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## HRIS-HMIS Interoperability Assessment for Kenya

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Optimizing health sector decision-making through the strategic  
exchange of data

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July 2013

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*(Swahili phrase for “talking  
together”)*

## Acknowledgement

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## I. Executive Summary

Accurate, readily available, and timely data for health planning, workforce management, policy development, monitoring, and evaluation are critical for optimal health system functioning. Two types of data collection systems supply critical information to meet these needs: Human Resources Information Systems (HRIS) and Health Management Information Systems (HMIS). HRIS collect data on health care workers, including name, gender, age, qualifications (e.g., degree, diploma), specialty (e.g., pediatrics, anesthesia), facility of deployment, and attrition. HMIS collect data on health indicators and health facilities, including burden of disease, patient encounters by disease, mortality by cause, and service delivery by facility. Ideally, information from these two systems combines to provide the complete data needed to relate patterns of care and health outcomes with workforce capability and distribution throughout a country.

The Government of Kenya's (GoK) attention to e-government and focus on health information systems, in particular, has resulted in a reasonably mature HRIS, as well as significant progress towards the implementation of a HMIS. Kenya's commitment to the effective use of health and human services data, and its investments in information systems to support data collection, has provided an opportunity to examine the issues related to the interoperability of existing and developing information systems, and to identify potential projects for integration.

### **Purpose**

The purpose of the HRIS-HMIS interoperability assessment was to contribute to ongoing efforts in Kenya to optimize information for decision-making in the health sector through the strategic exchange of data. The activities employed in this assessment were designed to address the multiple facets of interoperability, including policies and procedures supporting data exchange; information communications technology (ICT) and workforce infrastructure; standards for electronic messages and data vocabularies; and implications of specific applications relevant to Kenya's health information system (HIS).

The assessment included three distinct activities: 1) A review of key documents; 2) an Interoperability Self-Assessment; and 3) Key Informant Interviews. These activities took place between November 2011 and January 2013. A workshop which included the key stakeholders was in April 2013. During this workshop, stakeholders reviewed the findings and agreed to seven recommendations as "action steps." Each of these activities and the recommendations are described in detail in the body of the report.

### **Summary of Findings and Recommendations**

The assessment revealed overwhelming support for greater interoperability within Kenya's health sector. Respondents noted that interoperability would facilitate data access, promote timely decision-making, increase efficiencies in data use, and enable complex analyses.

#### **1. Establish Data Sharing Agreements and Procedures**

Promoting interoperability, or even expanding user access to current web-based systems, requires policies that support data sharing. The self-assessment activity indicated relatively higher capability for establishing data exchange procedures and lower capability for the establishment of data exchange agreements. Specific recommendations include expanding the

data sharing agreement outlined by the Joint Regulatory Committee (JRC). The rHRIS collects data on health worker qualifications, specialties and continuing education – data which most stakeholders noted difficulty accessing. The policy could identify user-based rights to this data for departments and divisions within the Ministries of Health (MoH), between regulatory boards and councils, for researchers, partners working within the health sector and the general public, among others.

## 2. Address Data Standards Collaboratively

Three recommendations have been offered to support use of applicable data standards. These include:

- **Implement vocabulary standards for classifying members of the health workforce.** The World Health Organization (WHO) recommends<sup>1</sup> that countries observe international standards, including the International Standard Classification of Occupations (ISCO). KWHIS uses vocabulary codes issued by the Regulatory Boards and GoK. Regulatory Boards and MOH should explore ISCO and related tools<sup>2</sup> for developing national occupation classifications that meet GoK's needs and incorporate standard vocabulary terms to describe concepts associated with attrition, resignation, transfer, and migration. Any standard vocabulary terms adopted by Kenya to classify its health workforce should be incorporated in all of its HRIS.
- **Utilize a vocabulary standard in HMIS,** like the International Statistical Classification of Diseases and Related Health Problems (ICD)<sup>3</sup>, to describe morbidity and mortality events.
- **Implement messaging standards.** While adopting vocabulary standards allows data to be captured in a consistent manner across systems, messaging standards support interoperability by defining how data elements should be organized into messages that multiple systems can interpret and process. Currently, WHO supports the Statistical Data and Metadata Exchange – Health Domain (SDMX-HD)<sup>4</sup> format for exchanging indicator data between aggregate data systems. DHIS-2 and iHRIS have discussed the development of an API to support SDMX-HD XML-based data exchange.<sup>5</sup> KWHIS does not have the ability to construct or ingest XML-based messages, including SDMX-HD messages. With respect to HMIS, as they explore interoperability issues, GoK could consider messaging standards such as SDMX-HD for indicator data, and Health Level Seven (HL7) for clinical data. It was also noted that funding agencies should provide guidance to implementing partners developing health information systems regarding development and data standards, such as ISCO, ICD-10, SDMX-HD and HL7.

<sup>1</sup> World Health Organization. *Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies*. World Health Organization (2010). Page 27.

<sup>2</sup> <http://www.ilo.org/public/english/bureau/stat/isco/index.htm>

<sup>3</sup> World Health Organization. *International Statistical Classification of Diseases and Related Health Problems (ICD)*. 10th Revision, Second Edition. Geneva, World Health Organization, 2005. <http://www.who.int/classifications/icd/en/>

<sup>4</sup> <http://www.sdmx-hd.org/>

<sup>5</sup> <http://www.capacityplus.org/technical-brief-2/content/appendix-making-it-easier-share-data>

### **3. Develop a Shared Information Model and Enterprise Architecture**

The Regulatory Boards in Kenya are collaborating on shared information model and enterprise architecture. A shared information model could determine how common data elements across HRIS and HMIS are implemented in databases, including the use of standard vocabularies.

Recommendations include:

- **Document clearly the information model and enterprise architecture**, with detailed descriptions of the databases that will be implemented. Database descriptions could include metadata articulating the ownership, origins, purposes, and limitations of the data.
- **Consider supporting multiple approaches to integration.** While web-based applications and APIs will likely continue to support increasingly more sophisticated data exchange, Kenya's enterprise architecture could support multiple approaches to integration. File-based data exchange and web applications that support client-side data storage could support the needs of users that have intermittent network connectivity. Expanded user rights to extant web-based HMIS and HRIS systems, specifically for departments and divisions within the Ministry of Health, can expand access to needed health and human resources data. Posting HMIS and HRIS summary reports on websites available to the public can further assist in accessing key information.

### **4. Develop a Minimum Human Resources for Health (HRH) Data Set and Method for Exchange**

This report documents the data requirements for various divisions and departments that are not currently being met by systems within the department, or to which they do not currently have access. Most notably, Ministry of Public Health and Sanitation (MOPHS) departments and divisions do not have access to health worker data. Both MOPHS and Ministry of Medical Services (MOMS) reported difficulty in accessing data on health worker qualifications, specialty and continuing education.

- Develop minimum data sets for exchange between specific systems and identify the most appropriate method for routine data sharing between systems.<sup>6</sup>
- Give attention to increasing access to data on health care worker qualifications, specialties, and continuing professional development – all of which are captured and updated in the rHRIS.

### **5. Increase Data Support Staff**

The assessment identified the need for more data support staff, including both Health Records Information Officers (HRIO) at the facility level and data managers to promote routine data quality assurance at the national level. Capacity building to support HRIOs and data managers is needed.

- Enhance staff capacity related to data management in MOMS/MOPHS – including the hiring of additional HRIOs at health centers and dispensaries.

<sup>6</sup> Appendix E includes a description of potential minimum data elements and guidance for collaborative definition of minimum data sets developed by WHO.

- Build capacity in data management. MOMS, specifically, reported a shortage of staff needed to collect, enter, clean and analyze data for decision-making. Staff reported the need for additional training in data management. For example, the self-assessment identified the need for routine, standardized data quality assessment practices.

### **6. Train MOMS Departments on District Health Information Systems-2 (DHIS-2) and Master Facility List (MFL)**

The assessment revealed that MOMS departments were not accessing data from DHIS-2 and MFL as readily as MOPHS departments and divisions.

- Train MOMS staff, data coordinators and managers on the use of DHIS-2 and MFL, both of which are web-based systems. While the data are readily available, no one interviewed from MOMS reported being able to access data on burden of disease and health facilities.

### **7. Allocate Resources to Support Specific Interoperability Activities**

Stakeholders and implementing partners, many of which were developing various types of health information systems, noted that they received little, if any, funding to support interoperability activities. Limited funding contributes to development silos, where information systems are developed in parallel without much thought for how they will integrate with a larger national health information system or exchange data with other health information systems.

- Consider allocating a certain percentage of information system project budgets to interoperability activities. Donor agencies should consider making interoperability a deliverable of any HIS project. While interoperability is currently viewed as something nice to do but not essential to individual project deliverables, this shift in funding could also shift individual projects activities to support greater data exchange.

### **Way Forward**

These recommendations should be implemented under the technical guidance and leadership of the MOPHS and MOMS. Special consideration should be given to development partners who are already working to support interoperability. Where possible, partners such as Futures Group, Emory Kenya Health Workforce Program, AfyaInfo, Capacity Kenya, I-TECH, and Management Science for Health/USAID among others, should identify relevant recommendations that can be incorporated into their current HIS work plans. Partners are encouraged to work directly with departments, divisions and agencies that either require or house HMIS or HRIS data to advance interoperability within Kenya's health sector.

### **Contributors**

The authors would like to thank the following partners, projects and representatives, who contributed heavily to the report and whose recommendations are deemed central to the success of interoperability activities:

- Dr. Charles Nzioka, Head, Division of Health Information Systems
- ICT – Ministry of Health
- Ministry of Health – Department Chiefs and Division Heads

- Regulatory Boards and Councils – Regulatory HRIS
- AfyaInfo – MFL system and interoperability work
- Emory KHWP – KHWIS and rHRIS systems
- Capacity Kenya – iHRIS
- Division of HIS - DHIS-2 Software – burden-of-disease data
- Futures Group – data warehousing, IQ Care Software
- I-TECH – interoperability experience with OpenMRS
- MSH – KEMSA’s Logistic Management Information System
- FUNZO Kenya – CPD and training database

A listing of individual contributors and stakeholders appears in Appendix A.

## II. Introduction

Accurate, readily available, and timely data for health planning, workforce management, policy development, monitoring, and evaluation are critical for optimal health system functioning. Two types of data collection systems supply critical information to meet these needs: Human Resources Information Systems (HRIS) and Health Management Information Systems (HMIS). HRIS collect data on health care workers, including name, gender, age, qualifications (e.g., degree, diploma), specialty (e.g., pediatrics, anesthesia), facility of deployment, and attrition. HMIS collect data on health indicators and health facilities, including burden of disease, patient encounters by disease, mortality by cause, and service delivery by facility. Ideally, information from these two systems combines to provide the complete data needed to relate patterns of care and health outcomes with workforce capability and distribution throughout a country. In practice, however, most countries lack national information systems that can produce accurate, reliable and timely information on workforce or service delivery patterns, much less integrated information that would support a more sophisticated understanding of the relationship between provider staffing and health outcomes.

The Government of Kenya's (GoK) attention to e-government and focus on health information systems, in particular, has resulted in a reasonably mature HRIS, as well as significant progress towards the implementation of a HMIS. Kenya's commitment to the effective use of health and human services data, and its investments in information systems to support data collection, provide an opportunity to examine the issues related to the interoperability of existing and developing information systems, and to identify potential projects for integration.

### Purpose

The purpose of the HRIS-HMIS interoperability assessment is to contribute to ongoing efforts in Kenya to optimize information for decision-making in the health sector through the strategic exchange of data. This assessment aims to provide actionable recommendations (both practical and based on sound informatics principles) for implementation by Kenya's Ministries of Health, in collaboration with development partners currently working on information system strengthening initiatives within Kenya's health sector.

An assessment of interoperability contributes to understanding the relationships between health services and workforce data needed to answer critical health policy questions, such as:

- What is the most strategic health information generated from HRIS and HMIS?
- What are key questions that can be answered by analysis of data from these two types of systems?
- By assessing a relatively mature environment, what can we learn that informs recommendations for the minimum data set needed for relevant analysis?

Interoperability has been defined as the ability of information systems and software applications from various programs to communicate; to exchange data accurately, effectively, and consistently; and to use the information that has been exchanged.<sup>7</sup> While interoperability

<sup>7</sup> Public Health Informatics Institute. (2009). *Public Health Informatics Profile Toolkit*. Decatur, Georgia: Public Health Informatics Institute.

efforts often focus on technology, it is important to also consider sociological factors. These can include organizational, political, and economic drivers of and barriers to information exchange and the development of interoperable tools.

The activities employed in this assessment were designed to address the multiple facets of interoperability, including policies and procedures supporting data exchange; information communications technology (ICT) and workforce infrastructure; standards for electronic messages and data vocabularies; and implications of specific applications relevant to Kenya's health information system (HIS).

The assessment included three distinct activities: 1) a review of key documents; 2) an Interoperability Self-Assessment; and 3) Key Informant Interviews. The report is organized into three major sections, detailing the findings of each activity. Background information was gathered via a review of eHealth documents published between November 2011 and January 2012. The Interoperability Self-Assessment tool was piloted at a joint workshop hosted by the Emory University Kenya Health Workforce Project, the Public Health Informatics Institute (the Institute), and KEMRI-Wellcome Trust, in September 2012 in Naivasha. Finally, Key Informant Interviews were conducted between November 6 and December 3, 2012, to assess the information needs of users and data sharing practices. A description of the approach, methods, findings and conclusions from each assessment element is provided, and recommendations are offered in the final section. Stakeholders deemed key to interoperability within Kenya's health sector are listed in Appendix A.

For a list of key acronyms and terms in this paper, see Appendix F.

### III. Activity 1: Review of Key eHealth Documents and Background

Key documents were reviewed to develop an understanding of political, social and cultural impacts on the health sector and of the current governance structure for the Ministries. Insight into the current systems comprising Kenya's HIS (gained through the Key Informant Interviews) is also briefly described within this section.

#### **Kenya's eHealth Strategy and Health Information Environment**

Kenya is recognized for its innovative approach to information technology, and the government of Kenya has demonstrated its willingness to explore how electronic data systems can be used to improve policy and health care practice. In February 2011, the Republic of Kenya hosted a National eHealth Strategy Implementation Workshop, engaging stakeholders in the design of a national eHealth architecture.

