MINISTRY OF HEALTH

Electronic Community Health Information System (eCHIS) 2020 Landscape Assessment Report

DIVISION OF COMMUNITY HEALTH SERVICES
"AFYA YETU, JUKUMU LETU"

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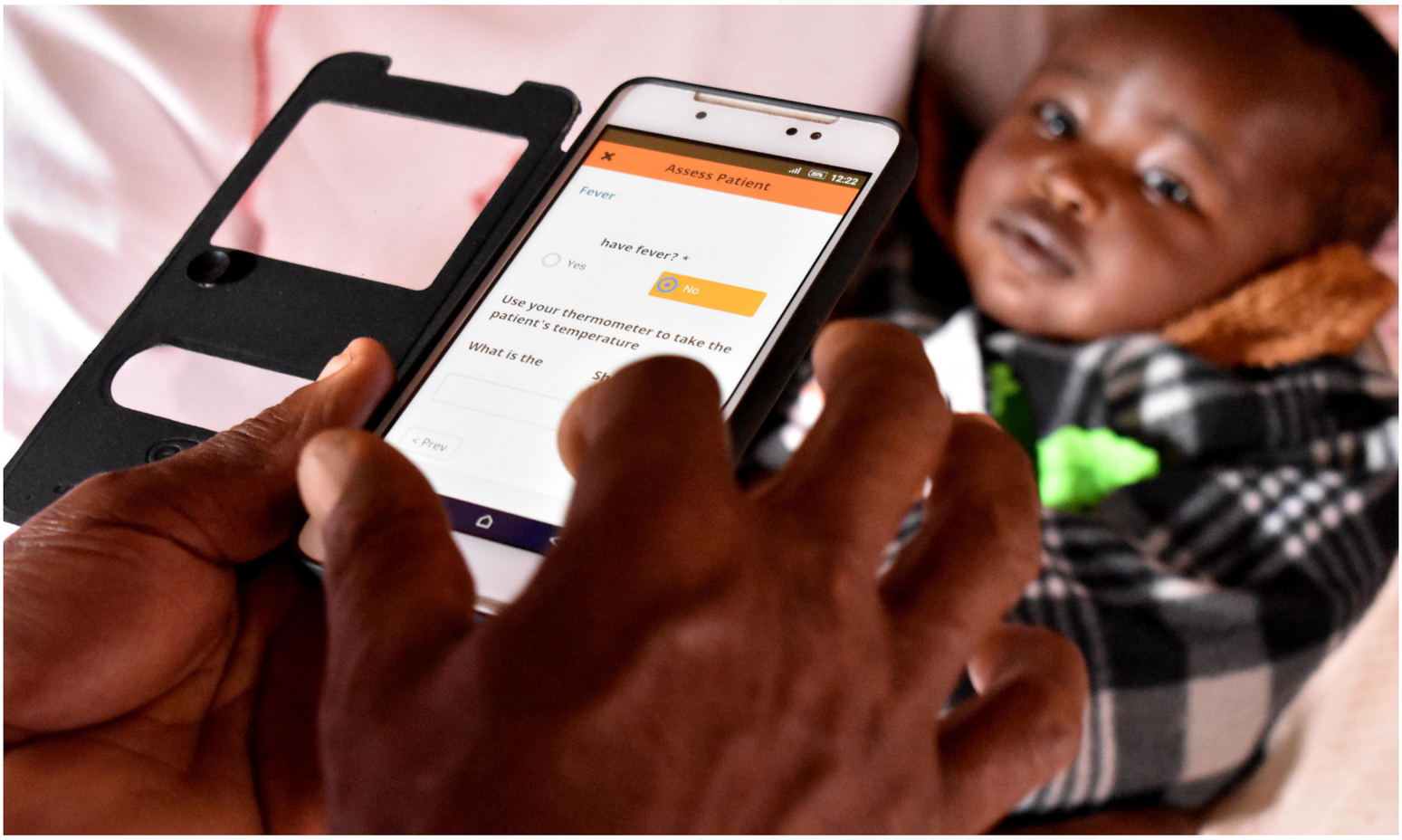
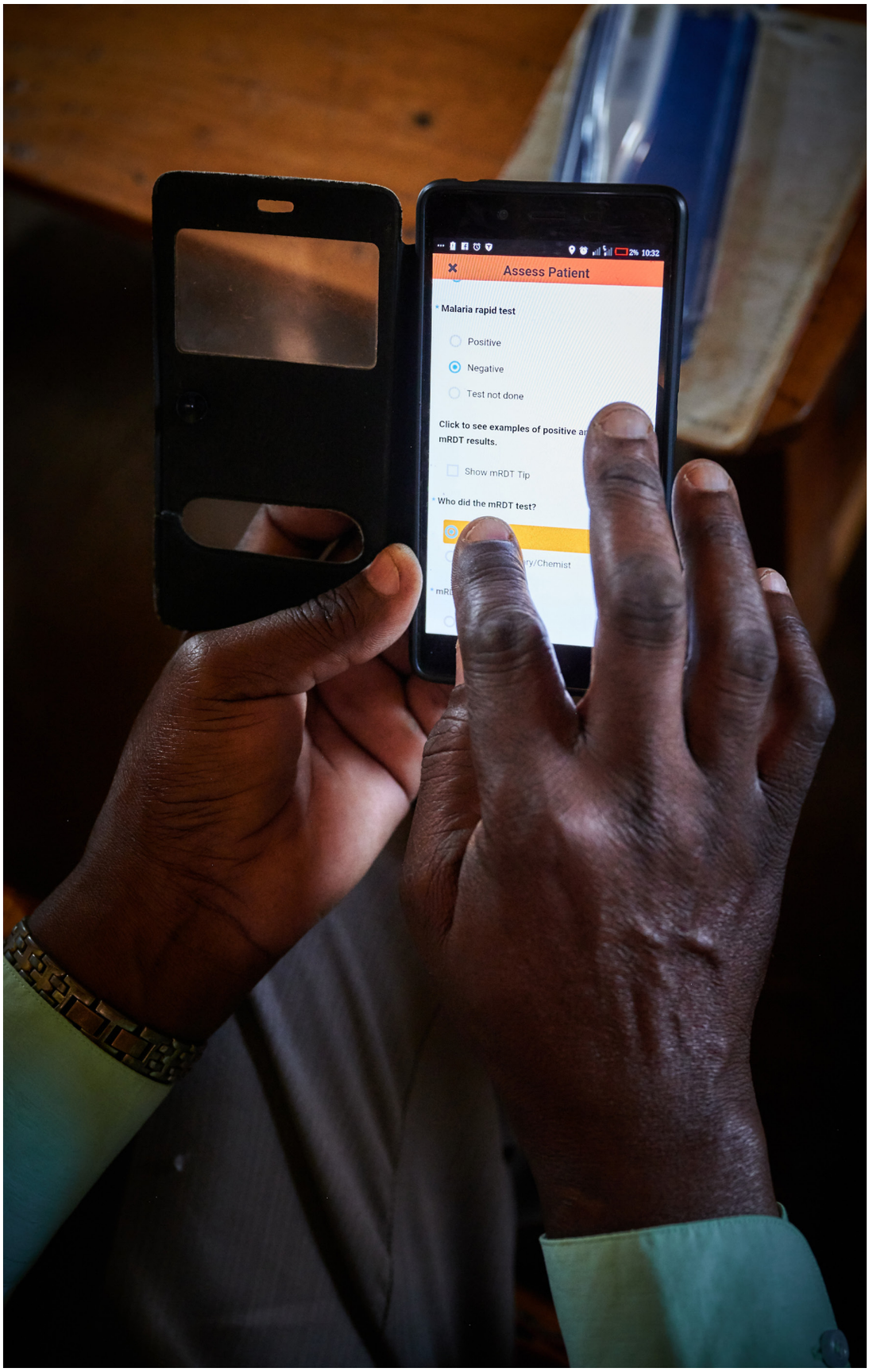


A CHV enters data in a phone while conducting an assessment on a sick child during a household visit.


2% 10:32
Assess Patient
* Malaria rapid test
Positive
Negative
Test not done
Click to see examples of positive a
mRDT results.
Show mRDT Tip
* Who did the mRDT test?

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List of Abbreviations

ANC	Antenatal Care
ASAL	Arid and Semi-Arid Lands
BP	Blood Pressure
CBDS	Case Based Disease Surveillance
CHA	Community Health Assistant
CHEW	Community Health Extension Worker
CHT	Community Health Toolkit
CHRIO	County Health Records and Information Officer
CCHFP	County Community Health Focal Person
CHV	Community Health Volunteer
COVID	CoronaVirus Disease
CSV	Comma Separated Values
DQA	Data Quality Audit
eCHIS	Electronic Community Health Information System
EBS	Event Based Surveillance
EMR	Electronic Medical Record
FGD	Focus Group Discussion
GIS	Geographic Information System
HIS	Health Information System
HRIO	Health Records and Information Officer
HTT	Household Tracking Tool
ICCM	Integrated Community Case Management

ICT	Information and Communications Technology
KHIS	Kenya Health Information System
KHRO	Kenya Health and Research Observatory
KII	Key Informant Interview
KMHFL	Kenya Master Health Facility List
KRCS	Kenya Red Cross Society
LG	Living Goods
LIS	Laboratory Information System
LMIS	Logistics Management Information System
MCH	Maternal and Child Health
MOH	Ministry of Health
NCDs	Non-Communicable Diseases
ODK	Open Data Kit
OJT	On-the-Job Training
PKI	Public Key Infrastructure
PNC	Postnatal Care
RBAC	Role-Based Access Control
SCCHFP	Sub-County Community Health Focal Person
SSL	Secure Sockets Layer
UHC	Universal Health Coverage
UNICEF	United Nations International Children's Emergency Fund
USSD	Unstructured Supplementary Service Data
WASH	Water, Sanitation and Hygiene

Executive Summary

Information systems play a critical role in measuring the performance of healthcare delivery and generating the necessary data for program monitoring, planning and evaluation. Information and Communication Technology, therefore, is a key enabler towards the achievement of Universal Health Coverage, a major item in the President's transformational Big Four Agenda. Despite the significant investments already made in Health Information Systems in Kenya, Community health continues to lag behind in this regard, with many of its reporting systems still paper-based and therefore error-prone and inefficient. It is for this reason that the Ministry of Health, together with Living Goods and other partners, commissioned this landscape assessment with the goal of investigating, describing and characterizing the available digital technologies used for community health. The results of this assessment will help inform the development of a National Community Health Digitization Strategy that seeks to provide guidance and streamline the implementation of ICT interventions for community health services in the country.

This landscape assessment was conducted using both quantitative and qualitative data collection methods. The questionnaire for the assessment was collaboratively developed with the MOH, and other participating partners based on the WHO Classification of Digital Interventions. The tool was then offered for data entry to Sub County and County Commsunity Health Focal Persons representing a total of 98 sub-counties from each of the 47 counties of Kenya. The sample was selected purposively to maximize the use of available time, personnel and financial resources while obtaining a nationally representative dataset. In addition to the quantitative data collection, Focus Group Discussions targeting County Health and Information Records Officers, National MOH Officials and representatives from selected partner organizations were also held. A subset of the implementers of some of the community health digital systems identified in the quantitative assessment were also contacted for Key Informant Interviews.

The assessment questionnaire received a total of 102 valid responses, mostly from community health focal persons at sub-county and county levels. About three quarters of the respondents

reported being aware of at least one digital system used for community health in their area. The most commonly reported digital interventions for community health were CHT/SmartHealth (19%) and MJali (16%). Others were Kobo Collect, AMPREF LEAP, DHIS2 Tracker, Empower Health, Toto Health, among others. The majority of these systems were reported to be supported by partner organizations rather than by the county or national government, with the nature of that support predominantly being in training, software development and data analysis. Hardware procurement and replacement was the least reported area of support.

In terms of maturity, most of the respondents reported that the system they cited had been deployed within the last 3 - 4 years. 89% of the respondents indicated that their system supported data collection at the community level, with only 7% and 3% supporting data collection at the sub-county and health facility levels respectively. Half the respondents reported that the community health digital intervention in their area was licenced under a closed source license. The devices used for accessing the community health systems reported were smartphones (85%), computers (24%) and feature phones (28%).

In keeping with the heavy prevalence of partner-supported community health digital interventions, 81% of the respondents reported that their data was stored on a server owned by the supporting partner. 69% of the respondents indicated that their community health system supported offline use, with post hoc data synchronization via the internet (84%), SMS (28%) or Bluetooth/Cable connectivity (4%). In terms of challenges faced by users when using community health digital systems, user-related challenges were most prominent, followed by system-related challenges and infrastructure-related challenges. Some of the prominently reported user-related challenges included poor computer skills among staff and lack of mentorship after training, while system-related challenges included system breakdown and poor technical support. Unstable internet and inconsistent electricity supply were some of the commonly reported infrastructure-related issues.

Information-related challenges were most frequently cited as the issue faced before the deployment of the digital system, followed by quality- and efficiency-related challenges. Commonly reported information-related challenges included lack of reliable data for decision making as well as lack of access to information. Majority of the respondents indicated that the community health system they cited was implemented to address data reporting challenges (69%), followed by patient management (35%), diagnostics (27%) and appointment management (22%). 88% of the respondents indicated that their community health digital systems gathered and stored personally identifiable data.

A total of 28 distinct digital systems used for community health were identified during this assessment, with the majority having been deployed within the last 3 to 4 years. The assessment found that there lacks a coordinated approach to the development, deployment, support, maintenance and sustainability of these solutions. It also found that although all the broad areas of community health information system functionality are covered by various existing solutions, none of them individually provides the full set of features. In addition, the assessment established that most existing digital community health systems are partner-supported in terms of both technical capacity and funding. Among the most common challenges facing users of community health information systems include training and capacity building, as well as system breakdown and limited infrastructure.

Other key findings include the fact that most of the existing digital solutions for community health are focused on addressing the data collection gaps faced by CHVs using paper-based systems. They also manage personally identifiable client data making them liable to the stipulations of the Data Protection Act (2019). In terms of success factors, among the critical ones identified from existing systems are broad stakeholder involvement, simplicity, flexibility, integration with other systems and comprehensive support and sustainability planning.

Dr. Patrick O. Amoth, EBS

Ag. Director General for Health, Ministry of Health

Preface

The implementation of digital solutions is very key in providing the support to service delivery and strengthening data management processes. In community health service delivery, use of technology has been introduced in several forms to support service provision. The UHC service delivery will require a unified digital solution implementation to enhance tracking of key indicators and to strengthen service delivery.

The eCHIS landscape assessment sought to identify the digital solutions that have been implemented across the country using the WHO Classification of Digital Interventions. The assessment identified key features of the existing digital solutions in the country as per community health service delivery operations, the technology they are based on, the support in implementation and their maintenance. The assessment was undertaken through focused group discussions with key stakeholders drawn from MOH national and sub-national levels, and partners implementing the community health digital solutions. The assessment identified some of the gaps in community health service delivery and data management that need to be addressed through investment in the eCHIS agenda.

