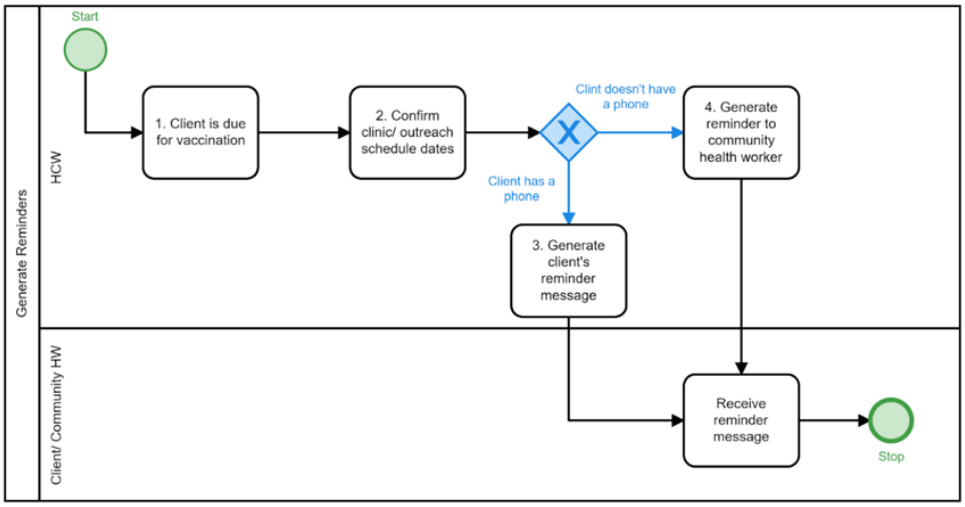
High level overview of key immunization workflow processes



Ghana immunization process workflows

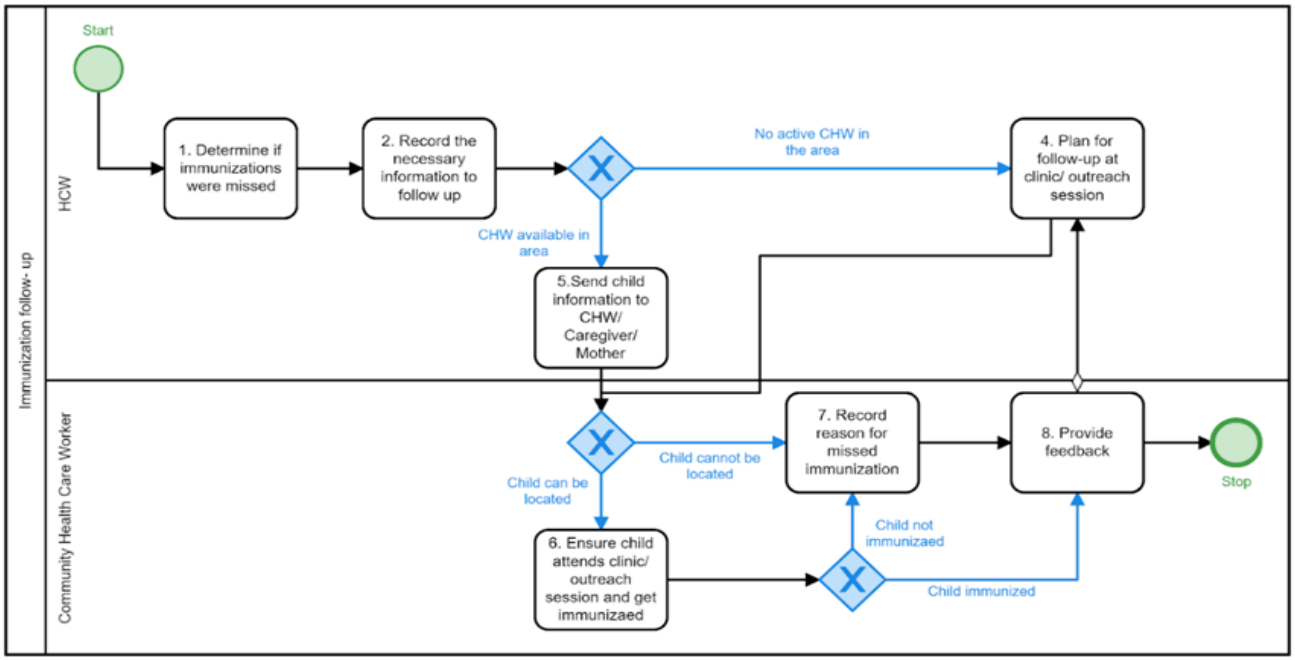
A. Generate reminders process flow

Objectives: To communicate to the client or parent/guardian if a patient is due now, due on a future date, or past due for vaccination.



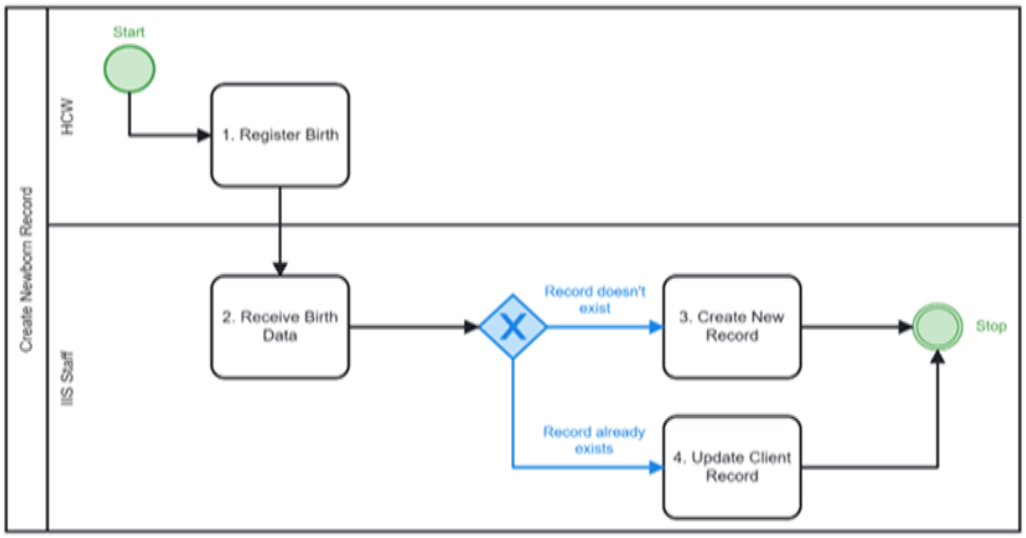
B. Immunization follow-up process flow

Objectives: To identify clients who were due to come for vaccination but missed their follow-up dates and are now past due.


Immunization follow- up
HCW
Community Health Care Worker
Start
1. Determine if immunizations were missed
2. Record the necessary information to follow up
No active CHW in the area
4. Plan for follow-up at clinic/ outreach session
CHW available in area
5.Send child information to CHW/ Caregiver/ Mother
Child cannot be located
7. Record reason for missed immunization
8. Provide feedback
Stop
Child can be located
6. Ensure child attends clinic/ outreach session and get immunizaed
Child not immunizaed
Child immunized

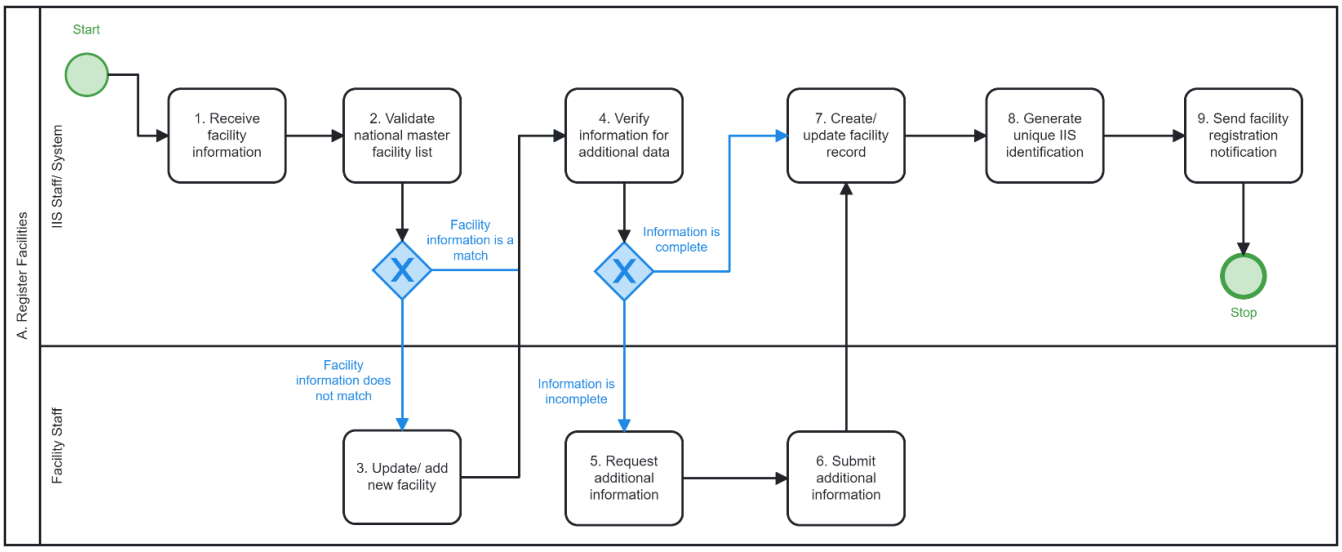
C. Create newborn record process flow

Objectives: To create an initial record in the system following the birth of a newborn.



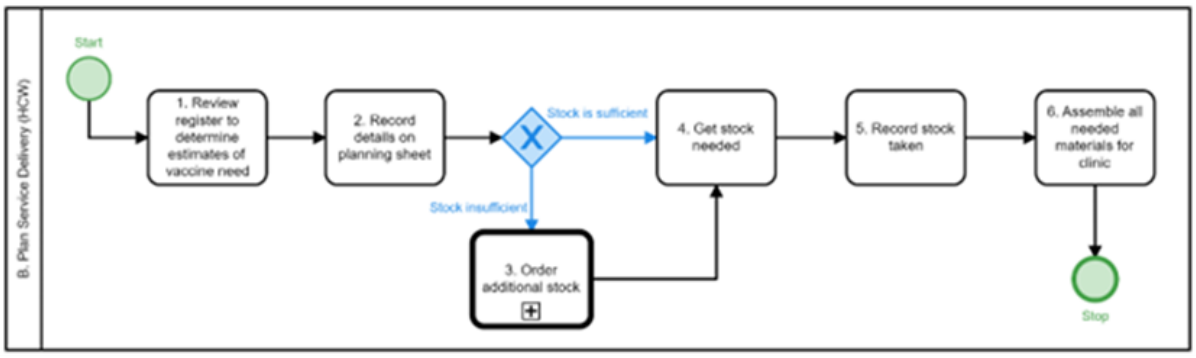
D. Register facilities process flow

Objectives: To enrol facilities into E-Tracker for vaccine reporting and reconcile with the National Master Facility List (NMFL).



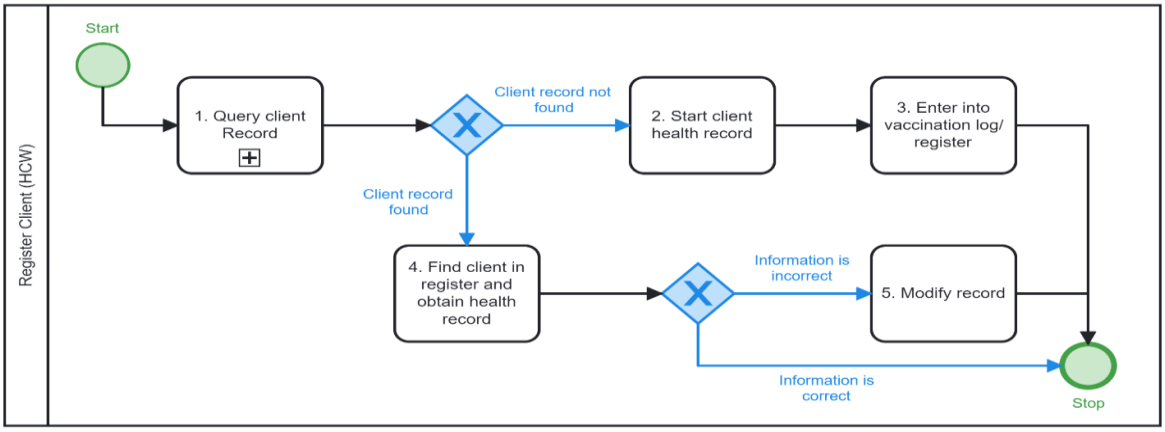
E. Plan service delivery process flow

Objectives: To prepare for an immunization session, either at the facility or done on outreach basis.



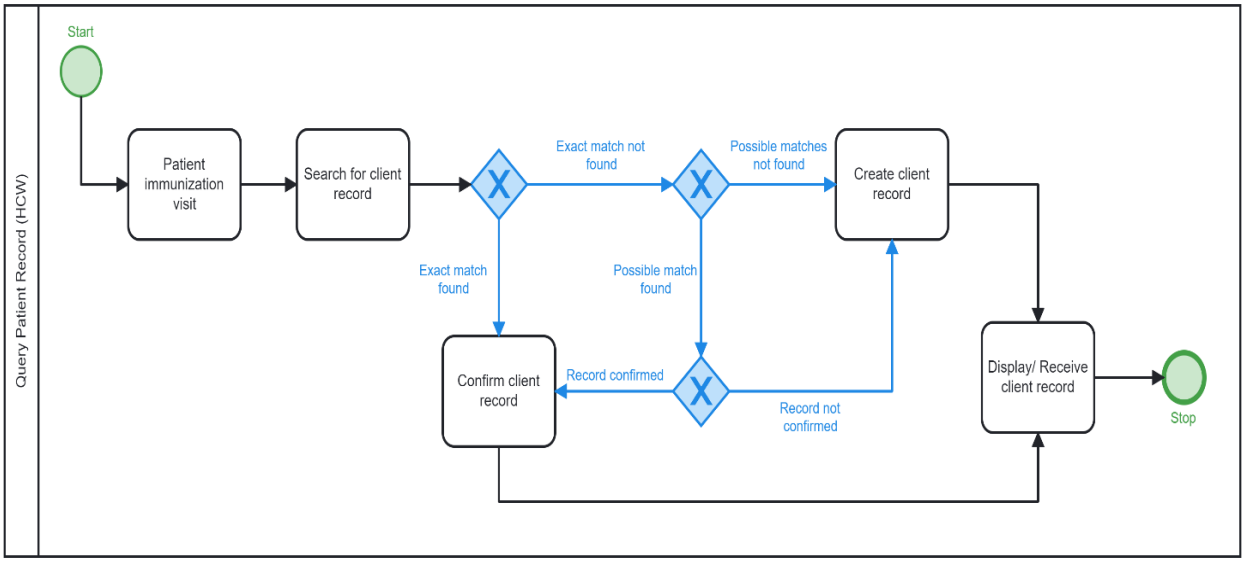
F. Register client process flow

Objectives: To start and contribute to the clients' lifelong vaccine record.