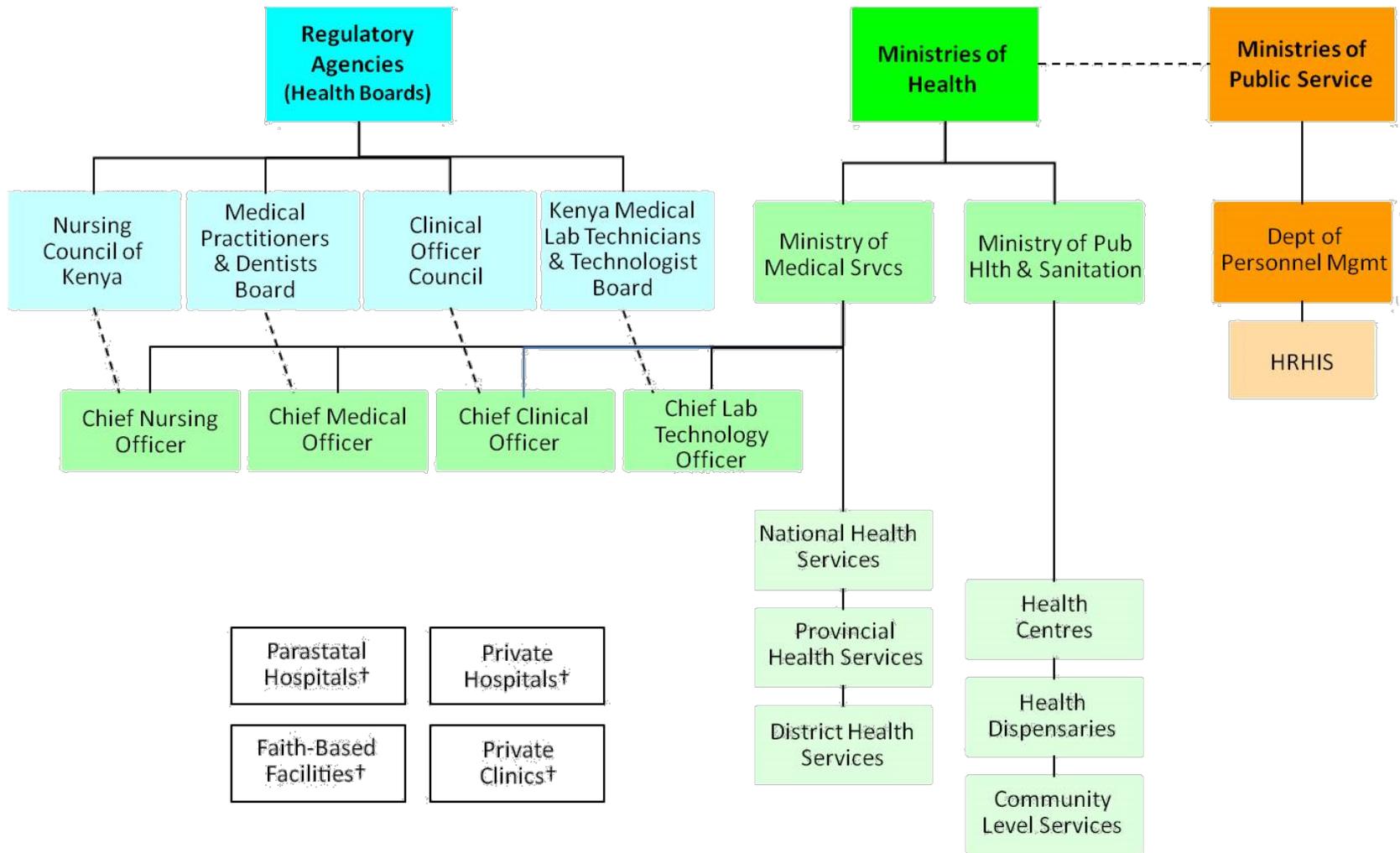
The Kenya National eHealth Strategy, 2011-2017, was developed by the Ministry of Medical Services (MOMS) and the Ministry of Public Health and Sanitation (MOPHS), and published in April 2011.<sup>8</sup> The strategy seeks to enhance the delivery of health care services by using ICT to support five core areas: telemedicine, health information systems, information for citizens, mobile health, and electronic learning. This assessment focuses on the second of those five areas, HIS.

Governance for the health sector in Kenya is shared by two Ministries of Health, MOMS and MOPHS. While MOMS focuses on curative health care through the delivery of medical services, MOPHS focuses on preventive health care through the promotion of public health and sanitation. MOMS oversees Level IV and V health facilities – including district and provincial hospitals, as well as national referral hospitals. MOMS works with regulatory bodies of health professionals to regulate the education and practice of health care workers, and to coordinate health facility inspections. MOPHS oversees Level II and III health facilities – including dispensaries and health centers. MOPHS is responsible for the inspection of food quality and hygiene for Kenyan establishments. They deliver health education and promote community health through control programs for HIV, TB and malaria. MOPHS also houses programs for reproductive health and vaccines and immunization. Figure 1 depicts the structure of the health services extending from the central level to the community, since 2008.

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<sup>8</sup> Kenya National e-Health Strategy 2011, 2017. Ministry of Medical Services, Ministry of Public Health & Sanitation, National E-Health Strategy, April 2011

FIGURE 1: KENYA HEALTH SYSTEM STRUCTURE 2008-2012



**FIGURE 1: KENYA HEALTH SYSTEM STRUCTURE 2008-2012 – DESCRIPTION****Ministries of Health (MOH)**

The MOH consists of the Ministry of Medical Services and the Ministry of Public Health and Sanitation. The MOH carries out several administrative functions related to human resources, including:

- Deployment decisions
- Promotion decisions
- Transfer decisions
- Provision of health services
- Health policy
- Supervision of health care providers

There are six levels of health systems in Kenya. Each level provides curative and prevention services and has a role in reporting and other administrative functions.

**Regulatory Agencies**

These agencies were created by a legislative act and are responsible for the following functions:

- Training (schools, curriculum, attrition)
- Examination
- Licensing
- Registration
- License updates (continuing education)
- Track out-migration and in-migration
- Training outside Kenya
- Private practice

**Department of Personnel Management**

Within the Ministries of Public Service, the Department of Personnel Management is responsible for the following personnel processing actions:

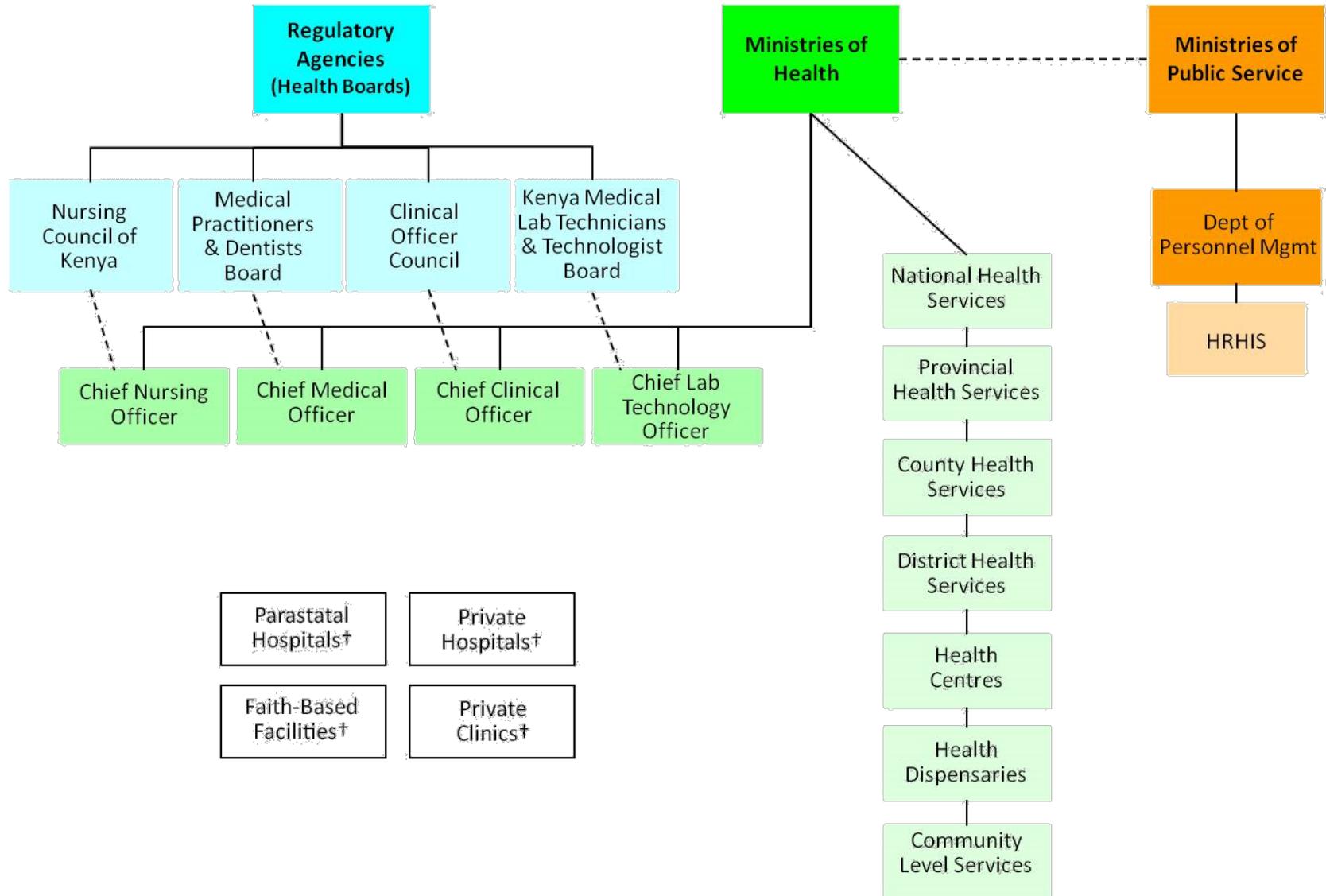
- Appointments
- Transfers
- Training approvals
- Promotions
- Disciplinary actions

**Notes:**

†The role of private, non-profit and faith-based health care institutions varies by level and historical relationship with the MOH. Some voluntarily report to the MOH, and some receive funding to provide health services.

One element of the policy and political environment which may impact Kenya's HIS is the restructuring of administrative boundaries, from districts to 47 counties. This will reorganize the health system and, of necessity, health IT. For example, changes in the boundaries may make sub-provincial reporting and analysis difficult. At the time of this report, it is not clear what functional or administrative role the counties will have. It is further anticipated that the two national-level health ministries (MOMS and MOPHS) will be combined into one central Ministry of Health.

FIGURE 2: KENYA HEALTH SYSTEM STRUCTURE (SPRING 2012)



**FIGURE 2: KENYA HEALTH SYSTEM STRUCTURE (SPRING 2012) – DESCRIPTION****Ministry of Health (MOH)**

The MOH carries out several administrative functions related to human resources, including:

- Deployment decisions
- Promotion decisions
- Transfer decisions
- Provision of health services
- Health policy
- Supervision of health care providers

There are seven levels of health systems planned for Kenya. Each level provides curative and prevention services and has a role in reporting and other administrative functions.

**Regulatory Agencies**

These agencies were created by a legislative act and are responsible for the following functions:

- Training (schools, curriculum, attrition)
- Examination
- Licensing
- Registration
- License updates (continuing education)
- Track out-migration and in-migration
- Training outside Kenya
- Private practice

**Department of Personnel Management**

Within the Ministries of Public Service, the Department of Personnel Management is responsible for the following personnel processing actions:

- Appointments
- Transfers
- Training approvals
- Promotions
- Disciplinary actions

**Notes:**

†The role of private, non-profit and faith-based health care institutions varies by level and historical relationship with the MOH. Some voluntarily report to the MOH, and some receive funding to provide health services.

## Description of Kenya’s Health Information Systems (HIS)

Several systems comprise Kenya’s HIS. These include systems that track commodities, health financing, health care professionals, health facilities, and health indicators, among other data. The key HRIS and HMIS health systems are described in this section.

### Master Facility List (MFL)

The MFL is a web-based system housing data on health facilities, which can be accessed at [www.ehealth.or.ke](http://www.ehealth.or.ke), updated by multiple officers and accessed by the public. The MFL is seen to be the backbone for HRIS and HMIS interoperability in Kenya, as most HRIS and HMIS systems have facility-based data. The “type of health facility” attribute is used by the workforce management system for describing and categorizing the types of facilities where services are provided and health workers are deployed. Types of health facilities include national referral hospitals, provincial hospitals, district and sub-district hospitals, health centers, dispensaries, research institutions, training schools, regulatory institutions (like the nursing council), clinics, VCT centers, nursing homes and administration institutions. Health facility tracking is fundamental to service delivery in a referral system, including the distribution of health workers in these facilities, by geographical area and population served.

The MFL, supported by AfyaInfo, provided an impetus for several systems within the health sector to align their facility codes. For example, the Kenya Medical Supplies Agency (KEMSA) requires health facilities to register with the MFL as a prerequisite to receiving commodities.

The District Health Management Team (DHMT), through the District Health Records Information Officers (DHRIOs), updates facility information with the Chief Health Administration Officer (CHAO). To add a new facility, the DHMT inspects the facility, captures the facility inspection report, and recommends to the regulatory body whether a facility should receive approval. The DHRIO enters facility details into the MFL web application, which generates a unique facility code, and sends the facility inspection report and recommendation to the MOH and regulatory boards. This process advances the facility status to “pending.” The regulatory bodies process the request from DHMT to license or gazette a facility, determine whether the facility meets the standards, and update the MFL to reflect the new facility’s licensure and level, or rejection and justification.

This information allows the DHMT, regulators, and the public to differentiate licensed from non-licensed facilities, enabling them to identify and eliminate illegal facilities. Correct grading of the newly upgraded facilities (e.g., from dispensaries to health centers) is also facilitated. The MFL captures facility data from public, private and faith-based sectors, strengthening the performance monitoring mechanism.

#### LIST 1: MFL DATA ELEMENTS

Facility code	Facility plot number	In-charge e-mail
Facility name	Facility ownership	In-charge mobile
Facility postal address	Facility type	Services provided
Facility location	Constituency	Number of beds
Facility district	Landline, mobile, fax	Number of cots
Facility division	E-mail address	Status (e.g., operational)
Facility sub-location	Person in charge	

## Human Resources Information Systems (HRIS)

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In Kenya, there are several HRIS, including the Kenya Health Workforce Information System (KHWIS), the regulatory HRIS (rHRIS), the Integrated Personnel Payroll Database (IPPD), the Government HRIS (GHRIS), and iHRIS Manage.

### **Kenya Health Workforce Information System (KHWIS) and Regulatory Human Resources Information System (rHRIS)**

The KHWIS and rHRIS systems were developed by the Emory University Kenya Health Workforce Project, in collaboration with Ministries of Health (MOH) and regulatory bodies. KHWIS is a web-based system that was handed over to the MOH in September 2012. It tracks deployment data on nurses, midwives, doctors, dentists, clinical officers, and laboratory technologists and technicians, although the nursing data are more extensively catalogued. This system collects staffing data on a quarterly basis, which is paper-based up to the provincial-level, where it is entered into the system. KHWIS is accessible to MOMS departments and supports health worker chiefs to more effectively deploy and manage the public sector's health workforce. For the KHWIS, the following fields are captured for deployed public sector health workers.

#### **LIST 2: KHWIS DATA ELEMENTS**

---

Health facility code	Marital status	Number of years in station
District code	Qualification	Last station (place worked)
Province code	Registration number	Area of deployment (ward)
Bed occupancy	Date of birth	Cause of attrition
Number of beds	Date of 1 <sup>st</sup> appointment	Date of death
Year of deployment	Previous promotions	Cause of death
Name	Date of last promotion	
Gender	Title/designation	

The rHRIS is housed in the health professional regulatory boards and councils, including the Nursing Council of Kenya (NCK), the Kenya Medical Practitioners and Dentists Board (KMPDB), the Clinical Officers Council (COC), the Kenya Medical Laboratory Technicians and Technologists Board (KMLTTB), the Pharmacy and Poisons Board (PPB) and the Kenya Nutritionists and Dieticians Institute (KNDI). The rHRIS is being transitioned to a web-based platform with plans to link to the KHWIS. The rHRIS allows the boards and councils to more effectively regulate the practice of health care workers in Kenya, using data captured when the health worker is first enrolled in training (indexed) and subsequently, upon licensure and renewal.

#### **LIST 3: rHRIS DATA ELEMENTS**

---

Surname	Secondary school	License status
First name	Grade obtained	Registration number
Middle name	Certificate held	License number
Citizenship	Certificate number	Employment*
Date of birth	Training institutions	Department*
Postal addressing	Date training began	Responsibilities*
Mobile phone number	Exam number	Continuing education*
E-mail address	Exam date	Intent to out-migrate
National ID	Index number	Continuing education
Passport number	Training cadre	

\* Data elements collected at licensure renewal

In addition to the training, certification and licensing of health care professionals, the regulatory boards license health facilities, particularly those not run by the government of Kenya. Inspection of these private practice facilities is carried out every three years, and the findings of inspections are documented in the system.

The rHRIS also maintains a list of approved training institutions. For a training institution to produce a health professional in a specified program, it must be attached to a health facility. Before a training institution is approved, a partner health facility must meet specific standards in a facility inspection to ensure students have a quality practical experience environment.

In addition to the MFL, KHWIS also maintains a list of health facilities, assigning each facility a unique ID and maintaining records on each facility based on this ID. Since training institutions are connected to health facilities, the health facility codes appear in the training institution table, noted as “Health Facility Attached.” Health facilities information is also used in the rHRIS to determine whether the health facility associated with a training institution possesses the appropriate number of beds, inpatients and outpatients to meet the clinical attachment and mentorship training needs of students.