MOH will utilize the findings of this assessment to define the national digitization strategy for community health services at national and county levels.

Dr. Pacifica Onyancha
Ag. Director Medical Services/Preventive and Promotive Health

Acknowledgment

The eCHIS Landscape assessment and subsequent report writing was executed through an intensive stakeholder engagement process that included stakeholders at national and sub-national levels. The stakeholders participated in both virtual and one-on-one meetings on key interviews and report writing.

We appreciate the Ministry of Health's leadership for providing an enabling environment for undertaking the landscape assessment and the development of this report. I wish to acknowledge the overall leadership by Dr. Joseph Sitienei and Dr. Maureen Kimani for their strategic leadership, and John Wanyungu for proving technical leadership to this process. I appreciate officers in the Divisions of Community Health Services, Health Informatics and Information Communication Technology among others for their invaluable contribution in the various eCHIS Technical Working Groups. Thank you to the Council of Governors for supporting engagements with the county stakeholders to participate in the activities towards development of this report.

The development of this document was financed by Johnson & Johnson through AMREF and Living Goods Kenya. We also wish to acknowledge technical contributions from different organizations which included: UNICEF, JICA, World Vision, WHO, PATH, UNICEF, USAID, In-supply Health, AMREF, Red Cross, Medic Mobile, Save the Children Kenya, Population Council, LVCT Health, Intrahealth, Health IT, Living Goods among others. An additional list of contributors is annexed.

Dr. Salim Hussein

Head, Department of Primary Health Care

1. Introduction

1.1 Background

The Government of Kenya recognizes the vital role played by information systems in measuring the performance of healthcare delivery and generating data to support program monitoring, planning and evaluation. As a result, Information and Communications Technology (ICT), has been identified as a key enabler towards the achievement of Universal Health Coverage (UHC)1. Indeed, significant investments have been made in the use of technology to improve the access and quality of healthcare delivered to citizens2. Such investments are manifest in the various Health Information Systems (HIS) deployed across the country, including Electronic Medical Record (EMR) systems; Laboratory Information Systems (LIS); Logistics Management Information Systems (LMIS); the Kenya Health Information System (KHIS); the Kenya Master Health Facility List (KMHFL); the Kenya Health and Research Observatory (KHRO); among others.

Despite these investments, the use of ICT at the lowest level of healthcare service delivery continues to be limited. The Strategy for Community Health (2014 - 2019) identified community health as an effective means for improving health and contributing to the overall socioeconomic development of the country3. In addition, it noted that the determinants of health are best achieved through integrated responses and citizens' active participation, especially at the community level. As such, the data generated at this level is crucial for performance monitoring, decision making, planning and measuring progress towards the attainment of UHC. Unfortunately, the process of reporting this data to the national level through the KHIS is largely paper-based, rendering it inefficient, unreliable and prone to data quality issues.

Deficiencies in basic community-based data collection and reporting tools hinder the optimal use of community health data to inform public health response and resource allocation at county and national levels. The declaration of UHC4 and the identification of community health services as a top priority for the Ministry of Health (MOH) and its partners5 has strengthened the need to ensure that quality data on service delivery and program performance is generated and reported in a timely and efficient manner right from the community through to the county and national levels.

1.2 Objectives

Following the gaps identified in data collection, management, processing and use within the community health subsector, the MOH in partnership with Living Goods (LG) and other partners sought to develop a National Community Health Digitization Strategy. The aim of this exercise was to provide guidance and streamline the implementation of ICT interventions for community health. Among the key deliverables towards this goal was a landscape assessment to identify, document and describe the available digital technologies used for community health within the country. Specifically, the landscape assessment aimed to answer the following questions:

1. What are the digital systems currently in use to support community health service delivery and data management?
2. What are the areas of functionality covered by the existing digital interventions for community health?
3. Who funds and supports the existing digital interventions in community health? What kind of support do they provide?
4. What are some of the challenges addressed by existing community health digital interventions? For whom are these interventions designed?
5. What are the challenges faced by the users of the existing community health digital interventions?
6. How do existing community health digital solutions store and secure sensitive personal data belonging to clients?
7. What are some of the factors influencing the success or failure of digital interventions for community health?

By answering these questions, this assessment enriches the National Community Health Digitization Strategy by characterizing the existing implementation context as well as identifying key lessons, best practices and potential challenges that can be harnessed towards ensuring the success of the planned national electronic Community Health Information System (eCHIS).

2. Methodology

The eCHIS landscape assessment was designed to engage with and draw insights from a wide range of stakeholders in the areas of community health and health information systems. These include county and national government officials as well as partner and private sector organizations involved in the implementation of digital interventions for community health. A two-pronged approach involving both quantitative and qualitative data collection and analysis was adopted. In order to yield nationally representative results, the assessment targeted each of the 47 counties, as well as selected HIS implementers working in the community health subsector. The survey was executed over a total of 4 weeks.

2.1 Quantitative Assessment

2.1.1 Questionnaire Development

A quantitative data collection instrument for the eCHIS landscape assessment was collaboratively developed with the MOH, LG and other participating partners. It was modeled on the landscape assessment questionnaire previously used by the MOH in 2018 for a countrywide HIS assessment. The HIS landscape assessment questionnaire was itself adapted from the WHO Classification of Digital Health Interventions6. The WHO Classification of Digital Health Interventions is a formalized tool for categorizing the different ways in which digital and mobile technologies are used to support health system needs. The tool aims to provide a mutually understandable language through which healthcare practitioners and technology innovators can assess and articulate system functionality using a shared and standardized vocabulary. It helps describe the characteristics of digital health interventions as well as the challenges they address and the users they serve. The eCHIS landscape assessment questionnaire was reviewed by the MOH and other stakeholders before it was deployed to the field for data collection.

2.1.2 Sampling

Sub-County Community Health Focal Persons (SCCHFPs), County Community Health Focal Persons (CCHFPs) and County Health Records and Information Officers (CHRIOs) were identified as the primary respondents for the eCHIS landscape assessment questionnaire. These cadres were selected because of their closeness to community health and data management activities at the county and sub-county levels and therefore were deemed most likely to possess the necessary information to respond to the questionnaire. All respondents were encouraged to consult broadly with their colleagues to ensure that they mobilized the best possible answers to the survey.

In consultation with the Ministry of Health, Living Goods and other stakeholders, it was decided that due to time and resource constraints, a purposive sample of 94 out of a total of 290 sub-counties would be selected to represent each of the 47 counties in Kenya. Each county contributed 2 sub-counties to the sample. This set of 2 was selected so that the first sub-county was the seat of the county government, while the second was selected conveniently from the remaining sub-counties. Considerations made in selecting the sample included ease of accessibility as well as population diversity i.e. by matching high density with low density areas and urban areas with rural areas. The assessment questionnaire was shared with each of the SCCHFPs from the sampled sub-counties, as well as all CCHFPs and CHRIOs from the 47 counties who attended the training and sensitization meetings. Both county and sub-county Health Records and Information Officers (HRIOs) were also sensitized on the exercise, as were officials national MOH and participating partner organizations.

2.1.3 Training and Sensitization

All designated respondents were invited to scheduled training and sensitization meetings. These were held through the Zoom teleconferencing service due to the prevailing social distancing regulations owing to the COVID-19 pandemic. A total of 4 training and sensitization meetings were arranged. During each session, the respondents were introduced to the eCHIS strategy development process in general and the landscape assessment in particular by a representative of the MOH. Thereafter, they were thoroughly trained on the data collection tools and protocols.

The training comprised two segments conducted consecutively in one sitting. The first segment involved articulating the meaning and motivation behind the various questions covered in the assessment tool, while the second segment covered the use of Hoji, the digital mobile data collection application used for the survey.

Each training session lasted approximately 1 hour 30 minutes and the facilitator projected both the questionnaire and the mobile data collection app for all participants to see as a means to ensure optimal delivery of the content. A question and answer session was also held at the end of each training session to address participants' questions, comments and concerns. In addition, participants were encouraged to practice administering the questionnaire by submitting dummy data both during and after the training event. This was intended to increase their proficiency in using the data collection tool ahead of the main exercise. In addition to the respondents, selected officials from the National Government MOH as well as representatives of participating partner organizations were also sensitized on the assessment as a means of obtaining their buy-in and support for the process. In total, approximately 140 individuals were trained on the eCHIS landscape assessment questionnaire.

2.1.4 Data Collection and Analysis

Data collection was conducted digitally using the Hoji mobile data collection and analysis platform. Each respondent was able to create a secure account on the system and log in to collect data. Respondents were able to enter data both online and offline, with internet connectivity only required for results transmission at the end of the data collection process. All SCCHFPs participated by self-administering the assessment questionnaire. However, in order to increase the reach of the survey and minimize non-response due to competing activities, a team of specially designated enumerators was dispatched to personally interview CCHFPs over the telephone.

All data collected through the mobile application was submitted to a secure centralized database for storage and analysis. Throughout the exercise, a team of technical support specialists was available to help address emergent issues and ensure that the data collection process ran smoothly. Data received from the field was cleaned and analyzed on the Hoji Platform, as well as using the R package for statistical analysis.

2.2 Qualitative Assessment

2.2.1 Focus Group Discussions

Focus Group Discussions (FGDs) were organized with the goal of generating qualitative data with which to augment the results of the quantitative assessment. These specifically targeted CHRIOs, National Government MOH officials and representatives from partner organizations. In particular, a total of 5 FGDs were scheduled. Of these, 4 were targeted at CHRIOs, roughly organized into groups of 12 based on the eight former provinces of Kenya. 1 FGD was arranged for National Government MOH officials and representatives of selected partner organizations.

FGD	Target
FGD 1	Mombasa, Kwale, Kilifi, Tana River, Lamu, Taita-Taveta County, Garissa, Wajir, Mandera counties
FGD 2	Marsabit, Isiolo, Meru, Tharaka-Nithi, Embu,Kitui, Machakos,Makueni, Nyandarua, Nyeri, Kirinyaga, Murang'a, Kiambu counties
FGD 3	Turkana, West Pokot, Samburu, Trans Nzoia, Uasin Gishu, Elgeyo-Marakwet, Nandi, Baringo, Laikipia, Nakuru, Narok, Kajiado, Kericho, Bomet counties
FGD 4	Kakamega, Vihiga, Bungoma, Busia, Siaya, Kisumu, Homa Bay, Migori, Kisii, Nyamira, Nairobi counties
FGD 5	National Government MOH and Partner Organizations

Table 1: Breakdown of FGD groups

A set of open ended FGD guide questions was developed and reviewed by MOH and its partners before deployment. Each FGD was scheduled to be held over a period of 1 hour 30 minutes and facilitated through the Zoom video conferencing service. The FGD sessions were recorded using the Zoom recording service and later transcribed for analysis.

2.2.2 Key Informant Interviews

In addition to FGDs, the results of the quantitative landscape assessment were further supplemented with Key Informant Interviews (KIIs) administered to a subset of digital health implementers. The KII participants were sampled from the list of community health digital health interventions identified during the quantitative part of the landscape assessment. The goal of the KIIs was to gather more information to better understand specific digital interventions as well as validate the data obtained from the quantitative assessment. Specific attention was paid to establishing the coverage of each digital intervention and the features it supports.

A set of open ended KII guide questions was developed and reviewed by MOH and its partners before administration. Each KII was held over a period of approximately 40 minutes and facilitated via Zoom video conferencing. All sessions were recorded using the Zoom recording service and later transcribed for analysis.

3. Results

3.1 Quantitative Analysis

3.1.1 Response Rate and Data Cleaning

A total of 122 responses to the eCHIS landscape assessment questionnaire were received from respondents at the sub-county, county and national levels. However, 20 of these were duplicates and were deleted before data analysis, bringing the total number of valid responses down to 102.

3.1.2 Coverage and Respondents

40 out of the 47 counties (85%) were represented in the 102 valid responses obtained after data cleaning. The majority of the responses was from Busia county (7), while Meru and Vihiga counties contributed 6 responses each. There were no responses received from Embu, Wajir, Tana River, Laikipia, Mandera, Nandi and Samburu counties. A total of 65 sub-counties were represented in the valid responses received, accounting for 69% of the 94 sub-counties sampled and just under a quarter (22%) of the 290 sub-counties in Kenya.

County	Responses	Percentage
Busia	7	6.86
Meru	6	5.88
Vihiga	6	5.88
Homa Bay	5	4.9
Homa Bay	4	3.92
Trans Nzoia	4	3.92
Nairobi	4	3.92
Nyeri	4	3.92
Elgeyo Marakwet	4	3.92
Kisii	3	2.94
Kwale	3	2.94
Tharaka Nithi	2	2.94
Marsabit	2	2.94
Mombasa	2	2.94
Siaya	2	2.94
West Pokot	1	2.94
Nyandarua	1	2.94
Lamu	1	2.94
Bungoma	2	1.96
Narok	2	1.96
Kakamega	2	1.96
Kisumu	2	1.96
Nakuru	2	1.96
Kajiado	2	1.96
Bomet	2	1.96
Makueni	2	1.96
Kericho	2	1.96
Kitui	1	0.98
Kilifi	1	0.98
Nyamira	1	0.98
Kiambu	1	0.98
Uasin Gishu	1	0.98
Machakos	1	0.98

County	Responses	Percentage
Migori	1	0.98
Turkana	1	0.98
Garissa	1	0.98
Muranga	1	0.98
Baringo	1	0.98
Isiolo	1	0.98
Kirinyaga	1	0.98
Grand Total	**102**	**100**