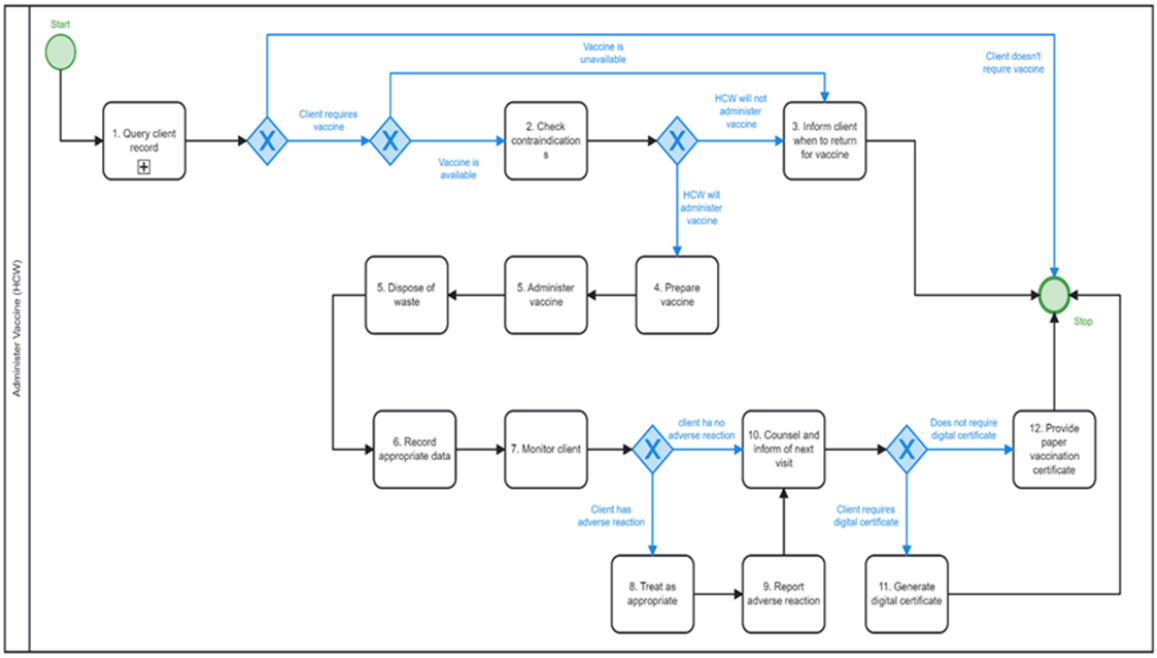
G. Query client record process flow

Objectives: To correctly locate or identify a client's vaccination record as well as review and update a client's record to provide a client's complete immunization history.



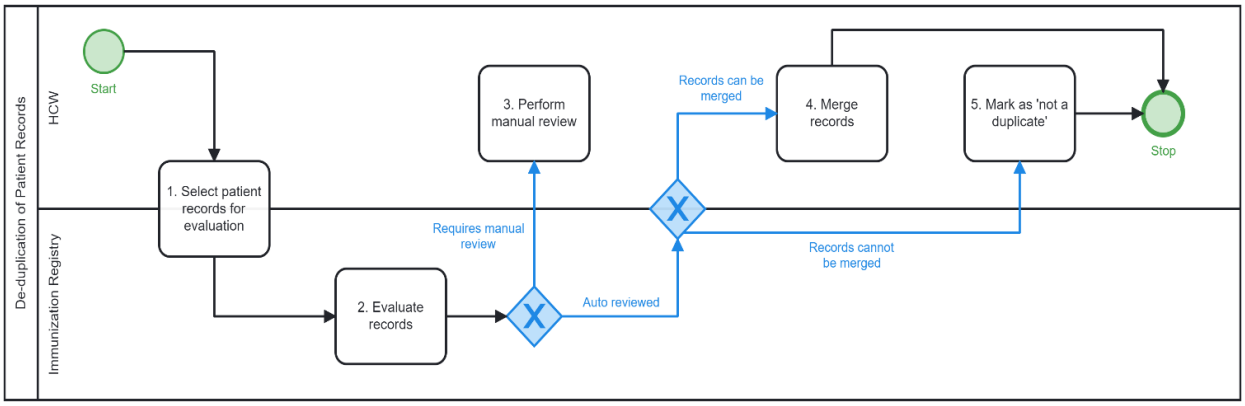
H. Administer vaccine process flow

Objectives: To determine what vaccines a client needs, administer vaccines, and record the relevant necessary data in the system as well as on the appropriate on home-based record.



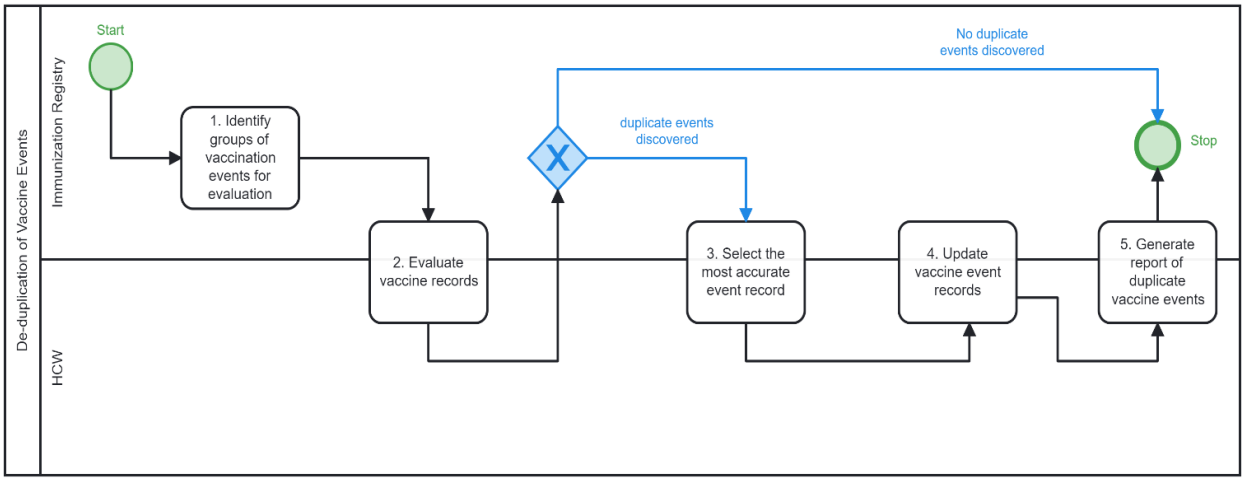
I. De-duplication of client records process flow

Objectives: To identify duplicate client records and consolidate them into one most accurate/suitable record.



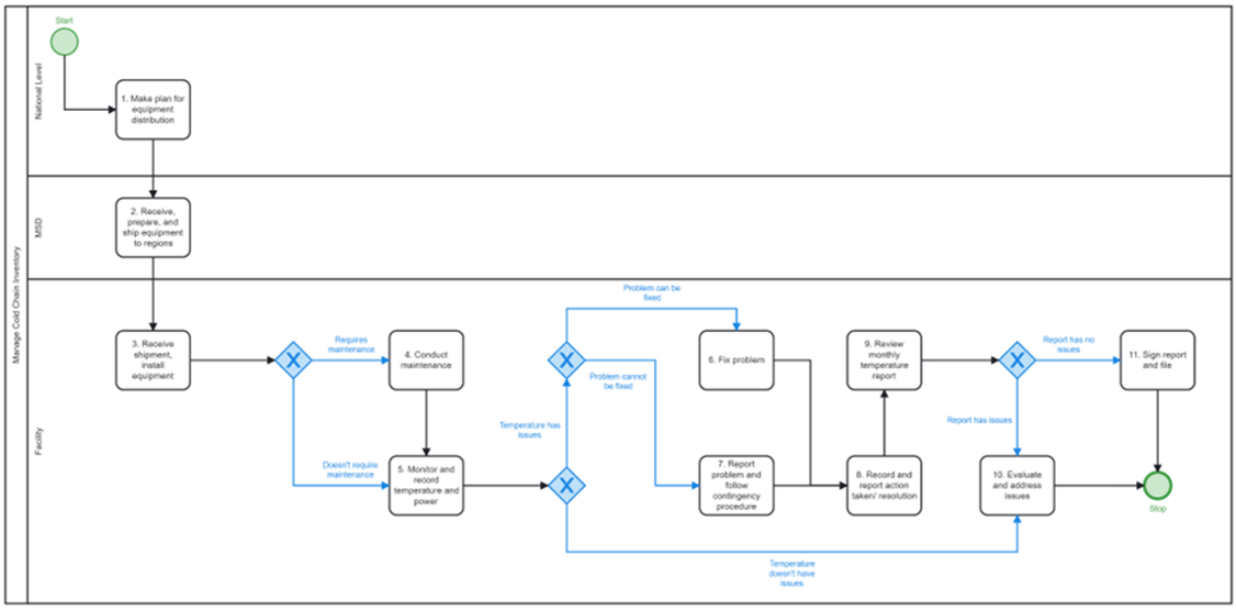
J. De-duplication of vaccine events process flow

Objectives: To identify duplicate vaccination events within a client record and update into one event.



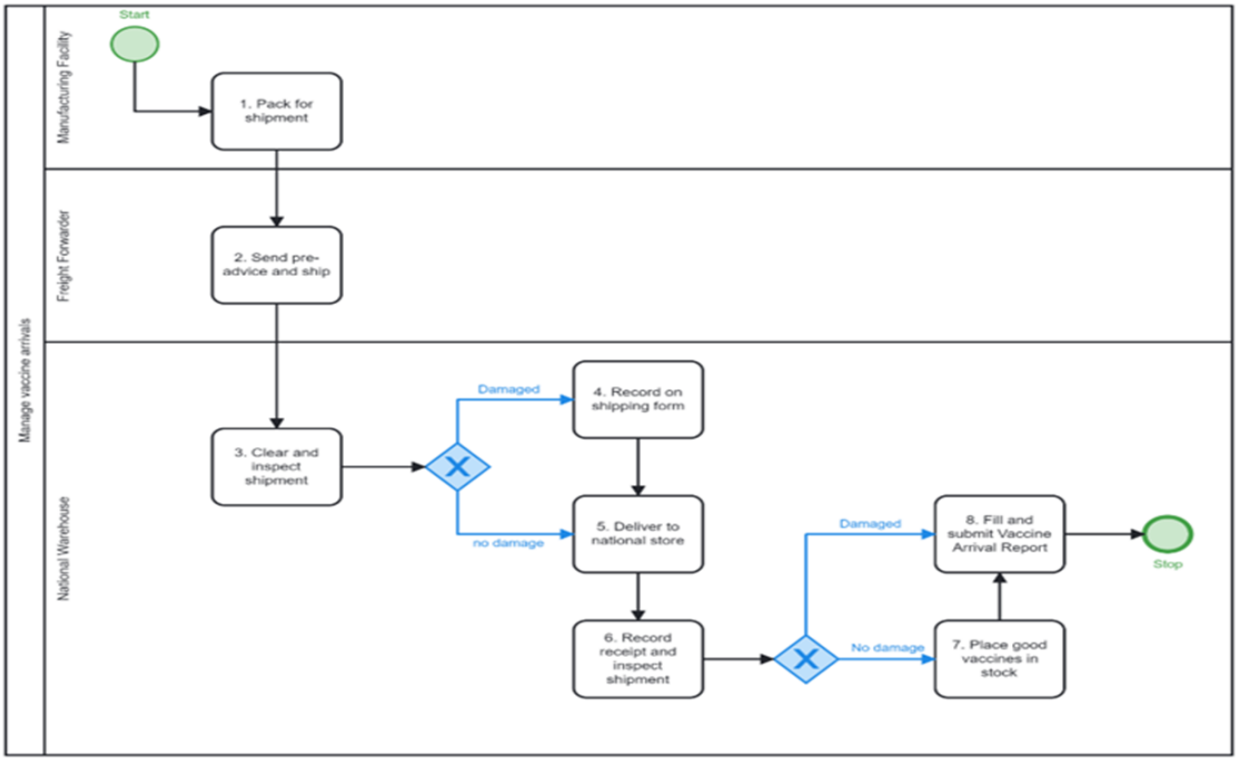
K. Manage cold chain inventory process flow

Objectives: To plan for equipment requirements at facility level.



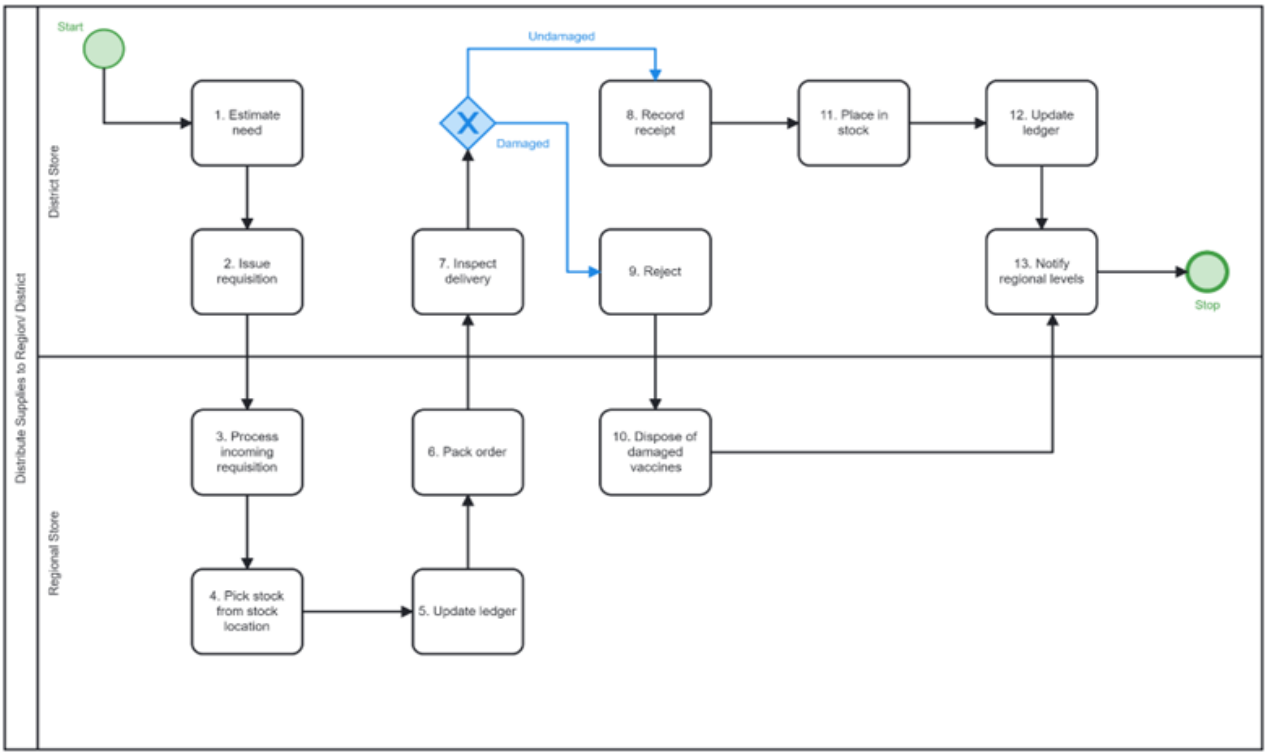
L. Manage vaccine arrivals process flow

Objectives: To manage the arrival of stock at facility level.



