

East African Community Digital Health and Interoperability Assessments

Kenya

September 2019



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ABBREVIATIONS

AOT	Assessment Oversight Team
ARA	Afya Research Africa
CDC	United States Centers for Disease Control and Prevention
DHA	Digital Health Atlas
Digital REACH	Digital Regional East African Community Health
EAC	East African Community
EASTECO	East African Science and Technology Commission
eHealth TWG	eHealth Technical Working Group
EHR	electronic health record
EMR	electronic medical record
GDHI	Global Digital Health Index
GIS	geographic information system
GPSDD	Global Partnership for Sustainable Development Data
HIE	health information exchange
HIS	health information system
HR	human resources
ICT	information and communications technology
I-TECH	International Training and Education Center for Health
KeHIA	Kenya Health Informatics Association
Kenya HMIS	Kenya Health Management Information System
LMIS	logistics management information system
MFL	master facility list
MOH	Ministry of Health
MoICT	Ministry of Information, Communications and Technology
SOP	standard operating procedure
UHC	universal health coverage
USAID	United States Agency for International Development
WEF	World Economic Forum

EXECUTIVE SUMMARY

There has been a great deal of momentum in the East African region regarding digital health. The East African Community (EAC) has been especially engaged in leading several regional initiatives in this area. Kenya has been one of the leaders in introducing digital health innovations in East Africa; as an early adopter of digital health, the country has seen both innovation and institutionalization of new technologies, as well as supportive policies and laws to govern digital health implementation. The EAC member states aspire to establish interoperable health information systems to enable cross-border sharing of key patient health information between the EAC states and ensure continuity of healthcare, and for overall management of health services in the region.

In May 2019, the Ministry of Health (MOH), in collaboration with the United States Agency for International Development (USAID)-funded MEASURE Evaluation project and Afya Research Africa (ARA), conducted a health information system (HIS) interoperability assessment and also collected data for the Global Digital Health Index (GDHI) and the Digital Health Atlas (DHA). The purpose of this digital health and interoperability assessment was to provide insights into Kenya's digital health landscape, with recommendations for achieving optimized, interoperable health information systems that enable data exchange between Kenya and its East African country counterparts. The assessment consisted of three components: a desk review of existing literature and policies on digital health in Kenya, a review of information systems and their implementation, and workshops and meetings with digital health stakeholders. Data were collected and analyzed from three tools: the HIS Interoperability Maturity Toolkit, GDHI and Maturity Model, and DHA.

Kenya has numerous policies in place to support digital health governance and interoperability; however, the country faces challenges in institutionalizing these policies evenly across the nation in the wake of decentralizing governance from the national to county level. There are varying levels of understanding of—and buy-in to—national policies and the vision for interoperable health information systems. Further, both human resources capacity and technological infrastructure to support HIS are not adequately distributed across the country. Formal digital health career paths do not exist within the public sector, and many health workers have had little to no training on digital health.

Triangulating the results of using the assessment tools with input of key stakeholders from consensus building workshops and stakeholder interviews, the assessment found that, although Kenya has a robust digital health ecosystem and has made significant progress in moving toward interoperable health systems in the areas of leadership and governance, human resources, and technology, more work remains in each of these domains. The MOH and eHealth Technical Working Group (eHealth TWG) should work closely with county governments to institutionalize digital health governance so that HIS activities do not occur as siloed efforts that fail to integrate with established policies, standards, and frameworks. Additionally, to encourage buy-in and facilitate alignment of work plans and implementation, stakeholders should be educated on the aims and benefits of interoperable HIS. We use the assessment results to provide recommendations to strengthen institutionalization of policies supportive of interoperability, increase HIS capacity, and ensure distribution of adequate infrastructure to support HIS activities.

BACKGROUND

EAC & Digital REACH

Momentum for digital health in the East African region has been growing steadily. Specifically, the EAC has been engaged in leading several regional initiatives on digital health. In 2010, the EAC convened a Regional eHealth Workshop and Ministerial Conference for member countries to share experiences and insights on how to move eHealth forward in the region. As a follow-on to the inaugural conference held in 2010, the East African Science and Technology Commission (EASTECHO), in collaboration with the EAC Secretariat and partner states, convened the 2nd EAC Regional eHealth and Telemedicine Ministerial Conference in Kigali, Rwanda in May 2018. At the close of the two-day conference, attendees concurred that EASTECHO, in collaboration with the EAC Secretariat, East African Health Research Commission (EAHRC), partner states' national science and technology commissions, and sectoral councils and partners, would do the following:

- Conduct an EAC regional eHealth readiness assessment incorporating aspects of systems interoperability, costs, and benefits of eHealth investment by December 30, 2019
- Promote the incubation of local digital health solutions and submit progress reports to relevant sectoral and ministerial councils every two years
- Coordinate the development of regional policies, laws, regulations, guidelines, and standards on health facility and patient safety, data sharing, data security, and privacy to facilitate eHealth in country, as well as cross-border patient referrals within EAC partner states, by June 2020
- Take leadership in convening the biannual EAC Regional eHealth and Telemedicine Ministerial Conferences, and associated workshops and international exhibitions, on a rotating basis among the partner states each year in the last week of October; these conferences will be part of the meetings of the EAC Sectoral Council of Ministers, which is responsible for health in collaboration with the EAC Secretariat, EAHRC, and EAC Regional Center for Excellence for Biomedical Engineering and eHealth

Furthermore, in 2018 the EAC launched the Digital Regional East African Community Health (Digital REACH) Initiative, whose mission statement is to “Maximise the power of digital health in East Africa by ensuring an enabling environment and by implementing scaled, coordinated, transformational, and innovative approaches” through a shared roadmap for creating a regional enabling environment for digital health. The roadmap consists of nine workstreams, in which responsibilities are divided for the region and partner states. The work streams are the following: organization formation and management; health programs; infrastructure; services and applications; leadership and governance; strategy and investment; legislation, policy, and compliance; workforce; and harmonization, standards, and interoperability. The premise behind the regional initiative is that regional ownership and development of some key components of the enabling environment for digital health will help partner states reduce costs by sharing those services that can be shared; for example, hosting common technology components on a shared cloud; standardizing digital health training; and aggregating demand for certain services, such as telemedicine. The initiative also will help develop the enabling environment, including policies, to facilitate cross-border data and information sharing.

Country Background

Kenya has long been on the leading edge of digital health in sub-Saharan Africa by being at the forefront of both innovation and institutionalization of new technologies, and supportive policies and laws. Kenya began developing its HIS in the mid-1970s, and the system, now known as KenyaHMIS, has reached national scale (MEASURE Evaluation, 2017). Furthermore, a number of HIS subsystems have reached national or near national scale, including electronic health records (EHRs), logistics management information systems (LMIS), and the master facility list (MFL).

Furthermore, Kenya adopted a national HIS policy in 2009 and a national eHealth strategy in 2011. These policies are critical to creating an enabling environment that fosters the progress and scale of HIS in Kenya. In addition, Kenya has a number of supportive laws in place to support the use of HIS, such as the protection of personally identifiable data and governance of civil registration and national identification management. Kenya also has a number of recent or draft policies that address digital health interoperability issues, including the Kenya National eHealth Strategy 2011–2017 (which includes the interoperability framework and an implementation roadmap), the Kenya National eHealth Policy 2016–2030, the Kenya Health Enterprise Architecture (2016), the Standards and Guidelines for Electronic Medical Record Systems in Kenya (2010), and the Kenya eHealth Information Systems Interoperability Standards Document (2015). Despite these policies, many HIS subsystems remain siloed owing to some entities not adopting standards and variable data quality that limits or prevents integration.

In May 2019, the MOH, in collaboration with MEASURE Evaluation and ARA, conducted an HIS Interoperability Assessment and collected data for the GDHI, and reviewed Kenya's data for the DHA. The hope is that the outcomes of the assessments, which focused on such digital health domains as leadership and governance, infrastructure, and human resources, will provide insights into Kenya's digital health landscape that will be considered when implementing both national and regional EAC-wide digital health initiatives. This report documents the results of the EAC-commissioned digital health and interoperability assessment described below.