Table 2: Distribution by county

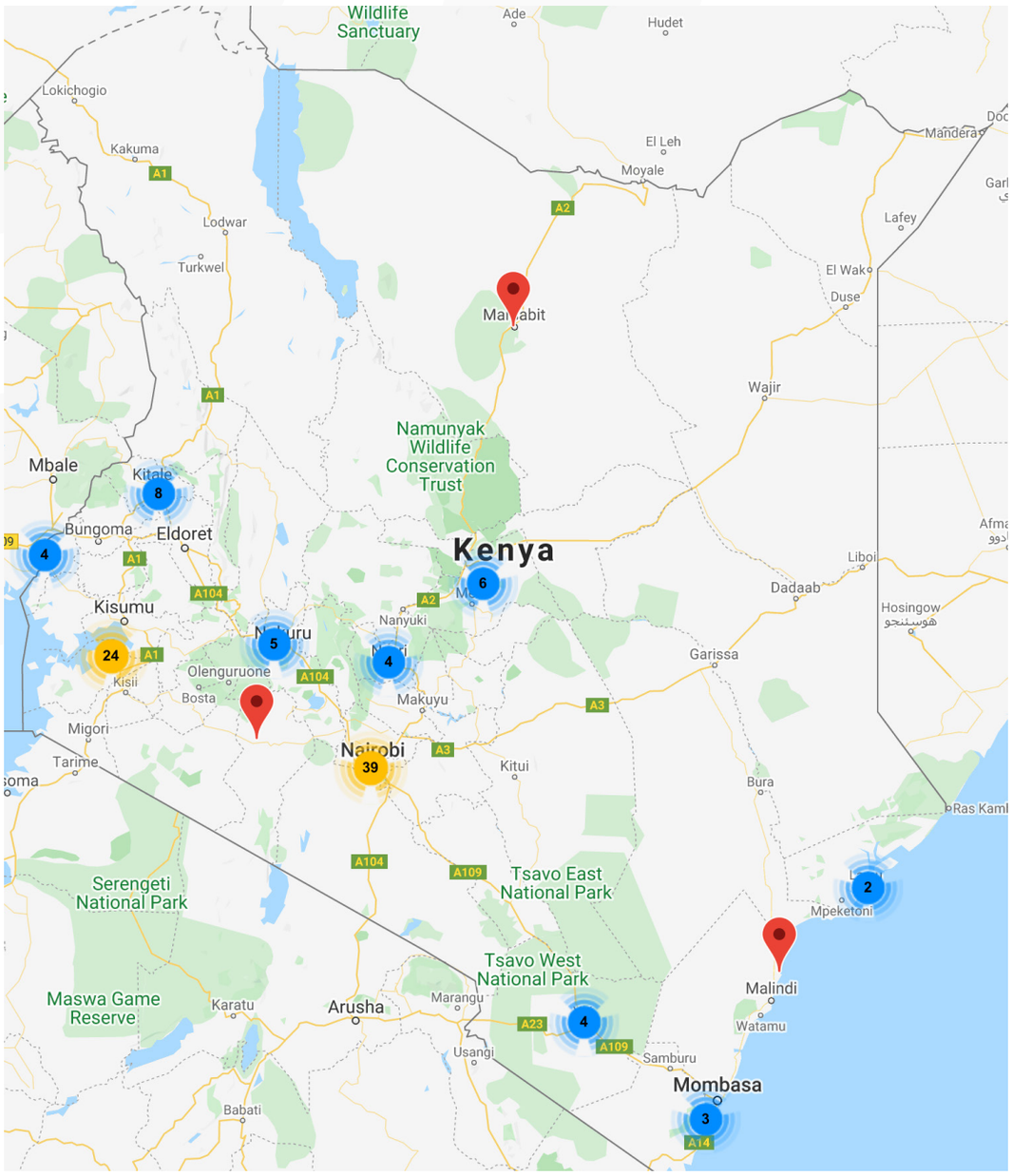


Fig 1: Locations where the data was collected. Note that respondents contacted via telephone had their data entered in Nairobi by the enumerators.

In terms of cadre, the majority of the responses were submitted by community health focal persons at both the county and sub-county levels. Specifically, CCHFPs contributed 48% of responses, while SCHFPs contributed 37% for a cumulative total of 85%. County Health Records and Information Officers (CHRIO) and National MOH were the least responsive cadres, contributing less than 2% of the total number of responses respectively. They were followed by Partners who submitted 3 out of the 102 valid responses (3%).

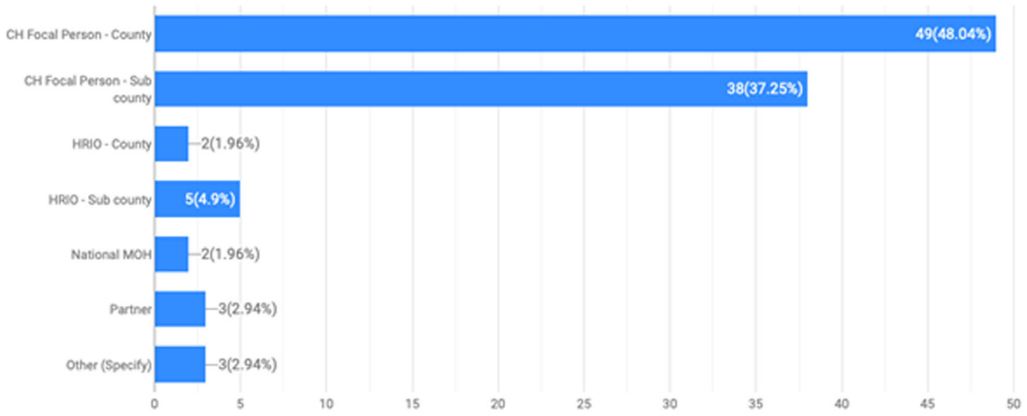


Fig 2: Distribution of response by cadre

Other cadres who responded to the surveys included 2 Community Health Extension Workers (CHEWs) and 1 Medical Social Worker.

3.1.3 System Prevalence and Characteristics

On the question of community health digital systems that are currently in use or have previously been used in their areas of jurisdiction, 75 respondents (76%) answered in the affirmative, while the remainder reported that they were not aware of any such systems in their area.

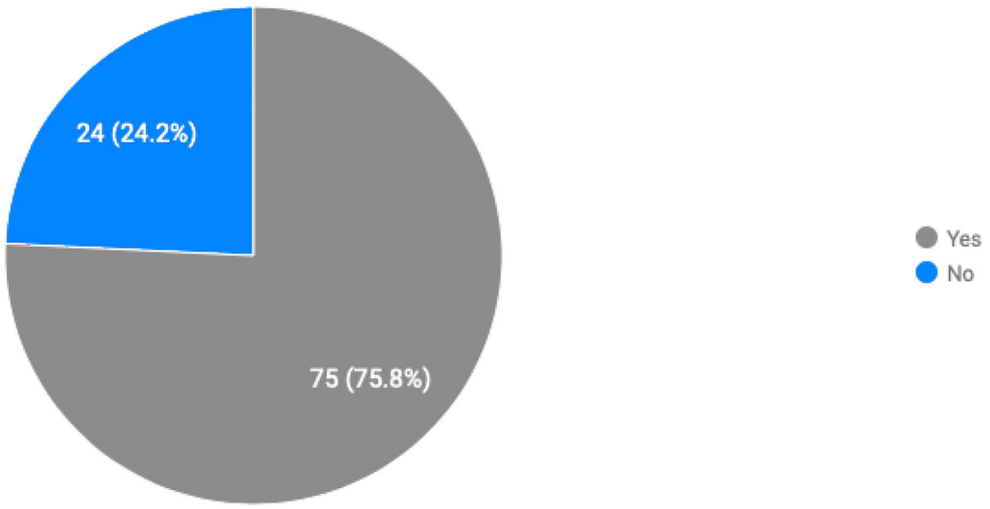


Fig 3. Distribution by presence of community health digital system

Of the community health digital systems reported during this assessment, Community Health Toolkit (CHT)/SmartHealth and MJali were the most widely deployed, accounting for 19% and 16% of the total cases reported respectively. Other digital systems reported include Kobo Collect (6.7%); Mobile (6.7%) and AMREF LEAP (5.3%). The total number of unique systems reported during this assessment was 28.

System	Responses	Percentage
CHT/ Smart Healh	14	18.7
MJali	12	16.0
Kobo Collect	5	6.7
Mobile	5	6.7
AMREF LEAP	4	5.3
DHIS2 Tracker	3	4.0
Empower Health	3	4.0
Totohealth	3	4.0
C-Stock	2	2.7
CHIS	2	2.7
Comcare	2	2.7
DHIS	2	2.7
mDharura	2	2.7
Verbal Autopsy	2	2.7
COVID-19 weekly Monitoring Tool	1	1.3
E Boresha	1	1.3
E Health	1	1.3
HTM (household Tracking Methodology)	1	1.3
IPAS	1	1.3
M-TIBA	1	1.3
MHealth	1	1.3
Movercado	1	1.3
ODK	1	1.3
PIC4C	1	1.3
REDCap	1	1.3
TDK	1	1.3
TIBIKA	1	1.3
USSD	1	1.3
TOTAL	75	100

Table 3: Distribution of digital community health systems

Among the 75 cases where digital community health systems were reported, 59 (79%) were reported as being currently in use, with 16 (21%) being out of use. In terms of support, over three quarters of the systems (79%) are supported by partners, while county governments and the national government support 8% and 4% of the systems respectively. An additional 9% of the systems were reported as being unsupported. Most sub-counties are supported for training and capacity building (84%), followed by support for software development (71%). Hardware procurement and replacement was identified as the least prevalent form of support, accounting for 42%.

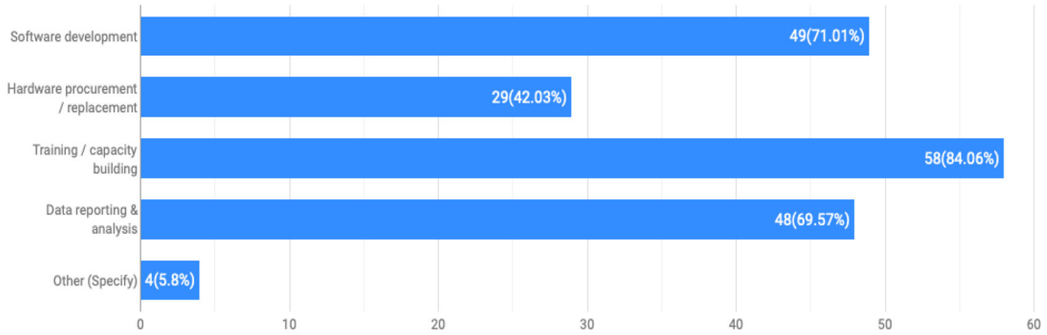
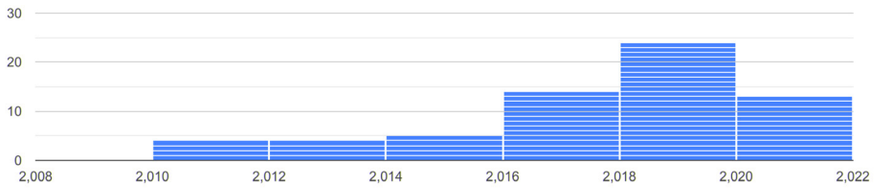


Fig 4: Distribution by type of support

On the question of the year in which the systems were deployed, it emerged that the digital interventions surveyed were deployed between the years 2010 and 2020. However, this distribution was heavily skewed leftward with the median year of deployment being 2018 (IQR = 2017 - 2019). In other words, half of the respondents reported that the systems they identified were deployed within the 3 year period between 2017 and 2019. In 11 of the 75 cases where a system was reported, the year of deployment could not be established.

14. In which year was the system implemented? (n=75)



MEAN	SD	MEDIAN	IQR	SKEWNESS	KURTOSIS	VAR	RANGE	SUM	MISSING
2,017.31	2.72	2,018	2,017 - 2,019	-1.3	1.01	7.42	2,010 - 2,020	129,108	11

Fig 5: Distribution by year of deployment

For 67 (89%) of the cases where a system was reported, data is collected at the community level, with only 7% reporting data collection at the sub-county level and 3% at the health facility level. In terms of funding, partner funding for the system was reported in 66 (88%) of the cases, followed by national government and county government funding at 5 (7%) and 3 (4%) cases respectively. In one case, the source of funding could not be established.

Half the respondents reported that their digital interventions were licensed under a closed-source license, while approximately 30% are open source. In 16 (21%) of the cases, the mode of licensing could not be established as the respondents reported that they were unsure.

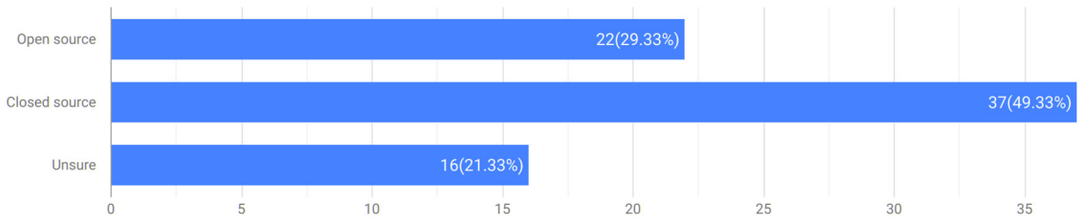


Fig 6: Distribution by source code licensing

Majority of the respondents reported that the community health system in their sub-county is accessed via a smartphone or tablet interface (85%). Other modes of accessing the system were desktop or laptop computers (24%) and feature phones (28%), with some systems reportedly supporting access through more than one type of device.

In terms of support for offline capability, it was reported in 69% of the cases that the system required internet connectivity in order to be used, while in 23 (30%) of the cases internet connectivity was not a requirement. Integration with other digital tools was reported in only about a quarter of the cases, while half reported no integration with other digital tools. In the remaining 25% of the cases, the respondents were unsure about integration whether the system they reported was integrated with other digital tools.

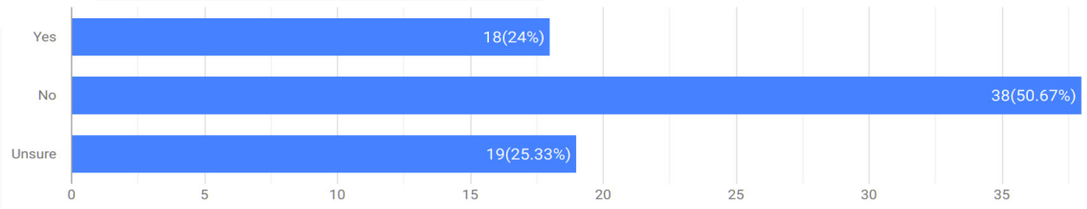


Fig 7: Does the system support integration with other digital tools or systems?

In most of the cases (81%), data was stored on a server owned by the supporting partner. Data storage at national, county and health facility levels accounted for 8%, 7% and 4% respectively. Data transmission was mostly reported to be via the internet (84% of the cases) followed by via SMS (28% of the cases). Only in 3 out of the total 75 cases (4%) was data transmission reliant on Bluetooth or cable connectivity. In terms of reliability, system use within the preceding 3 days was reported in slightly more than half the cases where a system was present (52%). On the other hand, in a quarter of the cases, the system was reported to have last been used more than 3 months before the date of the survey. System downtime was reported to range from 0 to 30 days, with a median of 0 (1QR = 0 - 2)

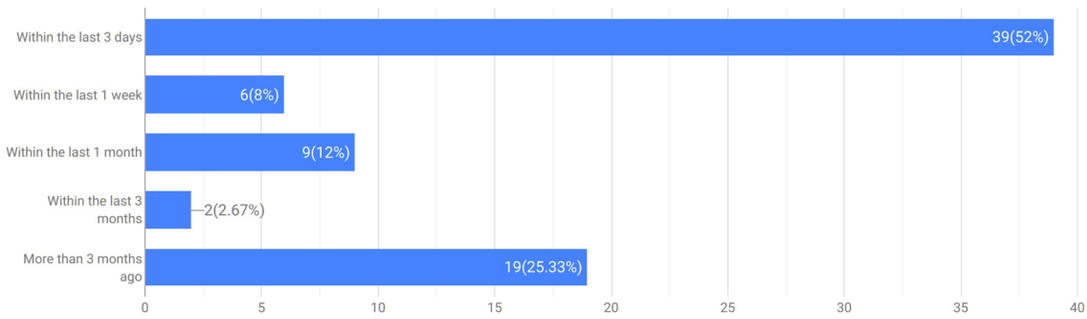


Fig 8: Distribution by recency of system use.