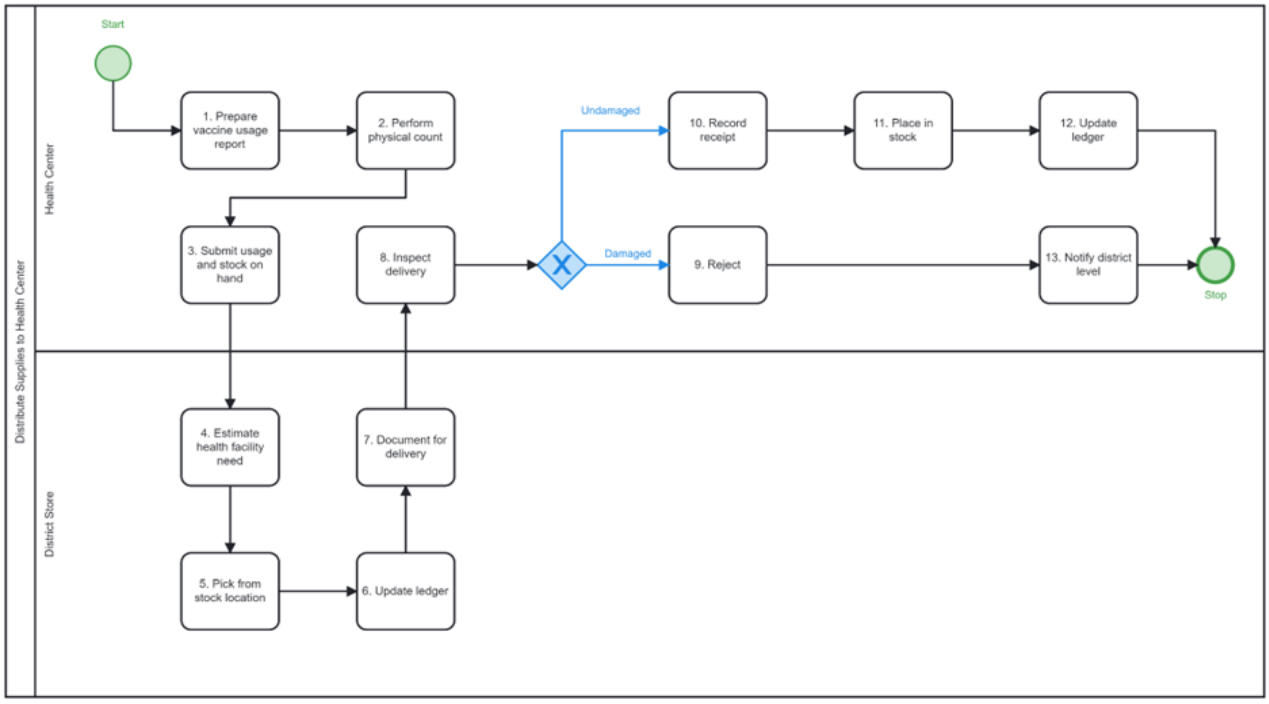
M. Distribute supplies to region/district process flow

Objectives: To manage stock at facility level.



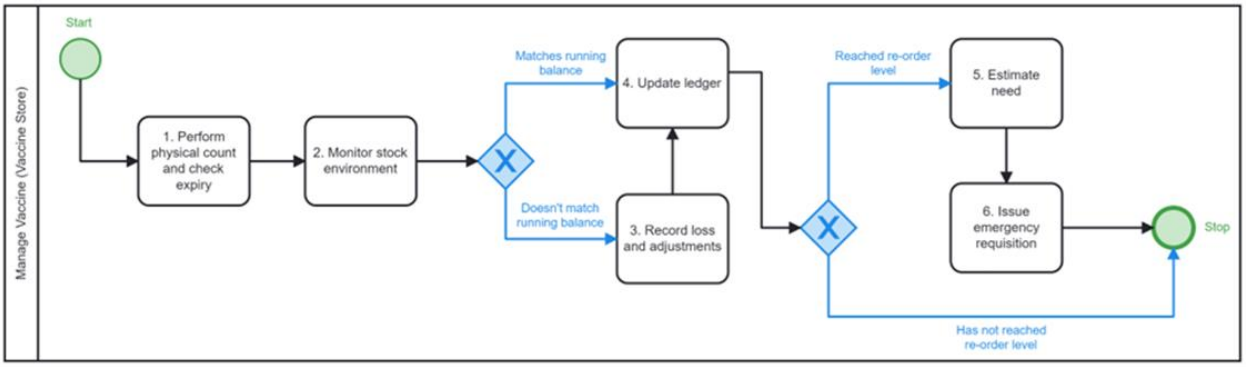
N. Distribute supplies to health centre process flow

Objectives: To manage stock at facility level.



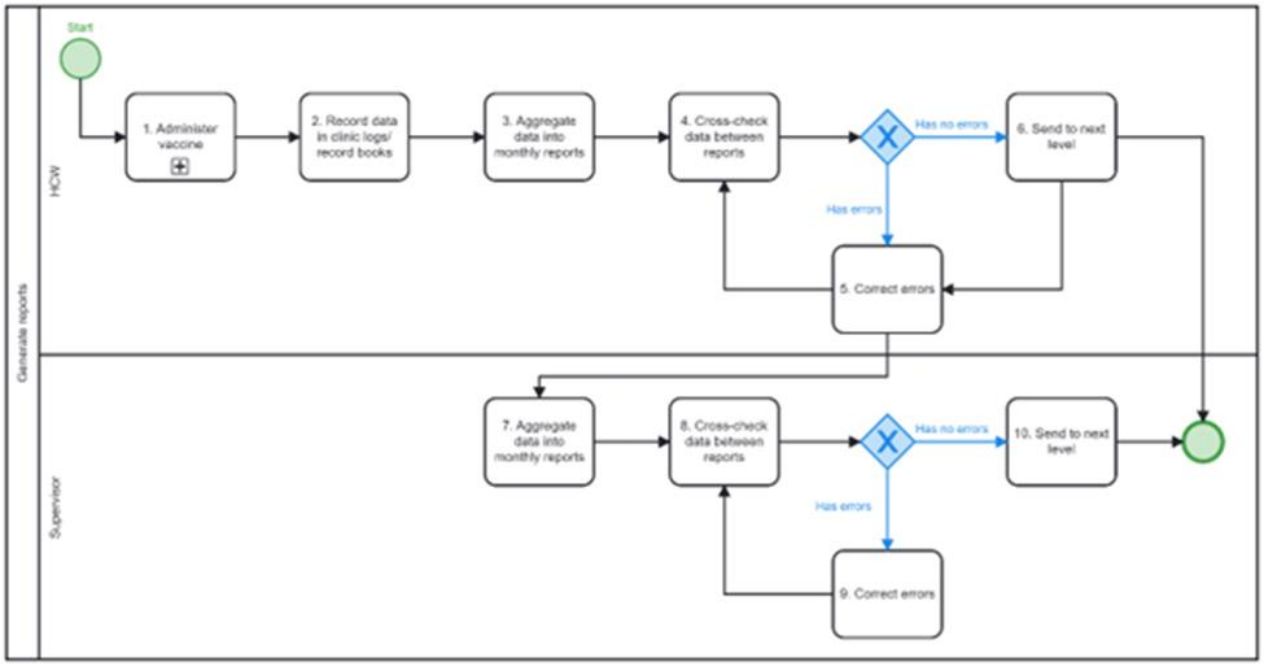
O. Manage inventory at facility process flow

Objectives: To manage stock at facility level.



P. Generate reports process flow

Objectives: To provide the ability to access and analyse data to improve immunization program decision making. This business process outlines the general steps to generate a variety of reports that are routinely needed by DIVO, RIVO, providers, and other partners.



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 can be used on any software system and lists the data elements relevant for immunization 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, validation checks, and concept dictionary codes is available in Annex A.

Inclusion of a data element in the table does not by itself indicate that collection of the data is required. Additionally, some data elements are dependent on other data elements (e.g., test results are only entered when a test has been performed). This will require review and adaptation. Data elements marked with an asterisk (*) e.g., Client name*, denote elements that have already been gathered in prior processes or activities.

Activity ID **Activity name**	**Data element ID**	**Data element name**	**Description and definition**
Business process A: Generate reminders			
GIZPS.A1: **Client is due for vaccination**	GIZPS.A1.DE.1	Client ID	Unique, system generated Client ID
	GIZPS.A1.DE.2	Client Name	Client's first and last name
	GIZPS.A1.DE.3	Vaccination Schedule	Client's required vaccination according to schedule
	GIZPS.A1.DE.4	Vaccination status	Current status of required vaccine
	GIZPS.A1.DE.5	Client Contact Number	Client or guardians contact number if available
GIZPS.A2: **Confirm clinic/**			
	GIZPS.A2.DE.1	Facility Name	The name of the facility

outreach scheduled dates	GIZPS.A2.DE.2	Facility Location	Physical address of where the facility is located
	GIZPS.A2.DE.3	Outreach Start Date	Start date of vaccination outreach
	GIZPS.A2.DE.4	Outreach End Date	End date of vaccination outreach
G**IZPS.A3: Generate client's reminder message**		*Reminder Message to Client (Template)*	
	GIZPS.A3.DE.1	Client ID*	Unique, system generated Client ID
	GIZPS.A3.DE.2	Client Name*	Client's first and last name
	GIZPS.A3.DE.3	Vaccination*	Client's required vaccination according to schedule
	GIZPS.A3.DE.4	Vaccination status*	Current status of required vaccine
	GIZPS.A3.DE.5	Facility Name*	The name of the facility
	GIZPS.A3.DE.6	Facility Location*	Physical address of where the facility is located
	GIZPS.A3.DE.7	Outreach Start Date*	Start date of vaccination outreach
	GIZPS.A3.DE.8	Outreach End Date*	End date of vaccination outreach
GIZPS.A4: Generate CHW's reminder message		*Reminder Message to CHW (Template)*	
	GIZPS.A4.DE.1	CHW Name	CHW's first and last name
	GIZPS.A4.DE.2	CHW Service Area	CHW's operation location
	GIZPS.A4.DE.3	CHW Contact number	CHW's contact number
	GIZPS.A4.DE.4	Client ID*	Unique, system generated Client ID
	GIZPS.A4.DE.5	Client Name*	Client's first and last name
	GIZPS.A4.DE.6	Vaccination*	Client's required vaccination according to schedule
	GIZPS.A4.DE.7	Vaccination status*	Current status of required vaccine
	GIZPS.A4.DE.8	Facility Name*	The name of the facility
	GIZPS.A4.DE.9	Facility Location*	Physical address of where the facility is located
	GIZPS.A4.DE.10	Outreach Start Date*	Start date of vaccination outreach
	GIZPS.A4.DE.11	Outreach End Date*	End date of vaccination outreach
Business process B: Vaccination follow-up			
GIZPS.B2: Generate necessary information for follow-up	GIZPS.B2.DE.1	Client ID*	Unique, system generated Client ID
	GIZPS.B2.DE.2	Client Name*	Client's first and last name
	GIZPS.B2.DE.3	Vaccination*	Client's required vaccination according to schedule
	GIZPS.B2.DE.4	Vaccine Status-Overdue*	Current status of required vaccine
	GIZPS.B2.DE.5	Client Contact Number*	Client or guardians contact number if available
	GIZPS.B2.DE.6	Facility Name*	The name of the facility
	GIZPS.B2.DE.7	Facility Location*	Physical address of where the facility is located
	GIZPS.B2.DE.8	Outreach Start Date*	Start date of vaccination outreach
	GIZPS.B2.DE.9	Outreach End Date*	End date of vaccination outreach
Business process C: Create newborn record			
GIZPS.C2: Create new record	GIZPS.C2.DE.1	Birth Registration Date	The date and time of registration of the birth
	GIZPS.C2.DE.2	Date and time of Birth	Client's date of birth
	GIZPS.C2.DE.3	Place of birth	Client's place of birth

	GIZPS.C2.DE.4	Facility of birth	The facility where the birth took place, if appropriate
	GIZPS.C2.DE.5	Sex	Baby's biological sex
	GIZPS.C2.DE.6	Birth Weight	Client's weight at birth in grammes
	GIZPS.C2.DE.7	Gestational Age	Client's gestational age at birth in weeks
	GIZPS.C2.DE.8	Multiple Pregnancy	A multiple pregnancy is a pregnancy with 2 or more fetuses.
	GIZPS.C2.DE.9	Multiple Birth type (name)	The birth of more than one baby from a single pregnancy.
	GIZPS.C2.DE.10	Baby's State	The baby's life state after birth
	GIZPS.C2.DE.11	Mother's Name	Mother's first and last name
	GIZPS.C2.DE.12	Mother's contact	Mothers contact information (mobile number).
	GIZPS.C2.DE.13	Father's name	Father's first and last name.
	GIZPS.C2.DE.14	Father's contact	Father's contact information (mobile number).
Business process D: Register facility			
GIZPS.D1: Receive facility information	GIZPS.D1.DE.1	Facility ID	The unique identifier for the facility
	GIZPS.D1.DE.2	Facility Name	The name of the facility
	GIZPS.D1.DE.3	Facility Address	The address of the facility
	GIZPS.D1.DE.4	Facility Type	The type of facility
	GIZPS.D1.DE.5	Facility Ownership	Type of organization that owns the facility
	GIZPS.D1.DE.6	Facility Location (Physical Address)	Physical address of where the facility is located
	GIZPS.D1.DE.7	Facility Contact Information	Contact information for the facility
	GIZPS.D1.DE.8	Record Date	Date when facility was recorded on the register
	GIZPS.D1.DE.9	Operational Status	Operational status of the facility
	GIZPS.D1.DE.10	Administrative level/ areas	Administrative level of the facility
	GIZPS.D1.DE.11	Geographic Coordinates (GPS)	Global Positioning System Coordinates
GIZPS.D3: Update/add new facility			
	GIZPS.D3.DE.1	*Facility Information**	Facility information entry fields
GIZPS.D8: Generate unique IIS identification	GIZPS.D8.DE.1	IIS Identification	System generated IIS identification
GIZPS.D9: Send facility registration information	GIZPS.D9.DE.1	Facility Name*	The name of the facility
	GIZPS.D9.DE.2	Facility Type*	The type of facility
	GIZPS.D9.DE.3	Facility Location*	Physical address of where the facility is located
	GIZPS.D9.DE.4	Facility Contact Information*	Contact information for the facility
	GIZPS.D9.DE.5	IIS Identification*	System generated IIS identification
Business process E: Plan Service Delivery			
GIZPS.E2: Review ledger and stock available	GIZPS.E2.DE.1	Vaccine doses in stock	Number of vaccine doses in stock
	GIZPS.E2.DE.2	Vaccine doses required	Number of vaccine doses required
	GIZPS.E2.DE.3	Vaccine doses shortfall	Number of vaccine doses shortfall
	GIZPS.E2.DE.4	Next clinic date	The date that the next immunization clinic is scheduled
	GIZPS.E2.DE.5	Number of clients due	Number of clients due at the next immunization clinic