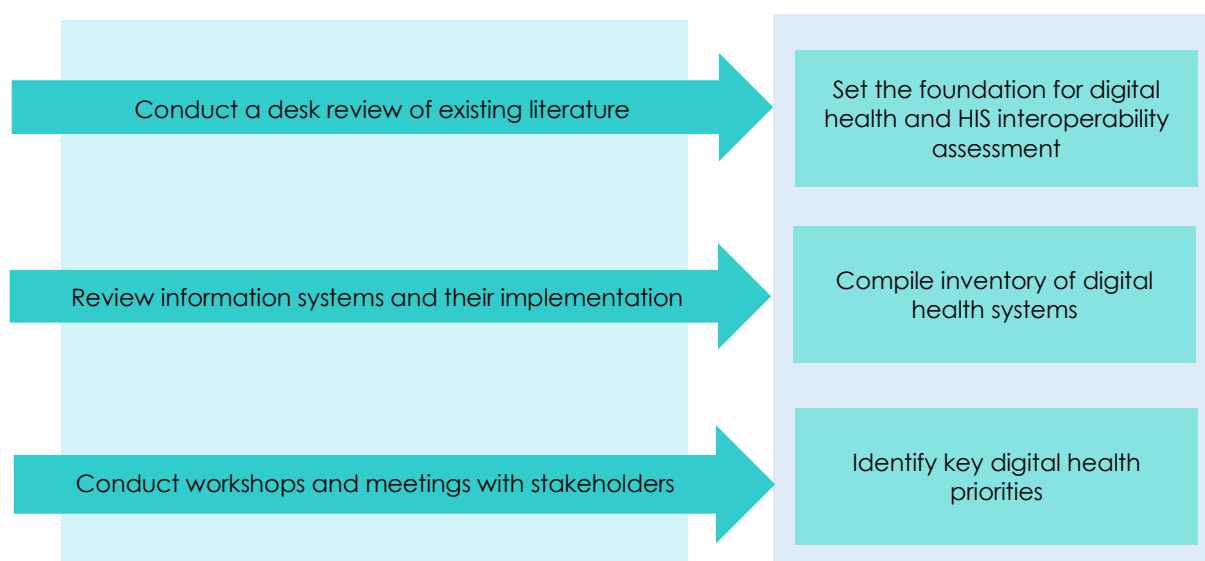
OBJECTIVES

The regional health program of the United States Agency for International Development (USAID)/Kenya and East Africa Mission, in coordination with the USAID Global Health Bureau, U.S. Global Development Lab, and USAID Bureau for Africa, engaged MEASURE Evaluation to provide technical assistance (TA) support to EASTECO in conducting an EAC regional digital health readiness assessment incorporating aspects of systems interoperability and the cost of investing in digital health in the EAC region. When completed, the assessment will have covered four of the six EAC partner states. This report details the results of the Kenya assessment, which had two objectives:

- 1) Assess the status of digital health and HIS interoperability in Kenya by assessing the processes, structures, and capacities needed to support the enabling environment for digital health and interoperability. This objective included beginning to develop a registry of digital health solutions being implemented in Kenya.
- 2) Using the Kenyan assessment results, contribute to the regional landscape assessment of digital health and interoperability in the EAC to inform regional analysis and recommendations for moving them forward.

METHODS

Figure 1. Overview of methods



The methods used in this assessment consisted of three components: a desk review of existing literature and policies on digital health in Kenya; review of information systems and their implementations in country; and workshops and meetings with stakeholders. These component processes were performed between April and June 2019. The initial desk review was conducted before the assessment trip, with additional documents added at the recommendation of key stakeholders. Upon arrival in the country, the assessment team formed a local digital health advisory team, also known as the Assessment Oversight Team (AOT) to review the assessment plan, review the list of key digital health stakeholders in the country who would contribute to the assessment, and plan the co-facilitation of the assessment workshops. The teams conducted two workshops:

- (1) A one-day workshop conducted with HIS and digital health key stakeholders to collect data for the GDHI (see Table A in Appendix 1 for a list of participants).
- (2) A second workshop to validate the findings of the HIS Interoperability Maturity Assessment Toolkit findings and identify key digital health priorities (see Table B in Appendix 1 for a list of participants).

The MEASURE Evaluation team also conducted one-on-one meetings with key stakeholders and digital health system owners (see Table A in Appendix 2 for the list of stakeholders interviewed). To take stock of Kenya's recent digital health assessments, the assessment team met with the implementers of those assessments and reviewed the ensuing results.

AOT Formation

While planning the assessment, the MEASURE Evaluation assessment team formed the AOT, made up of local digital health experts. The AOT provided key guidance on in-country HIS and digital health activities. The MOH worked with the MEASURE Evaluation team to select seven AOT participants from the ministry, as well as other information and communications technology (ICT) and HIS influencers. The specific mandate for the seven-member team (and four MEASURE Evaluation team members) was to

determine the scope and overall direction of the assessment, identify key digital health stakeholders in the country, select the people who would be invited to participate in the assessment, identify key documents for the desk review, and facilitate implementation of the assessment. In preparation, the MEASURE Evaluation team oriented the AOT to the assessment tools and envisioned assessment processes. Table B in Appendix 2 shows the composition of the team. For a full list of key digital health stakeholders identified by the AOT, see Table C in Appendix 2.

Desk Review

The assessment team conducted the desk review in April 2019, using documents sourced online and with guidance from the AOT. To obtain documents containing strategies for HIS, it collected literature through the web libraries of key implementers of digital health, including BroadReach, Digital REACH, and the International Training and Education Center for Health (I-TECH). It sourced policy and legislative documents from relevant government digital libraries and contacts in national health networks. Key digital health stakeholder platforms, such as the eHealth TWG, provided significant referrals to some online sources. The review specifically sought documents on digital health and HIS solutions for the HIV epidemic, tuberculosis and malaria burdens, and related health risks in Kenya, especially as related to interoperability of their respective information systems with others. The literature search produced reports from various national and regional projects, government policy and legislative documents, strategic documents from implemented projects, and scoping reports from different public and private initiatives. Insights from the desk review are discussed in the Results section below.

Stakeholder Meetings

The assessment team held individual meetings with HIS and digital health system stakeholders identified by the AOT or through stakeholder interviews. Stakeholders interviewed included donors and implementing partners working in the digital health space. The team used the interviews to gather insights into the state of HIS and digital health in Kenya, identify additional critical documents for the desk review, and determine other key stakeholders and HIS systems to be included in the assessment. Key themes gathered from stakeholder interviews are discussed in the Results section. Table A in Appendix 2 lists the stakeholders interviewed.

Tools and Workshops

To deepen the understanding of Kenya's digital health and interoperability landscape, the assessment team triangulated data gathered using three tools: the HIS Interoperability Maturity Toolkit, the GDHI, and the DHA. This section will describe the purpose and methods used with each tool to collect data.

Health Information Systems Interoperability Maturity Toolkit

The MEASURE Evaluation project, funded by USAID, and in collaboration with the Digital Health and Interoperability Technical Working Group of the Health Data Collaborative, has developed a toolkit of guiding documents and tools for countries to use in assessing their capacity to implement interoperable systems.

The kit contains three main components: a maturity model, an assessment tool, and a users' guide. It also offers a complete list of the references consulted in a literature review conducted as part of the toolkit's development.

The HIS Interoperability Maturity Model outlines the major components of HIS interoperability and lays out a country's growth pathway through using these components. Countries can use the assessment tool to systematically determine their HIS maturity level on the interoperability continuum. Using the assessment results, countries can create a path for strengthening their HIS subsystems, improve their ability to interoperate, and build resilient electronic HIS overall.