The rHRIS and KHWIS share a facilities list that has been harmonized with the MFL. A query was done in fall 2011 to verify that facilities in the rHRIS matched those in KHWIS.

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**LIST 4: HEALTH CARE FACILITY DATA ELEMENTS IN rHRIS/KHWIS**

---

District location	Private practice license #	Private facility address
Facility code	Business name	Continuing education interview
Name of facility	Date of 1 <sup>st</sup> license	
Type of facility (e.g., government)	Date of current license	
	License renewal due date	

***Integrated Personnel Payroll Database (IPPD) and Government HRIS (GHRIS)***

Both IPPD and GHRIS house payroll data on public sector workers. IPPD, which is not web-based, is housed in the Department of HR, MOMS/MOPHS. It captures basic biographical data, including name, date of birth, gender, marital status, date of first hire, cadre (e.g., nurse, doctor), date of last promotion, terms of service (e.g., temporary, contract), pay grade and pay station. Several departments and divisions in MOPHS and MOMS request data from IPPD, which is time consuming for IPPD staff. The GHRIS is a web-based system for all public sector workers, which has separate personal and administrative access levels, allowing employees to update their own personal information, but restricting administrative access to the HR Department, Public Service Department, and Department of Personnel Management. Neither system has data on the health care worker’s deployment facility.

***iHRIS Manage***

iHRIS Manage was developed by Capacity Kenya, in collaboration with the HR Department, to streamline personnel management processes such as recruitment, hiring, deployment and promotions within the health sector. iHRIS is a web-based system that captures data on health workers using staff payroll returns submitted to the ministry from facilities through the Provinces. Some data are also gathered from the Government IPPD system. These data are accessible to staff in the MOH HR Department.

**LIST 5: IHRIS MANAGE DATA ELEMENTS**

Personal number	Marital status	Pay station
National ID number	Number of dependents	Date of 1st appointment
Tax PIN number	Address, phone, e-mail	Date - current appointment
Name title (e.g. Mr.)	Cadre	Terms - current employment
Surname	Highest education level	Work district
First name	Designation/job title	Work county
Middle name	Designation code	Work province
Date of birth	Job classification	Facility name
Gender	Job group	Facility MFL code
Ethnicity	Ministry	

iHRIS Manage uses health facility codes from the MFL, and is considering the development of an application programming interface (API) to enable dynamic data exchange with the MFL system. Key reports generated by iHRIS include health workforce by cadre, gender, deployment, province and pay group.

**FUNZO**

FUNZO Kenya is currently designing a training database that will collect data on health care worker students, as well as on the continuing professional development (CPD) of the current health workforce.

**Health Management Information Systems (HMIS)**

Key HMIS include the District Health Information System (DHIS-2), and the Division of Disease Surveillance and Response (DDSR) database. In addition, the MFL is considered a part of the HMIS.

***District Health Information System (DHIS-2)***

DHIS-2 is a web-based system, maintained by the HMIS Department in the MOH, which can be accessed at [www.hiskenya.org](http://www.hiskenya.org). DHIS-2 is a Free and Open Source Software (FOSS) that HMIS designed and developed under a global research and development initiative, Health Information Systems Project (HISP), originating from the Department of Informatics, University of Oslo, Norway.<sup>9</sup> DHIS-2 is platform-independent, based on open standards, and can run in both online and offline modes to accommodate various Internet connectivity environments.

DHIS-2 facilitates data for storage, analysis, and visualization of data sets. It serves as a data collection, recording and compilation tool, using XML standards for import and export of the data sets in the system. It also allows import via structured Excel spreadsheets, or manual entry into predefined templates, which is how districts enter data. Once a facility defines various performance indicators, DHIS-2 provides a number of ways to analyze and display relevant data.

DHIS-2 routinely supports health facility reporting and data analysis at the facility level to strengthen local decision-making, but its open architecture and modular development environment also allow for great flexibility in customizing the design of local applications. DHIS-2 has data on the number and types of facilities, populated from MFL, as well as information on

<sup>9</sup> [http://www.dhis2.org/doc/snapshot/en/user/html/ch01.html#mod1\\_](http://www.dhis2.org/doc/snapshot/en/user/html/ch01.html#mod1_) (accessed January 28, 2012)

disease burden (e.g., number of new cases of malaria), outpatient and inpatient service provision, and aggregate health care worker staffing. DHIS-2 captures data and generates reports on service delivery, workload and outbreaks, from public, private and faith-based facilities.

### ***Division of Disease Surveillance and Response (DDSR)***

The DDSR database captures data on burden-of-disease, and is housed in the Division of Disease Surveillance and Response. DDSR disseminates data on a monthly basis via e-mail, with reports broken down by geographic area (e.g., districts, counties). DDSR shares data with the Department of HMIS, which disseminates data to other departments. DDSR also shares data sets directly with some MOPHS divisions.

There are several HRIS and HMIS systems within Kenya's HIS. While some are web-based, others are not. Currently, even web-based systems have limited use or restricted access. While the majority of the HR or health data required by HR and health managers are currently being collected, access is often limited to the department or division collecting the data. Thus, HR managers in MOMS have little access to data on service delivery, and health program managers in MOPHS have little access to HR data. To assess the interoperability between and amongst Kenya's HMIS and HRIS systems, two activities were undertaken – an interoperability self-assessment and interviews with key informants. These activities examined the organizations' capability to support interoperability, assessed the data needs of HR and health managers, and identified data gaps and opportunities for data sharing.

## IV. Activity 2: Interoperability Self-Assessment

The Institute was asked by the sponsors of this work, the Centers for Disease Control and Prevention (CDC), to develop a simple pen-and-paper assessment that could be used in various locations to help non-technical stakeholders assess interoperability. Institute staff adapted an approach based on a capability maturity model that characterizes interoperability across the four domains of policies, infrastructure, data and standards, and applications, to create the self-administered assessment tool. The tool was piloted with a group of approximately 40 invited health leaders from seven regulatory boards and health facilities. Feedback from the meeting participants indicated the tool was useful for them in planning the organizational activities needed to enable interoperable data exchange with partners.

### Methods

#### ***Background on Capability Maturity Model (CMM) Approach***

The self-assessment tool is based on the Capability Maturity Model (CMM), a framework developed at the Software Engineering Institute located at Carnegie Mellon University in Pittsburgh, Pennsylvania.<sup>10</sup>

According to CMM, organizations progress through five levels of process maturity as they adopt more standardized and defined operating procedures designed to achieve desired objectives. Initially, an organization's practices are ad-hoc and not well understood. Any success results from isolated efforts from determined individuals. With time and effort, an organization becomes more familiar with its practices and seeks to make initial successes more routine by establishing policies and governance. With even more effort, an organization learns to monitor and evaluate its processes and act on resulting information for quality improvement. Throughout this evolution, an organization is said to become more "mature" as its processes yield results that are increasingly predictable and controllable. The five maturity levels posited by CMM are described in Table 1.

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<sup>10</sup> Software Engineering Institute. (1993). *Capability Maturity Model for Software, Version 1.1*. Pittsburgh: Carnegie Mellon University.

**TABLE 1: CAPABILITY MATURITY MODEL'S FIVE LEVELS OF PROCESS MATURITY**

Level	Name	Description
1.	Initial	Undocumented processes; work results achieved through isolated, ad-hoc efforts and individual heroics.
2.	Managed	Early attempts at establishing processes with intent of repeating initial successes; shared understanding of desired process outcomes.
3.	Defined	Defined guidelines for processes and services, policies, and processes; supporting policies and governance established.
4.	Measured	Mechanisms for evaluating and controlling processes are established.
5.	Optimized	Feedback from evaluation is used to continuously improve processes.

#### ***Development of Interoperability Self-Assessment Based on CMM***

CMM was originally intended to evaluate the ability of software vendors to perform to a contract. The concepts have since been adapted for a wider variety of process evaluation and improvement efforts. These efforts include building capacity for developing interoperable information systems. The interoperability self-assessment tool developed by the Institute is informed by several of these initiatives, as described below.

The Levels of Information Systems Interoperability (LISI) is an effort by the United States military to develop a CMM-based application to characterize interoperability for information systems within the purview of the US Department of Defense.<sup>11</sup> Recognizing its multi-faceted nature and both technical and non-technical imperatives, LISI articulated four aspects of interoperability, described below:

- Procedures  
*The procedures and policies that enable systems to exchange information, capabilities, and services.*
- Infrastructure  
*The hardware, networking, and system services that enable system interaction.*
- Data  
*The information formats and protocols that enable the exchange of data and information.*
- Applications  
*The set of applications used to enable information exchange, processing, and manipulation.*

<sup>11</sup> C4ISR AWG Architectures Working Group. (1998). *Levels of Information Systems Interoperability (LISI)*. Washington DC: United States Department of Defense.

While the Institute found utility in defining interoperability in terms of those aspects, it was useful to modify them to better reflect the health and public health sectors, to better resonate with those audiences:

- Policies  
*The procedures and practices that enable systems to exchange information, capabilities, and services.*
- Infrastructure  
*The hardware, networking, and staffing that enables system interaction.*
- Data & Standards  
*The information formats and protocols that enable the exchange of data and information.*
- Applications  
*The tools used by the health workforce to enable the exchange, processing, and analysis of information.*

Work done by Australia's National E-Health Transition Authority<sup>12</sup> and the World Health Organization's Health Metrics Network<sup>13</sup> was referenced to design the self-assessment tool itself. To assess capacity for the four aspects of interoperability, subtopics reflecting specific issues related to those aspects were identified and used as the basis for questions. These questions were designed to identify behaviors, abilities, or practices that demonstrate a certain level of capability. Details are provided below in the description of methods for this activity. A complete copy of the self-assessment tool is included as Appendix C.

### ***Purpose of Interoperability Self-Assessment Activity***

An HRIS and HMIS interoperability self-assessment activity was designed to engage organizational leaders, program managers, and technology staff in a guided discussion intended to characterize their organizational capability to develop interoperable systems. By collaboratively completing an interoperability self-assessment tool as a group exercise, organizations would identify conditions that support interoperable health information systems and reveal gaps they have in meeting those conditions. By framing these conditions in the context of a capability maturity model, the self-assessment activity provides actionable guidance for organizations to address gaps and improve their capability to create interoperable systems.

### ***Setting***

The setting for the interoperability self-assessment activity was the Joint Regulatory Bodies & Health Managers Workshop, a three-day session held in September 2012 in Naivasha, Kenya. The workshop was sponsored by the Emory University Kenya Health Workforce Project, Kenya Medical Research Institute (KEMRI) – Wellcome Trust, and the Public Health Informatics Institute. Scheduled topics addressed a range of attendee interests, including the interoperability self-assessment activity. This activity, along with orientation presentations, occupied approximately five hours of the workshop.

<sup>12</sup> National E-Health Transition Authority. (2007). *Interoperability Maturity Model, Version 2.0*. Sydney, Australia: National E-Health Transition Authority Ltd.

<sup>13</sup> Health Metrics Network. (2008). *Framework and Standards for Country Health Information Systems*. Geneva: World Health Organization.

### ***Scope of Interoperability Self-Assessment***

While the concept of this interoperability self-assessment tool does consider the four interoperability dimensions described above, only two dimensions were included in the assessment activity described below. Policies and Infrastructure were included; Applications and Data & Standards were excluded, each for a different reason.<sup>14</sup>

The scope of the self-assessment activity was also limited with respect to the levels of maturity assessed. As discussed above, the CMM describes five levels of maturity. However, this activity assessed interoperability along a continuum of four maturity levels. Due to *a priori* assumptions about participants' organizational capability for interoperable systems, the maturity levels addressed with this self-assessment activity included "0" (None), "1" (Initial), "2" (Managed), and "3" (Defined). This differs from the more traditional CMM by the exclusion of levels "4" (Measured) and "5" (Optimized), and by the addition of level "0" (None). These adaptations were intended to better reflect both the range of current organizational capability and the near-term interoperability goals characterized by maturity level "3" (Defined). Table 2 describes the capability maturity levels within the scope of this activity.

**TABLE 2: LEVELS OF MATURITY WITHIN SCOPE OF SELF-ASSESSMENT ACTIVITY**

Level	Name	Description
1.	None	No awareness of interoperability issues or processes to support interoperability.
2.	Initial	Awareness of need for interoperability. Isolated, ad-hoc efforts to address interoperability often supported by key interpersonal relationships, typically within a program area.
3.	Managed	Adoption of standards and interoperability goals begun. Shared understanding of data, services, and internal processes. Early governance intending to repeat initial successes.
4.	Defined	Defined guidelines for interoperability standards, services, policies, and processes. Established governance.

### ***Self-Assessment Activity Execution***

A series of self-assessment questions was included for each of the included interoperability dimensions, Policies (nine questions) and Infrastructure (eight questions). Each question was designed to elucidate organizational capability for an interoperability subtopic. Subtopics related to Policies addressed information needs assessment, health information systems strategy, data exchange procedures, data quality, and project management. The Infrastructure dimension was assessed with questions addressing ICT hardware and network connectivity, workforce and business processes, and staff turnover.

<sup>14</sup> At the time of the assessment activity described in this document, the authors were unconvinced that a CMM-based approach would be ideal for the Applications dimension in this context, as it seemed unrealistic to develop and populate the software applications database that would be required to catalog needed information about the HRIS and HMIS applications for Kenya. The Data & Standards dimension was excluded from the assessment activity due to logistical constraints (such as time limitations) and a lack of domain expertise among those in the workgroup.

Each question had four response options corresponding to the four levels of capability maturity within the scope of this assessment activity. Rather than boilerplate selections of “0-None”, “1-Initial”, “2-Managed”, or “3-Defined”, the self-assessment tool provided response options specific to the question. These contextualized response options were intended to describe organizational conditions and better resonate with participants.

For example, the question “Has your organization completed an assessment intended to describe its information needs?” had the following response options, each corresponding to maturity levels “0-None” through “3-Defined” (respectively):

- 0 - Organization has not undertaken this assessment.
- 1 - Organization has made initial efforts to begin this assessment.
- 2 - Organization has completed this assessment.
- 3 - Organization has completed this assessment and updates it periodically.

The self-assessment was administered at a workshop of regulators and health managers in Naivasha where participants were asked to form groups from their organizations, ideally including senior leaders, program managers, and technology staff. Within each group, participants read and discussed the questions then collaboratively selected an answer from the four response options. In some instances, when a group could not reach a consensus answer, more than one response option was indicated.

For each question, key concepts and discussion items were included in the assessment tool. Key concepts were intended to help participants reach a common understanding of important terms. Discussion items were open-ended questions intended to encourage dialog among participants. Although it was not requested, some participants provided responses to the discussion items. Responses from both the self-assessment questions and the discussion items are shared below.

Following the completion of the interoperability self-assessment, the organizational groups reconvened into a larger assembly and shared impressions from their experience. Each group was provided with a copy of their completed self-assessment and the suggestion to share it with organizational colleagues and, if needed, reassess their capabilities by including participants who did not attend the workshop.

## Results

### *Capability Maturity Scores*

The interoperability self-assessment activity yielded capability maturity scores for seven organizations: Ministry of Medical Services (government services representing the district hospital level), Clinical Officers Council (a regulatory board), Pharmacy & Poisons Board (a regulatory board), Maua Methodist Hospital (a health care facility), Nursing Council of Kenya (a regulatory board), Kenya Medical Practitioners and Dentists Board (a regulatory board), and Ministries of Health – Nursing Department (a national level governmental agency).