3.1.4 System Challenges

User-related challenges were most commonly reported as the issue faced when using the digital system (67%), followed by system-related and infrastructure-based-related challenges at 59% and 47% respectively. Other challenges articulated included disruptive system restructuring; theft of smartphones and clients' apprehension on the use of their personal data (including association with voter fraud).

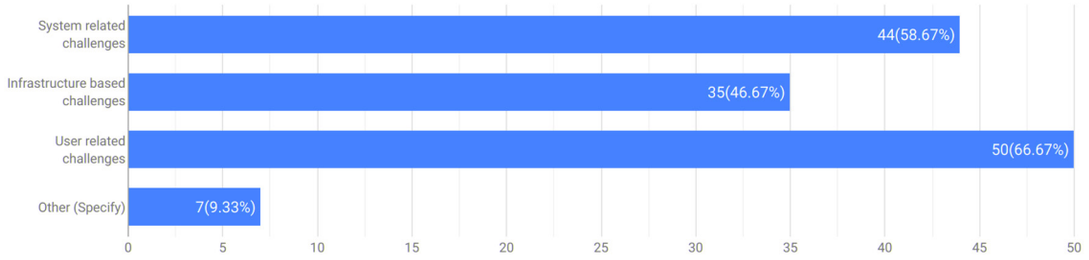


Fig 9: Challenges faced by users when using the system

In terms of specific user-related challenges, lack of or poor computer skills among staff was most commonly reported (54%), followed by lack of mentorship after training and struggling to navigate through the system with ease (39% each). High staff turnover was also a significant user-based challenge reported in just over a third of the cases (32%). The least common user-based challenges were negative staff attitude towards the system and lack of support by leadership (12 each%).

System breakdown (41%) and lack of or poor system support (39%) were the most commonly reported system-related challenges. These were followed by lack of integration with other digital systems, which was cited in 32% of the cases where system-related challenges were reported. The least common system-related challenge was the inability of the system to handle a bulk number of users at the same time, which was reported in only 9% of the cases. In terms of infrastructure-related challenges, unstable internet connectivity and inconsistent electricity supply were reported most frequently (69%), followed by system networking challenges and lack of power back-up (UPS), each accounting for 40% and 37% of the cases respectively.

On the question of service delivery challenges experienced prior to the implementation of the system, information-related challenges were most commonly reported (61%), followed by quality related challenges (40%), efficiency related challenges (35%) and utilization related challenges (33%). Availability, cost, and accountability related challenges were relatively low at approximately 25% each.

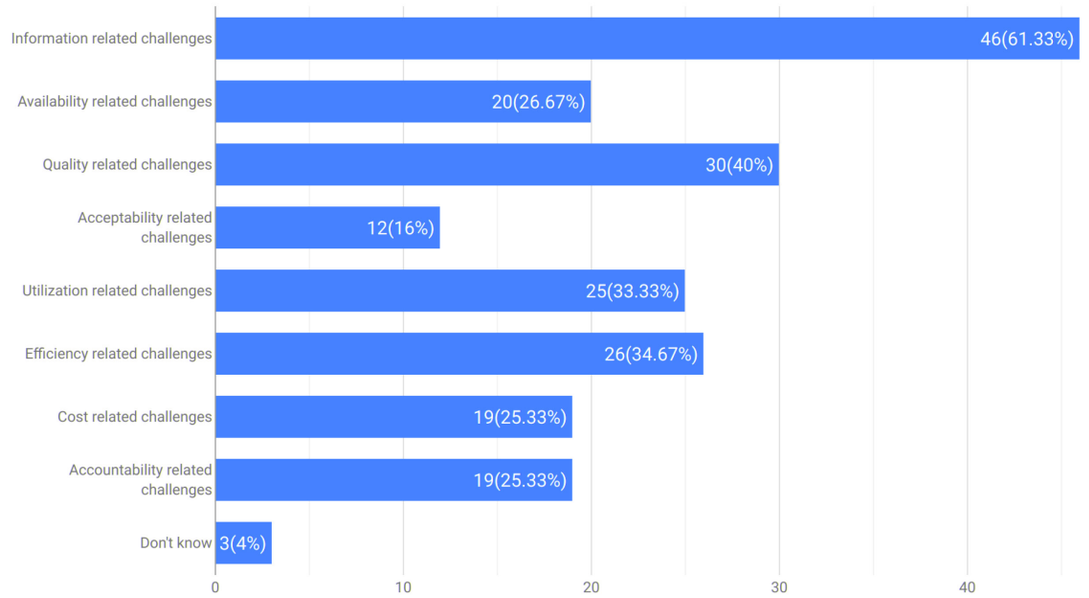


Fig 10: What service delivery challenges were you experiencing prior to implementation of the system?

Specifically, the most commonly cited information-related challenge was lack of quality/reliable data and lack of access to information or data, each accounting for 67% and 65% respectively. Delayed reporting of events was also identified as a big information-related challenge (58%). The least reported information-related challenge was lack of a unique identifier (7%).

As far as availability challenges are concerned, insufficient supply of commodities (60%) was the leading challenge of this type, followed by the insufficient supply of services and equipment (50% each), and insufficient qualified health workers (19%). The most commonly reported quality challenges were inadequate supportive supervision (57%), low health worker motivation (50% and insufficient continuity of care (43%). Low quality health commodities was only reported as a challenge in 4 (13%) out of the 30 cases where quality challenges were reported.

Other less commonly reported challenges included lack of alignment with local norms, as well as programs that do not address individual beliefs and practices. These were raised by 50% and 83% of the 12 respondents who reported acceptability related challenges, respectively. Low demand for services and loss to follow up were also identified as challenges that compromised efficiency in the delivery of community health services. In terms of cost related challenges, the lack of effective resource allocation was cited as a challenge (68%), as was the high cost of manual processes (63%). Absence of community feedback mechanisms (68%) coupled with poor accountability between the levels of the health sector (37%) were reported as important accountability related challenges.

3.1.5 System Purpose and Use

Data reporting was most commonly cited as the purpose for which the system was deployed, accounting for 54 of the 75 cases (69%) in which a digital intervention for community health was found. Other common functions were patient management (35%), diagnostics (27%), appointment management (22%), and commodity management (20%). Only in two cases were there systems reported as catering to human resource management. On the question of specific clinical areas covered by community health digital interventions, respondents mentioned maternal health (100%), child immunization, HIV/TB and Malaria (29% each) , NCDs (43%) and verbal autopsy (14%). However, this question was administered to a smaller sample of only 7 respondents owing to the fact that it was included while the survey was already in progress.

In terms of targeted users, Community Health Volunteers were the most commonly reported user category (97%) followed by Community Health Assistants (61%) and government program officers (26%). Clients were reported as being the primary system users in only 1 of the 75 cases (3%).

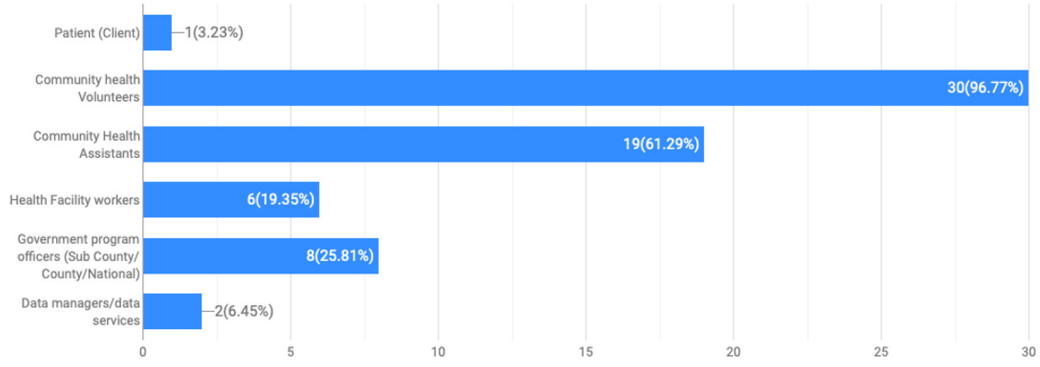


Fig 11: Who is the primary user of the system?

Community healthcare workers were reported as using the system mainly for referral coordination (54%), client identification and registration (46%), client health records (42%) and healthcare provider communication (34%). More specifically, community healthcare workers used digital community health systems to verify unique client identity, enroll clients for services, collect and manage routine health indicators, track clients' health longitudinally, screen clients by risk or other health status, conduct consultation for case management, manage referrals between service points, identify clients in need of services and track prescriptions.

3.1.6 Personally Identifiable Information

Personally identifiable information was reportedly collected by the digital community health system in 66 (88%) of the 75 cases. Of these, biometric data collection was reported in 11 (17%) of the cases, distributed between fingerprint (10) and palm print (1) biometric identifiers.

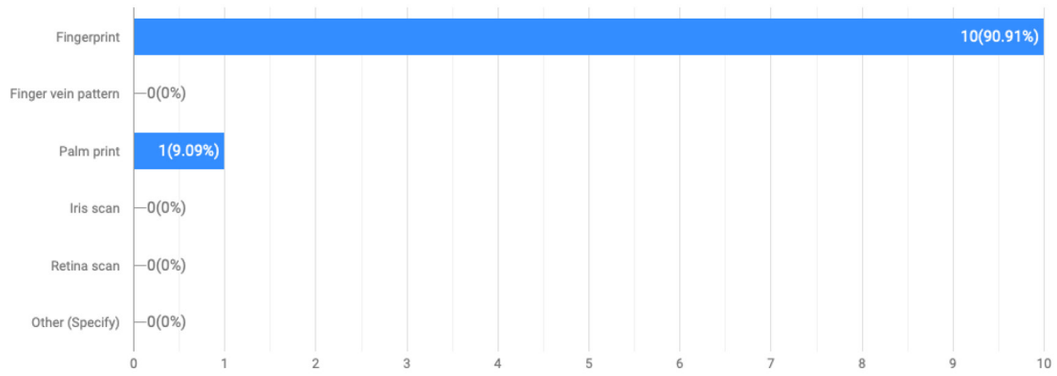


Fig 12: What biometric identifier does the system collect?

3.2 Qualitative Analysis

3.2.1 Focus Group Discussions

Only 1 of the 5 scheduled FGD (FGD 3) was successfully conducted, with the other 4 being called off due to lack of quorum. A total of 9 counties were represented during FGD 3, namely, Baringo, Garissa, Elgeyo Marakwet, Kericho, Nyeri, Narok, Machakos, Samburu and Trans Nzoia.

More than half of the participants reported that they were not aware of the efforts by the MOH to digitize community health nor did their counties have any digital interventions for the same. However, one participant intimated that their county had been provided with some training material for digital community health by National Government MOH officials and asked to deploy it in anticipation for the implementation of an electronic system. Another participant indicated that their county had deployed Open Data Kit (ODK) for community health. In particular, the county had the standard community health data collection forms MOH 513 and MOH 514 digitized on the tool (ODK). They reported that data collected in this manner is manually summarized by Community Health Assistants (CHAs) using Microsoft Excel and used to populate the MOH 515 report for uploading onto the KHIS. Yet another participant mentioned being aware of the use of ODK by CHVs for a Water, Sanitation and Hygiene (WASH) program in their county. However, he was not aware of the specific details.

Another system reported during the discussion was Empower Health. Empower Health is a community health digital intervention developed and deployed by Medtronic LABS. The application is currently used to collect and manage data on Non-Communicable Diseases (NCDs), specifically hypertension and diabetes. Although CHVs have been trained on the use of the system and are expected to start using it, Empower Health is currently used by healthcare providers during outreach activities where health facilities dispatch clinicians to conduct NCD screening in the community. Healthcare providers also use Empower Health for patient management for clients who turn positive, as well as for routine follow-up and transfer between health facilities. Empower Health runs on Android and users access it through a mobile interface using tablets. The application is still in the piloting stage and currently covers 10 health facilities within Nyeri county. Empower Health is able to produce the standard MOH 740 report for uploading on the KHIS. In addition to Empower Health, MTIBA was also briefly mentioned as an application that is currently being used to broadcast COVID-19 awareness messages to registered clients in the community.

A commonly recurring challenge cited by almost all participants was the prevalence of multiple information systems in the same health facility and used by the same healthcare workers to manage the same patients. This was made worse, they said, by the fact that those systems are usually not interoperable. This claim is borne out by the results of the quantitative assessment in

which half the respondents indicated that the digital system they identified was not integrated with other health information systems. This disjointedness creates a lot of inefficiencies, as the same patient has to be registered in and managed from multiple places. An example was given of one major health facility that has KenyaEMR for the HIV clinic, Medboss for hospital management and yet another system running the pharmacy. The participants wondered whether it was possible to have one information system that addressed all the health information management needs including those of community health, or at the very least have the different systems interoperating with each other. One FGD participant eloquently summarize the issue as follows:

"We are wondering why we cannot have one system in which all the information is available for Kenyans. I have worked for long, and I can assure you that systems have been brought. Softwares (sic) have come. I remember we had Lab, we had Malaria, we had TB, we had Pharmacy, we had … you know … and each was on their own. We really need a policy that states that anyone introducing a system must meet certain requirements. So that we make sure that they are interoperable, and we don't have the problem of training for one, then after a while training for another one and so on. I think we need to have one system that can cover all the areas."

Despite this and other complaints, the participants generally agreed that electronic health information systems had generally led to tangible improvements, especially in terms of data quality. However, they also pointed out that digital interventions were not without their challenges. For example, one participant reported that EMRs had made it harder to conduct Data Quality Assessments (DQAs) because they required a higher level of competence to query the electronic database and this skill was often lacking at the facility level. These competency challenges were attributed to lack of or poor training, as well as attrition of trained staff without a suitable replacement. Other challenges identified included the lack of routine On-the-Job Training (OJT), overreliance on partner support, lack of sustainability planning, inadequate infrastructure and lack of routine support, maintenance and system upgrades.

Participants agreed that they would be willing to support the digitization of community health but emphasized the need to ensure that the transition was adequately prepared for. Among the critical preparation steps they mentioned included consulting widely to ensure that the system spoke to the needs of the end users; supplying and installing the necessary infrastructure; adequately training users and their managers; promoting data demand and information use at the lower levels; and communicating with users, especially CHVs, in a simplified language that they can understand. Creating a culture of data use at the lower levels was identified as one way of motivating the individuals who conduct data collection activities to be more invested in their work and therefore generate better quality data in a timely manner.

3.2.2 Key Informant Interviews

A total of 8 KIIs were conducted with system developers and implementers of some of the electronic community health information systems identified during the quantitative survey. The specific systems covered during the KIIs were CStock, DHIS2 Tracker, Empower Health, Household Tracking Tool, Kobo Collect, mDharura, CHT (Medic Mobile and LG) and Movercado.