Global Digital Health Index and Maturity Model

The GDHI is an interactive digital resource that enables countries to assess their maturity in digital health and benchmark themselves against other countries. It uses the World Health Organization (WHO)/International Telecommunications Union (ITU) eHealth Strategy Toolkit as the underlying framework and aligns with the WHO Digital Health Resolution; it can serve as a baseline to inform the development of a global digital health strategy and a tool to monitor progress against the objectives set forth in the resolution.

The GDHI offers an interactive database that shows the status and historical progression of key digital health performance indicators at a national and global level. It empowers health ministries, funders, policymakers, and industry to make intelligent and informed strategic decisions about how and where to allocate resources as they strive to build sustainable digital health solutions at scale.

The GDHI benchmarks countries along a maturity model against standard digital health indicators. It uses 19 core indicators to measure a country's progress in digital health across the 7 categories of the WHO/ITU eHealth Strategy Framework, thereby helping countries track their progress and identify weaknesses. The GDHI creates incentives for improvements in national digital health systems and more targeted global digital health investments that can benefit multiple countries; it also facilitates learning and sharing resources from countries that are more advanced in specific areas.

Digital Health Atlas

The DHA is a WHO-funded open-source web platform designed to support governments, technologists, implementers, and donors to better coordinate digital health activities globally. This web platform offers users the information they need to improve the planning, coordination, and use of digital health information systems for health.

The DHA platform is used to curate digital health interventions and shared asset infrastructure investments, thus supporting governments, donors, technologists, and implementers in mapping, monitoring, and fostering digital health investment planning to meet government strategic health goals.

The DHA also supports implementers in assessing the maturity of their digital health projects and gaining access to global resources on current best practices in digital health.

RESULTS

Desk Review

The desk review provided key background information about digital health in Kenya. Results were grouped using the three domains of the HIS maturity model: leadership and governance, human resources, and technology.

Leadership and Governance

Digital health interoperability is being approached holistically in Kenya. Evidence exists of institutionalized policy documents in the form of frameworks that evaluate digital health policy and strategy documents that guide the implementation of digital health interventions. The Constitution of Kenya (2010) and the national Health Act (2017) adequately provide for digital health. The latter cites establishment of a unified health system to coordinate the interrelationship between national government health systems; provide for regulation of healthcare services and healthcare providers, health products, and health technologies; and related purposes. The national Health Information System Policy, the Health Policy (2014–2030), and the National eHealth Policy (2016–2030) further provide a framework for implementing digital health, enabling the articulation of implementation instruments—most notably the Kenya National eHealth Strategy (2011–2017) and the Kenya Health Sector Strategic and Investment Plan (2013–2017). This institutional and strategic planning work has informed the landscape analyses and evaluations conducted to date, including Kenya’s eHealth Policy and Interoperability Maturity Review. Further, some key guidelines in the Kenya eHealth Information System Interoperability Standards have been determined by outputs from this work. A draft interoperability framework for health data and health data management in Kenya that applies across government and health service providers has also been produced, and is supported by multiple ministries. The national MOH is very involved and is taking a lead role in developing interventions to support HIS interoperability.

There is evidence of strong collaboration between the Ministry of Information, Communications and Technology (MoICT) and MOH in supporting HIS and the eHealth TWG, which is made up of key digital health stakeholders and meets routinely (quarterly as per available governance documents). The eHealth TWG leadership produced the Kenya Health Enterprise Architecture (2016), which guides the synergistic links of all digital health initiatives. As a result, a technical working group comprising representatives of government, donors, and community and faith-based organizations established the Joining-Up Health Data in Kenya: Contributing to Universal Health Coverage initiative, through which some important health data sources have already been identified.

Human Resources

No literature or source documents were available that explicitly lay out human resources (HR) policies and strategies related to digital health. The Health Act (2017) mentions HR broadly, but not specifically related to HIS or digital health.

Technology

There is strong evidence of digital health solutions drawn from published reports, landscape assessments, plans, and initiatives from key stakeholders. The AOT provided a comprehensive list of active systems and their owners. These systems are implemented at all government levels (national and county). The Digital Health Landscape Analysis, an October 2017 document published by the Regional Action through Data

(RAD) project, lists available health information products from different sources, including government, donors, and private implementers. Inventoried health data sources in Kenya include the following:

- Data sets from the Kenya National Bureau of Statistics (KNBS)
- Data sets from public health bodies and facilities
- Data sets from private and church-run health facilities
- Data held in the Kenya HIS
- Data produced under the custodianship of the National Aids Control Council (NACC)
- Data produced by the United States President’s Emergency Plan for AIDS Relief (PEPFAR) and implementing partners
- Data produced through the African Regional Data Cube initiative
- Data produced and held by international organizations operating in country, such as WHO, the United Nations Programme on HIV/AIDS (UNAIDS), and the Global Fund for AIDS, TB and Malaria

The desk review findings reveal that leadership and governance for digital health implementation in Kenya is strong, with guidelines and policies developed, and strong collaborations between the MOH and digital health stakeholders. This strong governance environment supports some robust technological initiatives and lays the foundation for competent digital health interventions. The existence of a strong information technology and communication infrastructure has enabled proliferation of digital health information systems. Nevertheless, the HR component remains a challenge, although not an insurmountable one.

Stakeholder Meetings/Interviews

Stakeholder interviews were critical in helping to contextualize the results of the assessment tools and identify additional key stakeholders with whom to meet and documents to be included in the desk review. Key themes from stakeholder meetings were as follows:

- **Investment in Leadership and Governance.** Financial and HR investment to support leadership and governance at both the national and subnational levels is critical to the successful implementation and institutionalization of policies. Kenya devolved many national-level functions, including health, to counties in the 2010 constitution, effective in 2012. The 2010 devolution means that although policies may be developed centrally, their adoption requires support and enforcement at the county level (USAID, 2019). Resource allocation for HIS is not uniform across counties, resulting in some of them not having key personnel to champion HIS initiatives. This issue can be seen in the uneven maturity of HIS and digital health across counties.
- **Incentives for Public-Private Integration.** Kenyan citizens receive a significant proportion of their care from private facilities, with up to 60 percent of the population seeking care from the private sector. However, private facilities currently have little incentive to participate in national digital health and interoperability initiatives, leaving the health data landscape incomplete.
- **Weak HR Capacity.** At the county level in particular, HR capacity to support digital health is weak. This weak capacity includes county leadership, IT capacity, and health professionals with adequate knowledge of digital health to generate demand for greater interoperability and governance.
- **Costing.** Understanding the total cost of implementation and ownership is critical to planning for long-term scale-up and sustainability of HIS systems and subsystems. However, most HIS systems

in Kenya have been around for many years, having changed both owners and funders over time and thus making historical tracking of costs impossible.

- **People.** Stakeholders have varying understanding of interoperability and its benefit to them. It is critical to establish a common understanding of interoperability to help stakeholders determine the value of investing in interoperability initiatives. A common understanding might be facilitated through common use cases of problems that affect everyone and could be mitigated through interoperable systems.
- **County-Level Variations.** Wide variation in policy and technology implementation exists within and across counties. For example, two different hospitals within a county may report full implementation of an EHR; however, in one hospital, healthcare providers use it in real time, whereas in the other, a data entry clerk enters data at the end of the day. Similarly, some counties adhere to an implementation roadmap before implementing new systems, whereas others allow partners to introduce new technologies outside of the roadmap.

Despite these concerns, stakeholders identified numerous areas where progress has been made toward promoting or improving interoperability. Stakeholders noted that the KenyaHMIS has been nationally scaled, and integration with a number of critical subsystems has occurred, such as the MFL and some EHR systems. In addition, stakeholders noted that progress has been made in enacting policies to support interoperability.