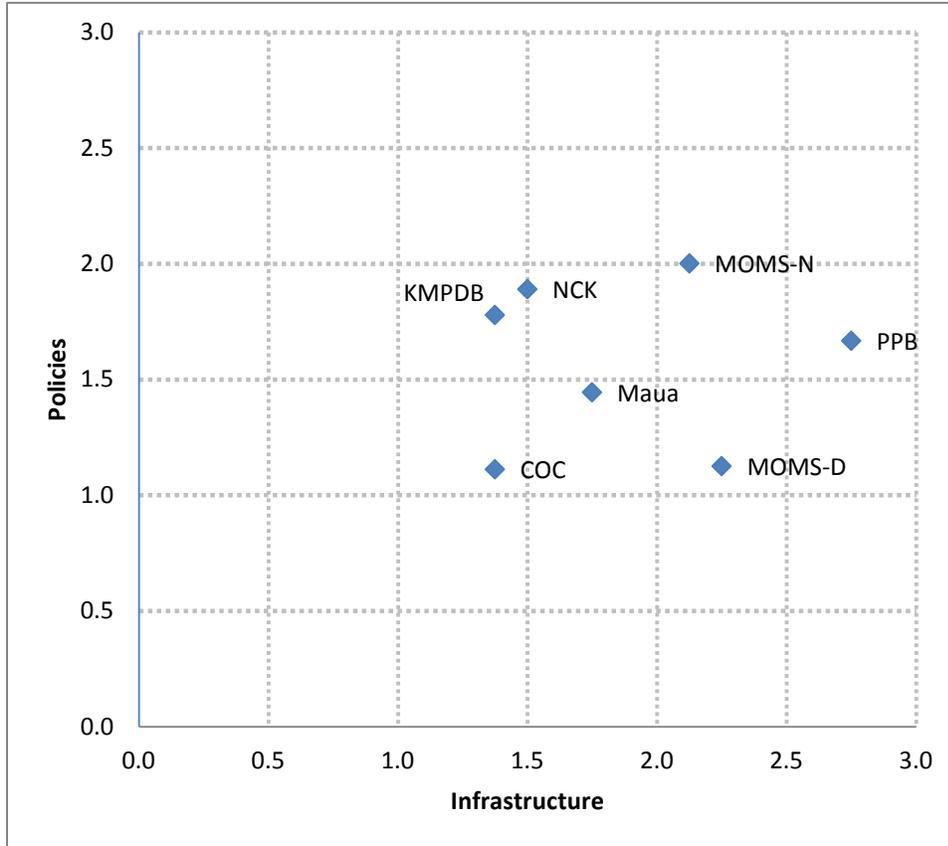
As described above, the four response options for each question corresponded to a four-point ordinal scale of capability maturity levels. Organizational composite scores for both Policies and Infrastructure were calculated by treating the individual question scores as interval values and

calculating arithmetic means. These composite scores provide a summary indicator of each organization's capability maturity for the Policies and Infrastructure interoperability aspects. Additionally, an arithmetic mean for each question was calculated by averaging scores across organizations. Mean question scores provide a single indicator across organizations for each of the interoperability subtopics included in the Policies and Infrastructure aspects.

In one instance a group did not answer a question, and that question was excluded from the organizational composite score and mean question score (i.e., it was not treated as a zero). In seven instances, a group selected two response options for a question; in those instances the higher of the two scores were used to calculate the relevant composite and mean question scores, as the higher score indicated that the corresponding higher level of capability maturity had been reached, even if temporarily or with some disagreement.

Composite scores are provided in Figure 3; while individual question scores are provided in Table 3. The contextual response options that correspond with the question scores are provided in the self-assessment tool, which is included as an appendix to this report.

**FIGURE 3: COMPOSITE CAPABILITY MATURITY LEVEL SCORES FOR POLICIES AND INFRASTRUCTURE INTEROPERABILITY ASPECTS**



Group/Organizational Affiliation	Composite Scores	
	Policies	Infrastructure
Ministry of Medical Services - District Level (MOMS-D)	1.1	2.3
Pharmacy & Poisons Board (PPB)	1.7	2.8
Clinical Officers Council (COC)	1.1	1.4
Maua Methodist Hospital (Maua)	1.4	1.8
Nursing Council of Kenya (NCK)	1.9	1.5
Ministry of Medical Services – Department of Nursing (MOMS-N)	2.0	2.1
Kenya Medical Practitioners and Dentists Board (KMPDB)	1.8	1.4

**TABLE 3: CAPABILITY MATURITY LEVEL RESPONSES FOR POLICIES AND INFRASTRUCTURE INTEROPERABILITY SUBTOPICS**

1	Policies	MOMS-D	PPB	COC	Maua	NCK	MOMS-N	KMPDB	Row Mean
1.1	Has your organization completed an assessment intended to describe its information needs?	0	1	3	0	3	3	2	1.7
1.2	Does your organization have a formal leadership group that guides health information systems (HIS) projects?	1*	3	0	1	2	3	2	1.7
1.3	Has your organization completed an assessment that identifies existing or potential data exchange partners?	0	1	1	1	1	1	1	0.9
1.4	Has your organization adopted data exchange procedures?	2	0	1	3	3	3	3	2.1
1.5	Has your organization established data sharing agreements with other organizations it would like to exchange data with?	2	2	1	0	1	1	1	1.1
1.6	Has your organization completed an assessment to identify and engage stakeholders in interoperability efforts?	1	1	1	1	1	1	1	1.0
1.7	Does your organization have any type of strategic planning document related to health information systems (HIS) projects?	1	2	0	3	3	3	3	2.1
1.8	Has your organization adopted techniques or procedures to ensure health information system projects are successfully completed in a manner that meets stakeholder expectations for quality, timeliness, and costs?	blank	3	1	2	1	1	1	1.5
1.9	To what degree does your organization ensure the quality of the data it collects or uses?	2	2	2*	2	2	2	2	2.0
	<b>Composite Policies Score:</b>	<b>1.1</b>	<b>1.7</b>	<b>1.1</b>	<b>1.4</b>	<b>1.9</b>	<b>2.0</b>	<b>1.8</b>	

2	Infrastructure	MOMS-D	PPB	COC	Maua	NCK	MOMS-N	KMPDB	Row Mean
2.1	Is a basic Information and Communications Technology (ICT) infrastructure available for your organization?	3	3	2	3	2	2	2	2.4
2.2	To what degree has your organization documented the business processes that describe its operation?	3	3	2	1	1	2	1	1.9
2.3	Does your organization have access to dedicated information and communication technology (ICT) staff to support program functions?	2	3	0	1	2	3	1	1.7
2.4	Does your organization have access to a dedicated unit or individual to support data management?	2	3	1	1	2	3	1	1.9
2.5	Does your organization have access to a dedicated unit or individual to support data analysis?	2	3	0	1	1	3	1	1.6
2.6	To what degree is staff turnover a problem for your organization?	2	3	3	2	1	0	2	1.9
2.7	To what degree is your organization connected to a computer network?	2	3*	2	3	2	3	2	2.4
2.8	How does your organization typically exchange information with partners?	2	1	1*	2	1*	1*	1*	1.3
	<b>Composite Infrastructure Score:</b>	<b>2.3</b>	<b>2.8</b>	<b>1.4</b>	<b>1.8</b>	<b>1.5</b>	<b>2.1</b>	<b>1.4</b>	

\* Indicates two response options were provided, and the higher was used for scoring.

### Discussion Item Responses

As described above, each capability maturity question in the self-assessment tool included additional open-ended discussion item questions designed to facilitate group conversation and consensus on a capability maturity response option. In some cases, groups voluntarily provided qualitative responses to those questions. Select responses are provided below, in Table 4.

**TABLE 4: SELECT DISCUSSION ITEM RESPONSES**

Interoperability Aspect – Subtopic	Discussion Item Question	Responses (separated by   )
Policies – Information needs assessment	Has your organization listed partners that it obtains data from or provides data to? Are there members from within your organization that share data from different information systems?	Yes we have partners: AMREF, APHIA IMARISHA, [?MSH]/USAID   Yes   AfyaInfo, MOH, CDC Emory, Capacity   MOH CHAK (Christian Health Association of Kenya)   There is data sharing within an internal framework (government framework). The organizations have just begun considering external partners and information systems.
Policies – Information needs assessment	What information problems does the organization face that are solved only through combining data from different information systems?	data fragmentation   Monitoring and Evaluation; Product recalls and withdrawals; fraud monitoring for products and [?practitioners]   [?attrition, incentive, trainers, mentors]   duplication; verification of data
Policies – Information needs assessment	Have you encountered any barriers or challenges to in conducting an assessment of your information needs? Can you anticipate any barriers?	lack of goodwill from people; a bit difficult in [?embracing] IT; lack of skill   lack of documented processes; resistance to change
Policies – Formal leadership, strategy	What barriers or challenges has your organization experienced in establishing governance for HIS development?	irregular meetings; lack of commitment   resistance to embracing the concept by some members of staff   competing tasks for members; politics and internal disagreements; lack of understanding of importance of HIS
Policies - Data exchange procedures	What will help you achieve better policy development and implementation?	making these policies as SOPs   enabling legal framework; proper coordination by central government

[?Response] *Indicates uncertainty associated with interpretation of handwritten response.*

## Discussion

The goal of the interoperability self-assessment tool is to help organizations develop interoperable health information systems. It is designed to facilitate a discussion that enables an organization to characterize their current capabilities related to ICT development, and to identify the conditions and practices that support interoperability. By including contextually descriptive response options representing conditions for each capability maturity level, as well as descriptions of key terms used therein, the tool is intended to help an organization both assess its current capability and identify conditions necessary to achieve a higher level of capability.

The iteration of the tool used in this assessment activity focuses on organizational practices consistent with Capability Maturity Levels 0, 1, 2, and 3 (see above). For the Policies interoperability aspect, these levels represent a continuum of organizational capability ranging from no awareness of interoperability issues (level “0”) to defined processes and policies aligned with developing interoperable ICT systems (level “3”). With respect to the Infrastructure

interoperability aspect, these capability levels can represent either the ability of processes and policies related to ICT infrastructure or, for appropriate subtopics, functional abilities of ICT hardware, software, and staff.

Based on composite scores for the Policies interoperability aspect, which range from 1.1 to 2.0, the organizations participating in this self-assessment fall short of having established governance and procedures to support interoperable ICT systems. With capability maturity level scores “1” and “2” representing initial, ad-hoc efforts by individuals and managed attempts to repeat any initial successes (respectively), these scores can be interpreted as a reflection of early efforts at establishing policies supporting interoperability. Average scores for the individual questions suggest capability levels generalized across organizations for subtopics of the Policies aspect. Particularly low scoring subtopics of Policies include identification of potential data exchange partners (question mean score: 0.9) and interoperability stakeholders (1.0), and establishment of data exchange agreements with external organizations (1.1). Higher scoring subtopics suggest somewhat higher capability related to ensuring data quality (2.0), documenting health information systems strategic plans (2.1), and adopting data exchange procedures (2.1). An interesting juxtaposition between higher capability scores for adoption of data exchange procedures and lower scores for establishing data exchange agreements was observed. Due to time constraints, the authors and participants were not able to explore this during the self-assessment activity at the workshop. A potential explanation is that, to the extent they require burdensome administrative and legal work, data exchange agreements may initially introduce barriers to actual data exchange but are necessary in the long term to support a routine and sustained exchange of information.

Organizational composite scores for Infrastructure range from 1.4 to 2.8, indicating somewhat higher capabilities when compared to Policies. Again, using average scores for individual subtopic questions, lower subtopic capability is suggested for dedicated ICT and data analysis staffing (1.7 and 1.6, respectively) and automated (e.g., “machine to machine”) data exchange (1.3). Higher infrastructure capabilities across organizations are suggested with respect to basic ICT infrastructure (question mean score: 2.4) and computer network connectivity (2.4), both of which are foundational to supporting further advances in interoperability.

The purpose of scoring organizational interoperability capability was not to yield precise, scientific measures but rather to offer specific guidance for organizations interested in creating conditions for ICT interoperability. The authors intend this self-assessment approach as a collaborative technique for evaluating and strategizing ICT development. By completing the self-assessment and comparing capability scores across interoperability aspects and their related subtopics, organizations can better prioritize particular areas for improvement.

There are certain limitations for both this self-assessment approach in general, and for the particular assessment activity described above. Self-assessment participants will likely have varying levels of knowledge with respect to different interoperability aspects. In general, an organization would be best served by assembling a self-assessment team knowledgeable of policies, infrastructure, applications, and data standards. This team would likely include senior management, ICT staff, and programmatic staff. With respect to the particular workshop activity discussed here, it could be that some of these perspectives were inadequately represented due to non-attendance. Similarly, it is possible that organizations participating in the workshop are not representative of all Kenyan HRIS and HMIS users.

The authors described how this self-assessment activity was scoped to include the Policies and Infrastructure aspects of interoperability and exclude the two remaining aspects: Applications and Data & Standards. While the rationale for this decision is provided above, resulting implications for this assessment activity are acknowledged here. Efforts to gather information related to data standards and applications interoperability were made outside of this self-assessment activity. These included follow-up conversations with HRIS and HMIS developers who were unable to attend the workshop. Information resulting from these conversations indicated that HRIS and HMIS have not implemented international vocabulary and messaging standards. Currently, KHWIS does not implement the International Standard Classification of Occupations. Instead, Regulatory Boards and GoK provide the vocabulary codes used in KHWIS. Regulatory Boards and MOH could explore International Standard Classification of Occupations and assess availability of standard vocabulary terms to describe terms associated with attrition, resignation, transfer, and migration. In addition, KWHIS does not have the ability to construct or ingest XML-based messages, including messages based on the Statistical Data and Metadata Exchange – Health Domain (SDMX-HD) standard supported by WHO. Currently, SDMX-HD is the de facto international standard for exchange of messages containing aggregate health indicator information, and is supported by DHIS-2. MOPHS departments manually entering data into DHIS-2 based on information captured in programmatic applications (e.g., those developed and used by DLTL and DVI) could consider implementing more automated data transfer to DHIS-2 using SDMX-HD messages.

With respect to applications, the goal of providing end-users the functionality they need to meet programmatic goals often requires discrete systems to communicate with one another. As stated earlier, the authors were unable to extend capability maturity level concepts to the evaluation of the Applications interoperability among all of the information systems mentioned by respondents from the key informant interviews. However, it is well known that an API is under development in Kenya to enable data exchange among many of the organizations that participated in this assessment, through the MFL and DHIS-2. In addition, the regulatory boards are collaborating on a shared information model and enterprise architecture which should facilitate data exchange. An emerging potential for cloud-based computing could have a positive impact on future data exchange opportunities, as well.

### **Conclusions from Self-Assessment Activity**

Based on the results described above, the participants of this self-assessment activity have important gaps to address with respect to developing policies and infrastructure to support interoperable health information systems. Efforts to identify and engage potential data exchange partners and stakeholders seem to be at very early stages, and based on key interpersonal relationships (i.e., Level 1). Results indicate that many participants have documented data exchange procedures, but the administrative protocols they entail may be limiting actual data exchange. Participants are not yet routinely following defined data quality assessment practices, yet they seem to have progressed beyond isolated, ad-hoc attempts to assess data quality. Lower capability with respect to staffing infrastructure could be related to capability limitations for establishing data quality assurance processes. ICT infrastructure may be adequate to support interoperability between health information systems users at national agencies or in urban areas. However, ICT infrastructure issues limiting the availability of electrical power and network connectivity will likely continue to be a barrier to a nationwide eHealth enterprise. Web-based HRIS and HMIS tools are a positive development and could

implement client-side data storage so intermittently disconnected devices can retain information until a network connection is established and data can be uploaded to a centralized repository. However even these systems are subject to outages in electricity or network connectivity.

In addition, there is important work to be undertaken to promote the use of data standards to facilitate exchange. The use of international standards will not only support data exchange between the HIS in Kenya, but could support data exchange with other countries. For HRIS, this is an important element in tracking the migration of health workers.

In general, the self-assessment exercise was described by the workshop participants as a helpful activity to identify specific action steps that could be undertaken by individual organizations.

## V. Activity 3: Key Informant Interviews

In addition to the interoperability self-assessment previously described, the second request by the sponsors was to assess the information needs of health leaders in Kenya. To do so, we conducted a series of key informant interviews (KIIs), assessing: (a) the information needs of key health leaders, related to the scale up of interventions for key health priorities, including malaria, tuberculosis, and HIV; and (b) what health analysis would be enabled by data exchange/interoperability between HRIS and HMIS; and (c) the challenges, barriers and opportunities for data exchange.