3.2.2.1 CStock

CStock was developed and is currently implemented by InSupply Health, an affiliate of the JSI Research and Training Institute. Based in East Africa, the firm provides clients with customized guidance on supply chain management and design.

The respondent noted that he was aware of the efforts by the MOH to digitize community health and thought that it was a step in the right direction. However, he also highlighted the importance of the MOH to take cognizance of existing solutions and accommodate them in the overall community health digitization strategy so as not to stifle innovation. The respondent opined that as long as the MOH articulated their requirements and set the minimum standards for information systems, innovators who introduce conformant solutions should be supported. CStock is currently implemented in 5 counties.

In terms of functionality, the respondent reported that the CStock system addresses the challenges associated with supply chain management at the community level. In particular, it provides a way for CHVs to track restocking, dispensing and stock on hand. When CHVs receive new stocks, they record this information using the CStock app. Afterwards, they go out to the

community and maintain a paper log of the commodities they dispense using an inventory card. The inventory card serves as a tallying system for tracking the commodities dispensed. At the end of the month, the CHVs review what they have dispensed based on the inventory card, compare it against their actual stock on hand and enter the data into cStock for accountability purposes.

CStock supports access both through an Android-based mobile application as well as via the less sophisticated USSD technology which ensures that it works even on ordinary feature phones. Since CHVs using CStock do so on their personal phones, this approach ensures that a wider group of users can be supported. In addition, the hybrid implementation where the application is supplemented using paper-based inventory cards was chosen to accommodate the realities of the environment where the CHVs work. In some cases, and especially in Arid and Semi-Arid Lands (ASALs), CHVs struggle to find reliable internet connectivity or electricity with which to recharge their mobile devices. A paper-based tallying system, therefore, allows them to work in such communities in spite of these infrastructure challenges. Based on this experience, the respondent underscored the need to ensure that the eCHIS speaks to the unique circumstances under which CHVs operate.

Another key lesson from CStock is that the internet address that receives data sent through the system is whitelisted with the mobile service provider, thereby greatly reducing the cost of data transmission. The respondent indicated that the program spends less that KES 25 per CHV per month, a key lesson that can be adopted in the implementation of the eCHIS. Also, CStock liberally uses pictures and sound recordings to help CHVs identify the various commodities they need to manage in the course day-to-day activities. This was identified as a critical intervention that helps address the needs of semi-literate and even illiterate CHVs.

Other functionalities offered by CStock includes CHA's being able to configure the application with the products available in their community unit as well as validating the data entered by the CHVs or even - if necessary - entering consumption data into the system on behalf of CHVs. CHAs can also see the performance of the CHVs under their supervision, and the facility pharmacist can use CStock to record the commodities they dispense to the CHVs. The application is currently closed source, but the respondent expressed confidence that InSupply Health would be willing to share the source code with MOH and its partners for the purposes of integration into the eCHIS as necessary.

In terms of data hosting, cStock uses an instance of the DHIS2 Tracker as the backend. The current instance is hosted by InSupply Health but it can readily be migrated to the MOH data center if desired. The application does not collect any personally identifiable client data. It does, however, store the telephone numbers of the CHVs.

3.2.2.2 DHIS2 Tracker

As a community health intervention DHIS2 Tracker was deployed by 4Kenya in 3 sub-counties in Kilifi county namely; Msambweni, Matuga and Kinango. The ICT project officer responding on behalf of 4Kenya indicated that he was aware of the plans by the MOH to digitize community health. He mentioned that his project had used DHIS2 Tracker to digitize the standard MOH data collection and management tools, particularly the MOH 513, MOH 514 and MOH 515 tools. The implementation, however, was reported as being no longer active since the pilot project under which it was implemented had since come to an end.

In terms of the users of the system, it was reported that DHIS2 Tracker was primarily used by CHVs for data collection and by the CHAs for data analysis. Through the application, CHAs could automatically generate the MOH 515 report and forward it to CHRIOs for uploading onto KHIS. The application was accessed through an Android-based mobile app as well as through a regular web browser for the data analysis and reporting component. The data was hosted with 4Kenya and secured through mandatory usernames and passwords for all users.

3.2.2.3 Empower Health

Empower Health is a community health digital intervention deployed by Medtronic LABS with funding from Novartis. It focuses exclusively on non-communicable diseases, with existing modules covering diabetes and hypertension. Future modules are expected to cover cancer, gestational diabetes, mental health and other conditions. Currently, the application is implemented in 6 counties namely; Makueni, Meru, Nyeri, Kakamega, Nairobi and Kisumu. There are plans to scale up into Mombasa and Nakuru as well. At the moment, the application is used by healthcare providers during outreach missions where clients in the community are screened for diabetes and hypertension. The system is able to generate individualized care plans for ill patients, as well as support digital patient management and follow-up. In Nyeri, for example, all facilities running empower health and linked, and a patient can seamlessly be attended to or receive prescriptions from any of the 10 health facilities participating in the pilot program. The system also has a patient module through which patients with a blood sugar or Blood Pressure (BP) machine can monitor their own parameters and upload these onto Empower Health for use by their care providers. This feature, however, has only been deployed to private health facilities.

The application currently supports Android as well as browser-based access. It works both online and offline, with the data collected offline being synchronized with a central server via the internet. The server is hosted and managed by Medtronic LABS, the company that implements Empower Health under the auspices of the county government. There is currently no interoperability support between Empower Health and facility-based EMRs, but there are plans to address this gap in future. Personally identifiable data collected through the system is secured behind individualized login accounts, Role Based Access Control (RBAC), automatic logout from the application after a specified period of time, as well as encryption of data both at rest and in transit. The application is released under a closed source license.

3.2.2.4 Household Tracking Tool

The Household Tracking Tool (HTT) is deployed in Vihiga County by the local government with funding and technical support of the United Nations International Children's Emergency Fund (UNICEF). The County Director of Geographic Information Systems responded to the interview and reported that although he was aware of the efforts by the MOH to digitize health information management generally, he was not aware of any plans specifically targeting community health. He mentioned that the HTT is used for Maternal and Child Health (MCH) management at the community level, right from Antenatal Care (ANC) through to delivery, Postnatal Care (PNC) and until the child is 1 year old.

Data collected through the HTT is transferred using a Comma Separated Values (CSV) file to the mapping application ArchGIS where it is processed and used for mapping the locations of mothers within the county. The system is accessed through an Android app user interface but can also be used through a regular desktop browser. It supports offline capability with data transmitted via the internet at the CHVs convenience. At present, there is no integration between HTT and any other HIS. Data is secured through usernames and passwords granted to CHVs using the app, while only one individual has the necessary credentials to access the database backend for data analysis and transfer. The data is currently hosted with UNICEF.

3.2.2.5 Kobo Collect

Although not currently active, Kobo Collect was previously deployed for community health digitization in Tharaka Nithi and Bomet counties as a pilot program operated by the Kenya Red Cross Society (KRCS). The pilot program has since been concluded. In these counties, the application was used to offer a digital version of the MOH 513 household enrollment form. The digital form was then deployed to the community for data collection by CHVs, assisted by staff hired by KRCS. The respondent noted that pairing CHVs with KRCS staff was necessary to ensure that the less technology-oriented CHVs were suitably oriented and trained on the job the the KRCS staff. The application worked offline, with data being synchronized through the internet to a central server hosted by KRCS. The CHVs accessed the platform through an Android-based mobile application.

Kobo Collect was also used as a backend for a USSD-based application used for the event based surveillance of zoonotic diseases in certain counties including Narok, West Pokot and Bomet. The USSD application comprised a set of 4 short questions to which CHV would send responses whenever they identify a suspected case of a zoonotic disease. This raised a notification to the CHA, who then assessed the case and submitted more details on the same via Kobo Collect.

In terms of integration, the respondent noted that although their implementation of Kobo Collect did not directly interoperate with the KHIS, it did produce data summaries for use by CHRIOs.

The respondent felt that Kobo Collect as a solution for community health presented a major challenge in that it does not support longitudinal or case-based data collection. As such, CHVs needed to re-enter information they had already collected during every visit to a household. Kobo Collect data was hosted by KRCS but access to the same was granted to county officials as necessary.

3.2.2.6 mDharura

mDharura is an SMS-based, event-based surveillance application based on the same CHT technology developed and deployed by Medic Mobile. It currently serves over 6,000 CHVs in Kenya in the 4 counties of Nakuru, Marsabit, Meru and Mombasa. Events raised through the mDharura system are forwarded to Community Health Focal Persons for verification. mDharura is currently hosted with the University of Nairobi (UoN). There are currently no interoperability implementations between mDharura and other systems. However, there are plans to integrate the system with KHIS for the purposes of routine reporting of surveillance data

3.2.2.7 Community Health Toolkit and SmartHealth

The Community Health Toolkit is a mobile platform designed and developed specifically for digital community health. The CHT data entry interface is based on ODK (Android) with modifications to support SMS-based data collection and submission, among other functionalities. CHT collects personally identifiable client data and secures this through a variety of means including usernames and passwords for all users; Secure Sockets Layer (SSL) encryption during data transmission; and Public Key Infrastructure (PKI) based backend access that ensures only authorized devices can connect to and access information on the server. Besides these technical security measures, implementers are encouraged to follow security best practices such as password-protecting data files before sharing them as well as recommending full device encryption for CHVs. In terms of extensibility, the respondent noted that the addition of new service areas into CHT is largely a matter of configuration rather than additional software development. However, more sophisticated use cases such as integration with third-party applications would demand software engineering time and resources.

3.3.2.7.1 Community Health Toolkit

IThe Medic Mobile application of CHT is currently supports over 17,000 CHVs around the world, with approximately 6,800 of those being in Kenya. Medic Mobile has CHT implementations in Siaya, Vihiga, Kisumu, Lamu, Nakuru, Marsabit, Meru and Mombasa counties. Among the services covered by CHT include household enrollment, service delivery (maternal, child, adolescent and adult health), NCDs (diabetes, hypertension and mental health), COVID-19, maternal health (including ANC and PNC workflows), child immunization with Integrated Community Case Management (ICCM), Family Planning (FP), Nutrition, Case Based Disease Surveillance (CBDS), Event Based Surveillance (EBS) via mDharura, client referrals, and verbal autopsy. The application also supports two-way client messaging as well as a basic component of supply chain management to promote care coordination.

The CHT platform is primarily used by CHVs for data collection and by CHAs for death confirmations, performance management and summary reports. CHAs can also run through supervisory workflows, including a coaching module that helps them support CHVs to improve their performance. The application does not currently have any features for clinicians at the health facility level. However, the respondent intimated that these could be easily integrated provided the relevant use cases were clearly articulated. One possible use case, for example, could be to submit information from the EMR back to CHT for patients who honor community-based referrals. For CHRIOs, a module has been developed that will enable them to generate aggregate data that is readily exportable to KHIS. This functionality has not yet been deployed but it is due for piloting in Siaya in early 2021. CHT does not provide any features for this user category. However, the key informant observed that CHT data could easily be exported to a SQL database and from there be used to prepare both custom and ad hoc dashboards for reporting and monitoring purposes.

3.3.2.7.2 SmartHealth application

SmartHealth by Living Goods is an open-source technology based mobile platform on the Community Health Toolkit framework. The SmartHealth implementations is used by approximately 11,130 CHWs globally and 4,200 CHWs in Kenya. It is used in Isiolo, Kisii, Busia, Kakamega, Kisumu, Kiambu and Nakuru counties

SmartHealth supported by Living Goods has features that cover services including household enrollment, service delivery (maternal-ANC and PNC, child health – ICCM, adolescent and adult health), client referrals management, pandemic monitoring (e.g. COVID-19), Family Planning (FP) and Nutrition monitoring. The application also supports two-way client messaging as well as a basic feature on supply chain inventory management to operations of the CHV. The interoperability to DHIS2 feature is fully functional and can be extended for other systems e.g. LMIS, OpenMRS. For reporting, the module is available for the CHA and HRIO to generate the monthly report, review and send automatically to DHIS. This feature is fully functional in Isiolo and Kisii installations. The SmartHealth platform is enhanced from the base CHT to support the CHVs in running workflows that have been adopted prompts that enhance the information they share with the client and the information they enquire as they provide services. The CHVs and CHAs can be able to see targeted performance areas through information available on their app dashboards. The application has seamless enhancement design in-place to support the inclusion of new service areas is through custom configurations by non-software developers.

The Smart Health Application customized by Living Goods has been built with extra capability to convert the data to FHIR Data format that aligns with OpenHIE guidelines. The Platform's back-end has also been re-engineered with a micro-services based back-end architecture that can easily scale. In terms of data hosting, the SmartHealth allows for configuration to a specific server location. Currently, an instance is hosted at MOH datacenter. There are plans underway to migrate the live installations to the enhance MOH data center upon its completion. The security mechanisms are as those in CHT with enhancements in the app access control and device level data encryption standards.

3.2.2.8 Movercado

Movercado is a now-defunct application deployed for community health digitization by Population Services Kenya. PS Kenya used the application specifically for NCD screening (diabetes and hypertension) at the community level and to track the positive cases. The application was accessed by both CHVs and healthcare providers through an Android application interface with support for offline use. The CHVs would conduct screening at the community level using Movercado, and the outcome would later be confirmed at the health facility by a healthcare provider. Data coming through the system was hosted centrally by Movercado, the company that develops and deploys the technology.

The scope of coverage for Movercado included Nyeri, Murang'a, Nairobi and Kajiado counties. The application was reportedly integrated with some EMR systems in private health facilities. The application is closed source and secured client data through a username and password based authentication system for users. The respondent intimated that they did not think the technology was sustainable owing to its closed source licence and perceived difficulty of use.

4. Discussion

4.1 Response Rate and Coverage

The assessment was well responded to, with only 20 of the 122 responses (16%) being duplicates. Half of these duplicates were caused by 2 respondents, implying a major capacity gap that may be attributable to individuals who either failed to follow the instructions provided or missed the training and sensitization session altogether.

In terms of coverage, nearly 70% of the sub-counties sampled submitted valid data, as did 85% of all counties. Despite the missing data from 7 counties and 29 of the sub-counties sampled, the assessment did obtain a majority of the data from the most critical community health stakeholders at the county and sub-county level i.e. CCHFPs and SCCHFPs. Together with the qualitative data from CHRIOs and system implementers, this provides a relatively reliable perspective of the eCHIS landscape in the country. It is likely that a higher response rate would have been achieved had more respondents been interviewed by enumerators instead of self-administering the assessment tool.

4.2 System Prevalence and Characteristics

From the results of this assessment, it is clear that while there are significant efforts to deploy digital community health solutions in the field, these efforts are generally fragmented and uncoordinated. On the upside, active use was reported in more than half of the cases where a system was identified, implying that counties and sub-counties have the ability to to succeed with digital health interventions given the appropriate support. Strikingly, the majority of digital community health systems is currently supported by partners, with particular focus on data analysis and reporting as well as capacity building and software development. Support for hardware procurement and replacement is relatively low, presumably due to its steep cost implications. As such, there is a clear over reliance on partner support at the county level for the sustenance of digital interventions for community health.