HIS Interoperability Maturity Assessment

In one-on-one meetings before the planned HIS Interoperability Maturity Assessment workshop, the assessment team learned that ARA, a local health technology and research organization, had completed a similar assessment two months before (March 2019). ARA had sourced the HIS Interoperability Maturity Toolkit from the MEASURE Evaluation website and followed the instructions provided on how to conduct the assessment, working with many of the same digital health stakeholders that would have been included in the planned assessment workshop. Rather than repeat the exercise, the team reorganized the workshop to with stakeholders review the results from the March assessment, and review the results from the GDHI workshop. With these two sets of results, stakeholders developed recommendations for moving HIS and interoperability forward in Kenya. Some minor corrections were also made to the results from the March assessment. Tables 1 and 2 below present the final HIS Interoperability Maturity Assessment results after the review workshop. For reference, maturity levels are defined as follows:

- **Level 1 (Nascent):** The country lacks HIS capacity or does not follow processes systematically. HIS activities happen by chance or represent isolated, ad hoc efforts.
- **Level 2 (Emerging):** The country has defined HIS structures, but they are not systematically documented. No formal or ongoing monitoring or measurement protocol exists.
- **Level 3 (Established):** The country has documented HIS structures. The structures are functional. Metrics for performance monitoring, quality improvement, and evaluation are used systematically.
- **Level 4 (Institutionalized):** Government and stakeholders use the national HIS system and follow standard practices.
- **Level 5 (Optimized):** The government and stakeholders routinely review interoperability activities and modify them to adapt to changing conditions.

Table 1. HIS Interoperability Maturity Assessments: Domain and subdomain-level results

Domain	Subdomain	Level	Comment
Leadership and governance	Governance structure for HIS	3+ ¹	Established
	Interoperability guidance documents	4	Institutionalized
	Compliance with data exchange standards	1	Nascent
	Data ethics	2	Nascent
	HIS interoperability monitoring and evaluation	1	Nascent
	Business continuity	1	Nascent
	Financial management	2+	Emerging
	Financial resource mobilization	2	Emerging
Domain total		1	Nascent
Human resources	HR policy	2	Emerging
	HR capacity (skills and numbers)	2	Emerging
	HR capacity development	2+	Emerging
Domain total		2	Emerging
Technology	National HIS enterprise architecture	3+	Established
	Technical standards	2+	Emerging
	Data management	1	Nascent
	HIS subsystems	3	Established
	Operations and maintenance	2+	Emerging
	Communication network: local area network (LAN) and wide area network (WAN)	4	Institutionalized
	Hardware	2	Emerging
Domain total		1	Nascent

¹ A plus sign (+) next to the maturity level score denotes partial achievement of the level above the domain level.

Table 2. Summary of HIS Interoperability Maturity Assessment results

Domain	Maturity level	Key highlights of the findings for domain maturity
Leadership and governance	1	<p>Nascent level definition: <i>The country lacks HIS capacity or does not follow processes systematically. HIS activities happen by chance or represent isolated, ad hoc efforts.</i></p> <ul style="list-style-type: none"> • Kenya has an established a governance structure for HIS and interoperability guidance documents. • Kenya has no formal and ongoing monitoring of financial management and financial resource mobilization for interoperability work. • Activities are happening but in an isolated manner on the following subdomains: compliance with data exchange standards, data ethics, HIS interoperability monitoring and evaluation, and business continuity.
Human Resources	2	<p>Emerging level definition: <i>The country has defined HIS structures, but they are not systematically documented. No formal or ongoing monitoring or measurement protocol exists.</i></p> <ul style="list-style-type: none"> • Kenya lacks formal and ongoing monitoring of HR policy, capacity (skills and numbers), and capacity development.
Technology	1	<p>Nascent level definition: <i>The country lacks HIS capacity or does not follow processes systematically. HIS activities happen by chance or represent isolated, ad hoc efforts.</i></p> <ul style="list-style-type: none"> • The Kenya government has embarked on laying the necessary communication networks. • Kenya has established national HIS enterprise architecture, technical standards, and HIS subsystems. • ICT hardware is not formally monitored, and no measurement protocols exist. • Management of data for the country still happens by chance and in isolation.

Global Digital Health Index and Maturity Model

The assessment team gathered GDHI scores in a one-day workshop with a group of 25 digital health stakeholders representing the government, donors, implementing partners, and the private sector. The team used a consensus-based approach, first reviewing the GDHI questionnaire individually and then coming together in a plenary session to discuss each question and agree on each response. The raw scores for the 19 GDHI indicators are shown in Table 3 below. These scores were subsequently submitted to the HealthEnabled team, which will calculate the final scores for the seven categories and the overall index score, and publish them on the GDHI website after MOH approval.

Table 3. GDHI raw scores

Category: Leadership and governance	
Indicator 1. Digital health prioritized at the national level through dedicated bodies/mechanisms for governance	
<i>Does the country have a separate department/agency/national working group for digital health?</i>	
Score 2	Governance structure is formally constituted though not fully functional or meeting regularly.
Indicator 2. Digital health prioritized at the national level through planning	
<i>Is digital health included and budgeted for in national health or relevant national strategies and/or plan(s)?</i>	
Score 3	Digital health is included in national health or relevant national strategies and/or plans
Category: Strategy and investment	
Indicator 3. National eHealth/digital health strategy or framework	
<i>Does the country have an eHealth or digital health strategy or framework and a costed digital health plan?</i>	
Score 3	National digital health costed plan developed and approved.
Indicator 4. Public funding for digital health	
<i>What is the estimated percentage (%) of annual public spending on health committed to digital health?</i>	
Score 1	No budget line item for ICT or digital health is available, or a budget line item for ICT exists but the proportions are not available.
Category: Legislation, policy, and compliance	
Indicator 5. Legal framework for data protection (security)	
<i>Is there a law on data security (storage, transmission, use) relevant to digital health?</i>	
Score 2	There is a law on data security (storage, transmission, use) relevant to digital health that has been proposed and is under review.
Indicator 6. Laws or regulations for privacy, confidentiality, and access to health information (privacy)	
<i>Is there a law to protect individual privacy governing ownership, access, and sharing of individually identifiable digital health data?</i>	
Score 2	There is a law to protect individual privacy governing ownership, access, and sharing of individually identifiable digital health data that has been proposed and is under review.
Indicator 7. Protocol for regulating or certifying devices and/or digital health services	
<i>Are there protocols, policies, frameworks, or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g., telemedicine, applications), particularly in relation to safety, data integrity, and quality of care?</i>	
Score 2	Protocols, policies, frameworks, or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g., telemedicine, applications), particularly in relation to safety, data integrity, and quality of care, have been proposed and are under review.

<p>Indicator 8. Cross-border data security and sharing <i>Are there protocols, policies, frameworks, or accepted processes in place to support secure cross-border data exchange and storage? This includes health-related data coming into a country, going out of a country, or being used in a country related to an individual from another country.</i></p>	
Score 2	Protocols, policies, frameworks, or accepted processes for cross-border data exchange and storage have been proposed and are under review.
Category: Workforce	
<p>Indicator 9. Digital health integrated in health and related professional <u>pre-service</u> training <i>Is digital health in general part of the curriculum for health and health-related support professionals in training?</i></p>	
Score 3	Digital health curriculum implementation is underway, covering an estimated 0–25 percent of health professionals in pre-service training.
<p>Indicator 10. Digital health integrated in health and related professional <u>in-service</u> training <i>Is digital health part of the curriculum for health and health-related support professionals in the workforce (as defined below) [defined as community health workers, nurses, doctors, allied health workers, health managers/administrators, and technologists]?</i></p>	
Score 3	A digital health curriculum is implemented as part of in-service (continuing education) training for 0–25 percent of health professionals in the workforce.
<p>Indicator 11. Training of digital health workforce <i>Is training in digital health/health informatics/HIS/biomedical informatics degree programs (in either public or private institutions) producing trained digital health workers?</i></p>	
Score 4	Trained digital health professionals are available and deployed but essential personnel gaps remain.
<p>Indicator 12. Maturity of public sector digital health professional careers <i>Are there public sector professional titles and career paths in digital health?</i></p>	
Score 1	No workforce strategy, policy, or guide that recognizes digital health is in place. The distribution of digital health workforce is ad hoc.
Category: Standards and interoperability	
<p>Indicator 13. National digital health architecture and/or health information exchange <i>Is there a national digital health (eHealth) architectural framework or health information exchange (HIE) established?</i></p>	
Score 3	The HIE is operable and provides core functions, such as authentication, translation, storage and warehousing function, a guide to what data are available and how to access them, and data interpretation.
<p>Indicator 14. Health information standards <i>Are there digital health/health information standards for data exchange, transmission, messaging, security, privacy, and hardware?</i></p>	
Score 3	Digital health/health information standards for data exchange, transmission, messaging, security, privacy, and hardware have been published and disseminated in the country under the government's leadership.