This activity seeks to contribute to the country's efforts to enable data exchange between key health information systems, by assessing the information needs as identified by key health leaders, identifying priority policy questions for scale-up of key health interventions, and identifying the specific data elements and sources needed to address priority health issues.

### Methods

The Institute engaged in a series of interviews with key health leaders in Nairobi, Kenya. The majority of the interviews were completed as part of face-to-face meetings that occurred between November 6 and December 3, 2012. Invitations to participate in interviews were extended by staff of the Nairobi-based EMORY/CDC project team via phone or personal contact. With their consent and agreement, individual meeting appointments were requested. Interviews typically occurred at health managers' offices. Two members of the project staff participated in each interview, with one staff member having primary responsibility for asking the interview questions and the other staff member taking notes. Each interview lasted approximately one hour. Participants included division heads for priority health areas such as malaria, vaccines and immunizations, reproductive health, leprosy, tuberculosis, and lung diseases, as well as health chiefs of medical services such as nursing, medicine, clinical officers, and laboratories.

A semi-structured discussion guide was used during each interview to ensure consistency in topics covered. The interview guide is included as Appendix B.

After each interview, one project staff member developed an initial summary and the other reviewed and edited the summary to ensure that it accurately reflected the interview. Upon completion of all interviews, each of the two project staff members independently reviewed the interview summaries to identify key points and common themes. The two project staff members then met to discuss their independent reviews and reached agreement on the key findings and themes.

### Results

Interviews quickly revealed that health leaders from the MOPHS and those from the MOMS differed significantly with regard to their information needs and data management practices. As a result of these striking differences, the results presented in this report are stratified by type of health leader (e.g., MOPHS versus MOMS).

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## Ministry of Medical Services (MOMS)

### **1. Information Needs**

The information needs of stakeholders interviewed from within MOMs can be categorized into one of four types: a) recruitment; b) deployment; c) retention; and d) forecasting. Stakeholders described a number of instances in which they have need for information related to recruitment, including the need to make hiring (a.k.a., posting) decisions for a particular site or facility, based on the number of additional staff that are needed, the number of current staff by job group or pay grade, the number and type of services that are provided, and the burden of disease in the area in which the site or facility exists.

They also had many information needs relevant to deployment decisions. Stakeholders indicated that deployment decisions should be guided by information related to individual skills, training, and site or facility workload. An individual's skills were described by stakeholders as including specialty (e.g., pediatrics, anesthesia, psychiatric) and qualifications (e.g., degree, diploma, and certificate). Training information was described as including information about short-courses and continued professional development courses completed by health care workers. Information about workload was described by stakeholders as including information about: a) patient wait times by facility; b) morbidity and mortality by facility; c) disease burden by facility; d) services provided in each facility; e) demographics of facility catchment area; f) distance between facilities; g) number and type of referrals by facility; and h) whether a facility is in an internship center.

Stakeholders within MOMS indicated a need for two primary types of information related to retention of health care workers. One type of information needed pertains to attrition, and includes information about the number of workers who leave their position for "natural" reasons (e.g., retirement, death) and the number who leave for "unnatural" reasons (e.g., absconding, resignation, transfer, migration). In instances of attrition due to unnatural causes, there is a further need for information about the reasons for resignation, transfer or migration. Several stakeholders also indicated a need to better understand what skills, specialties and qualifications are lost when a person leaves a position. To manage retention, information pertaining to disciplinary cases is also required, indicating the status of a case (e.g., pending, reinstated).

Forecasting information is also needed. Health leaders within MOMS need forecasting information related to the health workforce and commodities. With regard to the health workforce, stakeholders described needing several types of information, such as that related to: a) the number of health care workers (HCWs) deployed by sector (e.g., government, private, faith-based); b) the number of HCWs registered to practice with relevant board or council; c) the number of HCWs unemployed; d) population size by district and/or county; e) the number of facilities by district and/or county; and f) the types of facilities by district and/or county. There is also a need for information about how commodities are consumed at each site or facility (e.g., amount, type), the procurement source for specific commodities, and the number of tests administered by type.

## 2. Data Management

Data management was determined to consist of data collection, staff capacity, and data access. Among health leaders in MOMS, data collection was described as consisting mainly of gathering secondary data. For example, all departments (e.g., medicine, nursing, clinical officers, laboratories) reported collecting information on staff deployed in the public sector on a quarterly basis, and having a data coordinator who collected these data. However, departments differ with regard to how they use staffing data. For example, the Department of Nursing uses the staffing data to directly populate KHWIS, whereas the departments which oversee clinical officers and doctors input the staffing data into Excel spreadsheets that have been developed for their departments to populate KHWIS. Despite the advantages of standardized collection and submission of data, standard operating procedures are uncommon. Other barriers to efficient collection and transmission of data include a limited number of computers and unreliable electricity in some districts and provinces.

All health leaders within MOMS indicated that data management was hindered by a lack of qualified staff. There are generally too few staff members within all the MOMS departments to support data collection, analysis, and use. Most often, one data coordinator exists at the national level within each department, and that person is responsible for data collection, management, analysis and use. However, these staff members do not always have the appropriate skills and training for the job. As a result, there are ongoing problems with data collection, data completeness, and data accuracy. There appears to be an especially strong need for staff members with skills specific to data management and analysis. There is also a need to train current staff members on how to access and use information systems such as KHWIS, iHRIS, MFL, and DHIS-2.

The four data systems mentioned most frequently by health leaders within MOMS were KHWIS, iHRIS, IPPD, and DHIS-2. Most departments reported that they were able to access KHWIS to gather some HR data elements; however, several data elements were noted to be missing from KHWIS, and these included: a) HCW qualifications (e.g., degree, diploma); b) HCW specialty; c) completed continuing professional development; d) information about attrition, other than that due to death or retirement; e) deployment of HCWs in private and faith-based sectors; and f) workload data (e.g., patient wait times, disease burden, services offered by facility). Although none of the health leaders in MOMS reported having direct access to iHRIS, they do make requests to the HR department for information that comes from iHRIS (e.g., HCW qualifications).

The clinical officers, nursing and laboratory departments within MOMS each reported using data from the IPPD to confirm and/or augment data in KHWIS. All health leaders reported that they access information from IPPD by submitting a memo outlining the details of the request to the HR department. The HR department receives and fulfills many such labor intensive requests each week. Common data elements provided by IPPD included: a) name; b) date of birth; c) age; d) gender; e) personnel number; f) date of 1<sup>st</sup> appointment; g) designation (e.g. EN/RN/BScN); h) job group (e.g. promotion level); i) status (e.g., active or inactive, and if inactive, why); j) discipline; k) pay station; l) date of current appointment; m) terms of service (e.g. temporary); n) work district; o) attrition by cause; and p) date of exit.

Despite the fact that all the health leaders interviewed from MOMS reported a need for various types of data related to workload and disease burden, none of the health leaders in MOMS

reported having access to DHIS-2 (which is a web-based source of this type of information). Some stated that they had never been trained on how to access and use DHIS-2.

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## Ministry of Public Health Services (MOPHS)

### **1. Information Needs**

The information needs of stakeholders interviewed from within MOPHS can be broadly categorized as pertaining to either service delivery or commodities management. Within the category of service delivery, stakeholders noted information needs related to service provision, quality of care, and priority health interventions.

Information needs related to service provision included the need for data on the number and type of health care workers by facility. One health manager noted that he used data about the presence of certain types of health care workers in a specific facility to make assumptions about the types of services delivered in the facility. For example, the presence of nurses in a particular facility indicates that certain types of services, such as immunizations, are provided within the facility. Health managers also noted that information about skills (e.g., qualification, specialty, and continuing professional development) and status (e.g., active, temporarily inactive, permanently inactive) of health care workers is important for understanding service delivery patterns and training needs. Several health managers also noted the desire for information about causes of health care worker attrition (e.g., retirement, death, migration). The term “dynamic staffing” was used by at least two health managers to describe the desire to assign staff to a facility based on the type and number of services that are performed at a particular facility. For example, information about how often a specific test is being conducted at a particular facility could be used to identify and/or justify the need for an increase in the number of lab technicians there.

Information related to quality of care was described by stakeholders as being useful to identifying staff training needs. Health managers indicated that in order to determine the most needed and appropriate training to offer or approve for health care workers they needed information related to: a) position; b) specialty; c) qualification; d) job level; e) time in pay-grade; f) skills; and g) list of approved courses (e.g., EmOC, PMTCT, FP, cancer screening, microscopy).

Health managers also indicated that appropriate responses to priority health interventions, such as HIV/AIDS and malaria, require ready access to information about the number of new cases confirmed, number of admissions by diagnosis, number of laboratory confirmed cases, and number of deaths by cause.

Information needs related to commodities management included the need for data on procurement, disposal, distribution and forecasting. Desirable procurement information includes the number of commodities distributed, the number of tests done by type, and the number of technicians or technologists deployed by site. The information desired by health managers related to disposal includes the amount of unused commodities by type, and information about how unused commodities were disposed of (e.g., sold, auctioned, donated).

Health managers also cited a number of information needs related to commodities distribution and forecasting, including: a) service delivery by facility; b) number of technicians or

technologists by facility; c) number of tests conducted by type and facility; d) number of commodities (e.g., immunizations, nets) distributed by type and facility; e) amount of medication consumed by type and facility; f) inventory (e.g., number of days stock out) by type and facility; and g) commodity wastage by type and facility.

## **2. Data Management**

Data management was determined to consist of data collection, staff capacity, and data access. Health leaders in MOPHS described a number of different strategies used to obtain data. Several health leaders described “vertical systems” whereby divisions had developed their own databases with mechanisms in place to support data collection. For example, the Division of Leprosy, TB and Lung Diseases (DLTLD) System has been developed by that division specifically to support the collection and use of service statistics for TB control, and is used to augment data contained in DHIS-2. Another example is the Division of Vaccines and Immunizations (DVI) database, known as Stock Management Software, which supports vaccine commodities tracking.

Health leaders in MOPHS reported using DHIS-2. Several divisions, including DLTLD, DVI, and DRH, reported that they feed data into DHIS-2. One division reported that they collect data on maternal mortality using a form that they developed and then feed the collected data into DHIS-2. Despite the fact that several divisions reported feeding data into DHIS-2, the process for getting the data into DHIS-2 requires a substantial amount of manual work, and it is therefore a time consuming process.

In contrast to health leaders in MOMS, health leaders in MOPHS reported having fairly strong data management teams to assist with data collection, management and analysis. Typically, the data management teams in MOPHS divisions include one or more data manager, biostatistician, monitoring and evaluation officer, and data officer. Most health leaders in MOPHS indicated that their data management teams meet routinely to analyze, review and discuss data issues.

Despite having data management teams within each MOPHS division, health leaders reported that data management was somewhat hindered by having an insufficient number of staff – particularly Health Records Information Officers (HRIOs) beyond the district level. HRIOs are often responsible for data collection at the facility level, in addition to delivering patient services. This dual-responsibility is difficult for the HRIOs and can lead to lessened attention to data collection. In addition, some health managers reported difficulties in transitioning from a “push” based system (in which data is fed into a system) to a “pull” based system (in which data are extracted from a system and used). Some health managers suggested that having a HRIO at every facility would help improve the quality and consistency of data collection, management, and analysis.

Health managers in MOPHS cited the need for staff training information. Training is needed at all levels, including the national level, to enhance data management and the effective use of data. Health managers specifically mentioned the need for information that could be used to develop staff training around the topics of data management (e.g., standard operating procedures for collection, transmission and storage of data), data use (e.g., data-driven decision making), and system use (e.g., training on use of computers, tablets, and systems).

The seven data systems mentioned most frequently by health leaders within MOPHS were DHIS-2, MFL, DDSR, KEMSA, Lab, HRIS, and their own division systems. All MOPHS divisions reported having access to DHIS-2, and most reported exporting data sets from DHIS-2 for analysis. There

were some health leaders, however, who noted that the quality of data in DHIS-2 is lacking and indicated a desire for more accurate and complete data on in-patients and confirmed cases of diseases (e.g., malaria). Most health leaders in MOPHS also reported using data in MFL, although one division noted the desire for MFL to contain accurate data on facility status (e.g., open, permanently closed, temporarily closed). Some health leaders in MOPHS reported using electronic datasets sent weekly from the Division of Disease Surveillance and Response (DDSR) to triangulate data on the number of people tested for malaria.

Many divisions have developed their own “vertical” data systems. These data systems include the Malaria Information Acquisition System (MIAS) which is a data warehouse in which the Division of Malaria Control compiles relevant data from multiple sources, the Stock Management Software (SMS) used by the Division of Vaccines and Immunization to track commodities, and the Division of Leprosy, TB and Lung Diseases data system in which they store data collected by district coordinators on PDAs/tablets.

In addition to the “vertical” systems, MOPHS divisions also reported using KEMSA and Laboratory Information Management Systems (LIMS) to track commodities (e.g., syringes, delivery kits, rapid diagnostic tests). Although several health leaders also reported using laboratory data, most noted that the lab data is poor or missing. Laboratory data elements that were cited as being desirable include the number of tests done by type (e.g., malaria, TB, HIV, pap smear) and the number of tests that yielded a positive result.

All divisions reported being blind to HR data, in that they were not currently using HR data to make decisions or inform policies. However, MOPHS health leaders reported that they would like to have access to HR data elements including the following: a) cadre (e.g., nurse, midwife, doctor, lab tech, clinical officer); b) qualification (e.g., certificate, diploma, degree); c) specialty (e.g., reproductive health, obstetrics); and d) continuing professional development (e.g., microscopy, EmOC).

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## Stakeholder Views on Integration

Stakeholders from both MOPHS and MOMS spoke of the need for integration between existing health information systems and the benefits interoperable systems would provide, including facilitating data access, promoting timely decision-making, reducing the time burden to share data, enabling more complex analyses, and transitioning away from vertical systems.

### **1. Facilitate Data Access**

Foremost, stakeholders believed systems integration would enhance data access. Currently, much of the data requested by human resources and health managers are being collected; however, vertical systems housed in specific departments and divisions only allow managers within that department/division to access the data. For example, MOMS department chiefs cannot directly access iHRIS (located in the HR Department) and MOPHS division heads cannot directly access KHWIS (located in MOMS Departments).

## **2. Promote Timely Decision-Making**

System integration would also promote timely decision-making. All of the HR and health managers listed specific data requirements to inform decision-making, which is either delayed by the data acquisition process or uninformed due to missing data. For example, to obtain information on the specialty areas of currently deployed clinical officers (COs) to inform training and deployment needs, the CO Department had to call each of the provincial offices because the CO Department's KHWIS is not linked to the Clinical Officers Council's rHRIS, which collects data on CO specialty training.

## **3. Reduce Time Burden**

Interoperable systems would reduce the time needed to acquire data and fulfill service data requests. Several respondents noted the complex processes they used to acquire the data needed for decision-making. For example, departments and divisions requesting data from IPPD must submit an official memo explaining their data requirements and parameters. The amount of time some departments spend servicing data requests is also burdensome. For example, the HR Department noted they receive at least five requests per week for a variety of data elements with specific inclusion and exclusion criteria and timeframes.

## **4. Enable Complex Analyses**

Integrated systems would also enable more complex analyses. Since some divisions and departments are limited in the data they can access, it becomes difficult to conduct cost-effectiveness studies or distribute commodities based on the number and type of HCWs staffing a facility. Integrated systems would allow HR and health managers to view data on health professionals, health facilities, commodities and burden of disease together, enabling analyses that inform more targeted interventions.

Based on the interviews, Table 5 below has been developed as an example of the types of questions the respondents identified that require data from both HMIS and HRIS systems. The table identifies examples of the types of questions that can only be answered by combining data from two or more databases, and identifies the type(s) and source(s) of data.

