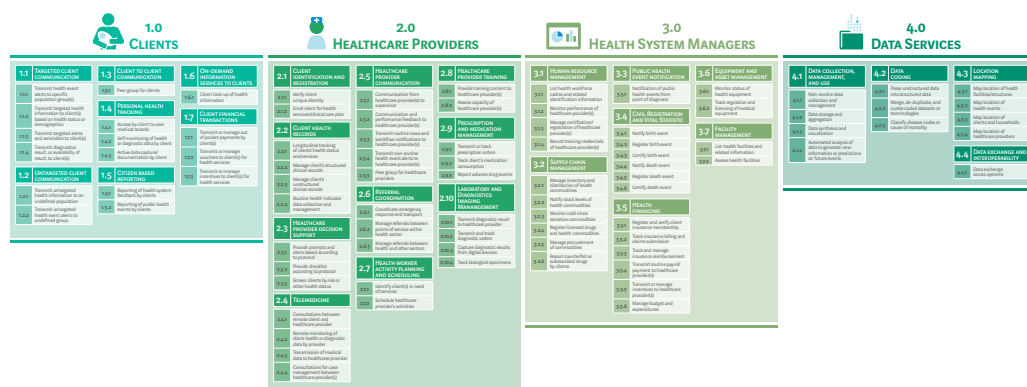


# CLASSIFICATION OF DIGITAL HEALTH INTERVENTIONS v1.0

A shared language to describe the uses of digital technology for health

## WHAT IS IT?

The classification of digital health interventions (DHIs) categorizes the different ways in which digital and mobile technologies are being used to support health system needs. Targeted primarily at public health audiences, this Classification framework aims to promote an accessible and bridging language for health program planners to articulate functionalities of digital health implementations. Also referred to as a taxonomy, this Classification scheme is anchored on the unit of a “digital health intervention,” which represents a discrete functionality of the digital technology to achieve health sector objectives.



## HOW TO USE IT?

The digital health interventions are organized into the following overarching groupings based on the targeted primary user:



**INTERVENTIONS FOR CLIENTS:** Clients are members of the public who are potential or current users of health services, including health promotion activities. Caregivers of clients receiving health services are also included in this group.



**INTERVENTIONS FOR HEALTHCARE PROVIDERS:** Healthcare providers are members of the health workforce who deliver health services.



**INTERVENTIONS FOR HEALTH SYSTEM OR RESOURCE MANAGERS:** Health system and resource managers are involved in the administration and oversight of public health systems. Interventions within this category reflect managerial functions related to supply chain management, health financing, human resource management.



**INTERVENTIONS FOR DATA SERVICES:** This consists of crosscutting functionality to support a wide range of activities related to data collection, management, use, and exchange.

Each digital health intervention is accompanied by associated synonyms and other commonly used terms. The framework also includes programmatic examples of these terms based on cited descriptions from project documentation.

## WHY WAS IT CREATED?

The diverse communities working in digital health—including government stakeholders, technologists, clinicians, implementers, network operators, researchers, donors—have lacked a mutually understandable language with which to assess and articulate functionality. A shared and standardized vocabulary was recognized as necessary to identify gaps and duplication, evaluate effectiveness, and facilitate alignment across different digital health implementations.

In particular, four primary use cases prompted the development of this classification scheme:

- synthesizing evidence and research;
- conducting national inventories and landscape analyses;
- developing guidance resources to inform planning;
- articulating required digital functionality based on identified health system challenges and needs.

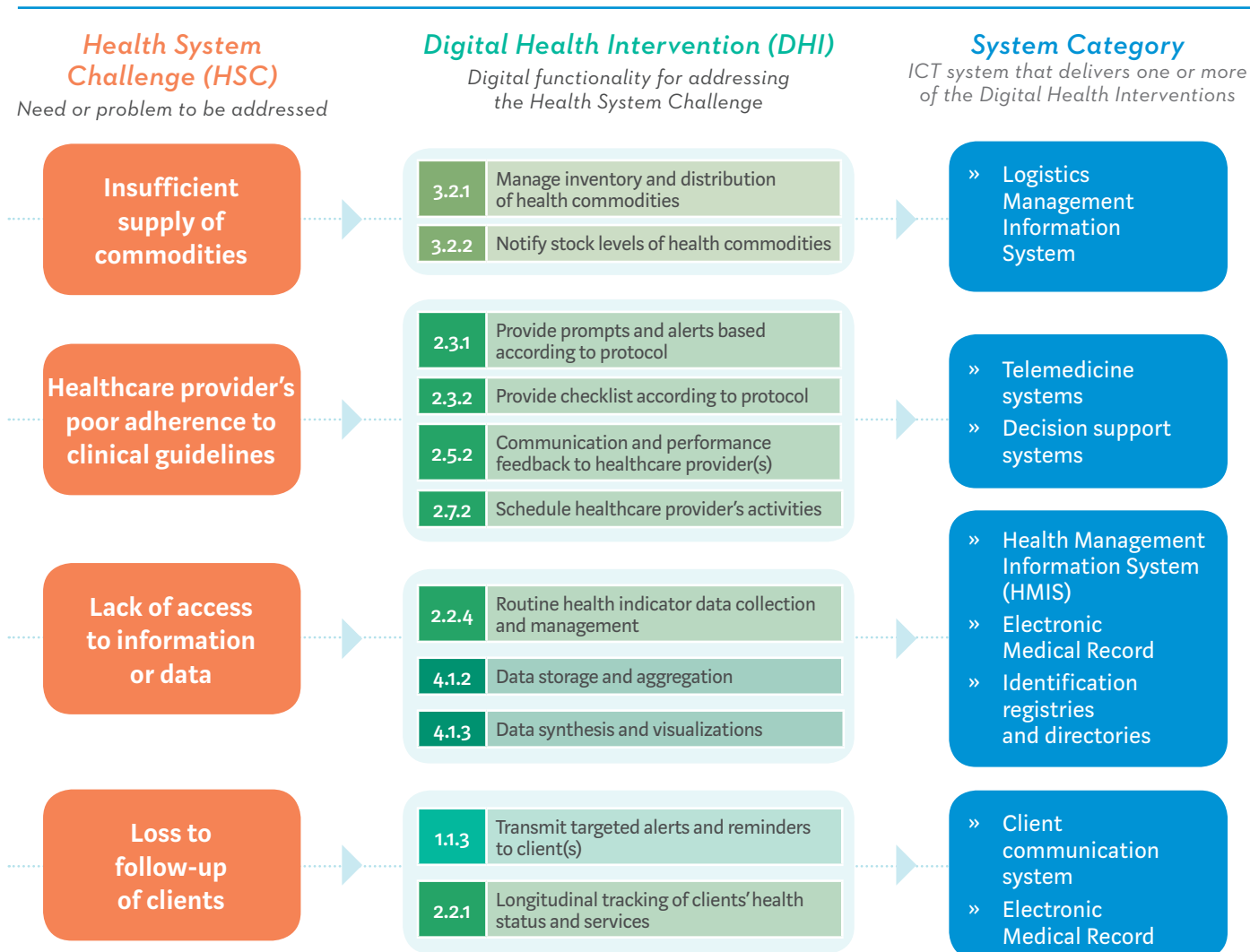
Although frameworks such as the Control Objectives for Information and Related Technologies (COBIT) [1], Health Level Seven (HL7) [2], and International Standards Organization (ISO) [3] exist, these frameworks provide highly technical terms for use by computer scientists and software developers in health. This new classification scheme offers a simplified language to help support a dialogue between public health practitioners and technology-oriented audiences.

## HOW DOES THIS LINK TO OTHER CLASSIFICATIONS?

This classification of **Digital Health Interventions (DHIs)** should be used in tandem with the list of **Health System Challenges (HSC)** in order to articulate how technology is addressing identified health needs, such as lack of service utilisation. The HSC framework provides an overview of needs and challenges faced in health systems, in order to assist program planners to express what they expect to achieve through implementation of a digital health intervention. For example, one may implement a digital health intervention, such as “**targeted communication to clients**”, in order to address a health system challenge, such as “**lack of service utilisation**,” to achieve an overarching **eHealth outcome** of “improving clients’ access to knowledge resources and support for better management of their health”[5].

The classification of DHIs also highlights functionalities that fit within various **System Categories**, such as Logistics Management Information Systems (LMIS) or Electronic Medical Records (EMR). **System Categories** represent the types of ICT applications and information systems designed to deliver one or more digital health interventions. A digital health intervention such as “**notify stock levels of health commodities**” would fit into the **System Category of LMIS**. Linking digital health interventions to system categories is critical as these serve as the starting point for interoperability considerations.

**FIGURE 1. LINKAGES ACROSS HEALTH SYSTEM CHALLENGES, DIGITAL HEALTH INTERVENTIONS, AND SYSTEM CATEGORIES**



**HOW WAS IT DEVELOPED?**

This Classification scheme reflects emerging uses of digital technologies for health. The taxonomy leverages mobile health (mHealth) categorizations from the mHealth Technical Evidence Review Group (mTERG) and Labrique et al.[4], and expands on these terms to be inclusive of eHealth and broader capabilities that have relevance in the health sector. WHO convened a series of technical consultations to further refine these terminologies and definitions. Public feedback was solicited through the Health Data Collaborative Digital Health and Interoperability Working Group. Additionally, a desk review was conducted to align with reference frameworks [1-3], and to establish examples of DHI in current use.

**HOW IT WILL EVOLVE?**

This reference Classification will evolve as new digital functionalities emerge. The WHO Secretariat will periodically update and version this Classification based on technical consultations and public feedback. Subsequent releases of this Classification will be available at <http://who.int/reproductivehealth/topics/mhealth/en/>.