In terms of maturity, most of the community health digital systems identified were deployed within the last 3 to 4 years. While indicative of good progress in the digitization of community health, this also indicates a relatively immature landscape characterized by experimentation and pilot programs. The multiplicity of systems reported is emblematic of a sector that is actively looking for an ideal solution to a felt need. This is also manifested in the fact that many respondents reported the use of ordinary mobile data collection applications such as ODK, Kobo Collect and REDCap for community health information management despite the associated challenges. The dominance of applications licensed under proprietary licenses implies that licensing schemes are not yet an important concern of the implementers of digital community health interventions at this early stage.

As far as the nature of the technologies themselves is concerned, it is encouraging to note that most of the systems identified readily support mobile-based interfaces through either smartphones and tablets or feature phones. This augurs well for the needs of community healthcare providers who spend the majority of their time on the go, visiting households and interacting with communities. It also suggests that existing community health volunteers can, with the appropriate training and capacity building, be expected to acquire the necessary competence to conduct their activities using digital technologies instead of the traditional pen and paper method. Also, the reported reliance on internet connectivity to collect and transmit data from the various applications implies reliable mobile internet coverage. However, further investigation may be necessary to validate this speculation. Lastly, system reliability is still an issue given that only in half of the cases was the system identified reported to have been used within the three days preceding the date of the assessment.

4.3 System Challenges

User and system-related challenges stood out as the two most commonly experienced problems when using digital community health interventions. Challenges associated with infrastructure were also reported. In particular, the lack of or poor computer skills among staff stood out as the most prominent user based challenge. This raises critical questions about the competence of community health workers particularly with respect to computer literacy. Many respondents also reported that users struggled to navigate through the system with ease. This may represent not just a capacity gap but also a software design problem. Further, although training and capacity building on the use of the system was strongly supported especially by partner organizations, many users felt that they did not receive adequate mentorship post training. Issues of negative staff attitude were not widely reported, further strengthening the case that the community health subsector is ready for the deployment of digital solutions.

System breakdown and lack of or poor system support stood out as the most common system-related challenges. This implies that there may be a gap in post-implementation support planning and resourcing for the majority of community health digital interventions. It may also indicate the lack of a structured approach to software quality assurance and ongoing maintenance and technical support. The fact that the system's inability to handle a bulk number of users at the same time was the least reported system challenge is an indication of a low level of adoption where the systems have not yet needed to support a large user base. As such, it is likely that potential performance problems are yet to be experienced.

Unreliable electricity and internet connectivity were highlighted as the most important infrastructure-based challenges. To a lesser degree, delayed or absent hardware repair and maintenance was also singled out as an issue. This indicates a strong need for infrastructure support to complement the existing support for data analysis, software development and capacity building. Infrastructure based challenges tend to be more expensive to address but are just as important to the success of digital health interventions.

4.4 System Purpose and Use

It was interesting to note from the sub-counties assessed that existing digital community health interventions tended to focus more on data reporting than on creating efficiencies in service delivery and client engagement. In line with the MOH policy of promoting client-centered digital solutions, it is important to balance more carefully between meeting clients' needs and generating data for decision making. Only in one of the cases surveyed was the system reported to address clients needs directly. This is an important gap that must be addressed if the client is going to be at the center of the digital health revolution.

4.5 Personally Identifiable Information

The majority of the digital community health systems identified during the assessment were found to be collecting personally identifiable information, including, in some cases, biometric identifiers. In most cases, only a basic level of username and password-based security was provided. Only a few digital interventions were reported as having implemented more sophisticated information security features that reflect the scale of modern threats to sensitive client data. This underscores the need to develop the necessary policies and standards to guide the management of this sensitive information to safeguard clients' privacy and the confidentiality and comply with the Data Protection Act of 20197.

4.6 Focus Group Discussions

Among CHRIOs, the FGD revealed a general lack of awareness of the efforts by the MOH to digitize community health. This represents a critical gap in communication and sensitization. Despite this, demand for digital community health solutions is already growing in some counties as evidenced by the existence of interventions such as Empower Health, ODK and M-TIBA. It is clear that, in the absence of standards and guidelines from the MOH, different counties have taken different approaches to community health digitization, further threatening to exacerbate an already highly fragmented HIS landscape.

Generally, the FGD participants corroborated many of the findings from the quantitative survey, including over reliance on partner organizations for funding and technical support, lack of comprehensive post-implementation sustainability plans, competence and capacity gaps and infrastructure deficiencies. Despite these challenges, the participants reported significant familiarity with health information systems in general and the benefits they bring in terms of efficiency and data quality. However, they also pointed out the need to ensure that healthcare workers were not required to be familiar with and use a wide variety of disjointed systems as this undermined the very benefits of ICT for health. Overall, the participants indicated that they would be supportive of community health digitization provided the process was adequately resourced and designed with the involvement of all stakeholders to ensure that the end product answers to the needs of all user categories involved.

4.7 Key Informant Interviews

As with the FGDs conducted among CHRIOs, KIIs with community health system implementers largely corroborated the results of the quantitative landscape assessment. In particular, they revealed an eCHIS landscape characterized by relatively young, partner-supported implementations defined by rapid experimentation and pilot programs. Of the 8 digital systems for which KIIs were conducted, 2 (Kobo Collect and Movercado) were reported to have been implemented as pilot programs, while the remainder were reported to be in active production. None of the pilot programs was reported as being currently active. Of the digital systems in production, only DHIS2 Tracker was reported as being inactive due to the withdrawal of partner support.

In terms of integration, only one of the applications (CHT) was reported as supporting direct integration with DHIS2. Within the CHT distribution implemented by Medic Mobile, integration with DHIS is yet to be deployed in production. However, integration between DHIS2 and SmartHealth is currently in use in Isiolo and Kisii. On their part, Empower Health and Kobo Collect were reported as having the ability to generate "DHIS2-ready" reports that could be manually entered into DHIS2. The table below summarizes the nature of these community health digital systems in terms of their implementation type and DHIS2 integration.

	Implementation Type	Implementation Status	Implementation Coverage	DHIS2 Integration
cStock	Production	Active	5 counties	No
DHIS2 Tracker	Production	Inactive	1 county	No
Empower Health	Production	Active	6 counties	No
Household Tracking Tool	Production	Active	1 county	No
Kobo Collect	Pilot	Inactive	3 counties	No
CHT	Production	Active	8 counties	No
mDharura	Production	Active	4 counties	No
SmartHealth	Production	Active	7 counties	Yes
Movercado	Pilot	Inactive	4 counties	No

Table 4: A summary of community health digital interventions by implementation type and DHIS2 integration.

Another interesting finding from the KIIs was that the different systems surveyed tended to focus on a few areas of functionality and not the full scale of functional specifications defined for the eCHIS. The table below summarises the broad areas of functionality available on the systems assessed as reported by the respondents during the KIIs.

	Household Enrollment	Service Delivery	Commodity Supply Chain	Community Based Disease Surveillance	Messaging	Reporting
cStock	No	No	Yes	No	No	Yes
DHIS2 Tracker	Yes	Yes	No	No	No	Yes
Empower Health	No	Yes	No	No	Yes	Yes
Household Tracking Tool	No	Yes	No	No	No	No
Kobo Collect	Yes	Yes	No	No	No	No
mDharura	No	No	No	Yes	Yes	No
CHT	Yes	Yes	No	Yes	Yes	Yes
SmartHealth	Yes	Yes	Yes*	Yes	Yes	Yes
Movercado	No	Yes	No	No	No	Yes

*Table 5: A summary of community health digital interventions support for broad areas of eCHIS functionality. *SmartHealth Application can track the commodity consumption but requires integration to provide end to end medical supply chain visibility.*

Service delivery was the most widely supported area of functionality with the different systems covering the specific areas:

Community Health System	Service Delivery Areas Covered
cStock	None
DHIS2 Tracker	Digital version of MOH 514 (Demographics, Maternal and Child Health, Defaulter Tracing, Deaths, Water and Sanitation etc.)
Empower Health	Non-Communicable Diseases (Diabetes and Hypertension)
Household Tracking Tool	Maternal and Child Health (Antenatal Care, Postnatal Care, Labor and Delivery, Child Immunization)
Kobo Collect	Digital version of MOH 514 (Demographics, Maternal and Child Health, Defaulter Tracing, Deaths, Water and Sanitation etc.)
mDharura	None
CHT	Digital version of MOH 514 (Demographics, Maternal and Child Health, Defaulter Tracing, Deaths, Water and Sanitation etc.)
SmartHealth	Digital version of MOH 514 & 515 (Demographics, Maternal and Child Health, Defaulter Tracing, Deaths, Water and Sanitation etc.)
Movercado	Non-Communicable Diseases (Diabetes and Hypertension)

Table 6: Specific service delivery areas covered by various community health systems

CStock stood out as the only community health digital intervention addressing commodity supply chain management. Reporting was also well supported among the various tools. Commodity supply chain management and CBDS were reported as the least supported areas functionality covered by 1 and 2 of the digital health solutions reviewed respectively.

In terms of coverage, none of the applications reviewed reported nationwide deployment. Most of the digital health interventions identified are local in nature, addressing the needs of a few counties. This nonetheless presents a strong set of case studies from which the envisaged national eCHIS can draw important lessons. Some of the lessons highlighted by the system implementers include favoring simple rather than complex user interfaces and workflows, whitelisting server internet addresses to save costs and involving all relevant stakeholders during the application development process.

4.8 Limitations

The findings articulated in this report are subject to the following limitations:

The data collected and analyzed for the eCHIS landscape assessment was based on a sample of sub-counties rather than a full-scale census. Although extra care was taken to ensure optimal county representation, not all targeted respondents were able to participate. As such, it is possible that additional insights may have been missed as a result.

Not all respondents reached during this assessment were equally knowledgeable about the community health digital interventions in their areas. The assessors further validated the responses from SCCHFPs and CCHFPs through KIIs with system implementers. However, not all system implementers identified during the quantitative survey were interviewed due to time constraints.

Although a total of 5 FGDs were organized, only one of them was held successfully due to quorum challenges. This limits the extent to which the findings from the FGD can be generalized across the board.

The question on disease areas covered by the various digital interventions for community health was included after the assessment was already in progress. This limited the number of responses received for this variable, thereby undermining the generalizability of the associated conclusions.

The assessment of system functionality against the high level features defined for the eCHIS was based on the information provided by respondents during the KIIs rather than an actual review of the technology itself. As such, it does not cover extra details such as the extent or robustness of the implementation of those features.

Responses to the quantitative component of the assessment were submitted in one of two possible modes, i.e. self-administration of the questionnaire or through a telephone interview with a suitably trained enumerator. It is possible that there may be subtle differences in the quality of responses depending on the mode of questionnaire administration. These have not been accounted for in this report.

5. Conclusion and Recommendations

The following are the key conclusions obtaining from the results of this landscape assessment:

The deployment of digital solutions for community health continues to grow, with 28 individual systems being identified during this assessment. The majority of these have been implemented over the last 3 to 4 years. However, there lacks a coordinated approach to the development, deployment, support, maintenance, and sustainability of these solutions. The MOH should endeavor to create the appropriate policies and standards to guide digitization activities in community health.

Together, existing electronic solutions cover, to some degree, all the broad areas of functionality essential to the digitization of community health. These include household enrollment, service delivery (maternal and child health, adolescent health, adult health, NCDs etc.), commodity supply chain management, client referral, messaging and community-based disease surveillance. However, there is not one system that covers all these areas at once. As such, there is a need to invest in a more comprehensive information system for community health that unifies all these critical areas of functionality.

Majority of the existing digital community health systems are partner-supported both in terms of technical capacity and funding. This exposes the counties to potential sustainability problems due to the transient nature of partner support and their susceptibility to volatile funding cycles. For this reason, a gradual transition to direct county and national government support is an important step in ensuring greater sustainability for digital interventions for community health.

Implementations of digital solutions for community health are faced with multiple challenges. The main ones among these relate to users' training and capacity building, as well as challenges associated with the systems themselves and the infrastructure that supports them. More investment in post implementation planning is bound to ameliorate many of these challenges, including ongoing mentorship and on-the-job training for users, regular system maintenance, technical support and comprehensive hardware repair and replacement plans.

Existing digital solutions for community health are predominantly focused on addressing the data collection gaps faced by CHVs using paper-based systems. Many of them also offer support for both case-based and aggregate reports for middle- and higher-level health managers. However, there is a dearth of client-centered digital interventions that address the information and service delivery needs of the consumers of community health services. It is therefore imperative to encourage system developers and implementers to include specific features to address the needs of clients as well as create efficiencies in service delivery workflows that go beyond data collection.

Most community health digital systems collect and manage personally identifiable client data. As a consequence, there is need for the MOH to provide the necessary guidance and standards to ensure that this data is protected and managed according to the stipulations of the Data Protection Act (2019) and the Constitution of Kenya (2010). Such guidance should cover both technical features as well as security best practices for observance by system users and data processors and custodians.

Among the critical success factors for digital interventions identified from existing systems are broad stakeholder involvement, simplicity, flexibility, integration with other systems and comprehensive support and sustainability planning. These lessons will be valuable in the implementation of the national eCHIS and close consultation with the implementers of existing community health digital interventions is highly encouraged.

In conclusion, this landscape assessment has brought out the maturity status of the various eCHIS solutions. MOH continues to engage stakeholders' collaboration to progress. Based on the Global Digital Health Index (GDHI) and Maturity Model and findings of this assessment the following key indicator categories require further validation in the next phase including detailed prototyping and testing.

Among the critical success factors for digital interventions identified from existing systems are broad stakeholder involvement, simplicity, flexibility, integration with other systems and comprehensive support and sustainability planning. These lessons will be valuable in the implementation of the national eCHIS and close consultation with the implementers of existing community health digital interventions is highly encouraged.

Lastly, this report recommends a more detailed evaluation of the features and implementation scope of the community health digital solutions it identified. This would present an opportunity to validate the information gathered from system implementers in a more comprehensive assessment that may include, among other activities, source code and documentation review as well as site visits and interviews with end users to gauge the suitability and utility of the technology.