	GIZPS.E2.DE.6	Number of clients overdue	Number of clients overdue at the next immunization clinic
GIZPS.E3: Order additional stock from facility	GIZPS.E3.DE.1	Vaccine Product Name	The name of the vaccine
	GIZPS.E3.DE.2	Vaccine Product Description	The description of the vaccine
	GIZPS.E3.DE.3	Batch number	The vaccine product code.
	GIZPS.E3.DE.4	Vaccine expiry date	The last date of vaccine usage.
	GIZPS.E3.DE.5	Vaccine manufacturer	The name of vaccine manufacturer.
	GIZPS.E3.DE.6	Stock Request Date	Date new vaccine stock ordered
	GIZPS.E3.DE.7	Stock Request Number	Unique identifier for the stock request (order)
	GIZPS.E3.DE.8	Stock Requestor ID	The UID (Provider ID) of the person requesting stock, if available
	GIZPS.E3.DE.9	Stock Requestor First Name	The first name of the person requesting stock, if UID not available
	GIZPS.E3.DE.10	Stock Requestor Last Name	The first name of the person requesting stock, if UID not available
GIZPS.E5: Record stock taken	GIZPS.E5.DE.1	Number of vaccine doses dispensed	Number of vaccine doses dispensed/removed from fridge at facility to prepare for clinic
Business process F: Register client			
GIZPS.F2: Start client health record	GIZPS.F2.DE.1	Client ID	Unique, system generated Client ID
	GIZPS.F2.DE.2	Client First Name	Client's first or given name
	GIZPS.F2.DE.3	Client Family Name	Client's last or family name
	GIZPS.F2.DE.4	Client Birth Date	Client's date of birth capturing day, month and year of birth
	GIZPS.F2.DE.5	Age	Estimated age in years/ months of the client, captured if client_birth_date is unknown
	GIZPS.F2.DE.6	Sex	Client's biological sex at birth, either male or female
	GIZPS.F2.DE.7	Contact Number	Number where client may be reached
	GIZPS.F2.DE.8	Client Adress	Client's address including street name, district/county, city and region
	GIZPS.F2.DE.9	Next of Kin	Client's next of kin details including name, address and contact number
GIZPS.F3: Enter into vaccination log/register			
	GIZPS.F3.DE.1	Update vaccination schedule	Align vaccination schedule to client according to age and update vaccination log
GIZPS.F4: Find client in register and obtain health record			
	GIZPS.F4.DE.1	Client ID*	Unique, system generated Client ID
	GIZPS.F4.DE.2	Client First Name*	Client's first or given name
	GIZPS.F4.DE.3	Client Family Name*	Client's last or family name
	GIZPS.F4.DE.4	Client Birth Date*	Client's date of birth capturing day, month and year of birth
	GIZPS.F4.DE.5	Age*	Estimated age in years of the client, captured if client_birth_date is unknown
	GIZPS.F4.DE.6	Sex*	Client's biological sex at birth, either male or female
	GIZPS.F4.DE.7	Contact Number*	Number where client may be reached
	GIZPS.F4.DE.8	Client Adress*	Client's address including street name, district/county, city and region

	GIZPS.F4.DE.9	Next of Kin*	Client's next of kin details including name, address and contact number
Business process H: Administer vaccine			
GIZPS.H1: Query client record	GIZPS.H1.DE.1	Client Details (Search)*	Search any client registration details
	GIZPS.H1.DE.2	Display Client Record*	Display Client Record
	GIZPS.H1.DE.3	Vaccine Schedule	Display clients current vaccine card
GIZPS.H2: Measure body weight			
	GIZPS.H2.DE.1	Allergies	Has the client had any severe, life-threatening allergies to vaccines or anything else?
	GIZPS.H2.DE.2	HIV Status	Is the client diagnosed with HIV positive or severe immunodeficiency?
	GIZPS.H2.DE.3	Health Status	Currently, is the client very sick and/or have a very high temperature (>39 degrees Celsius)?
	GIZPS.H2.DE.4	Administer Vaccine (Y/N)	Does the HCW recommend for the vaccine to be administered?
	GIZPS.H2.DE.5	Reason for non-administration of vaccine	Reason for non-administration of vaccine
GIZPS.H4: Inform client when to return for vaccine			
	GIZPS.H4.DE.1	Client First Name*	Client's first or given name
	GIZPS.H4.DE.2	Client Family Name*	Client's last or family name
	GIZPS.H4.DE.3	Client ID*	Unique, system generated Client ID
	GIZPS.H4.DE.4	Vaccine Type*	The type of vaccine
	GIZPS.H4.DE.5	Vaccine Dose*	Vaccine dose i.e., first, second, third, first booster, etc.
	GIZPS.H4.DE.6	Vaccination Status*	Vaccine due/ missed/ requested (non-routine).
	GIZPS.H4.DE.7	Follow up date	The scheduled date for immunization follow up
	GIZPS.H4.DE.8	Additional notes	Any additional notes
GIZPS.H6: Administer vaccine			
	GIZPS.H6.DE.1	Vaccine Type*	The type of vaccine
	GIZPS.H6.DE.2	Vaccine product code	The vaccine product code
	GIZPS.H6.DE.3	Vaccine Dose*	Vaccine dose i.e., first, second, third, first booster, etc.
	GIZPS.H6.DE.4	Date of administration	Date that the vaccine was administered to the client
	GIZPS.H6.DE.5	Mode of Administration	Route in which vaccine was administered
	GIZPS.H6.DE.6	Vaccine Batch Number	The batch number of the vaccines for traceability purposes
	GIZPS.H6.DE.7	Vaccine Manufacturer (Drop down?)	The manufacturer of the vaccines for traceability purposes
	GIZPS.H6.DE.8	Place of administration*	The place where the vaccines was administered to the client
	GIZPS.H6.DE.9	Vaccinator (Provider ID)*	The UID of the person performing the vaccination, if available
	GIZPS.H6.DE.10	Strategy	e.g.: campaign, routine, school-based,
	GIZPS.H6.DE.11	Client ID*	Unique identifier Generated for new clients or returned from a query to Client Registry
	GIZPS.H6.DE.12	Client Consent	Indicates if the client (or caregiver if client < 18years old) has given consent
	GIZPS.H6.DE.13	Facility ID*	The unique identifier for the facility
	GIZPS.H6.DE.14	Next Visit Date	Next date client is due for vaccination (immunization appointment)

GIZPS.H9: Monitor client	GIZPS.H9.DE.1	Client has an adverse reaction (Y/N)	Client has experienced and adverse reaction to the vaccine
	GIZPS.H9.DE.2	Type of adverse reaction experienced	Adverse reaction experienced by client
GIZPS.H10: Treat as appropriate			
	GIZPS.H10.DE.1	Treatment Received? (Y/N)	Whether or not any kind of treatment was provided to Client
	GIZPS.H10.DE.2	Prescription given? (Y/N)	Whether or not any kind of medicine or prescription was provided to Client
	GIZPS.H10.DE.3	Type of Prescription	Prescription given (List all)
	GIZPS.H10.DE.5	Additional Notes	Any extra notes by provider regarding treatment or prescription
	GIZPS.H10.DE.6	Additional Comments	Any additional comments
	GIZPS.H10.DE.7	AEFI Form	Adverse Effects Following Immunization
GIZPS.H13: Generate digital certificate			
	GIZPS.H13.DE.1	Name*	The full name of the Tested Person
	GIZPS.H13.DE.2	Date of birth*	The Tested Person's date of birth (DOB) if known. If unknown, use assigned DOB for administrative purposes.
	GIZPS.H13.DE.3	Unique identifier*	Unique identifier (ID) for the Tested Person, according to the policies applicable to each country. There can be more than one unique identifier used to link records (e.g., national ID, health ID, medical record ID).
	GIZPS.H13.DE.4	Vaccine Type*	The type of vaccine
	GIZPS.H13.DE.5	Vaccine product code*	The vaccine product code
	GIZPS.H13.DE.6	Vaccine Dose*	Vaccine dose i.e., first, second, third, first booster, etc.
	GIZPS.H13.DE.7	Date of administration*	Date that the vaccine was administered to the client
	GIZPS.H13.DE.8	Mode of Administration*	Route in which vaccine was administered
	GIZPS.H13.DE.9	Vaccine Batch Number*	The batch number of the vaccines for traceability purposes
	GIZPS.H13.DE.10	Vaccine Manufacturer*	The manufacturer of the vaccines for traceability purposes
	GIZPS.H13.DE.11	Place of administration*	The place where the vaccines was administered to the client
Business process L: Manage arrivals of vaccines			
GIZPS.L1: Review vaccine	GIZPS.L1.DE.1	Date	Today's date
	GIZPS.L1.DE.2	Name of vaccine	Official name of vaccine
	GIZPS.L1.DE.3	Strength	Strength or potency of vaccine (antigen concentration, dosage,…)
	GIZPS.L1.DE.4	Condition	Physical condition of vaccine
	GIZPS.L1.DE.5	Number of vaccines	Count of vaccines
	GIZPS.L1.DE.6	Accepted order quantity	Accepted order quantity
	GIZPS.L1.DE.7	Special conditions of care required	
	GIZPS.L1.DE.8	Memory test	
	GIZPS.L1.DE.9	The highest level	
	GIZPS.L1.DE.10	The lowest level	
	GIZPS.L1.DE.11	Storage space	
	GIZPS.L1.DE.12	Memory number to receive	Unique identification number for receipt

	GIZPS.L1.DE.13	Received amount	Count of vaccines received
	GIZPS.L1.DE.14	Received from	Name of DIVO or facility
	GIZPS.L1.DE.15	Manufacturer	Manufacturers name and information
	GIZPS.L1.DE.16	Batch number	Vaccine batch number
	GIZPS.L1.DE.17	Expiration date	Expiration date of batch
GIZPS.L3: Document for delivery			
	GIZPS.L3.DE.1	Memory number to issue	Unique identification number for issue
	GIZPS.L3.DE.2	Name of vaccine*	Official name of vaccine
	GIZPS.L3.DE.3	Issued amount	Count of vaccines issued
	GIZPS.L3.DE.4	Issued to	Name of facility
	GIZPS.L3.DE.5	Manufacturer*	Manufacturers name and information
	GIZPS.L3.DE.6	Batch number*	Vaccine batch number
	GIZPS.L3.DE.7	Expiration date*	Expiration date of batch
GIZPS.L4: Inspect delivery			
	GIZPS.L4.DE.1	Name of vaccine*	Official name of vaccine
	GIZPS.L4.DE.2	Manufacturer*	Manufacturers name and information
	GIZPS.L4.DE.3	Batch number*	Vaccine batch number
	GIZPS.L4.DE.4	Corrections	Any vaccine discrepancies e.g. mismatching stock and damage
Business process M: Manage stock			
GIZPS.M1: Query stock available	GIZPS.M1.DE.1	Name of vaccine*	Official name of vaccine
	GIZPS.M1.DE.2	Manufacturer*	Manufacturers name and information
	GIZPS.M1.DE.3	Batch number*	Vaccine batch number
	GIZPS.M1.DE.4	Available amount	Amount of vaccine stock at hand available at the facility
GIZPS.M3: Inspect stock			
	GIZPS.M3.DE.1	Vaccine Vial Monitor	Vaccine vial monitor status (Stage I,II, III,IV)
Business process O: Generate reports			
GIZPS.O1: Generate reports	GIZPS.O1.DE.1	Unique identification	Unique identifier generated for new clients or a universal ID, if used in the country.
	GIZPS.O1.DE.2	Report identification	A unique identifier for the instance of the report that has been generated.
	GIZPS.O1.DE.3	Report status	The status of the report (for example, initial, complete, etc.).
	GIZPS.O1.DE.4	Report type	The type of report which has been generated (i.e., is the report a list of individuals, a summary, etc.).
	GIZPS.O1.DE.5	Report indicator code	The indicator or measure definition which is being reported on (for example dropout rate, defaulters, etc.).
	GIZPS.O1.DE.6	Coverage rate	Report generated indicates the coverage rate of vaccinations versus target population.
	GIZPS.O1.DE.7	Dropout rate	Report generated indicates the aggregate dropout rate based on antigen.
	GIZPS.O1.DE.8	Immunization sessions conducted	Report generated indicates the immunization session conducted.
	GIZPS.O1.DE.9	Availability of vaccine and injection supplies	Report generated contains summary data related to availability of vaccine and injection supplies.
	GIZPS.O1.DE.10	Wastage of vaccine and injection supplies	Report generated contains summary data related to wastage of injection supplies.

	GIZPS.O1.DE.11	Adverse events following immunization	Report generate contains summary data related to adverse events following immunization.
	GIZPS.O1.DE.12	Report subject area	Location (facility or place) for which the data in the report is being represented.
	GIZPS.O1.DE.13	Report generation date	The date on which the report was generated.
	GIZPS.O1.DE.14	Reporting period	The period for which data in the report has been included (for example: from 2021-01-01 until 2021-02-01).
	GIZPS.O1.DE.15	Improvement indicator	Indicates to the receiver how to interpret the data (i.e., what constitutes an improvement or deterioration).
	GIZPS.O1.DE.16	Increase is improvement	Indicates that when the measure scores increase, the data can be interpreted as an improvement (used for coverage indicator).
	GIZPS.O1.DE.17	Decrease is improvement	Indicates that when measure scores decrease, the data can be interpreted as an improvement (used for dropout, wastage, and AEFI indicators).
	GIZPS.O1.DE.18	Report generator/author	Indicates the organization or location which is generating or producing the report.
	GIZPS.O1.DE.19	Report measures	Grouping of information related to the values of a measure for each population group in the report.
	GIZPS.O1.DE.20	Measure identifier/meaning	Codifies the meaning of the group/measure. For example, if the report indicator is "Coverage" each antigen/vaccine would have a measure (i.e., BCG coverage or BCG target).
	GIZPS.O1.DE.21	Measure population	Information related to the population of the reported measure/score in this group. For example, if the indicator being reported is "BCG Coverage" it would represent the population for that grouping.
	GIZPS.O1.DE.22	Measure numerator	The count of individual objects (persons, doses, etc.) is used as the numerator to calculate the measure score.
	GIZPS.O1.DE.23	Measure denominator	The count of individual objects (persons, doses, etc.) is used as the denominator to calculate the measure score.
	GIZPS.O1.DE.24	Measured score	The calculated score of the measure/indicator which is being reported on.
	GIZPS.O1.DE.25	Disaggregation	The stratification values within the group - each will track the disaggregation of each indicator (column I of annex C).
	GIZPS.O1.DE.26	Disaggregation group meaning	Indicates the overall strata or disaggregation which is being represented in the report (for example: by gender, by region, by age group, etc.).
	GIZPS.O1.DE.27	Disaggregation measures	An individual grouping of population and measures for the specified stratification. For example, if the stratifier is "by gender", then there would be a "male" or "female" stratum.
	GIZPS.O1.DE.28	Disaggregation measure identifier/meaning	The type or value of this stratum represents (male, female, region 1, dose 3, etc.).
	GIZPS.O1.DE.29	Disaggregation measure population	A description of the population which makes up this stratifier.