# HEALTH SYSTEM CHALLENGES

1 INFORMATION		3 QUALITY		6 EFFICIENCY	
1.1	Lack of population denominator	3.1	Poor patient experience	6.1	Inadequate workflow management
1.2	Delayed reporting of events	3.2	Insufficient health worker competence	6.2	Lack of or inappropriate referrals
1.3	Lack of quality/reliable data	3.3	Low quality health commodities	6.3	Poor planning and coordination
1.4	Communication roadblocks	3.4	Low health worker motivation	6.4	Delayed provision of care
1.5	Lack of access to information or data	3.5	Insufficient continuity of care	6.5	Inadequate access to transportation
1.6	Insufficient utilization of data and information	3.6	Inadequate supportive supervision		
1.7	Lack of unique identifier	3.7	Poor adherence to guidelines	7 COST	
2 AVAILABILITY		4 ACCEPTABILITY		7.1	High cost of manual processes
2.1	Insufficient supply of commodities	4.1	Lack of alignment with local norms	7.2	Lack of effective resource allocation
2.2	Insufficient supply of services	4.2	Programs which do not address individual beliefs and practices	7.3	Client-side expenses
2.3	Insufficient supply of equipment	5 UTILIZATION		7.4	Lack of coordinated payer mechanism
2.4	Insufficient supply of qualified health workers	5.1	Low demand for services	8 ACCOUNTABILITY	
		5.2	Geographic inaccessibility	8.1	Insufficient patient engagement
		5.3	Low adherence to treatments	8.2	Unaware of service entitlement
		5.4	Loss to follow up	8.3	Absence of community feedback mechanisms
				8.4	Lack of transparency in commodity transactions
				8.5	Poor accountability between the levels of the health sector
				8.6	Inadequate understanding of beneficiary populations

# SYSTEM CATEGORIES

<b>A</b>	Census, population information & data warehouse*	<b>I</b>	Emergency response system*	<b>R</b>	Laboratory and diagnostics information system*
<b>B</b>	Civil registration and vital statistics	<b>J</b>	Environmental monitoring system*	<b>S</b>	Learning and training system
<b>C</b>	Client applications	<b>K</b>	Facility management information system	<b>T</b>	Logistics management information system (LMIS)
<b>D</b>	Client communication system	<b>L</b>	Geographic information system (GIS)	<b>U</b>	Pharmacy information system*
<b>E</b>	Clinical terminology and classifications*	<b>M</b>	Health finance and insurance information system*	<b>V</b>	Public health and disease surveillance system*
<b>F</b>	Community-based information system	<b>N</b>	Health management information system (HMIS)	<b>W</b>	Research information system
<b>G</b>	Data interchange interoperability and accessibility*	<b>O</b>	Human resource information system	<b>X</b>	Shared Health Record and health information repositories*
<b>H</b>	Electronic medical record*	<b>P</b>	Identification registries and directories*	<b>Y</b>	Telemedicine
		<b>Q</b>	Knowledge management system*		

\*Adapted from the International Standards Organization [3]

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4. Labrique AB, Vasudevan L, Kochi E, Fabricant R, Mehl G. mHealth innovations as health system strengthening tools: 12 common applications and a visual framework. *Global Health: Science and Practice*. 2013 Aug 1;1(2):160-71.
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# 1.0 CLIENTS

<b>1.1</b>	<b>TARGETED CLIENT COMMUNICATION</b>	<b>1.3</b>	<b>CLIENT TO CLIENT COMMUNICATION</b>	<b>1.6</b>	<b>ON-DEMAND INFORMATION SERVICES TO CLIENTS</b>
<b>1.1.1</b>	Transmit health event alerts to specific population group(s)	<b>1.3.1</b>	Peer group for clients	<b>1.6.1</b>	Client look-up of health information
<b>1.1.2</b>	Transmit targeted health information to client(s) based on health status or demographics	<b>1.4</b>	<b>PERSONAL HEALTH TRACKING</b>	<b>1.7</b>	<b>CLIENT FINANCIAL TRANSACTIONS</b>
<b>1.1.3</b>	Transmit targeted alerts and reminders to client(s)	<b>1.4.1</b>	Access by client to own medical records	<b>1.7.1</b>	Transmit or manage out of pocket payments by client(s)
<b>1.1.4</b>	Transmit diagnostics result, or availability of result, to client(s)	<b>1.4.2</b>	Self monitoring of health or diagnostic data by client	<b>1.7.2</b>	Transmit or manage vouchers to client(s) for health services
<b>1.2</b>	<b>UNTARGETED CLIENT COMMUNICATION</b>	<b>1.4.3</b>	Active data capture/ documentation by client	<b>1.7.3</b>	Transmit or manage incentives to client(s) for health services
<b>1.2.1</b>	Transmit untargeted health information to an undefined population	<b>1.5</b>	<b>CITIZEN BASED REPORTING</b>		
<b>1.2.2</b>	Transmit untargeted health event alerts to undefined group	<b>1.5.1</b>	Reporting of health system feedback by clients		
		<b>1.5.2</b>	Reporting of public health events by clients		



## 2.0

# HEALTHCARE PROVIDERS

<b>2.1</b>	<b>CLIENT IDENTIFICATION AND REGISTRATION</b>	<b>2.5</b>	<b>HEALTHCARE PROVIDER COMMUNICATION</b>	<b>2.8</b>	<b>HEALTHCARE PROVIDER TRAINING</b>
2.1.1	Verify client unique identity	2.5.1	Communication from healthcare provider(s) to supervisor	2.8.1	Provide training content to healthcare provider(s)
2.1.2	Enrol client for health services/clinical care plan	2.5.2	Communication and performance feedback to healthcare provider(s)	2.8.2	Assess capacity of healthcare provider(s)
<b>2.2</b>	<b>CLIENT HEALTH RECORDS</b>	<b>2.6</b>	<b>REFERRAL COORDINATION</b>	<b>2.9</b>	<b>PRESCRIPTION AND MEDICATION MANAGEMENT</b>
2.2.1	Longitudinal tracking of clients' health status and services	2.6.1	Coordinate emergency response and transport	2.9.1	Transmit or track prescription orders
2.2.2	Manage client's structured clinical records	2.6.2	Manage referrals between points of service within health sector	2.9.2	Track client's medication consumption
2.2.3	Manage client's unstructured clinical records	2.6.3	Manage referrals between health and other sectors	2.9.3	Report adverse drug events
2.2.4	Routine health indicator data collection and management	<b>2.7</b>	<b>HEALTH WORKER ACTIVITY PLANNING AND SCHEDULING</b>	<b>2.10</b>	<b>LABORATORY AND DIAGNOSTICS IMAGING MANAGEMENT</b>
<b>2.3</b>	<b>HEALTHCARE PROVIDER DECISION SUPPORT</b>	2.7.1	Identify client(s) in need of services	2.10.1	Transmit diagnostic result to healthcare provider
2.3.1	Provide prompts and alerts based according to protocol	2.7.2	Schedule healthcare provider's activities	2.10.2	Transmit and track diagnostic orders
2.3.2	Provide checklist according to protocol			2.10.3	Capture diagnostic results from digital devices
2.3.3	Screen clients by risk or other health status			2.10.4	Track biological specimens
<b>2.4</b>	<b>TELEMEDICINE</b>				
2.4.1	Consultations between remote client and healthcare provider				
2.4.2	Remote monitoring of client health or diagnostic data by provider				
2.4.3	Transmission of medical data to healthcare provider				
2.4.4	Consultations for case management between healthcare provider(s)				



# 3.0

## HEALTH SYSTEM MANAGERS

<b>3.1</b>	<b>HUMAN RESOURCE MANAGEMENT</b>	<b>3.3</b>	<b>PUBLIC HEALTH EVENT NOTIFICATION</b>	<b>3.6</b>	<b>EQUIPMENT AND ASSET MANAGEMENT</b>
3.1.1	List health workforce cadres and related identification information	3.3.1	Notification of public health events from point of diagnosis	3.6.1	Monitor status of health equipment
3.1.2	Monitor performance of healthcare provider(s)	<b>3.4</b>	<b>CIVIL REGISTRATION AND VITAL STATISTIC</b>	3.6.2	Track regulation and licensing of medical equipment
3.1.3	Manage certification/ registration of healthcare provider(s)	3.4.1	Notify birth event	<b>3.7</b>	<b>FACILITY MANAGEMENT</b>
3.1.4	Record training credentials of healthcare provider(s)	3.4.2	Register birth event	3.7.1	List health facilities and related information
<b>3.2</b>	<b>SUPPLY CHAIN MANAGEMENT</b>	3.4.3	Certify birth event	3.7.2	Assess health facilities
3.2.1	Manage inventory and distribution of health commodities	3.4.4	Notify death event		
3.2.2	Notify stock levels of health commodities	3.4.5	Register death event		
3.2.3	Monitor cold-chain sensitive commodities	3.4.6	Certify death event		
3.2.4	Register licensed drugs and health commodities	<b>3.5</b>	<b>HEALTH FINANCING</b>		
3.2.5	Manage procurement of commodities	3.5.1	Register and verify client insurance membership		
3.2.6	Report counterfeit or substandard drugs by clients	3.5.2	Track insurance billing and claims submission		
		3.5.3	Track and manage insurance reimbursement		
		3.5.4	Transmit routine payroll payment to healthcare provider(s)		
		3.5.5	Transmit or manage incentives to healthcare provider(s)		
		3.5.6	Manage budget and expenditures		





# 4.0 DATA SERVICES

## 4.1 DATA COLLECTION, MANAGEMENT, AND USE

- 4.1.1 Non-routine data collection and management
- 4.1.2 Data storage and aggregation
- 4.1.3 Data synthesis and visualization
- 4.1.4 Automated analysis of data to generate new information or predictions on future events

## 4.2 DATA CODING

- 4.2.1 Parse unstructured data into structured data
- 4.2.2 Merge, de-duplicate, and curate coded datasets or terminologies
- 4.2.3 Classify disease codes or cause of mortality

## 4.3 LOCATION MAPPING

- 4.3.1 Map location of health facilities/structures
- 4.3.2 Map location of health events
- 4.3.3 Map location of clients and households
- 4.3.4 Map location of healthcare providers