Category: Infrastructure

Indicator 15. Network readiness

The World Economic Forum (WEF) Networked Readiness Index score can be sourced from the WEF Network Readiness Index (<http://reports.weforum.org/global-information-technology-report-2016/networked-readiness-index>).

Score 2 WEF score (>3.3–4.0). Kenya's score is 3.8.

Indicator 16. Planning and support for ongoing digital health infrastructure maintenance

Is there an articulated plan for supporting digital health infrastructure (including equipment: computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance?

Score 3 A plan for supporting digital health infrastructure (including equipment: computers/tablets/phones, supplies, software, devices, etc.) provision and maintenance has been implemented partially but not consistently, with an estimated 0–25 percent of necessary digital health infrastructure needed in the public healthcare service sector available and in use.

Category: Services and applications

Indicator 17. Nationally scaled digital health systems

Public sector health priorities are supported by nationally scaled digital health systems.

Score 5 All nationally prioritized health areas are supported by a diverse range of national-scale digital health services and applications (>75%), along with monitoring and evaluation systems and results.

Indicator 18. Digital identity management of service providers, administrators, and facilities for digital health, including location data for geographic information system (GIS) mapping

Are health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) available, accessible, and current? Are the data geotagged to enable GIS mapping?

Score 5 Health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) are available, up to date with geo-tagged data, and used for health system and service strategic planning and budgeting.

Indicator 19. Digital identity management of individuals for health

Are secure registries or a master patient index of uniquely identifiable individuals available, accessible, and current for use for health-related purposes?

Score 2 A secure registry exists, but is incomplete, only partially available and used, and irregularly maintained.

Digital Health Atlas

During the stakeholder interview with I-TECH, its staff described an HIS landscape assessment conducted in collaboration with the MOH in late 2018. The purpose of the landscape assessment was to chronicle information systems in use in health facilities throughout the country. Over the course of the assessment, 5,893 health facilities in all 47 counties were visited. Nearly 2,000 health facilities (1,959) were found to have at least one HIS implementation, and 3,322 HIS implementation instances were identified countrywide. Of these, the National Health Insurance Fund's (NHIF) Linda Mama had the highest

number of implementations, with two HIV electronic medical record (EMR) systems—IQCare and KenyaEMR—as the next most frequently implemented systems.

The results from this landscape assessment were for use in populating the DHA for Kenya. It is worthwhile noting that at the behest of the MOH, the landscape assessment was conducted from the facility and user perspective to get a sense of which systems are actually being used in facilities, and how. This information is important; however, many of the questions in the DHA require system-level information (such as technology platform used and interoperability and data standards), which a facility-level user is not likely to have. Thus, the possibility existed that there would be gaps in the DHA data as drawn from the HIS landscape assessment results.

In a subsequent meeting with the Nairobi-based WHO DHA consultant, it was learned that the data from the landscape assessment would be bulk uploaded to the DHA by the end of June 2019 and system owners would subsequently be contacted by the MOH and asked to fill in any information gaps. The system owners then would be responsible for keeping the DHA entries updated.

The DHA will also form the backbone of the certification framework for HIS systems in Kenya. Systems submitted to the DHA will be tested against the certification framework and then approved or not approved, with feedback provided through the country's administration interface.

Because there was a clear plan already being implemented for populating the DHA for Kenya, the assessment team did not duplicate these efforts or attempt to collect information on systems for entry in the DHA. Instead, it reviewed the results from the I-TECH HIS landscape assessment and the process cited above.

CHALLENGES

It was not possible to collect costing data for HIS as originally intended in the design of this assessment. During our interviews, stakeholders reported that these data historically have not been tracked; in an additional complication, many of the more mature systems in Kenya have changed ownership on several occasions. Although there have been some attempts to conduct costing exercises for select EMRs, this information is not complete and exists only in patches.

Another challenge the assessment team encountered was the recent completion of an HIS Interoperability Maturity Assessment by ARA in March 2019. Because the ARA-conducted assessment was so recent, it was not possible to redo the assessment and get independent results; instead, the team reviewed the previously collected results and developed recommendations based on these findings.

LIMITATIONS OF THE ASSESSMENT

As in the other EAC countries, and in keeping with the activity's scope, the Kenya digital health and interoperability assessment was conducted at a national level. However, health is a devolved function in Kenya—although the national level develops standards and guidelines, implementation happens at the county level, and counties have autonomy in deciding whether or how much to buy into national-level policies. By conducting it at the national level, this assessment was limited in the following ways:

- By not consulting with county-level stakeholders, the assessment may have missed critical information about implementation of digital health at subnational levels.
- The tools used in data collection were developed for national-level assessments and thus are not sensitive to county or subcounty variation in HIS maturity and interoperability. It was clear from discussions with stakeholders that digital health and HIS maturity differs widely across counties, so not accounting for this variation risks forming an incomplete picture of the situation in Kenya.

DISCUSSION

Triangulating the information gathered from the desk review, stakeholder interviews and workshops, and DHA discussions, it is clear that Kenya has a robust digital health ecosystem and has made significant progress in moving toward interoperable health systems in the areas of leadership and governance, human resources, and technology. However, significant progress still must be made toward achieving fully optimized, interoperable HIS.

Kenya has enacted or has draft proposals for policies to support digital health governance and interoperability, such as the Kenya Standards and Guidelines for mHealth Systems (2017) and the Standards and Guidelines for Electronic Medical Records in Kenya (2010). The eHealth TWG, supported by the MOH, has provided a governance structure to lead policy and operational planning for HIS, covering a broad area of policy needs. In 2011, a review of EMRs in use in Kenya was conducted to assess how well they aligned with the ministry-defined standards for EMRs; based on this review, a shortlist of systems was recommended as suitable for deployment in public health facilities. Additionally, the results from the HIS landscape assessment conducted by I-TECH will be included in the DHA, thus providing visibility into digital health implementation throughout the country and forming the backbone of a certification framework for HIS systems in Kenya. This information will allow the MOH to have a better picture of the countrywide digital health picture. However, digital health governance is challenged by the devolved nature of Kenya's health sector—although several policies, standards, and guidelines for digital health have been developed at the national level, stakeholder interviewees mentioned uneven implementation at the county level and a need for targeted support to facilitate understanding and buy-in within counties. Thus, the eHealth TWG and MOH need to work closely with county governments to effectively institutionalize policies throughout the country.

On the human resources front, Kenya, like many countries, faces a digital health workforce shortage in supporting digital health and HIS initiatives. Both the HIS Interoperability Maturity Assessment and the GDHI found a need to strengthen capacity for digital health within both the public and private health workforce. This need is true on both the technical side—to support software and infrastructure—and the HR side—healthcare workers trained in digital health. There is no formal career path for digital health specialists, and no professional bodies or structured programs are available to support their professional development. For healthcare workers, there is little to no digital health training as a part of the pre-service curriculum across healthcare cadres and only limited in-service training.

Kenya has made a great deal of progress in planning for digital health infrastructure, including computer equipment, services, and applications. Both the HIS Interoperability Assessment and the GDHI found that processes are in place to maintain and operate the hardware necessary for digital health; however, because these processes are under the purview of the MoICT, there may be some confusion over where ICT ends and digital health begins. An established and operable health enterprise architecture exists, and the communications infrastructure is well maintained. However, because policies are not applied consistently throughout the country, HIS activities may occur in siloed efforts that fail to integrate with established policies, standards, and frameworks.