Global Digital Health Index (GDHI) and Maturity Model	In-Country specific intervention areas
Leadership and Governance	
eCHIS requires to be prioritized at the national level through dedicated mechanisms for governance eCHIS requires to be included in the National and Sub-national digital health strategies and have corresponding budget	Anchor by including Division of Community Health Services on the National Health Information System Inter-Government Co-ordination Committee and the Health Informatics TWG at National and County Resource mobilization and advocacy for inclusion of eCHIS implementation requirements in MOH budget Develop and implement M&E framework
Strategy and Investment	
digital community health strategy is required a costed plan for implementing the digital community health plan should be in place Provision of a proportion of the annual public spending on health committed to digital health	National Community Health Digitization Strategy development that has a costed implementation plan On-going MOH budget planning and resource mobilization within the public expenditure bills
Legislation, Policy, & Compliance	
legal framework and policies on data security for storage, transmission and usage that are relevant to digital health legal framework to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data in and out of the country	Support the information security enforcement and adherence to the data protection laws and guidelines in country and globally. The Kenya Data Protection Act guides on the storage, transmission, access control and usage of different categories of data During prototyping, the eCHIS should be validated for compliance with the OpenHIE standards and the Interoperability standards
Workforce	
curriculum for health and health-related support professionals in training Training of digital health workforce on the digital solutions	Develop National eCHIS training curricula for the Health Workforce Train National ToTs and Content Management in the MOH Virtual Academy Sensitization and advocacy and the Community Health Committees Members at sub-national level

Standards & Interoperability	
national digital health (eHealth) architectural framework and/or health information exchange (HIE) established digital health information standards for data exchange, transmission, messaging, security, privacy, and hardware	Framework for minimum functionalities developed to guide enhancement of digital platforms. During the prototyping the eCHIS is able to easily integrate with other digital platform The eCHIS should implement the Kenya Health Information Interoperability Framework is available for implementation and guides on the OPENHIE utilization
ICT Infrastructure	
Network readiness and maintenance ICT infrastructure - hosting and end user devices	Support the development of the MOH owned ICT infrastructure with capability to support centralized management and monitoring that require minimal resources Support ICT equipment and provision of end user devices for community health workers.
Nationallyscalable digital health systems with services and applications	
Functionalities to support digital identity management Secure registries or a master patient index of uniquely identifiable individuals/clients	Standardized minimum requirements for a digital platform to support community health service delivery which can support the over 95,000 CHVs and be ICT equipment agnostic. Integration to the National master patient registry for the community health digital systems. The eCHIS application require stress testing in the prototyping stage to ensure it can support the over 95,000 CHVs Formulate and implement success matrices for judging the maturity level of the technology for the purposes of national scale up

6. References

1. The role of Information Communication and Technology in achieving Universal Health Coverage
2. Enhancing Health Information Systems for evidence-based decision making in the health sector
3. Strategy for Community Health (2014 - 2019)
4. Refocusing on quality of care and increasing demand for services; Essential elements in attaining universal health coverage in Kenya
5. Kenya Community Health Policy (2020 - 2030)
6. WHO Classification of Digital Interventions
7. Data Protection Act 2019

7. Annexes

7.1 Assessment Questionnaire

INTRODUCTION

The goal of this tool is to inventory and characterize the eCHIS applications currently in use at each of the 47 counties. It is based on the WHO taxonomy for digital interventions and modeled after the questionnaire used by the Ministry of Health during the 2018 HIS Landscape Assessment. The tool will help document areas of functionality that have already been addressed, as well as identify existing gaps. In addition, it will provide objective data on the maturity, reliability and maintainability of existing eCHIS applications. The data gathering through this tool will inform the Key Informant Interviews that will be administered to select subject matter experts to augment the quantitative survey.

The tool is divided into 2 sections i.e. County Section and Systems Section. The County Section is brief and will be filled out only once per county. It will collect basic information about the county as well as document the total number of existing eCHIS systems. Counties which indicate that they have existing eCHIS systems will be expected to fill as many instances of the Systems Section. For example, a county with no eCHIS systems will not need to fill out the Systems Section, but one with 3 systems will need to fill out the Systems Section 3 times, once for each system.

This tool will be administered to the CHIS Lead in the county, who may consult any other knowledgeable persons in the county to answer the questions satisfactorily. Data collection will be conducted digitally using the Hoji Mobile Data Collection Application. All respondents will be duly trained ahead of the exercise.

Question	Conditional
Instructions: Please fill out this section once for your county or sub county.	
County:	**Select from list of counties**
Sub county:	**Select from list of sub counties**
Respondent name:	
Respondent designation:	
Respondent designation:	
Respondent Tel No:	
Respondent Email Address:	
Are there any community health digital tools / interventions / systems that are currently in use or that have previously been used in your county? ☐ Yes ☐ No *[Include any mobile, desktop or web applications used for community health other than national reporting systems such as DHIS2]*	
How many digital interventions are currently in use or have previously been used in your county? *[Please indicate the total number, and then for each systems, fill out the Systems Form once for each one of them]*	

Question	Conditional
Systems Section	
Instructions: Please fill out this section for each individual eCHIS system currently deployed in your county.	
Name of system / digital tool :	
Respondent name: [Indicate the name of the individual answering questions for the selected system]	
Respondent designation: [Indicate the designation of the individual answering questions for the selected system]	
Respondent Tel No: *[Indicate the Tel No of the individual answering questions for the selected system]*	
Respondent Email: *[Indicate the email address of the individual answering questions for the selected system]*	
Is the system still in use? ☐ Yes ☐ No	
Is the system currently being supported? ☐ Yes ☐ No	
Who is currently supporting the system? ☐ County ☐ National ☐ Partner (Specify)	
What kind of support is provided by [supporting entity] ☐ Software development ☐ Hardware procurement / replacement ☐ Training / capacity building ☐ Data reporting & analysis ☐ Other (Specify)	
In which year was the system implemented? *[If unknown, enter 9999]*	
At which level is data collected for this digital tool? ☐ Community level ☐ Health Facility level ☐ Sub County level ☐ County level ☐ National level ☐ Don't know	

Question	Conditional
Which organization / institution funded the development of the system? ☐ Sub county / County Government ☐ National Government ☐ Partner Organization (Specify) ☐ Unknown *If partner, specify*	
Which organization is currently maintaining / supporting the system? ☐ County Government ☐ National Government ☐ Partner Organization (specify) ☐ Unknown	
Is the system open source or closed source (owned by a proprietor)? ☐ Open source ☐ Closed source	
How do users access the system? ☐ [Multiple selection is allowed] ☐ Desktop/laptop ☐ Feature phone ☐ Smartphone / tablet	
Does the system require internet connectivity in order to be used? [i.e. does the system support offline capability] ☐ Yes ☐ No	
Does the system integrate with other digital tools / systems? ☐ Yes ☐ No	
How many users are currently using the system?	
Where is this data stored / located? ☐ Health facility ☐ Sub County / County ☐ National level ☐ Supporting partner server ☐ Not sure	

Question	Conditional
How is data transmitted across devices from data collection to storage? ☐ Via cable ☐ Via internet ☐ Via bluetooth ☐ Via SMS ☐ Other (specify)	
When was the system last used? ☐ Within the last 3 days ☐ Within the last 1 week ☐ Within the last 1 month ☐ Within the last 3 months ☐ More than 3 months ago	
How many days of system downtime were experienced in the last one month?	
System Challenges	
What challenges do you experience when using the system? ☐ (Multiple selection is allowed) ☐ System related challenges ☐ Infrastructure based challenges ☐ User related challenges ☐ Other (specify)	Show subsequent sections depending on selection between 1 - 4
If Response = 1, **What system-related challenges do you face?** *(Multiple selection is allowed)* ☐ System does not address user requirements ☐ System is difficult to navigate or use ☐ Lack of or poor system support ☐ Multiple systems deployed for use concurrently ☐ System breakdown ☐ Data inaccuracy ☐ System does not integrate with other digital tools in use ☐ System cannot handle a bulk number of users at the same time ☐ Features / modules cannot be added / extended ☐ Other (specify)	
If Response = 2, **What infrastructure based challenges do you face?** *(Multiple selection is allowed)* ☐ Lack of devices (mobile phones/laptops) ☐ Inconsistent electricity supply ☐ No power back-up (UPSs) ☐ System networking challenges ☐ Delayed or absence of hardware repair and maintenance ☐ Unstable internet connectivity ☐ Use of outdated hardware (servers, network accessories, etc) Other (specify)	

Question	Conditional
If Response = 3, **What user-related challenges do you face?** *(Multiple selection is allowed)* ☐ End users not trained on system use ☐ Technology staff do not know how to manage the tool for feature upgrade ☐ Lack of mentorship following training ☐ Lack of/poor computer skills among staff ☐ Negative staff attitude towards system ☐ High staff turnover / Understaffing ☐ Lack of support/leadership from management ☐ Users struggle to navigate through the system with ease ☐ Other (specify)	
If Response = 4, **Please specify other challenges that have been experienced?**	
System Purpose	
What is the purpose of the system? *[Multiple selections is allowed]* ☐ Patient management ☐ Diagnostics ☐ Appointment management ☐ Drugs dispensing ☐ Laboratory management ☐ Commodity management ☐ Finance / Payment management ☐ Human resource management ☐ Data Reporting ☐ Other (specify)	
What service delivery challenges were you experiencing prior to implementation of the system? ☐ Information related challenges ☐ Availability related challenges ☐ Quality related challenges ☐ Acceptability related challenges ☐ Utilization related challenges ☐ Efficiency related challenges ☐ Cost related challenges ☐ Accountability related challenges ☐ Don't know	

Question	Conditional
If Response = 1, **What information challenges were you experiencing prior to implementation of the system?** ☐ Lack of population denominator ☐ Delayed reporting of events ☐ Lack of quality/reliable data ☐ Communication roadblocks ☐ Lack of access to information or data ☐ Insufficient utilization of data and information ☐ Lack of unique identifier	
If Response = 2, **What availability challenges were you experiencing prior to implementation of the system?** ☐ Insufficient supply of commodities ☐ Insufficient supply of services ☐ Insufficient supply of equipment ☐ Insufficient supply of qualified health workers	
If Response = 3, **What quality challenges were you experiencing prior to implementation of the system?** ☐ Poor patient experience ☐ Insufficient health worker competence ☐ Low quality health commodities ☐ Low Health worker motivation ☐ Insufficient continuity of care ☐ Inadequate supportive supervision ☐ Poor adherence to guidelines	
If Response = 4, **What acceptability challenges were you experiencing prior to implementation of the system?** Lack of alignment with local norms Programs which do not address individual beliefs and practices	
If Response = 5, **What utilization challenges were you experiencing prior to implementation of the system?** ☐ Low demand for services ☐ Geographic inaccessibility ☐ Low adherence to treatments ☐ Loss to follow-up	

Question	Conditional
If Response = 6, **What efficiency challenges were you experiencing prior to implementation of the system?** ☐ Inadequate workflow management ☐ Lack of/inappropriate referrals ☐ Poor planning and coordination ☐ Delayed provision of care ☐ Inadequate access to transportation	
If Response = 7, **What cost challenges were you experiencing prior to implementation of the system?** ☐ High cost of manual processes ☐ Lack of effective resource allocation ☐ Client-side expenses ☐ Lack of coordinated payer mechanism	
If Response = 8, **What accountability challenges were you experiencing prior to implementation of the system?** ☐ Insufficient patient engagement ☐ Unaware of service entitlement ☐ Absence of community feedback mechanisms ☐ Lack of transparency in commodity transactions ☐ Poor accountability between the levels of the health sector ☐ Inadequate understanding of beneficiary populations	
To what extent have these service delivery challenges been addressed? ☐ Fully addressed ☐ Partially addressed ☐ Not addressed	
System Use	
Who is the primary user of the system?* ☐ Patient (Client) ☐ Community health Volunteers ☐ Community Health Assistants ☐ Health Facility workers ☐ Government program officers (Sub County/County/National)	
What do patients (clients) generally use the system for? ☐ Targeted client communication ☐ Untargeted client communication ☐ Client to client communication ☐ Personal health tracking ☐ Citizen based reporting ☐ On demand information services to clients ☐ Client financial transactions	

Question	Conditional
How do patients (clients) use the system for targeted client communication?	
☐ Transmit health event alerts to specific population group(s)	
☐ Transmit targeted health information to client based on health status or demographics	
☐ Transmit targeted alerts and reminders to client(s)	
☐ Transmit diagnostics result or availability of result to clients	
How do patients (clients) use the system for untargeted client communication?	
☐ Transmit untargeted health information to an undefined population	
☐ Transmit untargeted health event alerts to undefined group	
How do patients (clients) use the system for client to client communication?	
Peer group for clients	
How do patients (clients) use the system for personal health tracking?	
☐ Access by client to own medical records	
☐ Self monitoring of health or diagnostic data by client	
☐ Active data capture/documentation by client	
How do patients (clients) use the system for citizen based reporting?	
☐ Reporting of health system feedback by clients	
☐ Reporting of public health events by clients	
How do clients use the system for on-demand information services to clients?	
Client look-up of health information	
How do clients use the system for client financial transactions?	
☐ On demand information services to clients	
☐ Transmit or manage vouchers to client for health services	
☐ Transmit or manage incentives to clients for health services	
What do healthcare providers generally use the system for?	
☐ Client identification and registration	
☐ Client health records	
☐ Healthcare provider decision support	
☐ Telemedicine	
☐ Healthcare provider communication	
☐ Referral coordination	
☐ Scheduling and activity planning for healthcare providers	
☐ Healthcare provider training	
☐ Prescription and medication management	
☐ Laboratory and diagnostics imaging management	
How do healthcare providers use the system for client identification and registration?	
☐ Verify client unique identity	
☐ Enroll client for health services/clinical care plan	

Question	Conditional
How do healthcare providers use the system for client health records?	
☐ Longitudinal tracking of client's health status and services received	
☐ Manage client's structured clinical records	
☐ Manage client's unstructured clinical records (e.g. notes, images, documents)	
☐ Routine health indicator data collection and management	
How do healthcare providers use the system for healthcare provider decision support?	
☐ Provide prompts and alerts based according to protocol	
☐ Provide checklist according to protocol	
☐ Screen clients by risk or other health status	
How do healthcare providers use the system for telemedicine?	
☐ Consultations between remote client and healthcare provider	
☐ Remote monitoring of client health or diagnostic data by provider	
☐ Transmission of medical data (e.g. images, notes, and videos) to healthcare provider	
☐ Consultations for case management between healthcare providers	
How do healthcare providers use the system for healthcare provider communication?	
☐ Communication from healthcare provider to supervisor	
☐ Communication and performance feedback to healthcare provider	
☐ Transmit routine news and workflow notifications to healthcare provider(s)	
☐ Transmit non-routine health event alerts to healthcare providers	
☐ Peer group for healthcare providers	
How do healthcare providers use the system for referral coordination?	
☐ Coordinate emergency response and transport	
☐ Manage referrals between points of service within health sector	
☐ Manage referrals between points of service within health sector	
How do healthcare providers use the system for scheduling and activity planning for healthcare providers?	
☐ Identify clients in need of services	
☐ Identify clients in need of services	
How do healthcare providers use the system for healthcare provider training?	
Provide training content and reference material to healthcare provider(s)	
Assess capacity of healthcare provider	