**TABLE 5: EXAMPLES OF HEALTH ANALYSIS ENABLED BY DATA EXCHANGE BETWEEN HRIS AND HMIS, BY KENYA MINISTRY OF HEALTH DIVISION**

Question	Indicator(s)	Type(s) of Data Needed and Source(s) of Data	Accessibility	Health System Objective(s) <sup>15</sup>	Relevant Program Area(s) <sup>16</sup>
<b>Ministry of Medical Services (MOMS)</b>					
Does the number and type of HCW <sup>17</sup> deployed to a particular health facility align with the workload (i.e., number and type of services rendered) of the particular health facility?	Degree, diploma, specialty of HCW; # and type of services rendered, by facility	Degree, diploma, specialty of HCW (source: rHRIS, KHWIS and/or IPPD); # and type of services rendered, by facility (source: DHIS-2 and MFL); HCW deployment by facility (KHWIS and iHRIS)	MOMS has access to KWHIS and can get information from IPPD by request to HR, but limited access to DHIS-2 and MFL  The rHRIS is not linked to MOMS  MOM departments can access KHWIS, but not iHRIS	Access and efficiency	All
Does the number and type of HCW deployed to a particular health facility align with the disease burden associated with the particular health facility?	Degree, diploma, specialty of HCW; disease prevalence, by facility/location	Degree, diploma, specialty of HCW (source: KHWIS and/or IPPD); Disease prevalence (source: DHIS-2 and DDSR)	MOMS has access to KWHIS and can get information from IPPD by request to HR, but limited access to DHIS-2 and MFL	Equity and efficiency	All
What are the characteristics of HCWs who are scheduled to retire during the next five years, by facility/location?	Age, degree, diploma, skills, specialty of HCW, by facility; qualifications of HCW, by facility	Age, degree, diploma, skills, specialty of HCW (source: KHWIS and/or IPPD); Qualifications (source: iHRIS)	MOMS has access to KWHIS and can get information from IPPD by request to HR, but no direct access to iHRIS (under development)	Efficiency and quality	All

<sup>15</sup> Murray, C.J.L. and Frenk, J. *A WHO Framework for Health System Performance Assessment*. Geneva, Switzerland. World Health Organization, 1999. (Global Programme on Evidence for Health Policy Discussion paper no. 6.)

<sup>16</sup> Program areas include HIV, malaria, TB and other lung diseases, reproductive health, vaccines/immunizations

<sup>17</sup> Health care workers

Question	Indicator(s)	Type(s) of Data Needed and Source(s) of Data	Accessibility	Health System Objective(s) <sup>15</sup>	Relevant Program Area(s) <sup>16</sup>
What is the number and type of HCW with specific continuing professional development points/competencies, by facility?	Degree, diploma, skills, specialty of HCW; continuing professional development points	Degree, diploma, skills, specialty of HCW (source: KHWIS and/or IPPD); Continuing professional development points (source: rHRIS)	MOMS has access to KWHIS and can get information from IPPD by request from HR, but no direct access to rHRIS (via request only)	Quality	All
<b>Ministry of Medical Services (MOMS) (cont'd)</b>					
Are commodities (e.g., medical supplies and materials) distributed in a way that aligns with health facility workload (i.e., number and type of services rendered) and disease burden?	# and type of commodities distributed, by facility; # and type of services rendered, by facility; disease prevalence, by facility/location	# and type of commodities distributed, by facility (source: KEMSA); # and type of services rendered, by facility (source: DHIS-2 and MFL); Disease prevalence (source: DHIS-2 and DDSR)	Unclear whether MOMS has access to KEMSA; limited access to DHIS-2 and MFL.	Access, equity and efficiency	All
<b>Ministry of Public Health and Sanitation (MOPHS)</b>					
Are vaccines distributed in a way that aligns with health facility workload (i.e., number and type of services rendered) and disease burden?	# and type of vaccines distributed, by facility; # and type of services rendered, by facility; disease prevalence, by facility/location	# and type of vaccines distributed, by facility (source: Stock management software used by Division of Vaccines and Immunization); # and type of services rendered, by facility (source: DHIS-2 and MFL); Disease prevalence (source: DHIS-2 and DDSR)	MOPHS Division of Vaccines and Immunization has access to stock management software, DHIS-2 and MFL; however, the databases are not integrated	Access, equity and efficiency	Vaccines and Immunization
Does the distribution of HCW by degree, diploma, skills, specialty and training in ART align with the disease burden of HIV, by facility/location?	Degree, diploma, skills, specialty of HCW; continuing professional development points related to ART; disease prevalence, by facility/location	Degree, diploma, skills, specialty of HCW (source: KHWIS and/or IPPD); Continuing professional development points related to ART (source: rHRIS); Disease prevalence (source: DHIS-2 and DDSR)	MOPHS has access to DHIS-2 and DDSR, but does not typically access HR data from KHWIS, IPPD or rHRIS	Equity, access and quality	HIV

Question	Indicator(s)	Type(s) of Data Needed and Source(s) of Data	Accessibility	Health System Objective(s) <sup>15</sup>	Relevant Program Area(s) <sup>16</sup>
What is the distribution of HCWs trained to perform male circumcision (MC), by type, facility, and disease burden?	# HCW trained to perform MC; degree, diploma, skills, specialty of HCW; continuing professional development points related to MC; disease prevalence, by facility/location	Degree, diploma, skills, specialty of HCW (source: KHWIS and/or IPPD); Continuing professional development points related to MC (source: rHRIS); Disease prevalence (source: DHIS-2 and DDSR)	MOPHS has access to DHIS-2 and DDSR, but does not typically access HR data from KHWIS, IPPD or rHRIS	Equity, access and quality	HIV
<b>Ministry of Public Health and Sanitation (MOPHS) (cont'd)</b>					
Are mosquito nets and other anti-malaria supplies distributed in accordance with disease burden and number of laboratory confirmed malaria cases?	# and type of malaria supplies distributed; disease prevalence, by facility/location; # laboratory confirmed cases	# and type of malaria supplies distributed (source: Malaria Information Acquisition System); Disease prevalence (source: DHIS-2 and DDSR); # laboratory confirmed cases of malaria (Source: LIMS)	MOPHS has access to DHIS-2, DDSR and the Malaria Information Acquisition System, but does not have access to LIMS (for data on confirmed cases)	Quality and efficiency	Malaria
What is the number of maternal deaths, by facility/location?	# maternal deaths, by facility/location  # midwives by facility/location	# maternal deaths (Source: DRH collects own data)  # midwives by facility/location (Source: KHWIS and iHRIS)	MOPHS Division of Reproductive Health reported collecting their own maternal mortality data and inputting it into DHIS-2. Consideration is to have DHIS-2 link to DRH database containing maternal mortality data; MOPHS does not have access to KHWIS or iHRIS	Quality	DRH
What is the distribution of HCWs trained in microscopy, by type and facility?	# HCW trained in microscopy; degree, diploma, skills, specialty of HCW; continuing professional development points related to microscopy	Degree, diploma, skills, specialty of HCW (source: KHWIS and/or IPPD); continuing professional development points related to microscopy (source: rHRIS)	MOPHS has access to DHIS-2 and DDSR, but does not typically access HR data from KHWIS or IPPD or training/ continuing professional development data from rHRIS	Equity, access and quality	Malaria and TB/Lung Diseases

Question	Indicator(s)	Type(s) of Data Needed and Source(s) of Data	Accessibility	Health System Objective(s) <sup>15</sup>	Relevant Program Area(s) <sup>16</sup>
When HCWs are trained in PMCT, what is the impact on health outcomes (e.g., transmission rates, mortality)?	# HCW trained in PMCT; # cases of mother-to-child HIV transmission; mortality rates	Continuing professional development points related to PMCT (source: rHRIS); # cases of mother-to-child HIV transmission (source: DHIS-2 and DDSR); mortality rates (source: DHIS-2 and DDSR)	MOPHS has access to DHIS-2 and DDSR, but does not typically access training/continuing professional development data from rHRIS	Quality	DRH and HIV

### 5. Transition from Vertical Systems

Finally, moving towards an integrated HIS would assist in transitioning away from vertical systems. Currently, there are several systems collecting similar data elements. Integration would decrease both data collection effort and cost. For example, HR data is currently collected by DHIS-2 (e.g., aggregate level data), IPPD (e.g., for payroll), KHWIS (e.g., for staff deployment), and iHRIS (e.g., aimed for more efficient HR processing). Integration would allow the most relevant system to collect specific HR data elements, which would then be shared with others systems. Some groups, such as AfyaInfo, recommend that data collection from such similar systems be harmonized and used to populate an HRIS “data mart,” which would house and share HR data with other systems. Vertical systems are also expensive to maintain; therefore, costs (largely incurred by development partners such as iHRIS and USAID) could be reduced by transitioning to an integrated health information system.

#### Policies for Data Sharing

The key informant interviews revealed the need for policies to support data sharing. In general, data sharing policies are either non-existent or recently developed and in need of implementation. Efforts to advance data sharing policies should consult the Department of ICT within MOMS/MOPHS to participate in the policy development process to facilitate data sharing between departments and divisions in the Ministries of Health. The Futures Group was also noted for their core strength in data sharing policy development.

Health managers within the ministries see the clear benefit of data sharing, and have been working to advance such policies. Key data sharing policies include:

- The Division of HIS in the Department of Standards and Regulatory Services recently developed a data governance policy.
- The Joint Regulatory Committee (JRC), a collaboration between Kenya’s health professional boards and councils (i.e., Kenya Medical Practitioners and Dentists Board, Nursing Council of Kenya, and others), recently developed an memorandum of understanding with MOMS to jointly host and share HCW data based on user rights and access levels. This agreement

would enable MOMS department chiefs to see HCWs' qualifications and specialties, data housed in the boards and councils' rHRIS.

- iHRIS and DHIS-2 established a data sharing agreement in 2011 to export HR data from iHRIS to populate DHIS-2. Although this activity is currently on hold, DHIS-2 has developed an application program interface (API) and expressed interest in advancing this platform for data exchange. This would also allow DHIS-2 to stop collecting aggregate HCW data, which is reported to be less accurate than other HRIS data.

## Discussion

The interview results indicate that while most of the data required by human resources and health managers is being collected, typically it is only accessible to the department or division within MOMS or MOPHS housing that specific database. Thus, many HR and health managers do not currently have access to the data they need for day-to-day decision-making, program planning and policy development.

Stakeholders identified key gaps in the data they need to inform decision-making. This section explores specific data requirements and considerations for facilitating data access.

### 1. Health Care Worker Data

In the MOPHS departments and divisions, all respondents reported being “blind” to HR data. Most division heads ran their programs without any data on HCWs, despite noting ways that access to HR data could inform program planning (e.g., distribution of delivery kits based on facility staffing).

Given the various levels of data aggregation (e.g., aggregate, de-identified individual level, and identifiable individual level), most health managers in MOPHS required some form of individual level data, especially to see information on HCWs' qualifications, specialties and CPD. Key considerations include:

- Give MOPHS departments/divisions user rights, access and logins to iHRIS or KHWIS.
- Establish a minimum HR data set needed by MOMS/MOPHS departments and divisions for exchange, and identify the most appropriate HRIS system to supply each data element.
- Create an API between iHRIS or KHWIS and an HMIS system (e.g. DHIS-2 or MFL), which is already accessible to MOPHS through a web-based portal, to share HR data.

### 2. Qualifications and Specialty Data

Both MOMS and MOPHS reported the need for data on HCW skills, specifically qualification (e.g., degree, diploma, and certificate) and specialty (e.g., pediatrics, anesthesia, and psychiatry). While these data are essential to HCW deployment and in-service training, both Ministries of Health reported difficulty accessing this information. Key considerations include:

- Create user rights for the rHRIS (the databases housed in the health professional regulatory boards and councils) so that MOMS/MOPHS departments and divisions can log in and export data that are disaggregated to the appropriate level.
- Link the rHRIS to the KHWIS through a comma separated (CSV) file protocol to enable access for MOMS.

- Link the rHRIS to iHRIS through an API and expand the users of iHRIS to include MOMS/MOPHS departments and divisions.

### **3. Workload and Burden of Disease Data**

While data elements to measure workload and burden of disease vary greatly, most data required by MOMS department chiefs and MOPHS division heads are already being collected by DHIS-2. While MOPHS reported excellent access to DHIS-2, with the ability to access key data and export data sets, no one in MOMS reported having access to DHIS-2. Numerous respondents also noted difficulty in accessing laboratory services data to inform program planning. Key considerations include:

- Train MOMS department chiefs and data coordinators on DHIS-2, including the system access, usage, and data export.
- Coordinate with AfyaInfo, as they may be best positioned to conduct these trainings, given their plans to train users on DHIS-2.
- Establish user names and passwords, at the very least, for MOMS department chiefs and data coordinators to enable better access to available workload and burden of disease data.
- Coordinate with I-TECH, as they are supporting the migration of the paper-based Laboratory Management Information System to an electronic platform. Consideration should be given to a web-based platform with user rights across Ministry of Health departments and divisions, to support access to lab data.

### **4. Facility Services and Status Data**

The MFL currently lists services offered by various levels of health facilities in Kenya. While MFL software is programmed to capture a facility's status (e.g., open, temporarily inactive, permanently closed), these data are not currently being collected. Although both MOMS and MOPHS reported needing facilities data, few respondents listed MFL as a data source. Key considerations include:

- Train MOMS department chiefs and data coordinators, as well as MOPHS division heads and data teams, on MFL usage, given that it is a web-based system.
- Coordinate with AfyaInfo, given their plans to train users on MFL, to ensure these HR and health managers, and their data managers, receive the training.
- Link rHRIS, which collects data on newly approved facilities, to MFL, and have the rHRIS collect data on facility status.

### **5. Continuing Professional Development Data**

Data on continuing professional development (CPD) is not currently being captured, but was requested by HR managers in MOMS and health managers in MOPHS. Key considerations include:

- Capture CPD data in the rHRIS when health professionals come to renew their licenses, and allow MOMS/MOPHS managers to access the rHRIS based on user rights.

- Coordinate with FUNZO Kenya, which is developing a database focused specifically on training and CPD, and which will capture this information, to ensure data access by HR and health managers.

While working towards a fully integrated HIS, these recommendations will both enhance data access in the meantime and create an environment that will support and sustain Kenya's HIS in the future.

### Current Work within Kenya's HIS

AfyaInfo, a five-year project funded by USAID in its first year of operation, is working towards creating a "data warehouse" in the Ministries of Health that captures data on health commodities, health professionals, burden of disease, health facilities, population demographics, and health sector survey information. They are conducting an assessment of health information systems within Kenya's health sector to inform a four-year work plan, and would like to proceed in the following manner:

1. Identify minimum data sets
  - Identify minimum data sets for exchange between systems
  - Develop a national minimum data set for the data warehouse
2. Create Data Marts
  - Centralize data from systems collecting similar types of data (e.g., "HR data mart" with data from: KHWIS, IPPD, iHRIS, GHRIS)
3. Develop a Data Service Layer
  - Create an interface for consistent data access irrespective of database type
  - Develop API's to exchange data between different systems
4. Launch the Data Warehouse
  - Create an HIS Portal with different layers of data access and user roles

I-TECH is also working with the Ministry of Health to develop interoperability software to facilitate data exchange between Kenya's electronic medical records (EMRs) and DHIS-2. Furthermore, I-TECH is supporting the development of standards for an electronic Laboratory Management Information System (LMIS) and a pharmacy information system. The Futures Group developed an EMR middleware solution, IQ Care, which automates reporting to DHIS-2. More information on current interoperability activities can be found in Appendix D, the overview of the interoperability workshop.

### Conclusion

As Kenya moves towards an integrated HIS, the implementation of key recommendations can advance progress towards interoperable systems. This report focuses on recommendations that will enable HR and health managers to access data that is currently being collected by one of the many systems within Kenya's health sector – facilitating better access to health data by HR managers and to HR data by health managers. Given the vast number of information systems

collecting HR and health data, collaboration among partners, departments, divisions, projects and managers will be vital to the success of any interoperability work.