	GIZPS.O1.DE.30	Disaggregation numerator	The count of individual objects (persons, doses, etc.) is used as the numerator for the disaggregation score.
	GIZPS.O1.DE.31	Disaggregation denominator	The count of individual objects (persons, doses, etc.) which were used as the denominator for disaggregation score.
	GIZPS.O1.DE.32	Disaggregated score	The computed score for this disaggregation. For example -
			Report indicator: Coverage
			Measure: BCG vaccination coverage.
			Population numerator: All BCG doses given for period.
			Population denominator: Population of surviving infants.
			Disaggregation grouping: By-gender
			Disaggregation measure meaning: Male
			Disaggregation population numerator: # of males given BCG
			Disaggregation population denominator: # of surviving infant males
			Disaggregation score: # of males given BCG/# of surviving infant males

Component 6: Decision support logic

The decision-support logic component of this DAK provides the decision logic and algorithms, as well as the scheduling of services, in accordance with Ghana guidelines. In this DAK, the decision logic and algorithms deconstruct the recommendations within the immunization guidelines and guidance into a format that clearly labels the inputs and outputs that would be operationalized in a digital decision-support system.

Age	Vaccine	Dose	Route of administration	Site of administration
Birth	BCG	0.05 ml	Intra-dermal	Right upper arm
	OPV 0	2 drops	oral	
Six weeks	OPV 1	2 drops	oral	
	DPT-Hep B – Hib1	0.5 ml	Intra-muscular	Left thigh
	Pneumococcal 1	0.5 ml	Intra-muscular	Right thigh
	Rotavirus 1	5 drops (0.5 ml)	oral	
Ten weeks	OPV 2	2 drops	oral	
	DPT-Hep B – Hib2	0.5 ml	Intra-muscular	Left thigh
	Pneumococcal 2	0.5 ml	Intra-muscular	Right thigh
	Rotavirus 2	5 drops (0.5 ml)	oral	

Fourteen weeks	OPV 3	2 drops	oral	
	DPT-Hep B – Hib3	0.5 ml	Intra-muscular	Left thigh
	Pneumococcal 3	0.5 ml	Intra-muscular	Right thigh
	Rotavirus 3	5 drops (0.5 ml)	oral	
	IPV	0.5 ml	Intra-muscular	Right thigh (2 cm from PCV site)
Six months	Vitamin A 1	100,000 I.U	oral	
	Malaria 1 (RTS, S)	0.5 ml	Intra-muscular	Left thigh
7 Months	Malaria 2 (RTS, S)	0.5 ml	Intra-muscular	Left thigh
9 Months	Measles-Rubella1 (MCV1)	0.5 ml	Sub-cutaneous	Left upper arm
	Malaria 3 (RTS, S)	0.5 ml	Intra-muscular	Left thigh
	Yellow Fever	0.5 ml	Sub-cutaneous	Right upper arm
12 Months	Vitamin A 2	200,000 I.U	oral	
18 Months	Measles-Rubella2 (MCV2)	0.5 ml	Sub-cutaneous	Left upper arm
	Meningococcal A	0.5 ml	Intra-muscular	Right upper arm
	Vitamin A 2	200,000 I.U	oral	
	Insecticide Treated Net (ITN)	One		
24 Months	Malaria 4 (RTS, S)	0.5 ml	Intra-muscular	Left thigh

Abbreviations

- BCG = Bacille Calmette-Guérin (Tuberculosis) Vaccine
- OPV = Oral Polio Vaccine IPV= Inactivated Polio Vaccine
- MCV = Measles containing vaccine
- DPT = Diphtheria, Pertussis & Tetanus; Hep B = Hepatitis B; Hib = Hemophilus influenzae type B
- Penta consists of the 5 vaccines administered together i.e. DTP + Hep B + Hib

Component 7: Indicators and performance metrics

Indicators

This section details indicators and performance metrics considered in the Ghana context and would be aggregated from core data elements identified in Component 5. The list in the below table is a minimum set of indicators that can be aggregated for decision-making, performance metrics, and subnational and national reporting based on data collected from individual-level, routine health systems. These indicators may be aggregated automatically from the digital tracking tool to populate a digital HMIS, such as DHMIS (DHIS2).

Indicator name	Description	Numerator		Denominator		Disaggregation
		Definition	Computation	Definition	Computation	
Closed vial wastage rate	The closed vial wastage rate is used to measure percentage of doses of vaccine which were spoiled during the reporting period due to expiry, freezing, breakage, etc. This indicator is used to compare performance of management.	Number of doses in closed vials of vaccine product that were discarded (May be discarded due to: expiration, vaccine vial monitoring (VVM) state, freezing, breakage, etc.)	COUNT number of disposed vials of vaccine product.	Total number of doses vaccine product received and available for use during the reporting period.	COUNT number of total vials of vaccine product received and available for use.	1. Vaccine type (BCG, OPV, etc.). 2. Reasons for discard/Type of Spoilage (Broken, Heat Exposure/VVM state, Expired). 3. Facility Administrative Area.
Open vial wastage rate	The open vial wastage rate is used to measure the percentage of doses of vaccine that were opened but discarded due to under-utilization. For example, a 5-dose vile of an antigen may be thrown out after only 2 administrations of the vaccine, indicating an open vial wastage of 3 doses.	Total number of doses used (starting balance of doses + supplied doses - ending balance doses) minus total number of doses administered to patients. Starting Balance = The number of doses available for immunization at the start of day or session. Supplied Doses = The number of doses which were received or added to the stock during the day or session. Ending Balance = The number of doses which were left at the end of the day or session.	(Starting Balance + Supplied Doses - Ending Balance) - COUNT of persons who were administered the vaccine.	The total number of doses used (i.e., consumed) during the day or vaccination session.	Starting Balance + Supplied Doses - Ending Balance.	1. Vaccine type (BCG, OPV, etc.). 2. Facility Administrative Area.

Availability of vaccine stock and supplies	The proportion of clinics which have had no stock outs for vaccine or vaccination supplies when they are demanded/required.	The number of vaccination clinics which had no stock outs for the reporting period (i.e., they were able to fully meet all vaccine demand).	COUNT of facilities which were able to fulfill all vaccination activities.	Total number of facilities.	COUNT all facilities in the region.	Facility Administrative Area.
Functional status of cold-chain storage equipment	The proportion of refrigerators which are functional within a clinic.	The number of functional refrigerators in the clinic.	COUNT refrigerators which are functional during the reporting period.	The number of refrigerators which are present in the clinic, regardless of whether they are functioning or not.	COUNT total refrigerators (regardless of status).	Facility Administrative Area.
Adverse Event Following Immunization (AEFI) case rate	Clinics should report adverse events (reported and confirmed) to the central authority. This should be tracked as an aggregate tally (which should indicate the severity, and optionally the manifestation such as rash, vomiting, etc.), with severe cases being reported using case reporting forms, and should include an analysis of whether the AEFI was a direct result (confirmed) of vaccination or not (suspected). Serious cases are those which involved hospitalization, disability, or death. Investigation of	Number of persons which have received a vaccine dose and have reported an adverse event.	COUNT immunization events WHERE "Adverse reaction"= YES (IZPS.H31) AND vaccine "Date of administration "(IZPS.H20) is during reporting period.	The total number of doses administered to patients of the product.	COUNT number of immunization events WHERE vaccine "Date of administration " (IZPS.H20) during reporting period.	1. Vaccine type (BCG, OPV, etc.)/Vaccine Product Code where available 2. Vaccine Manufacturer 3. Adverse Reaction Severity - (IZPS.H40) - Severe, Non-Severe. 4. Adverse Reaction Type (IZPS.H32) Manifestation - Fever, Headache, Body aches, Fatigue, Abscess, Rash, Vomiting, Other. 5. Facility Administrative Area.

	AEFI events can lead to withdrawal of the vaccine from the market or inform further guidance on administration of a particular antigen/product.					
Immunization session completion rates	This indicator allows for supervisors to follow-up on planned and completed immunization sessions - which can give an indication of planning, operational, or budget issues at a facility.	The number of conducted immunization sessions performed at the facility.	COUNT number of vaccination sessions.	The planned number of vaccination sessions for a facility.	COUNT number of planned sessions.	1. Facility 2. Facility Administrative Area
Immunization coverage for BCG (Estimated Denominator)	Compares the doses of BCG (Bacillus Calmette-Guerin) vaccine administered with the target population.	Number of administrations of BCG during the reporting period.	COUNT immunization events WHERE "vaccine type" is a "BCG Vaccine" AND "status" = completed AND "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Facility Administrative Area 2. Sex
Immunization coverage for DTP containing vaccines (Estimated Denominator)	Compares the administered doses of a DTP (Diphtheria, Tetanus, and Pertussis) containing vaccine with the target population.	Number of administrations of vaccinations containing a Diphtheria, Tetanus, and Pertussis component during the reporting period.	COUNT immunization events WHERE "vaccine code" is a DTP Vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose Number - 1, 2, or 3 2. Age Group2 - < 1 year or >1 year 3. Administrative Area 4. Sex1
Immunization coverage for HepB containing vaccines birth dose (estimated denominator)	Compares the administered doses of Hepatitis B (HepB) containing vaccine (dose sequence 0) with the target population.	Number of administrations of vaccines containing a Hepatitis B component (dose sequence 0).	COUNT immunization events WHERE “vaccine code” is a HepB vaccine (IMMZ.Z1.DE6) AND “status code” = completed AND	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Age Group2 - <24 hours of Birth, < 2 weeks 2. Administrative Area 3. Sex1

			vaccine “date of administration” during reporting period AND “dose number” = 0.			
Immunization coverage for Meningococcal containing vaccines (Estimated Denominator)	Compares the administered doses of Meningococcal containing vaccine with the target population.	Number of administrations of vaccinations containing a Meningococcal component.	COUNT immunization events WHERE “vaccine code” is a Meningococcal AND “status code” = completed AND vaccine “date of administration” during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose Sequence - 1, 2, or 3 2. Age Group2 - <1 year or > 1year 3. Administrative Area 4. Sex1
Immunization coverage for inactivated polio containing vaccine (Estimated Denominator)	Compares the administered doses of Inactivated Polio Virus (IPV) containing vaccines with the target population.	Number of administrations of vaccinations using an inactivated polio vaccine (IPV) during the reporting period.	COUNT immunization events WHERE "vaccine code" is a Inactivated Polio Vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose sequence – 1, 2, or 3 2. Age Group2 - < 1 year or > 1 year 3. Administrative Area 4. Sex1
Immunization coverage for oral polio containing vaccine doses at birth (Estimated Denominator)	Compares the administered doses of Oral Polio Virus (OPV) containing vaccines given at birth (dose sequence 0) with the target population.	Number of administrations of vaccinations using an oral polio vaccine (OPV) where the dose sequence is 0 (birth dose) during the reporting period.	COUNT immunization events WHERE “vaccine code” is an Oral Polio Vaccine AND “status code” = completed AND vaccine “date of administration” during reporting period AND “dose number” = 0.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Age Group2 - <24 hours of birth, < 2 weeks 2. Administrative Area 3. Sex1
Immunization coverage for doses of oral polio containing vaccine (Estimated Denominator)	Compares the administered doses of Oral Polio Virus (OPV) containing vaccines which are non-birth doses (dose sequence > 0) with the with the	Number of administrations of vaccinations using an oral polio vaccine (OPV) where the dose sequence > 0, during the reporting period.	COUNT immunization events WHERE "vaccine code" is an Oral Polio Vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period AND	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose sequence - 1, 2, or 3 2. Age Group2 - < 1 year or > 1 year 3. Administrative Area 4. Sex1

	target population.		"dose number" > 0.			
Immunization coverage for Measles containing vaccine (Estimated Denominator)	Compares the administered doses of Measles Containing Vaccines (MCV) with the target population.	Number of administrations of vaccinations containing a Measles component during reporting period.	COUNT immunization events WHERE "vaccine code" is a Measles vaccine and "status code" = completed and vaccine "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose Sequence - 1, 2 2. Age Group2 - < 1 year or > 1 year 3. Administrative Area 4. Sex1
Immunization coverage for Pneumococcal containing vaccine (Estimated Denominator)	Compares the administered doses of Pneumococcal containing vaccine with the estimated target population.	Number of administrations of vaccines containing a Pneumococcal component during the reporting period.	COUNT immunization events WHERE "vaccine code" is a Pneumococcal vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose Sequence - 1, 2, or 3 2. Age Group2 - < 1 year or > 1 year 3. Administrative Area 4. Sex1
Immunization coverage for Haemophilus influenzae type b (Hib) containing vaccine (Estimated Denominator)	Compares the administered doses of Haemophilus influenzae type b containing vaccine with the target population.	Number of administrations of vaccines containing an Haemophilus influenzae type b component during the reporting period.	COUNT immunization events WHERE "vaccine code" is a Haemophilus influenzae type b vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Age Group2 - <1 year or > 1 year 2. Administrative Area 3. Sex1
Immunization coverage for Rotavirus containing vaccines (Estimated Denominator)	Compares the administered doses of rotavirus containing vaccine with the target population.	Number of administrations of vaccines containing a rotavirus component during reporting period.	COUNT immunization events WHERE “vaccine code” is a Rotavirus vaccine (IMMZ.Z1.DE16) AND “status code” = completed AND vaccine “administration date” during reporting period3.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Dose Sequence - 1, 2, or 3 2. Age Group2 - < 1 year or > 1 year 3. Administrative Area 4. Sex1
Malaria	Compares the administered	Number of administrations	COUNT immunization	Target population		