Question	Conditional
How do healthcare providers use the system for prescription and medication management?	
☐ Transmit or track prescription orders	
☐ Track client's medication consumption	
☐ Report adverse drug effects	
How do healthcare providers use the system for laboratory and diagnostics imaging management?	
☐ Transmit client diagnostic result to healthcare provider	
☐ Transmit client diagnostic result to healthcare provider	
☐ Capture diagnostic results from digital devices	
☐ Track biological specimens	
What do health system or resource managers generally use the system for?	
☐ Human resource management	
☐ Supply chain management	
☐ Public health event notification	
☐ Civil Registration and Vital Statistics (CRVS)	
☐ Health financing	
☐ Equipment and asset management	
How do health system and resource managers use the system for human resource management?	
☐ List health workforce cadres and related identification information	
☐ Monitor performance of healthcare provider(s)	
☐ Manage registration/certification of healthcare provider(s)	
☐ Record training information on healthcare provider(s)	
How do health system and resource managers use the system for supply chain management?	
☐ Manage inventory and distribution of health commodities	
☐ Notify stock levels of health commodities	
☐ Notify stock levels of health commodities	
☐ Register licensed drugs and health commodities	
☐ Manage procurement of commodities	
☐ Manage procurement of commodities	
How do health system and resource managers use the system for public health event notification?	
Notification of public health events from point of diagnosis	

Question	Conditional
How do health system and resource managers use the system for Civil Registration and Vital Statistics (CRVS)? ☐ Notify birth event ☐ Register birth event ☐ Certify birth event ☐ Notify death event ☐ Register death event ☐ Certify death event	
How do health system and resource managers use the system for health financing? ☐ Register and verify client insurance membership ☐ Track insurance billing and claims submission ☐ Track and manage insurance reimbursement ☐ Transmit or manage routine payroll payment to healthcare provider(s) ☐ Transmit or manage incentives to healthcare provider(s) ☐ Manage budget and expenditures ☐ Track billing (cash collection/receipts)	
How do health systems and resource managers use the system for equipment and asset management? ☐ Monitor status and maintenance of health equipment ☐ Track regulation and licensing of medical equipment	
What do data services generally use the system for? ☐ Data collection, management and use ☐ Data coding ☐ Location mapping ☐ Data exchange and interoperability	
How do data services use the system for data collection, management and use? ☐ Non routine data collection and management ☐ Data storage and aggregation ☐ Data synthesis and visualizations ☐ Automated analysis of data to generate new information or predictions on future events	
How do data services use the system for data coding? ☐ Parse unstructured data into structured data ☐ Merge, de-duplicate and curate coded datasets or terminologies ☐ Classify disease codes	

Question	Conditional
How do data services use the system for location mapping? ☐ Map location of health facilities/structures ☐ Map location of health event ☐ Map location of clients and households ☐ Map location of healthcare provider(s)	
How do data services use the system for data exchange and interoperability? ☐ Date exchange across systems	
Does the system collect personally identifiable information? ☐ Yes ☐ No	
If yes, **Does the system collect biometric identifiers?** ☐ Yes ☐ No ☐ Don't know	
b) Which biometric identifier does the system collect? ☐ Fingerprint ☐ Finger vein pattern ☐ Palm print ☐ Iris scan ☐ Retina scan ☐ Other (Specify)	
THE END	

7.2 Focus Group Discussion Guide

INTRODUCTION

Greetings, and thank you for responding to the invitation to attend this meeting.

The Ministry of Health is currently developing an end-to-end electronic solution through the Digital Health Platform (DHP). The DHP will cover the full range of health services, including community health.

Towards this end, the ministry, with support from its partners, has engaged a team of consultants to help develop a national strategy for the digitization of community health. As Health Records and Information Officers (HRIOs), you have been identified as key stakeholders in this process.

During this focus group discussion, we wish to gather your views, opinions and suggestions on community health digitization. In particular, we hope to understand the current situation with respect to electronic community health systems in your county, as well as your aspirations and expectations for the future.

The moderator will ask a few questions to guide the discussion, but you are encouraged to share your thoughts freely. The session is scheduled to last for approximately one hour.

[Before we begin, we would like to request you to type your name and the name of your county in the chat box, so that we have a record of your attendance.]

Question	Goal
Are you familiar with the ministry's ongoing efforts to digitize community health? *[For participants who know about the landscape assessment, probe to understand their reasons for non-response.]*	Check if respondents are aware of the landscape assessment and why they may not have responded.
What digital systems are you aware of that are used to manage community health in your county? *[Probe to understand system characteristics e.g. who supports the system, is it currently in use, what challenges does it address e.t.c.]*	Check for awareness of existing digital health interventions for community health and their characteristics.
What broad areas of community health does your digital solution cover? ☐ Household enrollment ☐ Service delivery (which areas?) ☐ Child immunization ☐ Maternal health ☐ HIV/TB ☐ Malaria ☐ NCDs ☐ COVID 19 ☐ Verbal autopsy ☐ Other (specify) ☐ Client referrals ☐ Commodity supply chain management ☐ Case-based surveillance ☐ Client messaging ☐ Other (specify) *[Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]*	Understand the focus of the digital health intervention in terms of functionality.

Question	Goal
How do you think the digitization of community health would enhance or hamper service delivery and data management in your county? [Probe for arguments both for and against the eCHIS]	Check for an understanding of the utility of the eCHIS.
What kinds of challenges do you think would result from the digitization of community health? *[Probe to better understand anticipated problems e.g. capacity gaps, data migration issues, attitude issues e.t.c.]*	Check for any apprehension around the deployment of the eCHIS.
If the ministry deployed an electronic community health information system in your county, what would influence your decision to support or not support it? [Probe especially for reasons not to support the eCHIS.]	Understand what it takes to gain the support of the participants towards the eCHIS.
What are some of the ways you have found digital health information systems to be supportive of or detrimental to your day-to-day activities? *[Probe for arguments both for and against digital health interventions, if any.]*	Understand past experience with digital health information systems.
What do you think makes a good digital health information system? *[Probe for the motivation behind the reasons offered.]*	Understand expectations and the basis for those expectations.
What do you think makes a poor digital health information system? *[Probe for the motivation behind the reasons offered.]*	Understand what makes systems fail from the participants' point of view.
How well would you say the community health system implemented in your county has worked? *[Probe for reasons why the respondent thinks the system has or has not worked well.]*	Understand the perceived usefulness/ utility of the system to the respondent.
What community health services have been digitized by the system implemented in your county? *[Offer pointers e.g. immunization, maternal health, HIV/TB, malaria e.t.c.]*	Understand the scope of community health services covered by the system.
Within the county, who else do you think are critical stakeholders that would influence the success or failure of an electronic community health information system? *[Encourage broad thinking e.g. to cover the community, private sector, partner organizations, local government e.t.c. Probe for why these stakeholders are important.]*	Understand other important stakeholders at the county level.

7.3 Key Informant Interview Guide

INTRODUCTION

Greetings, and thank you for responding to the invitation to participate in this interview.

The Ministry of Health is currently developing an end-to-end electronic solution through the Digital Health Platform (DHP). The DHP will cover the full range of health services, including community health.

Towards this end, the ministry, with support from its partners, has engaged a team of consultants to help develop a national strategy for the digitization of community health. Through a landscape assessment they conducted recently, your organization was identified as a developer/implementer of one of the existing digital solutions for community health. As a representative of your organization, you have been identified as a key informant for the purposes of this interview.

During this session, we wish to tap into your expertise to better understand your community health digital intervention, including its characteristics, current deployment status, and potential for growth and large scale deployment.

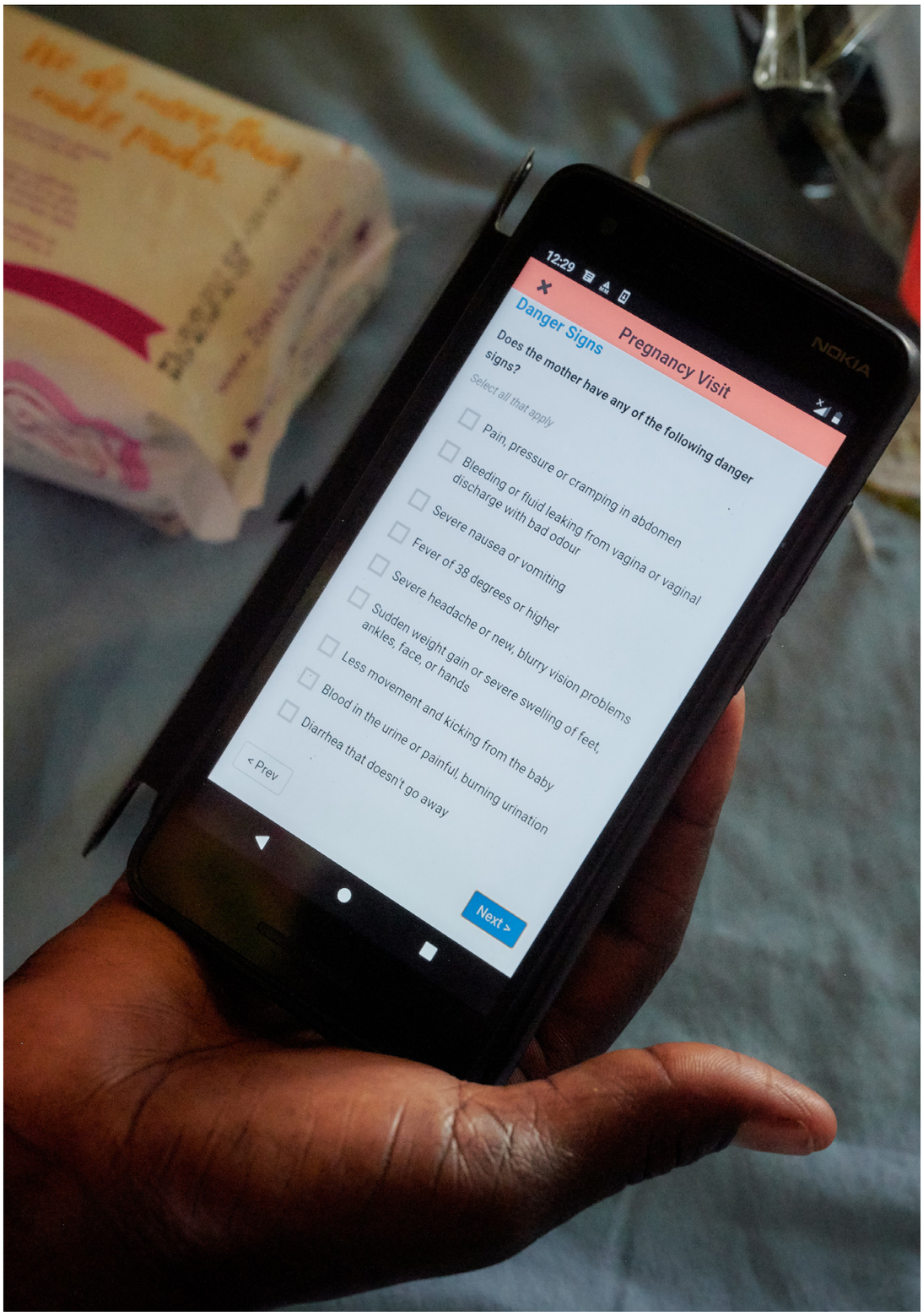
I will ask you a few questions to guide this discussion, but you are encouraged to share your thoughts freely. The session is scheduled to last for approximately 40 minute

Question	Goal
Name of Participant:	Preliminary
Participant's Organization:	Preliminary
☐ Type of Organization: ☐ For profit ☐ Not for profit ☐ Social enterprise ☐ Government agency ☐ Other (specify)	Preliminary
Designation of Participant:	Preliminary
Date of Interview:	Preliminary
Name of Digital Intervention:	Record the name of the digital intervention/system.
Are you familiar with the ministry's ongoing efforts to digitize community health? What do you know about it? ☐ Yes ☐ No [For participants who know about the ministry's efforts to digitize community health, ask follow up questions to understand their level of knowledge.]	Check for familiarity with the ministry's efforts to digitize community health.

Question	Goal
How would you describe the geographical scale and scope of coverage of your digital intervention for community health? ☐ Large-scale/nationwide deployment ☐ County/localized deployment ☐ Single site deployment ☐ Pre-production pilot deployment ☐ Other [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the scope of the digital health intervention in terms of coverage.
What broad areas of community health does your digital solution cover? ☐ Household enrollment ☐ Service delivery (which areas?) ☐ Child immunization ☐ Maternal health ☐ HIV/TB ☐ Malaria ☐ NCDs ☐ COVID 19 ☐ Verbal autopsy ☐ Other (specify) ☐ Client referrals ☐ Commodity supply chain management ☐ Case-based surveillance ☐ Client messaging ☐ Other (specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the focus of the digital health intervention in terms of functionality.
What does it take to expand your digital intervention to cover new areas of functionality? ☐ Additional software features ☐ Additional configuration ☐ Combination of both additional software features and additional configuration ☐ Other (specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand system scalability to accommodate new functionality.

Question	Goal
Who uses your digital health intervention? What do they use the system for? ☐ Clients ☐ CHVs ☐ CHAs ☐ Clinicians at health facility ☐ Focal persons ☐ HRIOs ☐ Health managers e.g. CHMT ☐ National MOH ☐ Other (specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the users of the system and the utility they gain from it.
What platforms does your digital intervention for community health support? ☐ Mobile (Android) ☐ Mobile (iOS) ☐ Mobile (Windows) ☐ Desktop app ☐ Browser ☐ Other (Specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the nature of platforms supported by the digital health intervention.
Does your digital intervention work offline? What methods are used to synchronize data? ☐ Mobile internet ☐ WiFI ☐ Cable ☐ Bluetooth ☐ USB ☐ Other (Specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the connectivity requirements of the digital intervention.
Has your digital intervention been integrated with other Health Information Systems? If yes, which ones? [Probe and list other applications with which the digital intervention has been integrated.]	Understand the current integration/interoperability capabilities of the digital health intervention.
Where is your digital health intervention/system hosted? ☐ With my organization ☐ With an NGO/Partner organization ☐ With a local government? ☐ With the national government? ☐ Not sure ☐ Other (Specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand current data/system hosting environment.

Question	Goal
Does your system collect personally identifying client data? How is this data secured? [Probe to understand data security measures and protocols.]	Understand measures and protocols used to secure sensitive data collected through the system.
Under what license is the digital solution that you develop or implement released? ☐ Open source ☐ Close source ☐ Mixed licensing ☐ Unsure [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the nature of source code licensing for the digital health intervention.
How is your digital intervention for community health currently financed? ☐ By government ☐ By an NGO/Partner organization ☐ By profits from sale/deployment of solution ☐ Other (specify) [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the nature of financing for the digital health intervention.
Given the necessary support, would you describe your digital intervention as being ready for nationwide scale? Why, or why not? ☐ Yes ☐ No [Options are for easily summarizing respondent's answer. Responses outside the options provided are allowed as well.]	Understand the system owner's own perception of readiness for scale.



Digitizing and integrating the community heath system with the broader health ecosystem is one of government's key aspirations as part of far reaching health sector reforms to achieve UHC. By leveraging networks of trained, supervised, compensated and digitally enabled CHVs, government can ensure that pregnant mothers and children under age 5 have access to high quality essential health services.

MINISTRY OF HEALTH

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