A significant challenge faced by Kenya is the operationalization of policies at the subnational level. The 2010 Constitution of Kenya devolved power and responsibilities from the national government to 47 elected county governments. It also recalibrated the powers between the executive, legislative, and judicial branches. Although devolution has allowed for advanced democratization in Kenya, stakeholders report that it also has created challenges in consistently applying HIS policies and prioritizing healthcare needs

across counties. Some counties, such as Kakamega and Kisumu, have received significant support in HIS implementation from donors and implementing partners, allowing for greater technical capacity at the administrative level. This situation contrasts greatly with other counties, which have not received such additional investments and where there are no HIS champions at the county administrative level, resulting in implementation that has stalled or is incomplete. Further, stakeholders reported that some implementing partners circumvent national policy, such as the implementation roadmap, in pursuit of their own interests by going directly to the county and ignoring the policies and standards being put in place. This issue is especially problematic in counties with low capacity in digital health governance and those that have not been oriented on the national standards.

Another challenge faced within the digital health and HIS ecosystem is that there is no common understanding of the concept of interoperability. Stakeholders reported that although interoperability is often spoken about as a desirable outcome, different stakeholders have different interpretations of what it means, how it can be achieved, and how it can benefit them. Thus, there is a lack of alignment of workplans and objectives; digital health implementers are not incentivized to think about interoperability as they plan and execute their interventions, so they tend to focus only on the immediate problem they are trying to solve and the immediate results. Stakeholders need to be educated on the aims and benefits of interoperable digital health systems to buy into the interoperability vision and incorporate it into their planning and implementation.

RECOMMENDATIONS AND NEXT STEPS

The following next steps are recommended for making progress in HIS and HIS interoperability in Kenya. These recommendations are organized by their respective domains. A detailed table for each recommendation, including timeframes and responsible parties, can be found in Appendix 3.

Leadership and Governance

Legislation. Complete the ongoing e-legislation processes aimed at strengthening the governance of digital health, including digital data, electronic data platforms, and how to share the data responsibly. This e-legislation will fortify the governance structure and encourage the compliance needed for a stronger and more interoperable HIS.

Interoperability Guidance Documents. Existing documents that provide guidance to interoperability are either outdated or lack adequate content for appropriate guidance. These documents need to be updated regularly, especially to take cognizance of emerging lessons from the international digital health and HIS working groups, and countries and programs with promising lessons on the subject. To make this updating possible, the MOH and the eHealth TWG should set a schedule and budget for reviewing, updating, and disseminating interoperability guidance documents.

Monitoring and Evaluation of Leadership and Governance. Monitoring and evaluation of HIS maturity needs to be a continuous process with annual reviews. The MOH, in collaboration with the MoICT, and in liaison with implementing partners, should ensure there are both financial and human resources set aside to support a sustainable review and work planning process.

Certification Framework. The MOH should expedite efforts to establish a certification framework for digital health interventions, which will be an important cog in the system for enforcing compliance. Alone, the certification framework will be ineffective; it should be matched with an annual review process; when found inadequate, it needs to be attuned accordingly to meet current needs.

Digital Health Stakeholders. In its current setup, the eHealth TWG enjoys broad-based representation from government, universities, nongovernmental organizations (NGOs), the private sector, and individual experts. Using this wide representation, the TWG needs to develop and maintain a listing of key digital health stakeholders in Kenya. The purpose of this list is to foster collaboration among key digital health implementers from subcounties all the way to the national level, many of which are currently not in the fold but can play a pivotal role in scaling up digital HIS.

Shared Health Records. Shared health records are the backbone for data sharing, a critical piece in achieving functional interoperable information systems. The eHealth TWG should consider establishing legal parameters for digital shared records, understand what legal gaps exist in implementing shared health records, and include their requirements in the digital health guidance documents. Because shared health records form a critical piece for the envisaged cross-border data sharing, the legal mechanism for them should be explored in consultation with other member states in the EAC.

Interoperability Roadmap. Using case studies, lessons learned, and the digital health assessments completed so far, the MOH, MoICT, and implementing partners should establish an interoperability roadmap that will provide vision and guidance to expeditiously, systematically, and sustainably move Kenya's HIS to a fully optimized, regularly reviewed, and interoperable HIS environment that provides quality and secure data for the national HIS.

Unique Patient Identifier. The *buduma namba*—part of a new National Integrated Identity Management System from the government of Kenya—has been established as a national unique identifier. Efforts should be made to leverage this initiative to develop a unique patient identifier, enabling patient-level data sharing between different systems, as well as cross-border data sharing. This process however, should be structured in a manner that supports provision of services but at the same time protects patients from discrimination and maintains their privacy. Lessons from existing systems in country (e.g., HIV, tuberculosis (TB), and diabetes) would offer important insights on how to model this unique patient identifier.

Global Thought Leadership. The eHealth TWG and ICT arm of the MOH need to take an active role in the ongoing global conversation about digital health and interoperability to stay current on best practices and advocate for the needs for Kenya and the other East African countries. This can be done in part by amending the mandate of the interoperability subcommittee of the eHealth TWG committee to include participation in global forums. In addition, there is a need for the TWG to organize annual conferences to showcase progress and innovation in interoperability for digital health solutions. To continue the current streak of innovations, such conferences would need the participation of national and county government, and other stakeholders.

Private Sector Participation. Many Kenyans receive healthcare from private health facilities. These facilities, however, have had limited involvement in interoperability processes in Kenya. The eHealth TWG, MOH, and MoICT should encourage the inclusion of existing private sector facilities into the national eHealth strategy, aiding in data sharing between the public and private sector, and fostering the overall strengthening of interoperability in Kenya.

Human Resources

Health Information and Records Officer Training. Metadata define each data element in a particular system and are an important component both of data quality and interoperability. The in-service training for health information and records officers should be enhanced to include metadata dictionary curation, with an emphasis on metadata for MFLs, patient identifiers, and GIS. Health information and records officers can ideally fill roles as metadata curators to help maintain system data quality and integrity.

Digital Health Competencies. Health professionals in all cadres need digital health competencies. Having a workforce with more digital health savvy will increase the demand for and use of digital health tools and improve the quality of data input in the HIS. The eHealth TWG should work with the various health professional bodies to establish minimum competencies that can be used to inform both pre-service and in-service curricula.

In-Service Training on Data Security. The eHealth TWG should lead an initiative to develop and disseminate an in-service training on data security and privacy for health workers, using international guidelines. Although an understanding of data security and privacy should be included as a digital health competency as provided in the recommendation above, it is important that this specific knowledge be instituted rapidly to protect the privacy of Kenya's patient population.

Health Information Technology and Capacity Assessment. At the facility level, an assessment of HIS readiness and capacity assessment is needed. This assessment should look not only at infrastructure within facilities available to health professionals, but also the technical self-efficacy of healthcare workers in using technology and the availability of technical support. The report should result in recommendations to address infrastructure and skills gaps at the facility level.

Data Sharing Culture. Stakeholder interviews revealed that healthcare providers are disincentivized to share data because of fear of litigation or reprimand. For example, when referring patients for care, providers may make referrals that often contain incomplete data to limit scrutiny of their previous care. Healthcare providers need to understand the benefits to both themselves and their patients of accurately and appropriately sharing patient information. It is important to establish a data sharing culture among health providers that promotes the unencumbered flow of data between them and health facilities to lower costs while improving patient safety and care quality. The MOH will need to work with health professional boards, health training institutes, and other organizations to apply various tactics for increasing data sharing.

MOH Engagement. The eHealth TWG should take the lead in sensitizing top-level management of MOH to current digital health needs and trends so the MOH can clearly understand where investment is needed in HR policy and capacity development.

HR Policy. The MOH, in liaison with the Ministry of Labor, needs to review current HR policy and make revisions to include digital health informaticians regarding remuneration and accreditation, and offer a clear career pathway for professional growth that encourages capacity building. This approach will help to ensure that there is capacity to meet the needs of Kenya's growing HIS.