The respondents were readily able to describe the benefits and value of data exchange, and express interest and support in these efforts. They were also able to articulate specific data elements needed and provide a rationale for data exchange. A number of specific needs have been identified as a result of the interviews:

- In some instances, efforts to move toward data exchange are hampered by either a lack of staff, or staff that lacks specific training. These related issues may require distinct strategies to address, but they are related in that staffing shortages or staff unfamiliar with basic concepts of data management, data quality and analysis will impede effective data utilization. A specific role identified as needed below the district level is that of Health Records Information Officer (HRIO). In addition, MOMS staff specifically indicated that they have not been trained on how to access and use DHIS-2.
- Although this assessment focused specifically on data exchange between HMIS and HRIS, a specific need identified by health managers was access to commodities information. It is likely that health managers are committed to effective resource management, and access to such data could support efforts to create a more efficient health services provision.
- The key informant interviews revealed the need for a greater focus on policies to support data sharing, as did the self-assessment exercise. Efforts to advance data sharing policies could benefit by consulting the Department of ICT within MOMS/MOPHS to participate in the development of policy to facilitate data sharing between departments and divisions in the Ministry of Health. The Futures Group was also noted for their core strength in data sharing policy development.

## VI. Recommendations

### Support for Interoperability

The assessment revealed overwhelming support for greater interoperability within Kenya's health sector. Respondents noted that interoperability would facilitate data access, promote timely decision-making, increase efficiencies in data use, and enable complex analyses. While the majority of data needed by HR and health managers for decision-making are already being collected, typically it is only accessible to the department or division housing the specific database. The question now becomes, "What is needed to enhance data access, promote data sharing and facilitate data exchange?" Expanding access to HR and health data will require collaboration among the many partners and projects supporting key HRIS and HMIS systems, as well as the stakeholders from departments and divisions that are developing, utilizing, managing and maintaining key information systems within Kenya's health sector.

The following partners, projects and representatives, among others, are deemed central to the success of interoperability activities:

- Dr. Charles Nzioka, Head, Division of Health Information Systems
- ICT – Ministry of Health
- Ministry of Health – Department Chiefs and Division Heads
- Regulatory Boards and Councils – Regulatory HRIS
- AfyaInfo – MFL system and interoperability work
- Emory KHWP – KHWIS and rHRIS systems
- Capacity Kenya – iHRIS
- Division of HIS - DHIS-2 Software – burden-of-disease data
- Futures Group – data warehousing, IQ Care Software
- I-TECH – interoperability experience with OpenMRS
- MSH – KEMSA's Logistic Management Information System
- FUNZO Kenya – CPD and training database

### Recommendations

#### 1. Establish Data Sharing Agreements and Procedures

Promoting interoperability, or even expanding user access to current web-based systems, requires policies that support data sharing. This work should be done in consultation with the Division of HIS in the Department of Standards and Regulatory Services that is working to develop a data governance policy.

- Develop policies to support data sharing within the Ministries of Health. The self-assessment activity indicated relatively higher capability for establishing data exchange procedures and lower capability for actual establishment of data exchange agreements. Individual agencies, departments or divisions developing data exchange procedures in isolation may contribute

to prioritizing the narrow interests of the organization over the broader interests of an eHealth infrastructure.

- Develop data exchange procedures. This could help result in a national data exchange framework to address legal and administrative barriers and foster information exchange across Kenya’s health enterprise. Ideally, data sharing procedures resulting from these collaborations will address the data use and protection concerns of individual agencies, while serving the goal of interdepartmental information exchange.
- Expand further the data sharing agreement outlined by the Joint Regulatory Committee (JRC). The rHRIS collects data on health worker qualifications, specialties and continuing education – data which most stakeholder noted difficulty accessing. The policy could identify user based rights to this data for departments and divisions within the Ministries of Health, between regulatory boards and councils, for researchers, partners working within the health sector and the general public, among others.

## **2. Address Data Standards Collaboratively**

HRIS and HMIS should implement or support international vocabulary and messaging standards. Funding agencies should provide guidance to implementing partners developing health information systems regarding development and data standards, such as ISCO, ICD-10, SDMX-HD and HL7.

- Implement vocabulary standards for classifying members of the health workforce. The World Health Organization (WHO) recommends<sup>18</sup> that countries observe international standards, including the International Standard Classification of Occupations (ISCO). KHWIS uses vocabulary codes issued by the Regulatory Boards and GoK. Regulatory Boards and MOH should explore ISCO and related tools<sup>19</sup> for developing national occupation classifications that meet GoK’s needs and incorporate standard vocabulary terms to describe concepts associated with attrition, resignation, transfer, and migration. Any standard vocabulary terms adopted by Kenya to classify its health workforce should be incorporated in all of its HRIS.
- Utilize a vocabulary standard in HMIS, like the International Statistical Classification of Diseases and Related Health Problems (ICD)<sup>20</sup>, to describe morbidity and mortality events.
- Implement messaging standards. While adopting vocabulary standards allows data to be captured in a consistent manner across systems, messaging standards support interoperability by defining how data elements should be organized into messages that multiple systems can interpret and process. Currently, WHO supports the Statistical Data and Metadata Exchange – Health Domain (SDMX-HD)<sup>21</sup> format for exchanging indicator data between aggregate data systems. DHIS-2 and iHRIS have discussed the development of an

<sup>18</sup> World Health Organization. *Monitoring the building blocks of health systems: a handbook of indicators and their measurement strategies*. World Health Organization (2010). Page 27.

<sup>19</sup> <http://www.ilo.org/public/english/bureau/stat/isco/index.htm>

<sup>20</sup> World Health Organization. *International Statistical Classification of Diseases and Related Health Problems (ICD)*. 10th Revision, Second Edition. Geneva, World Health Organization, 2005. <http://www.who.int/classifications/icd/en/>

<sup>21</sup> <http://www.sdmx-hd.org/>

API to support SDMX-HD XML-based data exchange.<sup>22</sup> KWHIS does not have the ability to construct or ingest XML-based messages, including SDMX-HD messages. With respect to HMIS, as they explore interoperability issues, GoK could consider messaging standards such as SDMX-HD for indicator data, and Health Level Seven (HL7) for clinical data. For example, MOPHS departments like DLTLD and DVI currently utilize standalone systems designed to meet their individual program needs. Currently, users of these systems manually enter data into DHIS-2. But as opportunities to modify and evolve programmatic applications emerge, end-users and developers could incorporate functionality to import and export XML messages that adhere to messaging and vocabulary standards.

### **3. Develop a Shared Information Model and Enterprise Architecture**

As noted above, the Regulatory Boards are collaborating on a shared information model and enterprise architecture. A shared information model could determine how common data elements across HRIS and HMIS are implemented in databases, including the use of standard vocabularies.

- Document clearly the information model and enterprise architecture, with detailed descriptions of the databases that will be implemented. Database descriptions could include metadata articulating the ownership, origins, purposes, and limitations of the data.
- Consider supporting multiple approaches to integration. While web-based applications and APIs will likely continue to support increasingly more sophisticated data exchange, Kenya's enterprise architecture could support multiple approaches to integration. File-based data exchange and web applications that support client-side data storage could support the needs of users that have intermittent network connectivity. Expanded user rights to extant web-based HMIS and HRIS systems, specifically for departments and divisions within the Ministry of Health, can expand access to needed health and HR data. Posting HMIS and HRIS summary reports on websites available to the public can further assist in accessing key information.

### **4. Develop a Minimum HRH Data Set and Method for Exchange**

This report documents the data requirements for various divisions and departments that are not currently being met by systems within the department, or to which they do not currently have access. Most notably, MOPHS departments and divisions do not have access to health worker data. Both MOPHS and MOMS reported difficulty in accessing data on health worker qualifications, specialty and continuing education.

- Develop minimum data sets for exchange between specific systems and identify the most appropriate method for routine data sharing between systems.<sup>23</sup>
- Give attention to increasing access to data on health care worker qualifications, specialties, and continuing professional development – all of which are captured and updated in the rHRIS.

<sup>22</sup> <http://www.capacityplus.org/technical-brief-2/content/appendix-making-it-easier-share-data>

<sup>23</sup> Appendix E includes a description of potential minimum data elements and guidance for collaborative definition of minimum data sets developed by WHO.

### **5. Increase Data Support Staff**

The assessment identified the need for more data support staff, including both HRIOs at the facility level and data managers to promote routine data quality assurance at the national level. Capacity building to support HRIOs and data managers is needed.

- Enhance staff capacity related to data management in MOMS/MOPHS – including the hiring of additional HRIOs at health centers and dispensaries.
- Build capacity in data management. MOMS, specifically, reported a shortage of staff needed to collect, enter, clean and analyze data for decision-making. Staff reported the need for additional training in data management. For example, the self-assessment identified the need for routine, standardized data quality assessment practices.

### **6. Train MOMS Departments on DHIS-2 and MFL**

The assessment revealed that MOMS departments were not accessing data from DHIS-2 and MFL as readily as MOPHS departments and divisions.

- Train MOMS staff, data coordinators and managers on the use of DHIS-2 and MFL, both of which are web-based systems. While the data are readily available, no one interviewed from MOMS reported being able to access data on burden of disease and health facilities.

### **7. Allocate Resources to Support Specific Interoperability Activities**

Stakeholders and implementing partners, many of which were developing various types of health information systems, noted that they received little, if any, funding to support interoperability activities. Limited funding contributes to development silos, where information systems are developed in parallel without much thought for how they will integrate with a larger national health information system or exchange data with other health information systems.

- Consider allocating a certain percentage of information system project budgets to interoperability activities. Donor agencies should consider making interoperability a deliverable of any HIS project. While interoperability is currently viewed as something nice to do, but not essential to individual project deliverables, this shift in funding could also shift individual projects activities to support greater data exchange.

## **Way Forward**

These recommendations should be implemented under the technical guidance and leadership of the MOPHS and MOMS. Special consideration should be given to development partners who are already working to support interoperability. Where possible, partners such as Futures Group, Emory KHWP, AfyaInfo, Capacity Kenya, I-TECH, and MSH among others, should identify relevant recommendations that can be incorporated into their current HIS work plans. Partners are encouraged to work directly with departments, divisions and agencies that either require or house HMIS or HRIS data to advance interoperability within Kenya's health sector.

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## Appendix B: Kenya Interoperability Project Discussion Guide

### **Discussants**

Key informants from the Ministry of Health (MoH) and selected national health program leaders.

### **Objectives**

- I. Understand information needs related to:
  - a. Program management and routine information needs specifically as related to interoperable information systems, such as KHWIS (a.k.a., HRIS) and DHIS-2.
  - b. Human resources scale up for key health priorities.
- II. Describe current practices related to:
  - a. Data collection
  - b. Data management
  - c. Data sharing
- III. Identify specific data elements needed to answer key health policy questions.

### **Discussion Topics and Prompts**

- I. What role do you play in the organization?
  - a. What are your main responsibilities?
  - b. What do you do on a day-to-day basis?
- II. What types of decisions do you make?
- III. What type(s) of data do you use to make decisions?
- IV. Do you ever find yourself in a situation where it is difficult to make a decision because you do not have adequate data or information?
  - a. Can you provide any examples of decisions that you have found difficult to make because of data limitations?
- V. Do you currently have the data you need to answer the following types of questions (note: select some of the following based on role of person in discussion):
  - a. What is the geographical distribution of health care workers trained in ART, by type/licensure, across Kenya?
  - b. Does the distribution of trained health care workers align with the incidence and prevalence of HIV/AIDS?
  - c. Can you document the supply of and/or need for trained health care workers, medications, supplies, etc. in a way that accurately and efficiently guides decision-making?
  - d. How many health care workers, by cadre/licensure, are trained to administer ART?
  - e. Of those trained in ART, what percent remain in Kenya after one year (or other specified time)?

- f. How many health care workers, by type and license, exit Kenya’s health care workforce each year? What are the reasons they leave? Where do they go (e.g., out of country, NGO in country, etc.)?
- VI. Where do you go for the data you need to make decisions or otherwise do your work?
  - a. Why do you go to that source (as opposed to another source)?
  - b. Have you ever used the DHIS-2? If so, what are your thoughts on reliability, accuracy, usefulness, etc.?
  - c. Have you ever used KHWIS (might also be referred to as HRIS)? If so, what are your thoughts on reliability, accuracy, usefulness, etc.?
- VII. Do you ever share data with partners or other authorized parties?
  - a. With which partners?
  - b. Do you share data routinely or only in special circumstances?
  - c. What type(s) of data are shared?
  - d. How are data shared?
  - e. Do you have any data sharing agreements in place?
  - f. What practices are in place to ensure the security of the data?
- VIII. What are the greatest challenges you face with regard to data and information needed for your work and/or decision-making?
- IX. Do you see value or utility in combining or connecting these datasets and/or databases so that they can interface (or “talk to each other”)?

## Appendix C: Interoperability Self-Assessment Tool

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### Interoperability Self-Assessment Tool

*Public Health Informatics Institute, 2012*

#### **Joint Regulatory Bodies & Health Managers Workshop**

Great Rift Valley Lodge, September 19-21, 2012

*Hosted by:*

CDC Emory Project – Kenya Health Workforce Information System  
Kenya Medical Research Institute (KEMRI) – Wellcome Trust

Participant's Name:

Participant's Organization:

Participant's Contact Information:

### **Introduction**

#### ***Approach***

The Public Health Informatics Institute (the Institute) has developed a self-assessment tool to help organizations evaluate their capability to develop interoperable health information systems. Interoperability has been defined as the ability of information technology systems from various programs and software applications to communicate, to exchange data accurately, effectively, and consistently, and to use the information that has been exchanged.

This self-assessment tool is based on the Capability Maturity Model (CMM), a framework developed at the Software Engineering Institute located at Carnegie Mellon University in Pittsburgh, Pennsylvania (Software Engineering Institute) and earlier efforts to apply a CMM framework to assess information systems interoperability (C4ISR AWG Architectures Working Group, National E-Health Transition Authority).

This self-assessment tool is designed to engage organizational leaders, program managers, and technology staff in a guided discussion. Collaboratively completing the self-assessment tool as a group exercise will help organizations identify the conditions that support interoperable health information systems.

#### ***Aspects of Interoperability***

There are many aspects that must be considered when developing interoperable information systems. Some of these aspects are technical while others can be more organizational. This self-assessment tool describes the following four (4) aspects of interoperability:

- Policies: the procedures and practices that enable systems to exchange information, capabilities, and services.
- Infrastructure: the hardware, networking, and staffing that enables system interaction.
- Data & Standards: the information formats and protocols that enable the exchange of data and information.
- Applications: the tools used by the health workforce to enable the exchange, processing, and analysis of information.

Participants following this self-assessment approach will likely have varying levels of knowledge with respect to the interoperability aspects listed above. Your organization may need more than one group discussion to allow for adequate participation addressing all of these aspects.

### **Capability Maturity Levels**

According to the Capability Maturity Model, organizations progress through five levels as they adopt practices or processes. Initially, these practices are ad-hoc and not well understood. With time and effort, an organization becomes more familiar with its practices and makes them more routine with defined guidance and governance. With even more effort, an organization learns to monitor and evaluate its practices for improvement.

As an organization adopts practices that are consistent with higher levels of capability, it is said to become more “mature.” This tool is designed to assess organizational practices related to health information systems interoperability.

The five levels of Capability Maturity are:

<i>Level</i>	<i>Name</i>	<i>Description</i>
1	Initial	Awareness of needs for interoperability. Isolated, ad-hoc efforts intended to address interoperability, typically within a program area.
2	Managed	Begin adoption of standards and interoperability goals. Shared understanding of data, services, and internal processes. Early governance intending to repeat initial successes.
3	Defined	Defined guidelines for interoperability standards, services, policies, and processes. Established governance.
4	Measured	Processes for evaluating interoperability standards, services, policies, and processes.
5	Optimized	Feedback from evaluation is used to continuously to improve interoperability capability.
<i>In addition to the levels described above, this tool includes a “Level 0 (Zero)” for organizations that have not yet achieved Capability Maturity Level 1:</i>		
0	None	No awareness of interoperability issue or processes to support it.

### **Instructions**

The goal of this tool is to help an organization develop interoperable health information systems. It is designed to facilitate a discussion that enables an organization to characterize its current capabilities and identify the conditions and practices supporting interoperability. In

particular, the tool focuses on organizational practices consistent with Capability Maturity Levels 0, 1, 2, and 3 (see above). When an organization has progressed through these levels it will have created the conditions for developing interoperable systems.