## 4.4 DATA EXCHANGE AND INTEROPERABILITY

- 4.4.1 Data exchange across systems

# 1.0 CLIENTS

<p><b>1.1 TARGETED CLIENT COMMUNICATION</b></p> <p>Transmission of targeted health information “in which separate audience segments (often demographic categories) benefit from a shared message.” [1] Targeted communication can also be further customized according to an individual’s specific needs, resulting in “tailored client communication,” whereby message content is matched to the needs and preferences of an individual [1]. The communication can be unidirectional and bidirectional, but initial contact is from the health system; as opposed to on-demand information service where the client initiates the first contact to the health system.</p>	<p><b>1.1.1 TRANSMIT HEALTH EVENT ALERTS TO SPECIFIC POPULATION GROUP(S)</b></p> <ul style="list-style-type: none"> <li>- PUBLIC HEALTH EVENT NOTIFICATION; DISEASE NOTIFICATION TO SPECIFIC OR PRE-IDENTIFIED POPULATIONS</li> <li>- NOTIFICATION OF HEALTH EVENTS TO SPECIFIC POPULATIONS BASED ON DEMOGRAPHIC CHARACTERISTICS</li> <li>- HEALTH PROMOTION MESSAGING</li> </ul> <p><b>1.1.2 TRANSMIT TARGETED HEALTH INFORMATION TO CLIENT(S) BASED ON HEALTH STATUS OR DEMOGRAPHICS</b></p> <ul style="list-style-type: none"> <li>- HEALTH EDUCATION, BEHAVIOR CHANGE COMMUNICATION, HEALTH PROMOTION COMMUNICATION, CLIENT-CENTERED MESSAGING;</li> <li>- HEALTH COMMUNICATION BASED ON A KNOWN CLIENT'S HEALTH STATUS OR CLINICAL HISTORY</li> </ul> <p><b>1.1.3 TRANSMIT TARGETED ALERTS AND REMINDERS TO CLIENT(S)</b></p> <ul style="list-style-type: none"> <li>- ALERTS FOR PREVENTIVE SERVICES AND WELLNESS</li> <li>- NOTIFICATIONS AND REMINDERS FOR APPOINTMENTS, MEDICATION ADHERENCE, OR FOLLOW-UP SERVICES</li> <li>- COMMUNICATION FOR RETENTION IN CARE, CONTINUITY OF CARE</li> </ul> <p><b>1.1.4 TRANSMIT DIAGNOSTICS RESULT, OR AVAILABILITY OF RESULT, TO CLIENT(S)</b></p> <ul style="list-style-type: none"> <li>- LABORATORY RESULTS MANAGEMENT, TESTS RESULTS MANAGEMENT</li> </ul>	<p><b>U-Report Ebola Response in Uganda:</b> “The following SMS alerts were carefully drafted and sent to Kibaale, and the surrounding districts Hoima, Kiboga, Mubende, Ntoroko, Bundibugyo, Kabarole Kyenjojo, Kyegogwa, Kyankwanzi, and Ibanda. SMS Alert 1: There is an Ebola outbreak in Kibaale. Today and tomorrow I am going to send u some SMSs to give u more info about how to recognise Ebola &amp; how to prevent it...” [7]</p> <p><b>Alive &amp; Thrive:</b> “...sent weekly text and voice messages to the phone of microcredit group leader to share messages on breastfeeding with microcredit group.” [8]</p> <p><b>MomConnect:</b> “...sends stage-based, personalized short message service (SMS) texts to each mom in the registry.” [8]</p> <p><b>EngageTB:</b> “Clients who are TB Negative will receive messages about behavior change to help them avoid the spread of TB and/or being infected by TB.” [8]</p> <p><b>Mobile Information For Maternal Health:</b> “A mobile interactive voice response system that provides pregnant women with information on the stage of her pregnancy and suggestions to keep her and her baby healthy via twice weekly phone calls.” [8]</p> <p><b>mDiabetes:</b> “...an SMS-based information service for people with diabetes during Ramadan fasting.” [9]</p> <p><b>EngageTB:</b> “Once a client has been confirmed as TB positive, the Lab Technicians will register the client back into the application and enable the client to receive reminders about Directly Observed Therapy (DOT).” [8]</p> <p><b>mTIKA:</b> “...send SMS reminders to families when their children are due for immunization services.” [8]</p> <p><b>Moby App:</b> “... sends automated SMS reminders to clients, reminding them of upcoming appointments, missed appointments, and approaching delivery dates so women can prepare to deliver in a health facility.” [8]</p> <p><b>Wired Mothers:</b> “Women receive appointment reminders, educational messaging and can call their primary care providers to discuss non-acute issues.” [8]</p> <p><b>txtAlert:</b> “This version of txtAlert delivers CD4 count results to patients who have been tested for HIV but may not return to the clinic to collect their CD4 counts results...” [8]</p> <p><b>WAHA Maternal Health mHealth Program:</b> “Two SMS campaigns were launched, targeting the inhabitants of the Iambacounda district... The second campaign targets all people, so that they are regularly informed of available medical services within the district.” [10]</p> <p><b>Ebola awareness through SMS:</b> “As part of a massive public awareness effort, Senegal’s Ministry of Health sent 4 million SMS messages to the general public warning of the dangers of Ebola and how to prevent it.” [11]</p> <p><b>Project Khuluma:</b> “Peer-led support groups for HIV-infected adolescents to communicate amongst themselves on topics they want to discuss.” [8]</p>
<p><b>1.2 UNTARGETED CLIENT COMMUNICATION</b></p> <p>Transmission of untargeted health promotion content “in which in which relatively large, undifferentiated audiences receive identical messages.” [1] This includes message blasts usually conducted to a mobile phone user bank. The communication can be unidirectional and bidirectional.</p>	<p><b>1.2.1 TRANSMIT UNTARGETED HEALTH INFORMATION TO AN UNDEFINED POPULATION</b></p> <ul style="list-style-type: none"> <li>- MASS MESSAGING CAMPAIGN OR COMMUNICATION TO AN UNDEFINED TARGET GROUP</li> <li>- HEALTH MESSAGING TO UNDEFINED TARGET GROUP REGARDLESS OF DEMOGRAPHIC CHARACTERISTICS OR HEALTH STATUS</li> </ul> <p><b>1.2.2 TRANSMIT UNTARGETED HEALTH EVENT ALERTS TO UNDEFINED GROUP</b></p> <ul style="list-style-type: none"> <li>- PUBLIC HEALTH EVENT NOTIFICATION; DISEASE NOTIFICATION</li> <li>- MASS MESSAGING CAMPAIGN</li> </ul>	<p><b>1.3.1 PEER GROUP FOR CLIENTS</b></p> <ul style="list-style-type: none"> <li>- PEER LEARNING, PEER GROUP, PEER-TO-PEER GROUPS, PEER NETWORK, PEER SUPPORT</li> </ul>
<p><b>1.3 CLIENT TO CLIENT COMMUNICATION</b></p> <p>Communication between clients as peers within an organized network/group.</p>		

<p><b>1.4 PERSONAL HEALTH TRACKING</b></p> <p>The use of mobile applications by clients, phone based sensors, health records, and wearables for clients to monitor their own health status. This can include wearable sensors, web-tools, and apps that allow clients to review and track their health status.</p>	<p><b>1.4.1 ACCESS BY CLIENT TO OWN MEDICAL RECORDS</b></p> <ul style="list-style-type: none"> <li>- SELF-ACCESS TO CLIENT HEALTH RECORD; PATIENT'S OWN ACCESS TO THEIR HEALTH RECORD.</li> <li>- ABILITY FOR CLIENTS TO TRACK THEIR HEALTH HISTORY AND CLINICAL RECORD</li> </ul>	<p><b>Digital Weighing Card:</b> "This project is therefore seeking to provide a digital copy of every child weighing card, such that, it can be accessed via mobile phone whenever needed and updated by Community health Workers at any point in time." [12]</p>
<p><b>1.5 CITIZEN BASED REPORTING</b></p> <p>Digital platforms, including social media, that enable clients to report on public health events, as well as experiences, issues, and satisfaction with health services.</p>	<p><b>1.4.2 SELF MONITORING OF HEALTH OR DIAGNOSTIC DATA BY CLIENT</b></p> <ul style="list-style-type: none"> <li>- PERSONAL HEALTH MONITORING, SELF-TRACKING SELF-CARE, SELF-MONITORING</li> <li>- SENSORS AND WEARABLES FOR PERSONAL HEALTH MONITORING</li> <li>- CLIENT'S HEALTH DATA IS COLLECTED BASED ON A MACHINE A CLIENT USES ON THEIR OWN</li> </ul> <p><b>1.4.3 ACTIVE DATA CAPTURE/ DOCUMENTATION BY CLIENT</b></p> <ul style="list-style-type: none"> <li>- PERSONAL HEALTH MONITORING, SELF-TRACKING SELF-CARE, SELF-MONITORING, JOURNALING; CAPTURE PATIENT ORIGINATED DATA, CLIENT DOCUMENTATION OF HEALTH STATUS AND ACTIVITIES</li> </ul> <p><b>1.5.1 REPORTING OF HEALTH SYSTEM FEEDBACK BY CLIENTS</b></p> <ul style="list-style-type: none"> <li>- PUBLIC REPORTING ON HEALTH SYSTEM ISSUES, SUCH AS THE AVAILABILITY AND QUALITY OF SERVICES RECEIVED, INTERACTION WITH HEALTH WORKER, SATISFACTION WITH SERVICES</li> <li>- ACCOUNTABILITY MONITORING, ACCOUNTABILITY REPORTING</li> <li>- CROWDSOURCED FEEDBACK, PATIENT/CLIENT FEEDBACK, QUALITY OF CARE FEEDBACK</li> </ul> <p><b>1.5.2 REPORTING OF PUBLIC HEALTH EVENTS BY CLIENTS</b></p> <ul style="list-style-type: none"> <li>- SURVEILLANCE NOTIFICATION, DISEASE NOTIFICATION, CLIENT REPORTING</li> </ul>	<p><b>Wearables and fitness trackers:</b> "...tracks every part of your day—including activity, exercise, food, weight and sleep." [13]</p> <p><b>Medopad Patient Monitoring:</b> "...you can monitor vital signs, log symptoms, share information with your care providers and more." [14]</p> <p><b>CycleTel Humsafar:</b> "...she enters the date of her last period and the service informs her of her fertile days during the cycle. She receives alerts on her "unsafe days" throughout the month." [8]</p> <p><b>U-Report:</b> "Youth can send alerts to key stakeholders about the issues being faced in their communities, and feeds back useful information to the U-Reporters." [8]</p> <p><b>MomConnect:</b> "Allow women to engage with the health system through help desk tools and feedback services." [8]</p> <p><b>EbolaTXT:</b> "Citizens can report suspected Ebola cases via SMS." [8]</p>
<p><b>1.6 ON DEMAND INFORMATION SERVICES TO CLIENTS</b></p> <p>Health information accessible to the general public triggered by the client. This could be available via websites, helplines, USSD/ SMS menus, or client applications, among other channels, that may inform decision-making.</p>	<p><b>1.6.1 CLIENT LOOK-UP OF HEALTH INFORMATION</b></p> <ul style="list-style-type: none"> <li>- CLIENT SEARCHES OR LOOKS UP INFORMATION ON A HEALTH TOPIC</li> <li>- DECISION SUPPORT FOR CLIENTS</li> </ul>	<p><b>Hesperian Health Wiki:</b> "An online source of clear, actionable, and thorough health information accessible via computer or mobile device." [8]</p> <p><b>EngageTB:</b> "The software enables clients do TB self-screening and access the basic health information related to TB via short messages (SMS) through their phones by sending a code word "TB" to a network neutral toll free short code, and a list of health facilities that have the capability to conduct laboratory tests to confirm TB." [8]</p> <p><b>m4RH:</b> "A set of text messages on family planning methods that users in can access via their mobile phones." [8]</p>
<p><b>1.7 CLIENT FINANCIAL TRANSACTIONS</b></p> <p>Digital approaches to facilitate financial transactions for clients. These digital financial transactions can be used to facilitate conditional cash transfers and payments related to health service delivery.</p>	<p><b>1.7.1 TRANSMIT OR MANAGE OUT OF POCKET PAYMENTS BY CLIENT</b></p> <ul style="list-style-type: none"> <li>- MOBILE MONEY PAYMENTS DIRECTLY MADE BY CLIENT (THIS CAN INCLUDE PAYMENTS FOR ANY HEALTH SERVICES SUCH AS EMERGENCY TRANSPORTATION, HEALTH FEES, ETC)</li> </ul> <p><b>1.7.2 TRANSMIT OR MANAGE VOUCHERS TO CLIENT FOR HEALTH SERVICES</b></p> <ul style="list-style-type: none"> <li>- HEALTH VOUCHER ISSUANCE (E.G. FOR MOSQUITO NETS, FOR TRANSPORT, ETC) AND REDEMPTION SERVICES</li> </ul> <p><b>1.7.3 TRANSMIT OR MANAGE INCENTIVES TO CLIENTS FOR HEALTH SERVICES</b></p> <ul style="list-style-type: none"> <li>- CASH TRANSFERS TO CLIENTS CONDITIONAL ON HEALTH RELATED BEHAVIOURS</li> </ul>	<p><b>mHealth for Safer Deliveries:</b> "use mobile banking instead of cash to pay for transportation to the health facility when the woman is in labor or in case of complications." [8]</p> <p><b>Changamika Maternal Health SmartCard:</b> "The maternal health smartcard is a pre-paid card that allows the bearer to obtain antenatal, delivery, and postnatal services at listed prices in participating maternity facilities." [8]</p> <p><b>Mobile Finance to Reimburse Sexual and Reproductive Vouchers:</b> "Voucher programs transmit SMS money transfer to reimburse social franchise service providers for FP services to clients." [8]</p> <p><b>Airtel Insurance with MicroEnsure:</b> "Airtel rewards loyal customers (who registered for the product by dialing a shortcode) with free insurance as long as they spent a minimum amount of airtime...through monthly SMS communication." [8]</p> <p><b>Tanzania National eVoucher Scheme:</b> "Web platform that allows clinic workers to issue vouchers for long-lasting insecticide-treated nets, redeemed at nearby retailers." [8]</p> <p><b>Interactive Alerts/Zindagi Mehfooz:</b> "A vaccine registry system that uses SMS reminders to caregivers and conditional cash transfers to caregivers ... The amount of cash the caregiver is eligible to win increases with each subsequent vaccine their child completes." [8]</p>