	doses of malaria containing vaccine with the target population.	of vaccines containing a malaria component during reporting period.	events WHERE "vaccine code" is a malaria vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period.			
Immunization coverage for Rubella containing vaccines (RCV) (Estimated Denominator)	Compares the administered doses of rubella containing vaccine (RCV) with the target population.	Number of administrations of vaccines containing a Rubella component during reporting period.	COUNT immunization events WHERE "vaccine code" is a Rubella vaccine AND "status code" = completed AND vaccine "date of administration" during reporting period.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Age Group2 - < 9 months, 9 - 18 months, 18 months - 15 years, > 15 years 2. Administrative Area 3. Sex1
Immunization coverage for Yellow Fever vaccine (Estimated Denominator)	Compares the administered dose of yellow fever vaccine with the target population.	Number of administrations of vaccines containing a yellow fever component during reporting period.	COUNT immunization events WHERE "vaccine code" is a Yellow Fever vaccine (IMMZ.Z1.DE23) AND "status code" = completed AND vaccine "administration date" during reporting period3.	Target population.	Target population is 4% of the estimated population as provided by Ghana national statistics office.	1. Administrative Area 2. Sex1
Dropout Rate of Penta1 to Penta3 Penta consists of the 5 vaccines administered together i.e., DTP + HepB + Hib	Indicates the aggregate dropout rate of Penta vaccines protocol (children who started the dose series but did not finish). The indicator compares the number of administrations of first dose of Penta protocol (DTP1+HepB1+ Hib1) containing vaccines minus the number of	Number of administrations of Penta1 (DTP1+HepB1+ Hib1) administered during reporting period minus the number of administrations of Penta3 (DTP3+HepB3+ Hib3) administered during report period.	COUNT immunization events WHERE "vaccine code" is a (DTP+HepB+Hi b) AND dose number = 1 AND "status code" = complete AND vaccine "date of administration" during reporting period. SUBTRACT COUNT immunization events WHERE	Number of doses of Penta 1 (DTP1+HepB1+ Hib1) administered.	COUNT immunization events WHERE "vaccine code" is a (DTP+HepB+Hi b) AND dose number = 1 AND "status code" = complete AND vaccine "date of administration" during reporting period.	Administrative Area

	administrations of the final dose of Penta protocol (DTP3+HepB3+ Hib3) divided by the number of administrations of first dose (Penta1 - Penta3/Penta1) .		“vaccine code” is a (DTP+HepB+Hi b)) AND dose number = 3 AND “status code” = complete AND vaccine “date of administration” during reporting period.			
Dropout Rate of MCV1 to MCV2	Indicates the aggregate dropout rate4 of children in the MCV (Measles Containing Vaccine) protocol (those that have received MCV dose 1 but not MCV dose 2). The indicator compares the number of administrations of MCV dose 1 minus the number of administration of MCV2 divided by the number of MCV1 vaccinations (MCV1 - MCV2/MCV1).	The number of first doses of measles containing vaccine administered during reporting period minus the number of last doses of measles containing vaccine during the report period	COUNT immunization events WHERE vaccine code is a measles containing vaccine AND "dose number" = 1 AND vaccine "date of administration" during reporting period and "status code" = complete SUBTRACT COUNT immunization events WHERE "vaccine code" is a measles containing vaccine AND "dose number" = 3 and "status code" = complete and vaccine "date of administration" during reporting period.	Number of first doses of measles containing vaccine administered during the reporting period.	COUNT immunization events WHERE "vaccine code" is a measles containing vaccine AND "status code" = complete AND "dose number" = 1 AND vaccine "date of administration" during reporting period	Administrative Area
Dropout Rate of Malaria	Indicates the aggregate dropout rate of children in the Malaria vaccine protocol (those that have received Malaria dose 1 but not Malaria dose 4). The indicator	The number of first doses of Malaria containing vaccine administered during reporting period minus the number of last doses of Malaria containing vaccine during	COUNT immunization events WHERE vaccine code is a malaria containing vaccine AND "dose number" = 1 AND vaccine "date of administration date" during reporting period	Number of first doses of malaria containing vaccine administered during the reporting period.	COUNT immunization events WHERE vaccine code is a malaria containing vaccine AND "dose number" = 1 AND vaccine "date of administration date" during reporting period	Administrative Area

	compares the number of administrations of Malaria dose 1 minus the number of administration of Malaria dose 4 divided by the number of Malaria vaccinations (Malaria1 - Malaria4/ Malaria1).	the report period.	and "status code" = complete SUBTRACT COUNT immunization events WHERE vaccine code is a malaria containing vaccine AND "dose number" = 4 AND vaccine "date of administration date" during reporting period and "status code" = complete.		and "status code" = complete.	
Total number of children who are fully vaccinated by age	The indicator compares the total number of children who have completed all vaccinations (as per Ghana vaccination schedule) to the target population.	The number of children who have completed all doses of the vaccines as per the full Ghana vaccination schedule.	COUNT FIC by age 1 FIC by age 2 FIC after age 2.	Total number of children who have received BCG, Penta 3, PCV-3, OPV-3 (excluding OPV-0 at birth, Rota-2, MR-2, YF and Men A.	COUNT total number of children who have received BCG, Penta 3, PCV-3, OPV-3 (excluding OPV-0 at birth, Rota-2, MR-2, YF and Men A.	Administrative Area

Component 8: Functional and non-functional requirements

This section provides an overview of illustrative functional and non-functional requirements that may be considered to kick-start the process of designing or adapting a Ghana-specific IIS digital tracking and decision-support 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

Plan and manage service delivery

ID	Activity	Entity/ Functional role	Requirement (The system must or should…)
Register facilities			
GIZPS.FXNREQ.001	Receive Facility Information	IIS Staff/System	Have ability to receive facility information from multiple sources (e.g., automatically or manually in multiple formats).

ID	Activity	Entity/ Functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.002	Validate National Master Facility List (NMFL)	IIS Staff/System	Have ability to interface with NMFL's database to validate if the facility is already registered in the NMFL (Note: If a facility is registered in the NMFL, then the facility information should be verified for accuracy and/or updated in the IIS).
GIZPS.FXNREQ.003	Validate NMFL	IIS Staff/System	Have ability to flag any facilities that are registered in the IIS that are not in the NMFL.
GIZPS.FXNREQ.004	Validate NMFL	IIS Staff/System	Have ability to validate NMFL with IIS master list.
GIZPS.FXNREQ.005	Does Facility Information match?	IIS Staff/System	Have ability to update IIS master facility registration information with information from the NMFL.
GIZPS.FXNREQ.006	Update/Add New Facility	Facility Staff	Have ability to provide a temporary unique ID to facilities not listed in the NMFL.
GIZPS.FXNREQ.007	Update/Add New Facility	Facility Staff	Have ability to add new facilities to IIS master registration list not listed in the NMFL.
GIZPS.FXNREQ.008	Update/Add New Facility	Facility Staff	Have ability to link the NMFL ID with IIS ID as the same record (Note: Reference table used to show the translation of records [e.g., when records are merged, it maintains a reference of the old/expired/obsolete record ID numbers and references the new ID number]).
GIZPS.FXNREQ.009	Update/Add New Facility	Facility Staff	Have ability to send notification of new facility to the NMFL manager.
GIZPS.FXNREQ.010	Update/Add New Facility	Facility Staff	Have ability to update facility information not captured in the NMFL.
GIZPS.FXNREQ.011	Update/Add New Facility	Facility Staff	Have ability to keep audit log of change history when any facility information is changed and saved (e.g., include date/time stamp).
GIZPS.FXNREQ.012	Verify Information for Additional Data	IIS Staff/System	Have ability to prompt user to accept changes to IIS master registration list.
GIZPS.FXNREQ.013	Verify Information for Additional Data	IIS Staff/System	Have ability to verify that all required fields are complete.
GIZPS.FXNREQ.014	Verify Information for Additional Data	IIS Staff/System	Have ability to notify user of incomplete mandatory fields.
GIZPS.FXNREQ.015	Validate NMFL	IIS Staff/System	Have ability to flag facility as temporary.
GIZPS.FXNREQ.016	Update/Add New Facility	IIS Staff/System	Have ability to convert temporary facility to permanent facility.
GIZPS.FXNREQ.017	Information Complete?	IIS Staff/System	Have ability to verify that all required facility information is complete.
GIZPS.FXNREQ.018	Information Complete?	IIS Staff/System	Have ability to generate an exception report.
GIZPS.FXNREQ.019	Information Complete?	IIS Staff/System	Have ability to generate report of missing information.
GIZPS.FXNREQ.020	Information Complete?	IIS Staff/System	Have ability to generate email to facility.
GIZPS.FXNREQ.021	Request Additional Information	IIS Staff/System	Have ability to support the process of receiving information.
GIZPS.FXNREQ.022	Create/Update Facility Record	IIS Staff/System	Have ability to audit facility data changes with date/time stamp "last updated".
GIZPS.FXNREQ.023	Create/Update Facility Record	IIS Staff/System	Have ability to collect total number of facility data changes and report to IIS staff.

ID	Activity	Entity/ Functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.024	Generate Unique IIS ID	IIS Staff/System	Have ability to generate a unique IIS ID.
GIZPS.FXNREQ.025	Send Facility Registration Notification and IIS ID	IIS Staff/System	Have ability to send IIS registration notification w/IIS ID (e.g., SMS, mail, email, etc.).
GIZPS.FXNREQ.026	Send Facility Registration Notification and IIS ID	IIS Staff/System	Have ability to insert/include instructions of how to use IIS ID (e.g., reporting requisition, etc.).
GIZPS.FXNREQ.027	Receive Registration Information	Facility Staff	Allow user to send/acknowledge confirmation of receipt of the registration notification.
Plan service delivery			
GIZPS.FXNREQ.028	Review register to determine estimates of vaccine needed	Health Care Worker	Identify all children due (or overdue) for vaccination by the next clinic date.
GIZPS.FXNREQ.029	Review register to determine estimates of vaccine needed	Health Care Worker	Sort the list by vaccine type (antigen).
GIZPS.FXNREQ.030	Review register to determine estimates of vaccine needed	Health Care Worker	Provide range estimates for vaccine need based on historical data (high and low ranges).
GIZPS.FXNREQ.031	Record details on planning sheet	Health Care Worker	Print list of necessary antigens and accessories (syringes, wipes, etc.) based on projected need.
GIZPS.FXNREQ.032	Sufficient stock in immediate location?	Health Care Worker	Identify the stock at the local source.
GIZPS.FXNREQ.033	Sufficient stock in immediate location?	Health Care Worker	Compare the list of needed antigens to the stock on hand and indicate if there is sufficient stock.
GIZPS.FXNREQ.034	Sufficient stock in immediate location?	Health Care Worker	Show the actual numbers of each vaccine type (antigen) in stock.
GIZPS.FXNREQ.035	Order additional stock	Health Care Worker	Allow the user to generate a stock request based on the information provided.
GIZPS.FXNREQ.036	Order additional stock	Health Care Worker	Allow the user to change the number of each vaccine type (antigen) as needed (using the shortage as a guideline).
GIZPS.FXNREQ.037	Order additional stock	Health Care Worker	Provide feedback for stock that is not available for ordering (back orders).
GIZPS.FXNREQ.038	Order additional stock	Health Care Worker	Indicate that the order has been processed.
GIZPS.FXNREQ.039	Order additional stock	Health Care Worker	Provide any relevant details for the order fulfillment (such as time of day to expect delivery or any special instructions).
GIZPS.FXNREQ.040	Order additional stock	Health Care Worker	Provide means to include some mandatory user feedback, such as stock on hand and reason for order.
GIZPS.FXNREQ.041	Get needed stock	Health Care Worker	Provide a printed list of vaccine type (antigen) stock order to be fulfilled.
GIZPS.FXNREQ.042	Record stock taken	Health Care Worker	Allow bar code reading of vaccine stock taken.
GIZPS.FXNREQ.043	Record stock taken	Health Care Worker	Record vaccine stock removed from cold storage and taken to clinic.
GIZPS.FXNREQ.044	Record stock taken	Health Care Worker	Maintain a tally of stock available at each location (cold fridge at center, out for clinic).
GIZPS.FXNREQ.045	Assemble all needed materials for clinic	Health Care Worker	Provide a clinic materials checklist.
Create new client (patient/newborn) record			

ID	Activity	Entity/ Functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.090	Create new client (patient/newborn) record	Health Care Worker	If the client record does not already exist in the IIS, create a new client record with demographic information.
GIZPS.FXNREQ.091	Manage multiple client identifiers	Health Care Worker	Provide ability to add or generate the unique Registration Number for the client (patient/newborn) and additional identifiers.

Awareness and demand generator

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
Generate reminders and immunization follow up			
GIZPS.FXNREQ.046	Define Criteria	IIS Staff/System & Immunization Provider	Allow user to select reminder/recall parameters. May include but not limited to: age range, vaccine type(s)/schedules, lot number, geographic area, event triggers, etc.
GIZPS.FXNREQ.047	Define Criteria	IIS Staff/System & Immunization Provider	Have ability to associate a patient with a clinic/site/facility/catchment area to generate a provider-based reminder/recall.
GIZPS.FXNREQ.048	Define Criteria	IIS Staff/System & Immunization Provider	Have ability to validate data against the immunization schedule (Note: Can use the immunization schedule to best schedule reminders/recall for series vaccinations, etc.).
GIZPS.FXNREQ.049	Select Notification Method	IIS Staff/System & Immunization Provider	Allow user to select one or more notification methods (e.g., telephone call, “robo call”, text message, letter, postcard, labels, email, CHW home visits, etc.).
GIZPS.FXNREQ.050	Select Notification Method	IIS Staff/System & Immunization Provider	Have ability to maintain patient’s preferred contact method.
GIZPS.FXNREQ.051	Generate List of Patients	IIS Staff/System & Immunization Provider	Have ability to produce a list of patients according to user-defined parameters.
GIZPS.FXNREQ.052	Generate List of Patients	IIS Staff/System & Immunization Provider	Have ability to print the list of patients.
GIZPS.FXNREQ.053	Generate List of Patients	IIS Staff/System & Immunization Provider	Have ability to log each time a user generates a list of patients.
GIZPS.FXNREQ.054	Generate List of Patients	IIS Staff/System & Immunization Provider	Have the ability to display the date the reminder/recall notice was sent to a patient.
GIZPS.FXNREQ.055	Generate List of Patients	IIS Staff/System & Immunization Provider	Have ability to display type of notification indicator per patient record (e.g., prevention or defaulter).
GIZPS.FXNREQ.056	Generate List of Patients	IIS Staff/System & Immunization Provider	Have ability to track the number of reminder/recall attempts (i.e., per patient and total).
GIZPS.FXNREQ.057	Generate List of Patients	IIS Staff/System & Immunization Provider	Prevent all records given an inactive or deceased status from being included in the list of patients for reminder/recall.
GIZPS.FXNREQ.058	Send Notifications	IIS Staff/System & Immunization Provider	Have ability to generate electronic notifications.