Digital Health Professional Associations. The MOH and MoICT need to nurture the evolution and growth of digital health professional associations and communities of practice, such as the Kenya Health Informatics Association (KeHIA). This will help ensure that digital health professionals in MOH and MoICT are up to date in trends and best practices in digital health, and provide a strong forum for country-driven discussion on moving Kenya's digital health systems forward.

Technology

Health Finances Subsystem. The eHealth TWG needs to lead a process to define, develop, and/or adopt a health finances information subsystem supported by a robust exchange of financial data for health. This subsystem is currently lacking or inadequate. Its presence will help to catalyze Kenya's adoption of universal health coverage (UHC) by having systems in place to financially manage care.

Digital Health Strategy. The eHealth TWG needs to conduct an annual review of the digital health strategy, standards, and technologies—in line with the certification framework—to ensure that the information available to the national HIS is up to date.

Standard Operating Procedures (SOPs) for the National Data Exchange Framework. The MOH, together with its implementing partners, need to develop SOPs for a national data exchange framework that supports UHC. This framework will be important in ensuring that the data exchange framework is implemented in a standard way.

Open Access Standard Drug Terminology. The MOH should develop and/or adopt open access standard drug terminology that contains all medications available in the Kenyan market. This terminology will help make the exchange of prescription information between health facilities and pharmacies more accurate, and promote efforts to abolish reselling of medications and distribution of counterfeit drugs.

Clinical Standards. The MOH should develop and/or adopt standard clinical and procedure nomenclature, such as ICD-10 and CPT codes—a critical component in achieving semantic interoperability between HIS that is crucial for realizing truly shared medical records (see Appendix 4 for definitions of different types of interoperability).

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APPENDIX 1. LISTS OF WORKSHOP PARTICIPANTS

Table A. Global Digital Health Index Assessment Workshop participants

GDHI Meeting – May 24, 2019	
Name	Organization
Karen Bett	Global Partnership for Sustainable Development Data
Leonard Cosmas	WHO
Joy Kamunyori	MEASURE Evaluation
Dr. Davis Kimanga	CDC
Kioko Kithuki	MOH
Manyobvo Machipanda	MEASURE Evaluation
Sam Mahula	Amref
Dr. Stephen Mburu	University of Nairobi
Dr. Mugumbi	MOH
Pascal Mwele	KenyaHMS/Palladium
Torooti Mwirigi	Careplay
Charles Ndemo	MEASURE Evaluation
Margaret Ndisha	United States Centers for Disease Control and Prevention (CDC)
Eunice Ndungu	UNICEF
Jacob Odhiambo	KenyaHMS/Palladium
Martia Osumba	RTI International
George Owiso	I-TECH
Raphael Pundo	HealthIT/University of Nairobi
Dr. Olivia Velez	MEASURE Evaluation
Prof. Peter Waiganjo	University of Nairobi/HealthIT
Sam Wambugu	MEASURE Evaluation
Rachel Wanjiru	MOH

Table B. HIS Interoperability Maturity Assessment Workshop participants

HIS Interoperability Maturity Assessment Workshop – May 29, 2019	
Name	Organization
Jeff Bernson	PATH
Karen Bett	Global Partnership for Sustainable Development Data (GPSDD)
Dr. Sherri Bucher	Indiana University
Jacob Ikilenya	EAC Secretariat
David Juma	Institute of Biomedical Informatics (IBMI) at Moi University
Onesmus Kamau	MOH
Joy Kamunyori	MEASURE Evaluation
James Kariuki	Kenya Medical Research Institute (KEMRI)
Gladys Malombe	SMART Applications International
Gertrude Muchibi	InSupply Health (John Snow Inc.)
Malic Mwendo	SMART Applications International
Moses Ndiritu	ARA
Margaret Ndisha	CDC
Job Nyameino	IBMI at Moi University
George Owilo	I-TECH
Dr. Saptarshi Purkayastha	Indiana University
Diana Too	Palladium
Dr. Olivia Velez	MEASURE Evaluation
Prof. Muliaro Wafuka	Jomo Kenyatta University of Agriculture and Technology (JKUAT)
Sam Wambugu	MEASURE Evaluation
Patience Wanjiru	mHealth Kenya
Rachael Wanjiru	MOH

Table C. Assessment Oversight Team meeting participants

Assessment Oversight Team meeting – May 17, 2019	
Name	Organization
Karen Bett	Global Partnership for Sustainable Development Data
Joy Kamunyori	MEASURE Evaluation
Kioko Kithuki	MOH
Manyobvo Machipanda	MEASURE Evaluation
Charles Ndemo	MEASURE Evaluation
Dr. Olivia Velez	MEASURE Evaluation
Sam Wambugu	MEASURE Evaluation
Rachel Wanjiru	MOH

APPENDIX 2. LISTS OF DIGITAL HEALTH STAKEHOLDERS

Table A. List of stakeholders interviewed

Assessment Oversight Team meeting – May 17, 2019	
Name	Organization
Karen Bett	GPSDD
Joy Kamunyori	MEASURE Evaluation
Kioko Kithuki	MOH
Manyobvo Machipanda	MEASURE Evaluation
Charles Ndemo	MEASURE Evaluation
Dr. Olivia Velez	MEASURE Evaluation
Sam Wambugu	MEASURE Evaluation
Rachel Wanjiru	MOH

Table B. Assessment Oversight Team members (AOT)

Assessment Oversight Team members (AOT)	
Name	Organization
Davis Adieno	GPSDD
Peter Arimi	USAID
Karen Bett	GPSDD
Onesmus Kamau	MOH
Dr. Cosmas Mugambi	MOH
Dr. Martha Muthami	MOH
Tom Orrell	Data Ready
Jane Otoko	MOH
George Owiso	I-Tech
Raphael Pundo	University of Nairobi / HealthIT
Prof. Peter Waiganjo Wagacha	University of Nairobi / HealthIT
Elizabeth Wala	Amref

Table B. Assessment Oversight Team members (AOT)(cont.)

Assessment Oversight Team members (AOT)	
Name	Organization
Davis Adieno	GPSDD
Dr. Peter Arimi	USAID
Karen Bett	GPSDD
Onesmus Kamau	MOH
Dr. Cosmas Mugambi	MOH
Dr. Martha Muthami	MOH
Tom Orrell	Data Ready
Jane Otoko	MOH
George Owiso	I-Tech
Raphael Pundo	University of Nairobi/HealthIT
Prof. Peter Waiganjo Wagacha	University of Nairobi/HealthIT
Dr. Elizabeth Wala	Amref

Table C. Key stakeholders and digital health system owners in Kenya

Key stakeholders and digital health system owners	
Name	Organization
Jeff Bernson	PATH
Karen Bett	GPSDD
Yasmin Chandani	John Snow, Inc.
Samuel Cheburet	Civil Registration and vital Statistics
Jackson Hungu	Clinton Health Access Initiative
Onesmus Kamau	MOH/eHealth
Koki Kanagwi	UCSF Institute for Global Health Sciences
Dr. Davies Kimanga	CDC
Cosmas Leonard	WHO
Kate Mbaire	PEPFAR
Jackson Mulungye	Aura Safira Consulting
Dr. Cosmas Mugambi	Office of Cabinet Secretary for Health
Prof Wafula Muliari	JKUAT

Martha Muthami	Head of HIS/MOH
Pascal Mwele	Kenya HMIS II
Tooroti Mwirigi	Kenya Health Federation's ICT Subcommittee
Eunice Ndungu	UNICEF
Job Nyangena	ARA
Rose Nzyoka	Health Informatics Governance and Data Analytics (HIGDA)
Elizabeth Ombech	Afya Research
Gonza Omoro	Department of Defense (DoD)
Dr. Martin Osumba	RTI
Washington Omwomo	USAID
Mercy Onsando	Civil Society Organization
Jane Otoko	Ministry of ICT/ICT Authority
George Owiso	I-TECH
Edel Tessema	Chemonics
Prf. Peter Waiganjo Wagacha	HealthIT
Dr. Elizabeth Wala	Amref
Rachael Wanjiru	MOH/ICT
Samuel Wataku	KEMSA