# 2.0 HEALTHCARE PROVIDERS

<p><b>2.1</b> <b>CLIENT IDENTIFICATION AND REGISTRATION</b> Client identity verification and enrollment into health services.</p>	<p><b>2.1.1</b> VERIFY CLIENT UNIQUE IDENTITY</p> <p><b>2.1.2</b> ENROL CLIENT FOR HEALTH SERVICES/ CLINICAL CARE PLAN</p> <p><b>2.2.1</b> LONGITUDINAL TRACKING OF CLIENTS' HEALTH STATUS AND SERVICES</p> <p><b>2.2.2</b> MANAGE CLIENT'S STRUCTURED CLINICAL RECORDS</p> <p><b>2.2.3</b> MANAGE CLIENT'S UNSTRUCTURED CLINICAL RECORDS (E.G., NOTES, IMAGES, DOCUMENTS)</p> <p><b>2.2.4</b> ROUTINE HEALTH INDICATOR DATA COLLECTION AND MANAGEMENT</p>	<ul style="list-style-type: none"> <li>- BIOMETRICS, CLIENT REGISTRY</li> <li>- REGISTER CLIENT/PATIENT FOR HEALTH SERVICES</li> <li>- DOMAIN-SPECIFIC REGISTERS; EREGISTRIES; EREGISTER, DIGITAL REGISTER, DIGITAL SERVICE RECORD, IMMUNIZATION REGISTRY</li> <li>- DIGITIZED REGISTERS FOR LONGITUDINAL HEALTH PROGRAM, INCLUDING TRACKING OF MIGRANT POPULATIONS' BENEFITS AND HEALTH STATUS</li> <li>- CASE MANAGEMENT LOGS WITHIN SPECIFIC TARGET POPULATIONS, INCLUDING MIGRANT POPULATIONS</li> <li>- CLINICAL RECORD OF AN INDIVIDUAL WITH INFORMATION THAT SPANS ACROSS MULTIPLE CLINICAL DOMAINS.</li> <li>- ELECTRONIC MEDICAL RECORD, PERSONAL HEALTH RECORD</li> <li>- ELECTRONIC MEDICAL RECORD AND PERSONAL HEALTH RECORDS WITH THAT ARE NOT BASED ON STRUCTURED DATA, AND INSTEAD INCLUDING NOTES, IMAGES, DOCUMENTS</li> <li>- DATA COLLECTION FOR HEALTH MANAGEMENT INFORMATION SYSTEM (HMIS)</li> <li>- CLIENT HEALTH DATA COLLECTION</li> <li>- CLINICAL DECISION SUPPORT, JOB AID--LINKED TO CLIENTS DIGITAL HEALTH RECORD</li> <li>- PROVISION OF ALERTS FOR ABNORMAL FINDINGS/LAB VALUES, "IF THEN STATEMENTS,"</li> <li>- PROCESS ALGORITHMS TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> <li>- JOB AID AND ASSESSMENT TOOLS TO SUPPORT SERVICE DELIVERY --MAY OR MAY NOT BE LINKED TO A DIGITAL HEALTH RECORD</li> <li>- DECISION TREES TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> <li>- TOOLS FOR SCREENING, RISK ASSESSMENT, TRIAGE AND CLIENT PRIORITIZATION;</li> <li>- JOB AID TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> </ul>	<p><b>MP3 Youth:</b> "Participant's biometrics are collected using Mobyotics, a smartphone-based system for identification and follow-up at the different service delivery point." [8]</p> <p><b>eCompliance:</b> "A portable biometric identification system operated by CHWs that is capable of identifying patients by their fingerprint and compiling patient adherence data for tuberculosis drug treatment (DOTs)." [8]</p> <p><b>MomConnect:</b> "Register each pregnancy at a government health facility..." [8]</p> <p><b>iCOMM:</b> "The first component of the iCCM application captures all elements of the village register used by the HSA. The application has built-in functionalities that support HSAs to register children between the ages of two and 59 months only and adhere to standard protocols." [8]</p> <p><b>mTIKA:</b> "...allows the health worker to digitally register children, track their immunization records, connect with nonadherent families before vaccination sessions end." [8]</p> <p><b>MobyApp:</b> "Each pregnant woman starting ANC, regardless of HIV status, is registered into a phone-based electronic record. This phone-based app is then used to prompt the nurse to provide (and record) a step by-step assessment of the mother and record all findings in the mother's health record." [8]</p> <p><b>CommCare Mobile Job Aid for Sahiyas:</b> "...electronic data collection to track and support the registration, follow-up, and completion of care for pregnant women, postpartum mothers, and children up to the age of two years." [8]</p> <p><b>OpenSmart Register Platform (OpenSRP):</b> "a client registry for enumeration and managing continuity of care..." [8]</p> <p><b>District Health Information Systems 2 (DHIS2) Tracker:</b> "...lets you store information about individuals and track these persons over time using a flexible set of identifiers." [15]</p> <p><b>OpenMedical Record System (OpenMRS):</b> "...a software platform and a reference application which enables design of a customized medical records system." [16]</p> <p><b>Epic Systems:</b> "...provide a full picture of health and membership information for your members and a secure web portal for providers to interact with and view managed care information." [17]</p> <p><b>Unpublished example:</b> Records are unstructured and designed to be readable by people rather than machine readable, distinct from structured medical records which are coded in question/answer format.</p> <p><b>Catholic Relief Services (CRS) Senegal [CommCare] mHealth Pilot:</b> "The app was developed to collect data on childhood illnesses and manage child diarrhea cases that is accessible via a central database." [8]</p> <p><b>SEDA Automated Health Data Exchange System (SEDA):</b> "Data [facility-level indicators] are aggregated in a web-based central system to visualize and manage decision support. Aggregate-level data reported into the mobile system from health facilities are automatically uploaded into DHIS2 once validated." [8]</p> <p><b>DHIS2:</b> "...used as national health information systems for data management and analysis purposes, for health program monitoring and evaluation." [15]</p> <p><b>Catholic Relief Services (CRS) Senegal [CommCare] mHealth Pilot:</b> "The app could provide appropriate messaging and steps for CHWs to increase the quality of health services or reference to the next level health post." [8]</p> <p><b>ePartogram:</b> "The application uses validated clinical algorithms based on WHO guidelines to alert providers when critical observations need to be made and if they are abnormal." [8]</p> <p><b>Mobile App for Management of HIV in Pregnancy:</b> "Clinical and administrative flags are generated on both patient-specific and clinic population-specific bases for missed appointments, concerning laboratory analysis values, and missing information." [8]</p> <p><b>cIMCI:</b> "HSAs are guided step by step through the process of registering sick children, listening to their complaints, performing an examination, delivering diagnosis, and administering treatment..." [8]</p> <p><b>ASHA-Links:</b> "The application included a decision tree to guide ASHAs through assessments and a combination of text prompts, audio recordings, and images to assist in identifying, managing, and referring complications." [8]</p> <p><b>OpenSRP:</b> "...contains electronic forms with embedded logic and decision-support, including checklists and algorithms for risk assessment." [8]</p> <p><b>Emergency Triage Assessment and Treatment (ETAT):</b> "Using the app with the ETAT protocol, health workers scan through the queues at the health centers assessing each child's for the level of acuity and identifying children who need immediate assessment." [8]</p> <p><b>ePartogram:</b> "...syncs data within a facility and automatically prioritizes laboring clients based on clinical algorithms, helping supervisors allocate staffing appropriately."</p> <p><b>CommCare Mobile Job Aid for Sahiyas:</b> "It is built on a complex decision-and logic-processing platform that can support these CHWs to deliver timely services." [8]</p>
<p><b>2.2</b> <b>CLIENT HEALTH RECORDS</b> Digitized record used to capture, store, access and share health information on a client or grouping of clients [2].</p> <p><b>2.3</b> <b>HEALTHCARE PROVIDER DECISION SUPPORT</b> Digitized job aids that combine an individual's health information with the health-care provider's knowledge and clinical protocols in order to assist health-care providers in making diagnosis and treatment decisions [2].</p>	<p><b>2.3.1</b> PROVIDE PROMPTS AND ALERTS BASED ACCORDING TO PROTOCOL</p> <p><b>2.3.2</b> PROVIDE CHECKLIST ACCORDING TO PROTOCOL</p> <p><b>2.3.3</b> SCREEN CLIENTS BY RISK OR OTHER HEALTH STATUS</p>	<ul style="list-style-type: none"> <li>- CLINICAL DECISION SUPPORT, JOB AID--LINKED TO CLIENTS DIGITAL HEALTH RECORD</li> <li>- PROVISION OF ALERTS FOR ABNORMAL FINDINGS/LAB VALUES, "IF THEN STATEMENTS,"</li> <li>- PROCESS ALGORITHMS TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> <li>- JOB AID AND ASSESSMENT TOOLS TO SUPPORT SERVICE DELIVERY --MAY OR MAY NOT BE LINKED TO A DIGITAL HEALTH RECORD</li> <li>- DECISION TREES TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> <li>- TOOLS FOR SCREENING, RISK ASSESSMENT, TRIAGE AND CLIENT PRIORITIZATION;</li> <li>- JOB AID TO SUPPORT SERVICE DELIVERY ACCORDING TO CARE PLANS, GUIDELINES, AND PROTOCOLS</li> </ul>	<p><b>MP3 Youth:</b> "Participant's biometrics are collected using Mobyotics, a smartphone-based system for identification and follow-up at the different service delivery point." 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This phone-based app is then used to prompt the nurse to provide (and record) a step by-step assessment of the mother and record all findings in the mother's health record." [8]</p> <p><b>CommCare Mobile Job Aid for Sahiyas:</b> "...electronic data collection to track and support the registration, follow-up, and completion of care for pregnant women, postpartum mothers, and children up to the age of two years." [8]</p> <p><b>OpenSmart Register Platform (OpenSRP):</b> "a client registry for enumeration and managing continuity of care..." [8]</p> <p><b>District Health Information Systems 2 (DHIS2) Tracker:</b> "...lets you store information about individuals and track these persons over time using a flexible set of identifiers." [15]</p> <p><b>OpenMedical Record System (OpenMRS):</b> "...a software platform and a reference application which enables design of a customized medical records system." [16]</p> <p><b>Epic Systems:</b> "...provide a full picture of health and membership information for your members and a secure web portal for providers to interact with and view managed care information." [17]</p> <p><b>Unpublished example:</b> Records are unstructured and designed to be readable by people rather than machine readable, distinct from structured medical records which are coded in question/answer format.</p> <p><b>Catholic Relief Services (CRS) Senegal [CommCare] mHealth Pilot:</b> "The app was developed to collect data on childhood illnesses and manage child diarrhea cases that is accessible via a central database." [8]</p> <p><b>SEDA Automated Health Data Exchange System (SEDA):</b> "Data [facility-level indicators] are aggregated in a web-based central system to visualize and manage decision support. Aggregate-level data reported into the mobile system from health facilities are automatically uploaded into DHIS2 once validated." [8]</p> <p><b>DHIS2:</b> "...used as national health information systems for data management and analysis purposes, for health program monitoring and evaluation." [15]</p> <p><b>Catholic Relief Services (CRS) Senegal [CommCare] mHealth Pilot:</b> "The app could provide appropriate messaging and steps for CHWs to increase the quality of health services or reference to the next level health post." [8]</p> <p><b>ePartogram:</b> "The application uses validated clinical algorithms based on WHO guidelines to alert providers when critical observations need to be made and if they are abnormal." [8]</p> <p><b>Mobile App for Management of HIV in Pregnancy:</b> "Clinical and administrative flags are generated on both patient-specific and clinic population-specific bases for missed appointments, concerning laboratory analysis values, and missing information." [8]</p> <p><b>cIMCI:</b> "HSAs are guided step by step through the process of registering sick children, listening to their complaints, performing an examination, delivering diagnosis, and administering treatment..." [8]</p> <p><b>ASHA-Links:</b> "The application included a decision tree to guide ASHAs through assessments and a combination of text prompts, audio recordings, and images to assist in identifying, managing, and referring complications." [8]</p> <p><b>OpenSRP:</b> "...contains electronic forms with embedded logic and decision-support, including checklists and algorithms for risk assessment." [8]</p> <p><b>Emergency Triage Assessment and Treatment (ETAT):</b> "Using the app with the ETAT protocol, health workers scan through the queues at the health centers assessing each child's for the level of acuity and identifying children who need immediate assessment." [8]</p> <p><b>ePartogram:</b> "...syncs data within a facility and automatically prioritizes laboring clients based on clinical algorithms, helping supervisors allocate staffing appropriately."</p> <p><b>CommCare Mobile Job Aid for Sahiyas:</b> "It is built on a complex decision-and logic-processing platform that can support these CHWs to deliver timely services." [8]</p>