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.059	Send Notifications	IIS Staff/System & Immunization Provider	Have ability to send electronic notifications.
GIZPS.FXNREQ.060	Send Notifications	IIS Staff/System & Immunization Provider	Send reminder/recall notification to patient or designated health worker (e.g., via CHV or CHN).
GIZPS.FXNREQ.061	Track Patient	Patient/Family	Have ability to assign CHW to a patient.
GIZPS.FXNREQ.062	Track Patient	Patient/Family	Have ability to generate and send a list of defaulted/overdue patients to CHW.
GIZPS.FXNREQ.063	Track Patient	Patient/Family	Allow CHV/CHN to send tracking updates to facility via SMS, email, etc.
GIZPS.FXNREQ.064	Update Patient Information and/or Status	IIS Staff/System & Immunization Provider	Have ability to track notification attempts and log back to a patient's record.
GIZPS.FXNREQ.065	Update Patient Information and/or Status	IIS Staff/System & Immunization Provider	Have ability to maintain an audit log of the changes and history.
GIZPS.FXNREQ.066	Update Patient Information and/or Status	IIS Staff/System & Immunization Provider	Have ability to update patient record with tracking information in the IIS from the CHV/CHN.
GIZPS.FXNREQ.067	Update Patient Information and/or Status	IIS Staff/System & Immunization Provider	Have ability to edit, update, and override patient information such as change of address (moved permanently or temporarily).
GIZPS.FXNREQ.068	Active or Inactive?	IIS Staff/System	Have ability to allow a patient record to be inactive for a selected time frame (e.g., temporarily lost residence, crop harvest).
GIZPS.FXNREQ.069	Client is due vaccine	System	Produce a report that identifies all children due a vaccination within the next month. The inputs to this report should be national vaccination schedule (rules based on each antigen), and the individual's vaccine record.
GIZPS.FXNREQ.070	Confirm clinic dates and outreach schedule dates	System	Validate the clinic dates for all clinics in the next month (outreach and local).
GIZPS.FXNREQ.071	Confirm clinic dates and outreach schedule dates	System	Provide a means to update the clinic calendar/schedule (e.g., with national holidays).
GIZPS.FXNREQ.072	Does client have a phone?	System	Identify if the client due for a vaccination has a phone number on record.
GIZPS.FXNREQ.073	Generate reminder message	System	Generate a pre-recorded reminder message for the client who is due a vaccination. The message can indicate the date and location of upcoming clinics (outreach and local).
GIZPS.FXNREQ.074	Generate reminder to CHW	System	Determine the CHV/CHN responsible for the area in which the person due a vaccination resides.
GIZPS.FXNREQ.075	Generate reminder to CHW	System	Send a list of all children (that the CHN has responsibility for) due vaccinations prior to the clinic.
GIZPS.FXNREQ.076	Determine if immunizations were missed	Health Care Worker	Display a list of children who missed their immunization for each antigen.
GIZPS.FXNREQ.077	Determine if immunizations were missed	System Admin	Allow the user to specify immunization schedule and thresholds for a child to qualify as requiring follow-up.

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.078	Determine if immunizations were missed	Health Care Worker	Allow the user to print a list of children requiring follow-up.
GIZPS.FXNREQ.079	Determine if immunizations were missed	Health Care Worker	Allow the user to export a list for follow-up.
GIZPS.FXNREQ.080	Record information to follow-up	Health Care Worker	Extract location and personal information.
GIZPS.FXNREQ.081	Record information to follow-up	Health Care Worker	Categorize defaulter information by location and CHV/CHN.
GIZPS.FXNREQ.082	Plan for follow- up at clinic sessions or during outreach	Health Care Worker	Display a list of planned outreach and clinic sessions.
GIZPS.FXNREQ.083	Send child information to CHW or mother/caregiver	Health Care Worker	Send list of missing children by email or SMS.
GIZPS.FXNREQ.084	Send child information to CHW or mother/caregiver	Health Care Worker	Send recall SMS to mother/caregiver.
GIZPS.FXNREQ.085	Ensure child is immunized	Health Care Worker	Mark located children for future follow-up.
GIZPS.FXNREQ.086	Record the reason	Health Care Worker	Allow the user to record reason: either permanent reason for not finding child or reason immunization was missed.

Administer and document care functional requirements

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
Register client			
GIZPS.FXNREQ.087	Does the patient have a record?	Health Care Worker	Allow the user to search for the patient given some demographic information.
GIZPS.FXNREQ.088	Does the patient have a record?	Health Care Worker	As a result of the search, return all potential matches.
GIZPS.FXNREQ.089	Does the patient have a record?	Health Care Worker	Allow for searching and matching on partial information (such as partial birthdates).
GIZPS.FXNREQ.090	Does the patient have a record?	Health Care Worker	Allow searching for children based on family relationships or demographics.
GIZPS.FXNREQ.091	Does the patient have a record?	Health Care Worker	Allow a system administrator to configure search parameters: what fields are mandatory, when partial information is acceptable, etc.
GIZPS.FXNREQ.092	Does the patient have a record?	Health Care Worker	Allow searching with wild cards.
GIZPS.FXNREQ.093	Does the patient have a record?	Health Care Worker	Allow the user to find patient records using barcodes.
GIZPS.FXNREQ.094	Does the patient have a record?	Health Care Worker	Include results that look or sound similar to the search term (fuzzy logic).
GIZPS.FXNREQ.095	Start Child Health Card	Health Care Worker	There will be a need for the patient to have their own paper record for some time. The child health book contains much more information than just immunizations and will require a much broader and more comprehensive solution to replace. In addition, it will serve as the paper back-up for patients and families as they rarely have online access to information.
GIZPS.FXNREQ.096	Enter into vaccination log/register/ system	Health Care Worker	Allow the user to enter all necessary registration data.
GIZPS.FXNREQ.097	Enter into vaccination log/register/ system	Health Care Worker	Allow family relations to be modeled by cross-referencing patient data. The mother and father field would thus refer to other records in the patient database.
GIZPS.FXNREQ.098	Enter into vaccination log/register/system	Health Care Worker	Allow the user to select the place of birth from a list as defined by the system administrator.
GIZPS.FXNREQ.099	Enter into vaccination log/register/system	Health Care Worker	Allow the user to select the health center of the patient from a list as defined by the system administrator.
GIZPS.FXNREQ.100	Enter into vaccination log/register/system	Health Care Worker	Validate that a patient does not exist before adding a new record. (All added activities must be preceded by a search).
GIZPS.FXNREQ.101	Enter into vaccination log/register/system	Health Care Worker	Enforce a minimal data set to allow for a new registration.
GIZPS.FXNREQ.102	Enter into vaccination log/register/system	Health Care Worker	Uniquely identify every person.
GIZPS.FXNREQ.103	Enter into vaccination log/register/system	Health Care Worker	Provide a mechanism to prevent unwanted duplication of records (e.g., the system warns if a child is registered with same name and DOB).
GIZPS.FXNREQ.104	Enter into vaccination log/register/system	Health Care Worker	Provide a means to handle duplicates (such as merging records).
GIZPS.FXNREQ.105	Enter into vaccination log/register/system	Health Care Worker	Allow for remote access and update of patient records (via mobile device).

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.106	Find patient in register as well as obtaining the child health booklet	Health Care Worker	Allow the system administrator to configure what information and what data will be returned to determine a match.
GIZPS.FXNREQ.107	Find patient in register as well as obtaining the child health booklet	Health Care Worker	Allow users to modify or update appropriate patient data as needed.
Query patient record			
GIZPS.FXNREQ.108	Review record to determine appropriate action/care	Health Care Worker	Allow user to be certain the record belongs to the subject of care (this means it contains enough information/demographics/photo/unique ID, etc.).
GIZPS.FXNREQ.109	Review record to determine appropriate action/care	System	Provide a history of previous care.
GIZPS.FXNREQ.110	Review record to determine appropriate action/care	System	Contain contact information.
GIZPS.FXNREQ.111	Record relevant information	Health Care Worker	Update patient's vaccination record with all relevant information (date, dose, lot number, antigen).
GIZPS.FXNREQ.112	Record relevant information	Health Care Worker	Allow the user to record additional vaccinations, even those that are not included in the national vaccination schedule.
GIZPS.FXNREQ.113	Does the information belong on the client record?	Health Care Worker	Allow space to record any significant observations (such as reaction) that may be specific to that client.
GIZPS.FXNREQ.114	Find appropriate general record/ledger	Health Care Worker	Allow for the recording of non-client-specific data, such as counts of antigens given.
GIZPS.FXNREQ.115	Find appropriate general record/ledger	System	Allow for the reporting of aggregate data from the individual data to suit reporting needs.
Administer vaccine			
GIZPS.FXNREQ.116	Query Client Record	Health Care Worker	Search if client is already in system (using at least two identifiers).
GIZPS.FXNREQ.117	Query Client Record	Health Care Worker	Require a user to search if a patient is already in the system prior to starting a new medical record entry.
GIZPS.FXNREQ.118	Query Client Record	System Admin	Allow a system administrator to configure or set if a search must happen in advance of allowing a new entry.
GIZPS.FXNREQ.119	Query Client Record	Health Care Worker	Read client information from a bar code on a patient ID and retrieve patient information.
GIZPS.FXNREQ.120	Configure vaccine protocol	System Admin	Allow a system administrator to add a new vaccine (antigen) and configure the vaccine protocol for each vaccine type (antigen) i.e. vaccine code, vaccine description, dose number, dose, route of administration, site of administration.
GIZPS.FXNREQ.121	Does client need vaccine?	Health Care Worker	Be able to determine vaccine required by looking at age of client, vaccines already given, and vaccine protocol.
GIZPS.FXNREQ.122	Does client need vaccine?	Health Care Worker	Display vaccine(s) already given and vaccines due according to vaccine protocol.

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.123	Is required vaccine available?	Health Care Worker	Display availability of vaccines stock.
GIZPS.FXNREQ.124	Is required vaccine available?	Health Care Worker	Warn the user if required vaccine is not in stock.
GIZPS.FXNREQ.125	Inform client of next vaccine date	Health Care Worker	Display due date of the next vaccine.
GIZPS.FXNREQ.126	Update record	Health Care Worker	Allow the user to enter antigen information (e.g., batch number, expiry date, VVM status).
GIZPS.FXNREQ.127	Update record	Health Care Worker	Update stock record.
GIZPS.FXNREQ.128	Inform next visit	Health Care Worker	Display due date of the next vaccine.
Adverse event reporting			
GIZPS.FXNREQ.180	Configure adverse reaction type	System Admin	The system must allow configuration of adverse reaction type.
GIZPS.FXNREQ.181	Configure adverse reaction severity	System Admin	The system must allow configuration of adverse reaction severity.
GIZPS.FXNREQ.182	Record adverse event following immunization (AEFI)	Health Care Worker	Record information about an adverse reaction experienced by patient/client following immunization.
GIZPS.FXNREQ.183	Report AEFI	Health Care Worker	Produce reports on adverse events reported by type and severity.
De- duplication of patient records			
GIZPS.FXNREQ.129	Select Patient Records for Evaluation	IIS Staff/System & User	Have ability to automatically identify new patient records as possible duplicates.
GIZPS.FXNREQ.130	Select Patient Records for Evaluation	IIS Staff/System & User	Have ability to automatically identify existing patient records as duplicates.
GIZPS.FXNREQ.131	Select Patient Records for Evaluation	IIS Staff/System & User	Have ability to prompt user of possible duplicate record prior to saving new record.
GIZPS.FXNREQ.132	Select Patient Records for Evaluation	IIS Staff/System & User	Allow users to manually flag duplicate records.
GIZPS.FXNREQ.133	Select Patient Records for Evaluation	IIS Staff/System & User	Have ability to schedule batching of duplicate record process.
GIZPS.FXNREQ.134	Evaluate Records	IIS Staff/System	Support a rule-based algorithm to evaluate duplicate records.
GIZPS.FXNREQ.135	Evaluate Records	IIS Staff/System	Have ability to generate a report of like IDs/confidence ratings (Note: Possible duplicates: name, address, quality data, reliable information, etc. Filter out missing/invalid value/data.).
GIZPS.FXNREQ.136	Evaluate Records	IIS Staff/System	Allow rules to be easily editable by IIS staff.
GIZPS.FXNREQ.137	Manual Review?	IIS Staff/System	Flag duplicate records that require manual review.
GIZPS.FXNREQ.138	Manual Review?	IIS Staff/System	Have ability to combine two or more duplicate records according to business rules. (Note: Business rules should define which criteria to use to merge records [e.g., what information to keep from the duplicates]).
GIZPS.FXNREQ.139	Manual Review?	IIS Staff/System	Allow user to manually flag records for manual review.

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ. 140	Perform Manual Review	User	Have ability to alert user of records pending for manual review.
GIZPS.FXNREQ. 141	Perform Manual Review	User	Allow user to view records simultaneously for decision to merge records.
GIZPS.FXNREQ. 142	Perform Manual Review	User	Allow user to navigate the system while reviewing possible duplicates.
GIZPS.FXNREQ. 143	Perform Manual Review	User	Have ability to plan and organize projects/tasks/assignments (e.g., task management, assign statuses like “completed” or “high priority”, etc.).
GIZPS.FXNREQ. 144	Can Records Be Merged?	IIS Staff/System & User	Have ability to determine if records have appropriate criteria in order to merge (e.g., personal identifying data to watch).
GIZPS.FXNREQ. 145	Merge Record	IIS Staff/System	Allow user to select data elements to merge into a consolidated record (Note: Could access additional source of data to validate information [e.g., ask the person, look up in another database]).
GIZPS.FXNREQ. 146	Merge Record	IIS Staff/System	Support an audit trail when records are merged.
GIZPS.FXNREQ. 147	Merge Record	IIS Staff/System	Have ability to produce and access a cross-reference listing of pre- and post-merged records (i.e., a list that shows the old patient record information with the corresponding converted new patient record).
GIZPS.FXNREQ. 148	Merge Record	IIS Staff/System	Have ability to “undo merge”.
GIZPS.FXNREQ. 149	Merge Record	IIS Staff/System	Have ability to retain “pre-merged” records.
GIZPS.FXNREQ. 150	Mark as “Not Duplicate” or Pending	IIS Staff/System	Allow user to flag record as “not a duplicate” (Note: The system could believe records are duplicates, but they are not).
GIZPS.FXNREQ. 151	Mark as “Not Duplicate” or Pending	IIS Staff/System	Have ability to prevent matching for the same pair of records that have been flagged as “not a duplicate”.
GIZPS.FXNREQ. 152	Mark as “Not Duplicate” or Pending	IIS Staff/System	Allow user to manually flag a record as pending for manual review (e.g., not enough information).
GIZPS.FXNREQ. 153	Mark as “Not Duplicate” or Pending	IIS Staff/System	Have functionality to determine what pair of records is “not a duplicate of” (i.e., record 123 is a duplicate of record 456 and vice versa).
GIZPS.FXNREQ. 154	Mark as “Not Duplicate” or Pending	IIS Staff/System	Have ability to enter comments for records marked as “not duplicate”.
De- duplication of vaccine records			
GIZPS.FXNREQ. 155	Identify Groups of Vaccination Events for Evaluation	IIS System	Have ability to prompt the user that the new vaccine is a duplicate.
GIZPS.FXNREQ. 156	Identify Groups of Vaccination Events for Evaluation	IIS System	Have ability to generate a list of possible patient vaccine duplicates.
GIZPS.FXNREQ. 157	Identify Groups of Vaccination Events for Evaluation	IIS System	Have ability to manually initiate duplicate search process.
GIZPS.FXNREQ. 158	Identify Groups of Vaccination Events for Evaluation	IIS System	Have ability to automate duplicate search process.