APPENDIX 3. HIS INTEROPERABILITY ASSESSMENT RECOMMENDATIONS

Recommendation	Related subdomains	Proposed timeline	Relationship to ongoing work	Responsible party
Leadership and Governance				
Complete the e-legislation processes to strengthen govern HIS	Interoperability guidance document	Immediate	Working with a variety of partners and stakeholders	eHealth TWG, in coordination with a variety of eHealth implementing partners
MOH should schedule and budget for reviewing, updating, and dissemination of eHealth guidance documents that guide interoperability of HIS	Interoperability guidance document	eHealth TWG to decide	Existing interoperability guidance documents	eHealth TWG
Conduct an annual review of the leadership and governance domain progress: <ul style="list-style-type: none"> Define the review process to know if it is feasible annually Allocate resources to ensure it is sustainable Leverage the work of the ICT authority to avoid duplication 	Monitoring and evaluation	eHealth TWG to decide	None currently known	eHealth TWG; relevant MOH departments
MOH should institute a certification framework for digital HIS and interoperability, which would be accomplished through the following subtasks: <ul style="list-style-type: none"> Complete the certification framework Expedite its implementation Schedule annual reviews to keep it up to date and aligned to current needs Share experiences and lessons with other countries implementing same work 	Governance structure for HIS Compliance Data exchange standards	eHealth TWG to decide	MOH currently working on a certification framework	eHealth TWG; relevant MOH departments and the team leading development of the certification framework
Develop and maintain an inventory of digital health stakeholders in Kenya	Governance structure for HIS	1 year	DHA is working on something similar (an inventory of digital health projects, which gives insight into who the stakeholders are)	eHealth TWG, I-Tech, and relevant MOH departments

Establish legal parameters for digital shared records, understand what gaps exist, and include these requirements in the review for digital health guidance documents	Interoperability monitoring and evaluation Data ethics Compliance with data exchange standards	3 years	None currently known	eHealth TWG
Develop an interoperability roadmap for the country	HIS monitoring and evaluation Covers most of the subdomains and is comprehensive	3 years	Current efforts contribute to this	Lead by Government of Kenya; key implementing partners for eHealth
Legislate, strengthen, and revitalize the health informatics subcommittee by doing the following: <ul style="list-style-type: none"> Identifying a champion for the committee Institutionalize key performance indicators (KPIs) for TWGs Provide input into the Health Act that contains guidance for eHealth standards 	Monitoring and evaluation Business continuity Governance structure for HIS Data ethics Data management Data security and privacy	Concurrent with e-legislation process	Related committees already exist, such as the health informatics subcommittee	MOH eHealth TWG MEASURE Evaluation WHO Digital Impact Alliance Government of Kenya
Leverage other national government efforts in the development of a unique patient identifier as follows: <ul style="list-style-type: none"> Structure legal provisions for use of <i>huduma namba</i> in the provision of health services to avoid discrimination Invest in data security measures to protect individual medical information Learn from existing systems that "work," e.g., HIV, TB, and diabetes 	Data ethics Compliance with data exchange standards	3 years	**quite a few projects going on in this space**	eHealth TWG Relevant government departments
Join the global conversation on interoperability by doing the following: <ul style="list-style-type: none"> Amending the mandate of the interoperability committee to include participation in the global conversation on digital health interoperability Organizing annual conferences for the government, counties, and other stakeholders to showcase progress and innovation in interoperability digital health solutions 	Governance structure for HIS	1 year/ continuous	Digital Health and Interoperability Working Group of Health Data Collaborative	eHealth TWG relevant MOH departments

Include existing private sector plans in the national eHealth strategy	Business continuity Communication network Data management	2 years	Begin small and methodically work upward	eHealth TWG; MOH and other government partners
Human Resources				
Upgrade the in-service training curriculum for health information and records officers to include metadata dictionary curation, with emphasis on metadata for MFLs, patient identifiers, and GIS	Leadership and governance Technology Health workforce Data management	Within 5 years	TBD	KeHIA; eHealth TWG
Define and propose minimum digital health competencies to relevant health professional boards to be included in pre-service and in-service training for all health cadres	HR skills and numbers HR capacity development	Within 5 years	TBD	KeHIA
Develop and disseminate in-service training for health workers on data security and privacy, using international guidelines	HR skills and numbers HR capacity development	Within 2 years	Adapt from international guidelines	eHealth TWG to consult with MEASURE Evaluation; WHO; DIAL; Government of Kenya
Conduct health information technology readiness and capacity assessment at health facilities; develop recommendations for addressing infrastructure and skills gaps	HR capacity development	Within 5 years	Build on HIS landscape assessment conducted by I-TECH in 2018	eHealth TWG
Establish a data sharing culture among health providers that promotes the unencumbered flow of data between providers and health facilities to lower costs while improving patient safety and care quality	HR skills and numbers HR capacity development	3 years	Leverage existing data use and data sharing initiatives in the country	MOH; health professional boards; health training institutions
Sensitize top-level management of MOH to current digital health needs and trends	HR policy HR capacity (skills and numbers) HR capacity development	1 year	TBD	eHealth TWG to take lead in organizing the sensitization
Review the MOH HR policy to include digital health informaticians regarding remuneration and accreditation, with a career pathway for professional growth that encourages capacity building	HR policy HR capacity (skills and numbers) HR capacity development	1 year	TBD	MOH

Nurture the evolution and growth of digital health professional associations and communities of practice, such as KeHIA	HR policy HR capacity (skills and numbers) HR capacity development		TBD	MOH; MoICT
Technology				
Define, develop, and adopt a health finances information subsystem supported by a robust exchange of financial data for health	HIS subsystems	1 year	TBD	eHealth TWG
Conduct an annual review of digital health strategy, standards, and technologies to ensure that information available to the national HIS is up to date	Data exchange	3 years	TBD	eHealth TWG
Develop SOPs for a national data exchange framework to support UHC	Data exchange	3 years	TBD	eHealth TWG
Develop and adopt open access standard drug terminology that contains all medications available in the Kenyan market	Standards	3 years	TBD	eHealth TWG
Develop and adopt a standard clinical and procedure nomenclature system	Standards	3 years	TBD	eHealth TWG

APPENDIX 4. COMMON TERMS AND DEFINITIONS

Types of interoperability (Health Information Management Systems Society, 2019).

- **Foundational interoperability** develops the building blocks of information exchange between disparate systems by establishing the interconnectivity requirements needed for one system or application to share data with and receive data from another. It does not outline the ability of the receiving information technology system to interpret the data without interventions from the end user or other technologies.
- **Structural interoperability** defines the structure or format of data exchange (i.e., the message format standards), in which there is uniform movement of healthcare data from one system to another such that the clinical or operational purpose and meaning of the data are preserved and unaltered. Structural interoperability defines the syntax of the data exchange. It ensures that data exchanges between information technology systems can be interpreted at the data field level.
- **Semantic interoperability** is the ability of two or more systems to exchange information and interpret and use that information. Semantic interoperability takes advantage of both the structuring of the data exchange and codification of the data, including standard, publicly available vocabulary so the receiving information management systems can interpret the data. Semantic interoperability supports the electronic exchange of patient data and information among authorized parties via potentially disparate health information and technology systems and products to improve quality, costs, safety, efficiency, experience, and efficacy of healthcare delivery.
- **Organizational interoperability** encompasses the technical components as well as clear policy, social, and organizational components. These components facilitate the secure, seamless, and timely communication and use of data within and between organizations and individuals. Inclusion of these nontechnical considerations enables interoperability that is integrated into end-user processes and workflows in a manner supporting efficiencies, relationships, and overall health and wellness through cooperative use of shared data both across and within organizational boundaries.

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