<p><b>2.4</b> <b>TELEMEDICINE</b></p> <p>Provision of health-care services at a distance [2]. The delivery of health care services, where patients and providers are separated by distance [3].</p>	<p><b>2.4.1</b> CONSULTATIONS BETWEEN REMOTE CLIENT AND HEALTHCARE PROVIDER</p> <ul style="list-style-type: none"> <li>- REMOTE CONSULTATION, TELE CONSULTATION, CLIENT BASED TELEMEDICINE, HOTLINES, CALL CENTERS, HELPLINE</li> <li>- REAL-TIME TELEMEDICINE, INTERACTIVE TELEMEDICINE, SYNCHRONOUS TELEMEDICINE</li> <li>- CLIENT CALLS A HEALTH WORKER OR HOTLINE TO RECEIVE CLINICAL GUIDANCE ON HEALTH ISSUE</li> </ul> <p><b>2.4.2</b> REMOTE MONITORING OF CLIENT HEALTH OR DIAGNOSTIC DATA BY PROVIDER</p> <ul style="list-style-type: none"> <li>- TELEMONITORING, VIRTUAL MONITORING.</li> <li>- PROVIDER IS ABLE TO MONITOR CLIENT'S HEALTH THROUGH AN IMPLANTED SENSOR/DIAGNOSTIC EQUIPMENT.</li> </ul> <p><b>2.4.3</b> TRANSMISSION OF MEDICAL DATA (E.G. IMAGES, NOTES, AND VIDEOS) TO HEALTHCARE PROVIDER</p> <ul style="list-style-type: none"> <li>- STORE AND FORWARD</li> <li>- ASYNCHRONOUS TELEMEDICINE</li> </ul> <p><b>2.4.4</b> CONSULTATIONS FOR CASE MANAGEMENT BETWEEN HEALTHCARE PROVIDERS</p> <ul style="list-style-type: none"> <li>- INTER-PROVIDER COMMUNICATION, CLOSED USER-GROUP, HEALTH, HEALTH WORKER TO HEALTH WORKER COMMUNICATION.</li> <li>- CONSULTING OTHER HEALTH CARE PROVIDERS, PARTICULARLY SPECIALISTS, FOR PATIENT CASE MANAGEMENT; SEEKING SECOND OPINION FOR PATIENT CASE MANAGEMENT</li> </ul> <p><b>2.5.1</b> COMMUNICATION FROM HEALTHCARE PROVIDER(S) TO SUPERVISOR</p> <p><b>2.5.2</b> COMMUNICATION AND PERFORMANCE FEEDBACK TO HEALTHCARE PROVIDER(S)</p> <ul style="list-style-type: none"> <li>- SUPPORTIVE SUPERVISION, COACHING/MENTORING, AUDIT AND FEEDBACK</li> <li>- COMMUNICATION TO HEALTHCARE PROVIDER BASED ON THEIR PERFORMANCE</li> </ul> <p><b>2.5.3</b> TRANSMIT ROUTINE NEWS AND WORKFLOW NOTIFICATIONS TO HEALTHCARE PROVIDER(S)</p> <ul style="list-style-type: none"> <li>- ALERTS AND REMINDERS TO HEALTHCARE PROVIDER</li> <li>- MOTIVATIONAL COMMUNICATION HEALTHCARE PROVIDER</li> <li>- TRANSMISSION OF WORKFLOW UPDATES TO HEALTHCARE PROVIDER</li> </ul> <p><b>2.5.4</b> TRANSMIT NON-ROUTINE HEALTH EVENT ALERTS TO HEALTHCARE PROVIDER(S)</p> <ul style="list-style-type: none"> <li>- PUBLIC HEALTH RELATED UPDATES TO HEALTH WORKERS</li> <li>- EMERGENCY ALERTS TO HEALTHCARE PROVIDERS</li> <li>- MASS MESSAGING TO HEALTHCARE PROVIDERS</li> </ul> <p><b>2.5.5</b> PEER GROUP FOR HEALTHCARE PROVIDERS</p> <ul style="list-style-type: none"> <li>- PEER SUPPORT, PEER LEARNING, CLOSED USER GROUPS</li> <li>- COMMUNICATION MECHANISMS FOR HEALTHCARE PROVIDERS TO DISCUSS AMONG THEMSELVES</li> </ul> <p><b>2.6.1</b> COORDINATE EMERGENCY RESPONSE AND TRANSPORT</p> <ul style="list-style-type: none"> <li>- AMBULANCE SYSTEMS, EMERGENCY RESPONSE MANAGEMENT</li> <li>- CARE COORDINATION</li> </ul> <p><b>2.6.2</b> MANAGE REFERRALS BETWEEN POINTS OF SERVICE WITHIN HEALTH SECTOR</p> <ul style="list-style-type: none"> <li>- CLINICAL TASK LINKING</li> <li>- REFERRAL MANAGEMENT</li> </ul> <p><b>2.6.3</b> MANAGE REFERRALS BETWEEN HEALTH AND OTHER SECTORS (SOCIAL SERVICES, POLICE, JUSTICE, ECONOMIC SUPPORT SCHEMES)</p> <ul style="list-style-type: none"> <li>- INTERSECTORAL REFERRAL MANAGEMENT</li> </ul>
<p><b>2.5</b> <b>HEALTHCARE PROVIDER COMMUNICATION</b></p> <p>Communication and transmission of information among healthcare providers, supervisors, and health system managers.</p>	<p><b>VillageReach Chipatala cha pa Foni (CCPP):</b> "A toll-free health hotline that is staffed by trained health workers who provide information, advice and referrals over the phone." [8]</p> <p><b>Ligne Verte:</b> "By dialing a toll-free number, callers speak to a trained educator and get accurate information about birth spacing, the correct use of family planning methods, how to avoid unwanted pregnancies, and locating the nearest partner clinic." [8]</p> <p><b>Body Sensor Networks for Mobile Health Monitoring:</b> "...patients' biosignals are measured by means of body worn sensors which communicate wirelessly with a handheld device. Alarms and biosignals can be transmitted over wireless communication links to a remote location, and a remote health professional can view the biosignals via a web application." [18]</p> <p><b>Africa Teledermatology Project:</b> "The Africa Teledermatology Project operates in six African countries, using cameras and laptop PCs to capture and send images of patients to specialists in other African countries, Austria and the United States providing diagnostic and treatment support: local physicians, dermatologists, and health care workers in hospitals and clinics in underserved regions." [19]</p> <p><b>Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC):</b> "Information collected in the mobile phones is uploaded to OpenMRS. A specialist in remote locations sends the recommendation through SMS." [8]</p> <p><b>Peek Vision:</b> "A health worker with minimal training can use Peek to gather detailed clinical information. Images are graded and patients diagnosed, either through an automated process, or via cascading of digital images to a network of experts around the world." [8]</p> <p><b>mHERO:</b> "...a two-way, mobile phone-based communication system that uses basic text: messaging, or SMS, to connect ministries of health and health workers." [8]</p> <p><b>Health Enablement and Learning Platform (HELP):</b> "...includes a group chat feature which allows CHWs to share knowledge and communicate directly with supervisors, and a toll-free help desk enables end-users to access support when they need it." [8]</p> <p><b>CommCare for performance feedback in Madhya Pradesh:</b> "To communicate detailed performance feedback, we set up a call center, placing weekly calls to the community nutrition experts and relaying feedback on performance metrics. Phone calls provided a way to discuss and receive feedback from the community nutrition experts regarding any work-related issues, personal needs, or technical difficulties..." [20]</p> <p><b>eLMIS Bangladesh:</b> "This system generates SMS alerts, sent in the name of the Ministry of Health and Family Welfare (MOHFW)/ Procurement and Logistics Management Cell (PLMC) for action reminder - time to report; tracking report submission against timeline; and alerts for potential stock imbalance/stock out of FP commodities." [8]</p> <p><b>Text message reminders to Kenyan health workers:</b> "...a one-way communication of text: message reminders about paediatric malaria case management sent to health workers' personal mobile phones. All health workers doing outpatient consultations in the intervention group received text messages about malaria case-management for 6 months." [21]</p> <p><b>mHERO:</b> "...a two-way, mobile phone-based communication system that uses basic text: messaging, or SMS, to connect ministries of health and health workers to communicate critical messages to health workers during a crisis or emergency response." [8]</p> <p><b>Health Enablement and Learning Platform (HELP):</b> "...includes a group chat feature which allows CHWs to share knowledge and communicate directly with supervisors, and a toll-free help desk enables end-users to access support when they need it." [8]</p> <p><b>mHealth for Safer Deliveries:</b> "...use text or voice communication to notify a health facility that a woman is in transit to ensure the facility is prepared." [8]</p> <p><b>Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC):</b> "CHWs can communicate with the specialists through open Medical Record System (OpenMRS) and refer patients for treatment in a timely manner." [8]</p> <p><b>ePartogram:</b> "It also strengthens the referral pathway between peripheral and referral facilities by enabling electronic transmission of data between facilities..." [8]</p> <p><b>Unnamed project:</b> Referrals do not only take place within the health sector, but also between the health sector and other non-health services. For example in cases of gender-based violence referrals may be made between social services, police, justice services and health services. In cases of traffic crashes referrals are needed between police, emergency services and health services. In cases of malnutrition referrals may be needed between health and food support services. In cases where health and poverty and closely inter-related, referrals may be needed between economic strengthening, social services and health services. Digital systems may provide features for supporting and tracking these referrals.</p>
<p><b>2.6</b> <b>REFERRAL COORDINATION</b></p> <p>Digital approaches to support communication and coordination mechanisms to facilitate referrals, both within the health sector and to other health-related sectors</p>	<p><b>mHealth for Safer Deliveries:</b> "...use text or voice communication to notify a health facility that a woman is in transit to ensure the facility is prepared." [8]</p> <p><b>Mobile-based Early Detection and Prevention of Oral Cancer (mEPOC):</b> "CHWs can communicate with the specialists through open Medical Record System (OpenMRS) and refer patients for treatment in a timely manner." [8]</p> <p><b>ePartogram:</b> "It also strengthens the referral pathway between peripheral and referral facilities by enabling electronic transmission of data between facilities..." [8]</p> <p><b>Unnamed project:</b> Referrals do not only take place within the health sector, but also between the health sector and other non-health services. For example in cases of gender-based violence referrals may be made between social services, police, justice services and health services. In cases of traffic crashes referrals are needed between police, emergency services and health services. In cases of malnutrition referrals may be needed between health and food support services. In cases where health and poverty and closely inter-related, referrals may be needed between economic strengthening, social services and health services. Digital systems may provide features for supporting and tracking these referrals.</p>