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.159	Identify Groups of Vaccination Events for Evaluation	IIS System	Allow users to manually flag duplicate events.
GIZPS.FXNREQ.160	Identify Groups of Vaccination Events for Evaluation	IIS System	Have ability to display to the end user the vaccine type, manufacturer, administrator date, eligibility, and administrator who entered the dose for manual vaccine de-duplication review.
GIZPS.FXNREQ.161	Evaluate Vaccine Event Records	IIS System & IIS Staff	Support a rules-based algorithm to evaluate duplicate events.
GIZPS.FXNREQ.162	Evaluate Vaccine Event Records	IIS System & IIS Staff	Support probabilistic algorithm to determine and flag when duplicate events need manual review.
GIZPS.FXNREQ.163	Evaluate Vaccine Event Records	IIS System & IIS Staff	Allow rules to be easily editable by IIS staff (add, remove, modify) when authorized.
GIZPS.FXNREQ.164	Duplicate Events?	IIS System	Allow user to manually flag events for manual review.
GIZPS.FXNREQ.165	Duplicate Events?	IIS System	Have ability to alert user of events pending for manual review.
GIZPS.FXNREQ.166	Duplicate Events?	IIS System	Allow user to view events and event details simultaneously for decision to merge (i.e., two or more).
GIZPS.FXNREQ.167	Duplicate Events?	IIS System	Allow user to navigate the system while reviewing possible duplicates (optional).
GIZPS.FXNREQ.168	Select the Most Accurate/ Suitable Event Record	IIS System & IIS Staff	Have ability to automatically select the most accurate/suitable vaccination event to be used as the (primary or master) record.
GIZPS.FXNREQ.169	Update Vaccine Event Records	IIS System & IIS Staff	Allow user to select data elements to merge into a consolidated event record.
GIZPS.FXNREQ.170	Update Vaccine Event Records	IIS System & IIS Staff	Have ability to combine two or more duplicate event records according to business rules.
GIZPS.FXNREQ.171	Update Vaccine Event Records	IIS System & IIS Staff	Support an audit trail when event records are merged.
GIZPS.FXNREQ.172	Update Vaccine Event Records	IIS System & IIS Staff	Have ability to retain “pre-merged” event records.
GIZPS.FXNREQ.173	Update Vaccine Event Records	IIS System & IIS Staff	Have ability to generate an audit list of vaccination events that are automatically merged.
GIZPS.FXNREQ.174	Update Vaccine Event Records	IIS System & IIS Staff	Allow user to delete a duplicate vaccine event while still maintaining audit record.
GIZPS.FXNREQ.175	Generate Report of Duplicates	IIS System & IIS Staff	Automatically schedule routine reports to run at a specific time.
GIZPS.FXNREQ.176	Generate Report of Duplicates	IIS System & IIS Staff	Allow for the restriction of confidential personal identifiable information.

Monitoring and evaluation functional requirements (data analysis and reporting)

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
Generate reports			
GIZPS.FXNREQ.177	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to select parameters (e.g., time, age, race/ethnicity, jurisdiction, vaccine grouping, vaccine dose count, specific program codes, other program codes, etc.).
GIZPS.FXNREQ.178	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to select report output parameters (e.g., display options, summary vs. detail report, sort options, alphanumeric vs. date, etc.).

ID	Activity	Entity/ functional role	Requirement (The system must or should…)
GIZPS.FXNREQ.179	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to choose a report-generation time frame (i.e., run now or set the time for later).
GIZPS.FXNREQ.180	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to save parameters as “public” to allow other users to generate the same report using the same parameters.
GIZPS.FXNREQ.181	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to modify/delete saved “public” parameters.
GIZPS.FXNREQ.182	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Have ability for system to determine if the report can be immediately generated or if it must be delayed based on size and generate a message “report processing” (i.e., based on types of criteria, size of data, etc.).
GIZPS.FXNREQ.183	Define Parameters	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to prompt user to confirm the generation of a report at a later time if required.
GIZPS.FXNREQ.184	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to save, display, or print report.
GIZPS.FXNREQ.185	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to produce reports in multiple formats (i.e., text delimited file, etc.).
GIZPS.FXNREQ.186	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to delete a report and track on audit log.
GIZPS.FXNREQ.187	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to delete and/or modify data elements within a report (Note: Allows the user to modify report based on the audience).
GIZPS.FXNREQ.188	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Automatically schedule routine reports to run at a specific time.
GIZPS.FXNREQ.189	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Allow for the restriction of some predefined data such as duplicate records.
GIZPS.FXNREQ.190	Generate Report	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to generate the report based on the parameters set.
GIZPS.FXNREQ.191	Report Acceptable?	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to return to and modify report criteria.
GIZPS.FXNREQ.192	Analyze	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to verify that the report is in the correct format.
GIZPS.FXNREQ.193	Analyze	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to send by email.
GIZPS.FXNREQ.194	Analyze	IIS Staff/System, Immunization Provider, & Other Partners	Have ability to export data in selected file formats.
GIZPS.FXNREQ.195	Analyze	IIS Staff/System, Immunization Provider, & Other Partners	Allow user to configure report displays.
GIZPS.FXNREQ.196	Analyze	IIS Staff/System, Immunization Provider, & Other Partners	Be interoperable with a statistical analysis software.

Non-functional requirements

Requirement ID	Category	Non-functional requirement
GIZPS.NFXNREQ.001	Security – confidentiality	Provide password-protected access for authorized users.
GIZPS.NFXNREQ.002	Security – confidentiality	Provide a means to ensure confidentiality and privacy of personal health information.
GIZPS.NFXNREQ.003	Security – confidentiality	Provide ability for allowed users to view confidential data.
GIZPS.NFXNREQ.004	Security – confidentiality	Anonymize data that is exported from the system.
GIZPS.NFXNREQ.005	Security – confidentiality	Prevent remembering username and password.
GIZPS.NFXNREQ.006	Security – confidentiality	Automatically log out the user after specified time of inactivity.
GIZPS.NFXNREQ.007	Security – confidentiality	Provide encrypted communication between components.
GIZPS.NFXNREQ.008	Security – authentication	Notify the user to change their password the first time they log in.
GIZPS.NFXNREQ.009	Security – authentication	Adhere to complex password requirements.
GIZPS.NFXNREQ.010	Security – authentication	Provide a mechanism to securely change a user's password.
GIZPS.NFXNREQ.011	Security – authentication	Notify the user of password change to their account.
GIZPS.NFXNREQ.012	Security – authentication	Reset a user's password in a secure manner.
GIZPS.NFXNREQ.013	Security – authentication	Lock a user out after a specified number of wrong password attempts.
GIZPS.NFXNREQ.014	Security – authentication	Notify a user if their account is locked due to wrong password attempts.
GIZPS.NFXNREQ.015	Security – authentication	Provide role-based access to the system.
GIZPS.NFXNREQ.016	Security – audit trail and logs	Log system logins and logouts.
GIZPS.NFXNREQ.017	Security – audit trail and logs	Record all authentication violations.
GIZPS.NFXNREQ.018	Security – audit trail and logs	Log all activities performed by the user, including date-and-time stamp.
GIZPS.NFXNREQ.019	Security – audit trail and logs	Log access to views of individual client records.
GIZPS.NFXNREQ.020	Security – audit trail and logs	Log access to data summaries, reports, analysis, and visualization features.
GIZPS.NFXNREQ.021	Security – audit trail and logs	Log exchange of data with other systems.
GIZPS.NFXNREQ.022	Security – audit trail and logs	Generate analysis of the usage of different system features and reports.
GIZPS.NFXNREQ.023	Security – audit trail and logs	Log all data and system errors.
GIZPS.NFXNREQ.024	Security – user management	Allow user with permission to create a new user and temporary password.
GIZPS.NFXNREQ.025	Security – user management	Provide role-based access.
GIZPS.NFXNREQ.026	Security – user management	Allow roles to be associated with specific geographical areas and/or health-care facilities.
GIZPS.NFXNREQ.027	Security – user management	Allow cascading user management and assignment of roles.
GIZPS.NFXNREQ.028	Security – user management	Allow user to change their own password.
GIZPS.NFXNREQ.029	Security – user management	Allow admin user to request password reset.
GIZPS.NFXNREQ.030	Security – user management	Notify the user to regularly change their password.
GIZPS.NFXNREQ.031	Security – user management	Allow each user to be assigned to one or more roles.

Requirement ID	Category	Non-functional requirement
GIZPS.NFXNREQ.032	Security – user management	Support definitions of unlimited roles and assigned levels of access, viewing, entry, editing and auditing.
GIZPS.NFXNREQ.033	System requirements – general	Provide a unique version number for each revision.
GIZPS.NFXNREQ.034	System requirements – general	Enable earlier versions of a record to be recoverable.
GIZPS.NFXNREQ.035	System requirements – general	Enable deployment in an environment subject to power loss.
GIZPS.NFXNREQ.036	System requirements – general	Work in an environment that is subject to loss of connectivity.
GIZPS.NFXNREQ.037	System requirements – general	Generate IDs that are unique across different installations or sites.
GIZPS.NFXNREQ.038	System requirements – general	Report version number when saving data to the database.
GIZPS.NFXNREQ.039	System requirements – general	Be designed to be flexible enough to accommodate necessary changes in the future.
GIZPS.NFXNREQ.040	System requirements – general	Allow for offline and online functionality.
GIZPS.NFXNREQ.041	System requirements – general	Show the number of records that are not yet synchronized.
GIZPS.NFXNREQ.042	System requirements – general	Have ability to easily back up information.
GIZPS.NFXNREQ.043	System requirements – general	Warn user if no valid backup for more than a predefined number of days.
GIZPS.NFXNREQ.044	System requirements – general	Must have the ability to store images and other unstructured data.
GIZPS.NFXNREQ.045	System requirements – scalability	Scalable to accommodate new demands.
GIZPS.NFXNREQ.046	System requirements – scalability	Be able to accommodate at least [*x* number of] health-care facilities.
GIZPS.NFXNREQ.047	System requirements – scalability	Be able to accommodate at least [*x* number of] concurrent users.
GIZPS.NFXNREQ.048	System requirements – usability	Be user-friendly for people with low computer literacy.
GIZPS.NFXNREQ.049	System requirements – usability	Provide informative error messages and tooltips.
GIZPS.NFXNREQ.050	System requirements – usability	Alert the user when navigating away from a form without saving
GIZPS.NFXNREQ.051	System requirements – usability	Support real-time data-entry validation and feedback to prevent data-entry errors from being recorded.
GIZPS.NFXNREQ.052	System requirements – usability	Simplify data recording through predefined drop-down menu or searchable lists, radio buttons, check boxes.
GIZPS.NFXNREQ.053	System requirements – usability	Support multiple languages.
GIZPS.NFXNREQ.054	System requirements – usability	Use industry standard user interface practices and apply them consistently throughout the system.
GIZPS.NFXNREQ.055	System requirements – usability	Easy to learn and intuitive to enable user to navigate between pages.
GIZPS.NFXNREQ.056	System requirements – usability	Provide guidance to users to better support clinical guidelines and best clinical practices.
GIZPS.NFXNREQ.057	System requirements – usability	Be reliable and robust (minimize the number of system crashes).
GIZPS.NFXNREQ.058	System requirements – usability	Adjust display to fit small screens (e.g., mobile phones).

Requirement ID	Category	Non-functional requirement
GIZPS.NFXNREQ.059	System requirements – configuration	Configure the system centrally.
GIZPS.NFXNREQ.060	System requirements – configuration	Configure business rules in line with guidelines and standard operating procedures (SOPs).
GIZPS.NFXNREQ.061	System requirements – configuration	Configure error messages.
GIZPS.NFXNREQ.062	System requirements – configuration	Configure workflows and business rules to accommodate differences between facilities.
GIZPS.NFXNREQ.063	System requirements – interoperability	Communicate with external systems through mediators.
GIZPS.NFXNREQ.064	System requirements – interoperability	Provide access to data through application programming interfaces (APIs).
GIZPS.NFXNREQ.065	System requirements – interoperability	Link with insurance systems to verify eligibility and submit claims.
GIZPS.NFXNREQ.066	System requirements – interoperability	Exchange data with other approved systems.
GIZPS.NFXNREQ.067	System requirements – interoperability	Accept data from multiple input methods including paper, geocoding (GPS).
GIZPS.NFXNREQ.068	System requirements – interoperability	Communicate with external systems through mediators.
GIZPS.NFXNREQ.069	System requirements – hardware and connectivity	Allow for data exchange and efficient synchronization across multiple facilities and points of service when Internet is available, even when it is intermittent and slow.

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 vaccinations. This may be in under 5 clinics which include monitoring and some other health promotion activities, or it may be in standalone vaccination clinics set up for specific vaccinations, such as COVID or flu.
Campaign	A time limited event aimed at vaccinating a main target population against one or more specific diseases. Campaigns may be *supplemental immunization activities (SIA)* or "catch up campaigns" which are *periodic intensification of routine immunization (PIRI*) activities, or through innovative local strategies that ensure individuals have the opportunity to receive routine immunizations for which they are overdue and eligible. This may also include the activities around new vaccine introductions.
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 *(7,8)*.
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.
Defaulter	A person who has missed the scheduled dose of a vaccine.
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 *(1,37)*.
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 *(7,8)*.
Functional requirement	Capabilities 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)*.
Immunization	A process by which a person becomes protected against a disease through vaccination.
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.
Periodic Intensification of Routine Immunization (PIRI)	An umbrella term to describe a spectrum of time-limited, intermittent activities used to administer routine vaccinations–including catch-up doses–to under-vaccinated populations and/or raise awareness of the benefits of vaccination. Examples include Child Health Days, National Vaccination Weeks, intensified social mobilization efforts, etc. PIRI activities are intended to augment routine immunization services by providing a catch-up opportunity for those who are the usual target for routine services but have been missed or not reached during the year. A key distinction between PIRI and SIAs (see below) is that PIRI doses are recorded on the home-based record/immunization card as routine immunization doses and included in the administrative routine immunization coverage data. In contrast, SIA doses are considered "supplemental" and not included as part of the administrative routine immunization coverage.
Persona	A generic aggregate description of a person involved in or benefitting from a health programme.
Reminder	A notification sent to remind a client that they have a vaccine due. The same mechanism may be used to alert clients that they have missed a scheduled vaccine.
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.
Supplementary Immunization Activity (SIA)	Vaccination campaigns that aim to quickly deliver vaccination of one (or multiple) antigens to a large target population with the objective of closing immunity gaps in the population. Achieving high population level immunity and speed are the priority, and typically there is no screening of vaccination history/status. The supplementary doses given are tallied but not included in the routine administrative national coverage data. SIA doses may only be recorded in campaign cards. Note: these campaigns are out of scope for this document.
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).*
Vaccination	The act of introducing a vaccine into the body to produce protection from a specific disease.
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)*.