<p><b>2.7 SCHEDULING AND ACTIVITY PLANNING FOR HEALTHCARE PROVIDERS</b></p> <p>Automated scheduling and planning tools to assist in prioritizing provider follow-up. Digital work planning and scheduling tools can take the form of reminders to healthcare providers on upcoming/overdue services and other mechanisms to flag clients that need to be prioritized for service delivery [4].</p>	<p><b>2.7.1 SCHEDULE CLIENT APPOINTMENTS BASED ON CLINICAL CARE PLAN</b></p> <ul style="list-style-type: none"> <li>- AUTOMATED SCHEDULING OF CLIENT'S HEALTH APPOINTMENTS</li> </ul> <p><b>2.7.2 SCHEDULE HEALTHCARE PROVIDER'S ACTIVITIES</b></p> <ul style="list-style-type: none"> <li>- WORK PLANNING</li> <li>- PRIORITIZATION OF DAILY ACTIVITIES/TASKS</li> <li>- TASK MANAGEMENT</li> </ul>	<p><b>OpenSRP:</b> "The platform integrates scheduling and service reminder tools..." [8]</p> <p><b>mCARE:</b> "...integrated mobile phone and server-based software system for CHWs that helps them to digitally manage their daily workflow." [8]</p> <p><b>CommCare for home-based care:</b> "...provides CHWs a checklist of activities which are expected to be performed during each home visit, as well as reminders of appointments." [8]</p>
<p><b>2.8 HEALTHCARE PROVIDER TRAINING</b></p> <p>The management and provision of education and training content in electronic form for health professionals [2]. In contrast to decision support, healthcare provider training does not need to be used at the point of care.</p>	<p><b>2.8.1 PROVIDE TRAINING CONTENT AND REFERENCE MATERIAL TO HEALTHCARE PROVIDER(S)</b></p> <ul style="list-style-type: none"> <li>- MLEARNING, ELEARNING, VIRTUAL LEARNING</li> <li>- EDUCATIONAL VIDEOS, MULTIMEDIA LEARNING AND ACCESS TO CLINICAL GUIDANCE</li> <li>- TRAINING REINFORCEMENT AND REFRESHERS</li> </ul> <p><b>2.8.2 ASSESS CAPACITY OF HEALTHCARE PROVIDER(S)</b></p> <ul style="list-style-type: none"> <li>- QUIZZES AND AND INTERACTIVE EXERCISES TO ASSESS KNOWLEDGE AND COMPETENCE</li> </ul>	<p><b>Projecting Health:</b> "Frontline healthcare workers are equipped with educational videos for conducting video screenings and leading group discussions on issues raised in the videos." [8]</p> <p><b>iDEA: Interactive Distance Education Application:</b> "Providing health workers with mobile-based video instruction and reference materials..." [8]</p> <p><b>Safe Delivery App:</b> "The App contains three animated clinical instruction films...can also be used as a reference tool during clinical work..." [8]</p> <p><b>OppiaMobile:</b> "...mobile learning platform for delivering learning content, video, and quizzes." [8]</p> <p><b>Mobile Academy:</b> "...an interactive voice response (IVR) training course designed to refresh CHWs' knowledge of simple steps families can take to improve the health of mothers and babies, and to improve their ability to clearly communicate them." [8]</p> <p><b>Safe Delivery App:</b> "The App features push messages with quiz questions spurring the health worker to use the application to update their knowledge." [8]</p>
<p><b>2.9 PRESCRIPTION AND MEDICATION MANAGEMENT</b></p> <p>Digital approaches to facilitate the management of prescriptions, including tracking prescription orders and monitoring physical consumption of medication.</p>	<p><b>2.9.1 TRANSMIT OR TRACK PRESCRIPTION ORDERS</b></p> <ul style="list-style-type: none"> <li>- TRACKING MEDICATION ORDERS</li> <li>- TOOLS TO PLACE PRESCRIPTION ORDERS OR TRACK THE STATUS OF PRESCRIPTIONS AND REFILLS</li> </ul> <p><b>2.9.2 TRACK CLIENT'S MEDICATION CONSUMPTION</b></p> <ul style="list-style-type: none"> <li>- MONITORING ADHERENCE TO MEDICATIONS AND DRUGS</li> <li>- MONITORING/OBSERVING WHETHER PATIENTS HAVE TAKEN THEIR PRESCRIBED MEDICATIONS</li> </ul> <p><b>2.9.3 REPORT ADVERSE DRUG EVENTS</b></p> <ul style="list-style-type: none"> <li>- REPORTING CONTRAINDICATIONS, DRUG INTERACTIONS, ADVERSE EFFECTS</li> </ul>	<p><b>Bahmni:</b> "Pharmacy management enables a healthcare facility to effectively dispense medications to patients, monitor &amp; manage stock and suppliers and in billing and accounting for drugs and services." [22]</p> <p><b>SIMPill® Medication Adherences Solution:</b> "When the patient opens his bottle of medication, an automatic SMS message is sent from the bottle's SIM card to the patient's health facility, which records that the medication has been taken." [8]</p> <p><b>Texting-based reporting of adverse drug reactions to ensure patient safety:</b> "Text messages received by any of the three mobile phone companies were directed to a central system. The system was accessible 24 hours a day and 7 days a week and was configured to set an alert if there was a cluster of similar adverse drug reactions (ADRs) from one or more drugs or one drug repeatedly reported for several ADRs entering the system." [23]</p> <p><b>Project Mwana-SMS for Early Infant Diagnosis of HIV:</b> "When test results are ready, the central SMS system sends a message alerting the clinic workers." [8]</p>
<p><b>2.10 LABORATORY AND DIAGNOSTICS IMAGING MANAGEMENT</b></p> <p>Digital approaches to manage and exchange laboratory and diagnostic orders and results.</p>	<p><b>2.10.1 TRANSMIT CLIENT DIAGNOSTIC RESULT TO HEALTHCARE PROVIDER</b></p> <ul style="list-style-type: none"> <li>- LABORATORY RESULTS MANAGEMENT</li> <li>- TESTS RESULTS COMMUNICATION BETWEEN HEALTHCARE PROVIDERS</li> </ul> <p><b>2.10.2 TRANSMIT AND TRACK DIAGNOSTIC ORDERS</b></p> <ul style="list-style-type: none"> <li>- LABORATORY TEST ACQUISITION AND MANAGEMENT</li> </ul> <p><b>2.10.3 CAPTURE DIAGNOSTIC RESULTS FROM DIGITAL DEVICES</b></p> <ul style="list-style-type: none"> <li>- POINT OF CARE DIAGNOSTICS</li> <li>- DIAGNOSTIC ACCESSORIES ADDED TO DIGITAL DEVICES</li> </ul> <p><b>2.10.4 TRACK BIOLOGICAL SPECIMENS</b></p> <ul style="list-style-type: none"> <li>- TRACKING OF BLOOD DONATIONS</li> </ul>	<p><b>Bahmni-OpenELIS:</b> "When a patient is registered in Bahmni using the registration module, the patient name and demographic information is synced automatically to the lab system. When the patient goes to the lab, the lab technician collecting the sample can look up the patient and add tests for that patient." [22]</p> <p><b>FloNet:</b> "...a mobile, in vitro diagnostic device that interprets commercially available RDTs for infectious diseases...; airFio is a secure cloud database that stores point-of-care data transmitted by Deki over local mobile phone networks." [8]</p> <p><b>GXAlert:</b> A system which attaches a 3G USB modem to GeneXpert machines and ensures real-time reporting of results to a centralized database." [8]</p> <p><b>Mobile Phone Microscopy for the diagnosis of Parasitic Worm Infections:</b> "Converts iPhone into a field microscope for point-of-care diagnosis of soil-transmitted helminths in school-aged children." [8]</p> <p><b>Unnamed example:</b> Biological products such as blood donations and specimens are collected, tested and transported to the point of use. Digital systems can support the identification and tracking of these products from the point of collection, through quality control procedures, to the point of use.</p>



## 3.0 HEALTH SYSTEM MANAGERS

<p><b>3.1 HUMAN RESOURCE MANAGEMENT</b></p> <p>Digital approaches to manage the health workforce, including the use of databases to record training levels, certifications, and identification of health workers.</p>	<p><b>3.1.1 LIST HEALTH WORKFORCE CADRES AND RELATED IDENTIFICATION INFORMATION</b></p> <ul style="list-style-type: none"> <li>- HEALTH WORKER REGISTRY; PROVIDER REGISTRY</li> <li>- DOCUMENTATION OF HEALTHCARE PROVIDERS' DEMOGRAPHICS, IDENTIFICATION, HEALTH FACILITY ASSIGNMENT, AND OTHER IDENTIFIER INFORMATION</li> </ul> <p><b>3.1.2 MONITOR PERFORMANCE OF HEALTHCARE PROVIDER(S)</b></p> <ul style="list-style-type: none"> <li>- REMOTE MONITORING OF HEALTHCARE PROVIDERS</li> <li>- WORKFORCE MANAGEMENT</li> <li>- AUDIT AND FEEDBACK</li> <li>- SUPERVISION, SUPPORTIVE SUPERVISION</li> <li>- CLINICAL TASK TRACKING</li> </ul> <p><b>3.1.3 MANAGE REGISTRATION/CERTIFICATION OF HEALTHCARE PROVIDER(S)</b></p> <ul style="list-style-type: none"> <li>- MANAGEMENT OF HEALTH WORKER REGISTRATION</li> <li>- CERTIFICATION OR LICENSURE WITH REGULATORY AUTHORITY SUCH AS A PROFESSIONAL COUNCIL</li> </ul> <p><b>3.1.4 RECORD TRAINING INFORMATION ON HEALTHCARE PROVIDER(S)</b></p> <ul style="list-style-type: none"> <li>- TRACK OR MANAGE PRESENCE AND/OR IN-SERVICE TRAINING RECEIVED BY A HEALTH WORKER</li> </ul>	<p><b>iHRIS Manage:</b> "... supports Ministry of Health and other service delivery organizations to track, manage, deploy, and map their health workforce." [24]</p> <p><b>iCCM:</b> The application includes a "routine supervision checklist on few key indicators of performance by the Health Surveillance Assistants (HSAs)...and a dashboard that enables users to see at a glance the status of the work being done by HSA." [8]</p> <p><b>Health Enablement and Learning Platform (HELP):</b> "Community Health Extension Workers (CHEWs) receive weekly reports on worker performance and are able to target those in need of additional support." [8]</p> <p><b>mHealth for Community-Based Family Planning Services:</b> "A system for the field team to monitor data and provide feedback to CHWs on a weekly basis..." [8]</p> <p><b>iHRIS Qualify:</b> "...enables a licensing or certification authority, such as a nursing council, to track complete data on a health worker cadre from pre-service training through attrition. It captures information about health professionals in that cadre from the time they enter pre-service training through registration, certification, and/or licensure." [24]</p> <p><b>iHRIS Train:</b> "Consolidates health worker training attendance and related data from several training organizations into a centralized database that can be queried and used to generate reports for further analysis." [24]</p>
<p><b>3.2 SUPPLY CHAIN MANAGEMENT</b></p> <p>Digital approaches for monitoring and reporting stock levels, consumption and distribution of medical commodities. This can include the use of communication systems (e.g. SMS) and data dashboards to manage and report on supply levels of medical commodities.</p>	<p><b>3.2.1 MANAGE INVENTORY AND DISTRIBUTION OF HEALTH COMMODITIES</b></p> <ul style="list-style-type: none"> <li>- STOCK MONITORING OF HEALTH COMMODITIES</li> <li>- LOGISTICS MANAGEMENT</li> <li>- STOCK MANAGEMENT</li> <li>- COMMODITY SECURITY</li> </ul> <p><b>3.2.2 NOTIFY STOCK LEVELS OF HEALTH COMMODITIES</b></p> <ul style="list-style-type: none"> <li>- STOCKOUT PREVENTION AND MONITORING</li> <li>- ALERTS AND NOTIFICATIONS OF STOCK LEVELS</li> <li>- RESTOCKING COORDINATION</li> </ul> <p><b>3.2.3 MONITOR COLD-CHAIN SENSITIVE COMMODITIES</b></p> <ul style="list-style-type: none"> <li>- SENSORS TO MONITOR TEMPERATURE AND STABILITY OF VACCINES</li> </ul> <p><b>3.2.4 REGISTER LICENSED DRUGS AND HEALTH COMMODITIES</b></p> <ul style="list-style-type: none"> <li>- DRUG REGULATION AND REGISTRATION</li> </ul> <p><b>3.2.5 MANAGE PROCUREMENT OF COMMODITIES</b></p> <ul style="list-style-type: none"> <li>- LOGISTICS MANAGEMENT</li> <li>- PROCUREMENT MANAGEMENT</li> </ul> <p><b>3.2.6 REPORT COUNTERFEIT OR SUBSTANDARD DRUGS BY CLIENTS</b></p> <ul style="list-style-type: none"> <li>- COUNTERFEIT DRUG NOTIFICATION</li> <li>- MONITORING DRUG AUTHENTICITY AND QUALITY</li> <li>- PHARMACOVIGILANCE</li> </ul>	<p><b>International Quality Short Messaging System (IQSMS):</b> "Healthcare workers send preformatted commodity reports on key HIV stock status to a central server via SMS. The tool enables districts to full order of all commodities as quantified by the system and based on what has been consumed." [8]</p> <p><b>eLMIS Bangladesh:</b> "...electronic Logistics Management Information System (eLMIS) collects data on consumption and availability of FP commodities, which is consolidated and entered for [viewing on] an interactive dashboard." [8]</p> <p><b>cStock:</b> "HSAs sent a toll-free SMS using their personal mobile phones reporting current stock levels and medicines received..." [8]</p> <p><b>iCCM:</b> "Health workers can report stock levels and then submitted the data to cStock, a program to improve the tracking of inventories..." [8]</p> <p><b>cStock:</b> "... automatically calculated resupply quantities and notified staff at health centers, who check their stock levels and advise HSAs whether stock was available for pick up or alerted health facilities and district managers that there was insufficient stock." [8]</p> <p><b>Informed Push Model:</b> "Logistics professionals enter logistics data into CommTrack on tablets at the moment of delivery, and CommTrack automatically calculates delivery quantities based on previous consumption." [8]</p> <p><b>Electronic Data Logging Thermometers:</b> "Continuous monitoring through data logging thermometers link with alarm capabilities and email notification." [25]</p> <p><b>Accredited Drug Dispensing Outlet (ADDO):</b> The app also includes "an SMS-based information exchange module, which allows ADDO and pharmacy personnel to send and receive information, for example, on accreditation requirements or drug recalls." [8]</p> <p><b>i-Import:</b> "An online platform to track all pharmaceutical import applications and approvals made by Ethiopia's pharmaceutical regulator...It also electronically integrates with procurement data from PFSA, the procurement and supply arm of the Ministry of Health." [26]</p> <p><b>mPedigree:</b> "...allows buyers to verify the authenticity of medicines for free by text messaging a unique scratch-off code found on the product to a universal number. This request is routed to mPedigree's servers and consumers receive a quick response to authenticate their purchase." [8]</p> <p><b>Mobile Product Authentication:</b> "Consumers send an SMS to the Sprolix server of a one-time-use scratch card code listed on the pharmaceutical products and receive reply SMS determining drug authenticity." [8]</p> <p><b>mSOS Ebola (KEMRI Laboratory module):</b> "Results on the laboratory confirmation of the patient serum samples were updated using the mSOS Ebola web portal, and text messages were automatically delivered to senior management and policy decisionmakers at the MOH." [8]</p> <p><b>GXAlert:</b> "Automatically send SMS text or email alerts to MOH officials when a new MDR positive or RfV positive case is detected." [8]</p>
<p><b>3.3 PUBLIC HEALTH EVENT NOTIFICATION</b></p> <p>Digital approaches for alerting and compiling information on non-routine public health events.</p>	<p><b>3.3.1 NOTIFICATION OF PUBLIC HEALTH EVENTS FROM POINT OF DIAGNOSIS</b></p> <ul style="list-style-type: none"> <li>- PUBLIC HEALTH SURVEILLANCE</li> <li>- SURVEILLANCE FROM LABORATORY SYSTEMS</li> <li>- DISEASE SURVEILLANCE</li> </ul>	

### 3.4 CIVIL REGISTRATION AND VITAL STATISTICS (CRVS)

Digital approaches to support the registration of births and deaths, issue birth and death certificates, and compile and disseminate vital statistics, including cause of death information [5].

3-4.1	NOTIFY BIRTH EVENT	- BIRTH EVENT ALERT	mTika: "Health Assistants can receive birth notifications from clients via SMS." [8]
3-4.2	REGISTER BIRTH EVENT	- BIRTH REGISTRATION (CAN INCLUDE REGISTRATION FOR HEALTH SYSTEM PURPOSES, AS WELL AS REGISTRATION TO CIVIL REGISTRAR)	<b>Mobile birth registration initiative in Tanzania:</b> "Health providers can register newborns by entering the child's information in a mobile phone application and sending it to a central database at the Registration, Insolvency and Trusteeship Agency (RITA), which is the Government Agency responsible for Birth Registration in Tanzania." [27]
3-4.3	CERTIFY BIRTH EVENT	- CIVIL REGISTRATION AND VITAL STATISTICS (CRVS) - ISSUANCE OF BIRTH CERTIFICATE	<b>Mobile birth registration initiative in Tanzania:</b> "Once health providers register the newborn with RITA, they can issue birth certificates to the child's parents at the same clinical visit." [27]
3-4.4	NOTIFY DEATH EVENT	- DEATH SURVEILLANCE - DEATH EVENT ALERT	<b>117 Call Alert System:</b> "The telephone number '117' could be used at no charge to the caller from any major mobile telecommunication network in the country. Calls were made to alert authorities of sick persons requiring isolation and Ebola testing (live alerts), and deaths from any cause (death alerts), which under national policy required safe and dignified burials performed by trained teams." [28]
3-4.5	REGISTER DEATH EVENT	- DEATH SURVEILLANCE; MORTALITY SURVEILLANCE	<b>MOVE-IT:</b> "Health workers can use SMS on mobile phones to notify a death event." [29]
3-4.6	CERTIFY DEATH EVENT	- ISSUANCE OF DEATH CERTIFICATE	<b>Innovative Mobile-phone Technology for Community Health Operation (ImTeCHO):</b> "Accredited Social Health Activists (ASHAs) can record infant deaths using a mobile phone application." [30]
3-5.1	REGISTER AND VERIFY CLIENT INSURANCE MEMBERSHIP	- ELIGIBILITY VERIFICATION FOR INSURANCE - DETERMINATION OF INSURANCE COVERAGE - RECORDING AND VERIFYING THAT A CLIENT IS A MEMBER OF A SCHEME OR ENTITLED TO BENEFITS - SOCIAL PROTECTION	<b>SmartVA system:</b> "Health care providers can collect and analyze verbal autopsy data using a mobile phone application." [31]
3-5.2	TRACK INSURANCE BILLING AND CLAIMS SUBMISSION	- SOCIAL PROTECTION, ADMINISTRATIVE TRANSACTION PROCESSING; CLAIMS MANAGEMENT	<b>mTIBA:</b> "Funds will be placed in specialized health wallets through M-Pesa and their use will be restricted to spending at healthcare providers who form part of a nationwide M-TIBA network...the treatment data is then checked by a medical person. If the treatment has been approved, Theresa's payment request is immediately accepted and the money is transferred to the healthcare provider." [32]
3-5.3	TRACK AND MANAGE INSURANCE REIMBURSEMENT	- CLAIMS AND ENCOUNTER REPORTS FOR REIMBURSEMENT - INSURANCE FINANCIAL TRANSACTIONS	<b>Ghanaian NHIA e-claims:</b> "The National Health Insurance Authority (NHIA) is introducing electronic payment of claims (e-claims) to 47 health care providers across the country to ease delays associated with payment of claims." [33]
3-5.4	TRANSMIT OR MANAGE ROUTINE PAYROLL PAYMENT TO HEALTHCARE PROVIDER(S)	- HEALTH WORKER ROUTINE PAYMENTS - PAYROLL MANAGEMENT	<b>Bahmni:</b> "Manage patient information across registration, point of care, investigations, and billing." [22]
3-5.5	TRANSMIT OR MANAGE INCENTIVES TO HEALTHCARE PROVIDER (S)	- FINANCIAL INCENTIVES FOR HEALTH WORKER MOTIVATION - CONDITIONAL PAYMENTS, PERFORMANCE-BASED FINANCING FOR HEALTH WORKERS, RESULTS BASED FINANCING	<b>Accredited Drug Dispensing Outlet (ADDO):</b> "The application included a mobile payment component for premises and personnel fees..." [8]
3-5.6	MANAGE BUDGET AND EXPENDITURES	- FINANCIAL MANAGEMENT - RESOURCE PLANNING	<b>mHealth for Community-Based Family Planning Services:</b> "...pay-for-performance system with monthly performance targets with real-time performance tracking on the CHW phone and program dashboard." [8]
3-6.1	MONITOR STATUS AND MAINTENANCE OF HEALTH EQUIPMENT	- LISTING OF AVAILABLE EQUIPMENT AND PHYSICAL ASSETS, E.G. HOSPITAL BEDS - TRACKING MAINTENANCE OF EQUIPMENT	<b>PlanRep:</b> "A planning and reporting database used by Local Government Authorities (LGAs) and designed to incorporate the Strategic Plan (Medium-Term Expenditure Framework), revenue projection, budgets, funds received, and track expenditure and physical implementation." [34]
3-6.2	TRACK REGULATION AND LICENSING OF MEDICAL EQUIPMENT	- PHYSICAL ASSET MANAGEMENT - REGULATION OF PHYSICAL ASSETS	<b>Unpublished example:</b> Mechanisms to regularly update a list of available physical assets within health facilities and track their maintenance needs.
3-7.1	LIST HEALTH FACILITIES AND RELATED INFORMATION	- REGISTER HEALTH FACILITIES - LIST UNIQUE IDS AND LOCATIONS OF HEALTH FACILITIES - HEALTH FACILITY REGISTRY	<b>Unpublished example:</b> Countries have regulatory and licensing procedures for equipment used in the health sector. Digital systems can help track equipment through the regulatory process and manage information about the regulatory status of different types and brands of equipment.
3-7.2	ASSESS HEALTH FACILITIES	- ASSES PERFORMANCE AND CAPACITY OF SERVICES PROVIDED AT HEALTH FACILITIES - REGULATE AND MONITOR SERVICES PROVIDED AT HEALTH FACILITIES - SUPERVISION OF HEALTH FACILITIES	<b>Kenya Master Health Facility List:</b> "An application with all health facilities and community units in Kenya. Each health facility and community unit is identified with unique code and their details describing the geographical location, administrative location, ownership, type and the services offered." [35]
			<b>Accredited Drug Dispensing Outlet (ADDO):</b> "Web-based database of information on private sector drug outlets' premises and personnel, including facility registration, personnel qualifications and certifications, inspections, and payments of associated fees." [8]
			<b>Supportive supervision for TB in Nigeria:</b> "...a standard, integrated TB supervision checklist to assess and monitor diagnostic laboratories and DOTS services in the public and private sectors." [8]

### 3.6 EQUIPMENT AND ASSET MANAGEMENT

Digital approaches to track and manage the maintenance of health equipment. This can include the use of databases, as well as sensors and feedback mechanisms for monitoring health equipment.

### 3.7 FACILITY MANAGEMENT

Digital approaches that enable administrative functions related to the management of facilities.





## 4.0 DATA SERVICES

<p><b>4.1</b> <b>DATA COLLECTION, MANAGEMENT, AND USE</b></p> <p>Digital approaches to data collection, management, analysis, storage. This can include standalone interventions focusing exclusively on data collection and management, as well as data services to support other interventions, such as data visualization within supply chain management.</p>	<p><b>4.1.1</b> NON-ROUTINE DATA COLLECTION AND MANAGEMENT</p> <ul style="list-style-type: none"> <li>- ELECTRONIC DATA COLLECTION, DIGITAL DATA</li> <li>- MOBILE BASED SURVEYS: USING APPLICATIONS SUCH AS OPENDATAKIT (ODK), ENKETO, FORMHUB, ETC</li> </ul> <p><b>4.1.2</b> DATA STORAGE AND AGGREGATION</p> <ul style="list-style-type: none"> <li>- DATA WAREHOUSE, REPOSITORY</li> </ul> <p><b>4.1.3</b> DATA SYNTHESIS AND VISUALIZATIONS</p> <ul style="list-style-type: none"> <li>- REPORTING DASHBOARDS, REPORT GENERATION</li> <li>- PRESENTATIONS OF DATA</li> <li>- BUSINESS INTELLIGENCE</li> </ul> <p><b>4.1.4</b> AUTOMATED ANALYSIS OF DATA TO GENERATE NEW INFORMATION OR PREDICTIONS ON FUTURE EVENTS</p> <ul style="list-style-type: none"> <li>- PREDICTIVE ANALYTICS</li> <li>- MACHINE LEARNING</li> <li>- ARTIFICIAL INTELLIGENCE</li> </ul>	<p><b>PMI Africa Indoor Residual Spraying (AIRS):</b> "Staff were initially tasked to record data on smartphones from roughly 12,000 households and electronically submit to a cloud-based system accessible to the M&amp;E manager at the home office." [8]</p> <p><b>Hang-Up and Track:</b> "ODK form collected distribution data on the number of sleeping places and the amount of LLINs given and installed..." [8]</p> <p><b>mHBB:</b> "Mobile phone-based methods for collection of HBB training and quality improvement data among facility-based birth attendants. 12 existing HBB paper forms were digitized for use on Android mobile phones using ODK." [8]</p> <p><b>Anesthesiological Data Warehouse Project:</b> "A web interface that will allow users to input and access pre-, peri- and postoperative anaesthesiological data." [36]</p> <p><b>cStock:</b> "District- and central-level managers could monitor supply chain performance, using over 10 indicators displayed on a web-based dashboard." [8]</p> <p><b>DHS2:</b> "Get the complete overview through the pivot table feature, spot trends in your data with charting and visualize your geographical data aspects using the GIS functionality." [15]</p> <p><b>Simplified, Effective, Labour Monitoring-to-Action (SELMA) tool:</b> "Prediction models will be developed to identify women at risk of intrapartum-related perinatal death or morbidity (primary outcomes) throughout the course of labour." [37]</p>
<p><b>4.2</b> <b>DATA CODING</b></p> <p>Digital approaches to code data and manage the use of standardized datasets.</p>	<p><b>4.2.1</b> PARSE UNSTRUCTURED DATA INTO STRUCTURED DATA</p> <ul style="list-style-type: none"> <li>- DIRTY DATA MANAGEMENT</li> <li>- AUTOMATED DATA CLEANING</li> </ul> <p><b>4.2.2</b> MERGE, DE-DUPLICATE AND CURATE CODED DATASETS OR TERMINOLOGIES</p> <ul style="list-style-type: none"> <li>- MAINTENANCE AND VERSIONING OF HEALTH INFORMATICS TERMINOLOGY STANDARDS</li> <li>- TERMINOLOGY SERVICES</li> <li>- SEMANTIC INTEROPERABILITY</li> </ul> <p><b>4.2.3</b> CLASSIFY DISEASE CODES AND CAUSE OF MORTALITY</p> <ul style="list-style-type: none"> <li>- RECORDING CAUSE OF DEATH</li> <li>- ICD CODING, CLINICAL CODING FOR REPORTING AND INSURANCE</li> <li>- MAPPING LOCAL TERMINOLOGY, CODES, AND FORMATS</li> </ul>	<p><b>Unpublished example:</b> This tool will develop a set of automated algorithms for cleaning and linking unstructured information (e.g. medical notes) to structured datasets.</p> <p><b>Open Concept Lab:</b> "This toolset will include a web application to search, export, subscribe, and map to standardized terminology and indicators...and functionality to collaboratively create, export, and subscribe to subsets of terms and indicators that represent particular specialty areas." [38]</p> <p><b>Bahmni:</b> "The clinicians can capture diagnosis of patients and manage their old diagnosis. In the backend these diagnoses can be mapped to ICD-10 codes for reporting purposes." [22]</p>
<p><b>4.3</b> <b>LOCATION MAPPING</b></p> <p>The use of geolocation coordinates to map objects and events.</p>	<p><b>4.3.1</b> MAP LOCATION OF HEALTH FACILITIES/ STRUCTURES</p> <ul style="list-style-type: none"> <li>- GLOBAL POSITIONING SYSTEM (GPS) MAPPING</li> </ul> <p><b>4.3.2</b> MAP LOCATION OF HEALTH EVENT</p> <ul style="list-style-type: none"> <li>- GEOSPATIAL VISUALIZATION</li> <li>- GPS MAPPING</li> </ul> <p><b>4.3.3</b> MAP LOCATION OF CLIENTS AND HOUSEHOLDS</p> <ul style="list-style-type: none"> <li>- DEMARCATION OF CATCHMENT AREAS</li> <li>- MAPPING COVERAGE AREAS</li> <li>- GEOSPATIAL VISUALIZATION</li> <li>- GPS MAPPING</li> </ul> <p><b>4.3.4</b> MAP LOCATION OF HEALTHCARE PROVIDERS</p> <ul style="list-style-type: none"> <li>- MAPPING OF HEALTH WORKER ROUTE TO TRACK THE SERVICES PROVIDED</li> </ul>	<p><b>mWater:</b> "A mobile platform for mapping sites such as water sources, sharing test results and performing surveys." [8]</p> <p><b>GIS Mapping of Health Facilities:</b> "The portal displayed the location of each facility location on Google Maps. It allows a user to conduct searches for facilities by district, public or private sector ownership, and services." [8]</p> <p><b>mSOS:</b> "Patient-level information on the suspected cases, response action conducted, [where the case was identified], and laboratory confirmation were displayed on the password-protected web portal dashboard." [8]</p> <p><b>mSpray:</b> "Team leaders enter data on their tablets while standing at each house, which is sent to the cloud server as soon as a data connection is established. The spatially-integrated spray data is then visualized on the tablet by the team leaders showing the location and type of spray point." [8]</p> <p><b>Vaccination Tracking System:</b> "Support enhancements to Immunization Plus Days (IPD) processes by recording the vaccination team positions (the "tracks") at regular interval. The use of GIS maps and GPS tracking has been identified as a valuable tool to locate settlements, help prepare microplans and to monitor the activity of vaccination teams." [39]</p>
<p><b>4.4</b> <b>DATA EXCHANGE AND INTEROPERABILITY</b></p> <p>The capability of two or more systems to communicate and exchange data through specified data formats and communication protocols. [6]</p>	<p><b>4.4.1</b> DATA EXCHANGE ACROSS SYSTEMS</p> <ul style="list-style-type: none"> <li>- DATA MEDIATION</li> <li>- INTEROPERABILITY AND ACCESSIBILITY</li> <li>- INFORMATION EXCHANGE</li> <li>- INTEROPERABILITY LAYER</li> <li>- DATA ORCHESTRATION</li> </ul>	<p><b>OpenHIM:</b> "It provides secure communications and data governance as well as support for routing, orchestrating and translating requests as they flow between systems." [36]</p>

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