1. Form a group of people from your organization. This group should include senior leaders, program managers, and technology staff. Alternatively, your group could include members of another organization with which you would like to exchange data and information.
2. Within your group, read and discuss the questions in the self-assessment tool. These questions are organized by interoperability aspects.
3. For each question, collaboratively select an answer from the four (4) response options. The response options correspond to Capability Maturity Levels 0, 1, 2, and 3. If your group cannot agree on one response option you may mark more than one.
4. Your group might not reach a consensus on each question. What is important is that your discussion indicates your current capability and how you might reach a higher level of capability maturity. Be encouraged to make notes and take information learned back to your organization to inform planning efforts.
5. If your self-assessment session was facilitated, you can expect a subsequent report describing findings.

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## Part 1: Policies

### Question 1.1

***Has your organization completed an assessment intended to describe its information needs?***

- Organization has not undertaken this assessment.
- Organization has made initial efforts to begin this assessment.
- Organization has completed this assessment.
- Organization has completed this assessment and updates it periodically.

### ***Key Concepts***

In addition to describing user specifications for specific software tools, an organization can benefit from more comprehensive assessment. An **informatics assessment** is an evaluation process designed to identify information needs or gaps current information systems have in supporting program planning and operations.

Such an assessment can support the electronic exchange of information by establishing a conceptual framework that depicts relationships between your organization's goals, partners, and information resources. This conceptual planning for information systems helps build tools that are more standards-based and interoperable (Public Health Informatics Institute).

### ***Discussion Items***

1. Has your organization listed partners that it obtains data from or provides data to? Are there members from within your organization that share data from different information systems?
2. What information problems does the organization face that are solved only through combining data from different information systems?
3. Have you encountered any barriers or challenges to in conducting an assessment of your information needs? Can you anticipate any barriers?
4. What was the most important factor(s) that influenced your group's response to this question?

## Question 1.2

***Does your organization have a formal leadership group that guides health information systems (HIS) projects?***

- Organization has no formal HIS planning/decision making group.
- Organization has individual HIS strategy champion(s).
- Organization has formed a HIS strategy committee.
- Organization has a functional HIS strategy committee.

### ***Key Concepts***

**Governance:** The formation of a formal planning group that guides informatics or health information systems (HIS) has been identified as a “best practice” for successful implementation of informatics projects. The formal leadership or steering committee forms a decision making body, is responsible for developing strategy, HIS policy, and defining project goals.

**Executive Sponsors:** The executive sponsor is a high-level official that works for the institutionalization of the project or program, creates a work environment that fosters innovation, has contacts with other key leaders, and can influence others. The executive sponsor performs the role of acquiring resources and funding.

**Champions:** The project or program “champions” are passionate about the work, have the respect of other staff and executives, access to senior leaders, and a willingness to devote significant effort to help the project succeed.

### ***Discussion Items:***

1. What barriers or challenges has your organization experienced in establishing governance for HIS development?
2. Does your organization have individuals that could act as champions and executive sponsors? Could they meet on a regular basis?
3. What HIS issues or initiatives would most benefit from a formal leadership group?
4. What was the most important factor(s) that influenced your group’s response to this question?

### Question 1.3

***Has your organization completed an assessment that identifies existing or potential data exchange partners?***

- Organization has not undertaken this assessment.
- Organization has made initial efforts to begin this assessment.
- Organization has completed this assessment.
- Organization has completed this assessment and updates it periodically.

#### ***Key Concepts***

**Data Exchange Partners:** Organizations that share data between or amongst them. Although the concept is simple, the process for achieving data exchange can be complex. Exchange of data between different information systems requires agreement on the goal(s) of data exchange, agreed-upon technical specifications for how information will be sent and received, consistent vocabulary and structure of the data, and agreements between the partners about how the shared data will be used.

#### ***Discussion Items:***

1. Who/what organizations are current data exchange partners?
2. Who/what organizations are planned data exchange partners?
3. What is the purpose or goal of these current or planned data exchange efforts?
4. Are there individuals/organizations that your organization anticipates needing to exchange data within the next five years? Ten years? Who are they?
5. Has your organization encountered barriers or challenges to establishing data exchange partnerships?
6. What was the most important factor(s) that influenced your group's response to this question?

### Question 1.4

#### *Has your organization adopted data exchange procedures?*

- Organization has no written data exchange policies, procedure.
- Organization has begun documenting data exchange procedures.
- Organization has written data exchange procedures, but implementation has been limited.
- Organization has written data exchange procedures that have been implemented.

#### *Key Concepts*

**Data exchange procedures:** Data exchange procedures are those that provide guidance to staff and their partners about under what circumstances data may be shared. These procedures are often used to establish data exchange partnerships and data sharing agreements. A goal for data exchange procedures and data sharing agreements is to adequately address privacy, security and confidentiality issues.

#### *Discussion Items:*

1. Does the organization currently have written policies for data exchange?
2. Does the organization provide training to staff about data privacy, security and confidentiality?
3. What are barriers in your organization to policy development and implementation?
4. What will help you achieve better policy development and implementation?
5. What was the most important factor(s) that influenced your group's response to this question?

### Question 1.5

***Has your organization established data sharing agreements with other organizations it would like to exchange data with?***

- Organization has not established data sharing agreements.
- Organization has held discussions on data sharing.
- Organization has occasionally reached agreements on data sharing.
- Organization has a process it uses to routinely establish data sharing agreements.

#### ***Key Concepts***

**Data sharing agreements** are increasingly being used to establish clear parameters for exchange between organizations. These are written agreements that may include:

- Privacy provisions that describe the circumstances when identifiable information about specific individuals may be exchanged.
- Security provisions describing who is able to view data, access data, or make modifications to data and how the organization ensures only authorized individuals perform those functions.
- Descriptions of the purpose for the data exchange and agreement on specific data elements to be exchanged.
- Descriptions of allowable use of data.
- Responsibilities of the parties to the agreement.
- Description of the legal authority or business reason to share data.
- Description of the frequency of data exchange.
- Provisions for reporting violations of agreements, including breaches of privacy or security.

#### ***Discussion Items:***

1. If your organization has considered data sharing agreements, which organizations have you considered sharing with? What kind of data have you considered sharing?
2. What are barriers in your organization to creating data sharing agreements?
3. What was the most important factor(s) that influenced your group's response to this question?

**Question 1.6**

***Has your organization completed an assessment to identify and engage stakeholders in interoperability efforts?***

- Organization has not undertaken this assessment.
- Organization has made initial efforts to begin this assessment.
- Organization has completed this assessment.
- Organization has completed this assessment and updates it periodically.

***Key Concepts***

**Stakeholders** include contributors of information, information users, funders, and others that will interact with, benefit from, or are impacted by the system. Stakeholder involvement means the stakeholder play a role in making critical decisions, establishing mutual goals, and providing meaningful and regular feedback to the implementing partners, supporters and/or developers of the information system.

***Discussion Items:***

1. Has your organization encountered any barriers or obstacles to identifying or engaging stakeholders?
2. What was the most important factor(s) that influenced your group's response to this question?

**Question 1.7**

***Does your organization have any type of strategic planning document related to health information systems (HIS) projects?***

- Organization has not begun documenting HIS strategy.
- Organization has begun documenting HIS strategy.
- Organization has a written HIS strategic plan.
- Organizational HIS strategic plan exists and guides decision-making.

***Key Concepts***

An **HIS strategic plan** generally includes:

- A high level vision and goal for the HIS with related and specific objectives and activities.
- A description of the desired state or health outcomes to be achieved.
- A description of the current operating environment, including technical and organizational factors.
- A gap analysis describing what is needed to move from the current state to desired state of operations and functions.
- An evaluation of the short and long-term fiscal costs and benefits. This may also be known as the “business case”.
- A timeline for activities.

***Discussion Items:***

1. Does the organization have a vision for HIS?
2. Who in your organization could lead an HIS strategy effort? Who should be a part of this effort?
3. Has your organization encountered any barriers or obstacles to an HIS strategy effort? Any facilitators?
4. What was the most important factor(s) that influenced your group’s response to this question?

### Question 1.8

***Has your organization adopted techniques or procedures to ensure health information system projects are successfully completed in a manner that meets stakeholder expectations for quality, timeliness, and costs?***

- Organization typically does not demonstrate techniques for successfully completing projects.
- Organization has begun demonstrating techniques for successfully completing projects.
- Organization occasionally practices techniques for successfully completing projects.
- Organization routinely practices documented techniques for successfully completing projects.

#### ***Key Concepts***

**Project management** is a methodology designed to ensure consistent communications, accountability and allocation of human, technical and financial resources to accomplish a specific outcome, i.e., successful project completion that meets stakeholder expectations. Typically, a program or project manager performs the role of identifying the activities needed to achieve the goals of the project, and monitors progress toward those goals through documentation.

#### ***Discussion Items***

1. How does your organization identify goals, objectives, and activities for projects?
2. Has your organization encountered any barriers or obstacles to successfully completing projects?
3. Does the organization have staff dedicated to tracking project activities, timelines, and costs? Are roles and responsibilities clearly defined? Are status updates provided to keep stakeholders informed about activities?
4. What was the most important factor(s) that influenced your group's response to this question?

**Question 1.9**

*To what degree does your organization ensure the quality of the data it collects or uses?*

- Organization does not assess data quality.
- Organization makes isolated efforts to assess data quality.
- Organization makes repeated efforts to assess data quality.
- Organization defines and follows routine assessments of data quality.

**Key Concepts**

**Data quality** criteria can include timeliness, periodicity, consistency (both internally within a dataset and externally between separate datasets), and the extent to which data adequately represent a population and are disaggregated for stratifications by demographic variables. Practices associated with data quality assurance include validating data entry, assessment of data completeness for key functions, and establishing metrics for data timeliness. In addition, reducing the burden on those who perform the data collection helps ensure that data that is captured is high quality. One way to reduce the data collection burden is to ask for the “minimum dataset” required for programmatic analyses (Health Metrics Network).

**Discussion Items**

1. How does your organization ensure the data it uses is reliable?
2. Has your organization encountered challenges that negatively impact data quality?
3. Does the organization have processes or plans in place to assess data quality? Are these processes or plans documented? Have they been implemented?
4. Does the organization have staff dedicated to data quality assessment practices?
5. What was the most important factor(s) that influenced your group’s response to this question?

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## Part 2: Infrastructure

### Question 2.1

***Is a basic Information and Communications Technology (ICT) infrastructure available for your organization?***

- Basic ICT infrastructure (electricity, telephone, Internet, e-mail) is not available.
- Basic ICT infrastructure (electricity, telephone, Internet, e-mail) is sometimes available.
- Basic ICT infrastructure (electricity, telephone, Internet, e-mail) is available.
- Basic ICT infrastructure (electricity, telephone, Internet, e-mail) is available and highly functional.

### ***Key Concepts***

According to the WHO's Health Metrics Network, a digital divide persists despite advances in ICT infrastructure. While some facilities and districts maintain broadband Internet connections, others experience a lack of Internet connectivity, inconsistent electrical power, or both. Therefore, strategies for multiple communication methods simultaneously supporting both electronic and paper-based information will be needed.

### ***Discussion Items***

1. If your organization's basic ICT infrastructure is lacking, what would be required to improve it?
2. If you are not able to improve your basic ICT infrastructure, are there ways you could still effectively exchange information?
3. What was the most important factor(s) that influenced your group's response to this question?

**Question 2 .2**

***To what degree has your organization documented the business processes that describe its operation?***

- No awareness of business processes.
- Isolated efforts to articulate business processes.
- Organization has documented business processes.
- Organization has documented business processes that are used to guide information solutions.

***Key Concepts***

A **Business Process** is a description of a set of activities and tasks that group together to accomplish a goal or produce something of value for an organization or its stakeholders. By understanding business processes, including their associated tasks, triggers, inputs, outputs, and objectives, an organization can better design a health information systems infrastructure that helps improve health outcomes.

***Discussion Items***

1. Has your organization gone through a business process analysis? If not, why not? Do you think it would help you?
2. Has business process analysis helped you improve your operating procedures and practices?
3. What was the most important factor(s) that influenced your group's response to this question?

### Question 2.3

***Does your organization have access to dedicated information and communication technology (ICT) staff to support program functions?***

- Organization has no dedicated ICT staff.
- Organization has one or two staff members who periodically address ICT issues.
- Organization has an ICT team assigned to ICT issues.
- Organization has a highly functional ICT team that includes specialists.

#### ***Key Concepts***

**Information and Communications Technology (ICT) staff:** can include workforce personnel with training and skills in computer programming, database design and administration, network administration, and web site design. Developing interoperable health information systems that improve health outcomes requires a range of ICT knowledge that can be difficult for some organizations to obtain.

Your organization might access this staff by hiring them or through partnerships with organizations that have this staff.

#### ***Discussion Items***

1. Does your organization have staff skilled in the ICT specialties described above? If not, why not? What are barriers? How could you overcome them?
2. Could you gain access to ICT specialists through collaboration with potential data exchange partners?
3. What was the most important factor(s) that influenced your group's response to this question?

### Question 2.4

***Does your organization have access to a dedicated unit or individual to support data management?***

- Organization has no dedicated data management staff.
- Organization has one or two staff members who periodically address data management issues.
- Organization has a team assigned to data management issues.
- Organization has a highly functional ICT team that includes specialists.

#### ***Key Concepts***

**Data Management** is an effort to ensure the value of an organization's data. Specific aspects include data quality, security, database design and management, and cataloging or documentation. Some aspects of data management may be conducted by highly technical ICT specialists like database administrators. Other aspects might be addressed by programmatic specialists that understand what the data represent and how data might be used to improve health outcomes. Your organization might access this staff by hiring them or through partnerships with organizations that have this staff.

Evidence of data management may include a written plan or established procedures to address issues associated with the collection, archiving, storage, retrieval and maintenance of data. Example of data management decisions include: the types of file formats utilized, how data are processed and organized, data accuracy, timeliness, storage and backup, and security.

#### ***Discussion Item***

1. What barriers has your organization experienced with data management?
2. Is your organization experiencing any data quality issues that better data management might address?
3. What was the most important factor(s) that influenced your group's response to this question?

### Question 2.5

***Does your organization have access to a dedicated unit or individual to support data analysis?***

- Organization has no dedicated data analysis staff.
- Organization has one or two staff members who periodically provide data analysis.
- Organization has a team assigned to data analysis.
- Organization has a highly functional data analysis team that includes specialists.

### ***Key Concepts***

**Data analysis functions** address the utilization of data to create information for decision making, routine analysis of key business functions, and research. While many health information systems are designed to run routine analyses and reports, there are times when a data analyst is needed to process data and generate information.

Data analysis functions may be performed by data users such as program managers, data coordinators, accountants, quality assurance specialists, and health officers. These functions may also be performed by trained specialists such as epidemiologists, statisticians, research analysts, economists, or demographers. Your organization might access this staff by hiring them or through partnerships with organizations that have this staff.

### ***Discussion Items***

1. What are barriers to data analysis staffing for your organization?
2. What types of data analyses does your organization currently conduct?
3. Could any of these analyses be improved with better data exchange between information systems?
4. What was the most important factor(s) that influenced your group's response to this question?

**Question 2.6**

*To what degree is staff turnover a problem for your organization?*

- Staff turnover is unacceptably high.
- Staff turnover rate is problematic.
- Staff turnover is moderate but manageable.
- Staff turnover is low and not a problem.

***Discussion Items***

1. What challenges does your organization face with respect to staff turnover?
2. What was the most important factor(s) that influenced your group's response to this question?

## Question 2.7

***To what degree is your organization connected to a computer network?***

- Organization is not connected to any computer network; data is exchanged manually via paper, removable media (e.g., portable hard disk drives, USB “thumb” drives), etc.
- Organization's computers are connected to a peer-to-peer Local Area Network (LAN).
- Organization's computers are connected to a client/server Local Area Network (LAN).
- Organization's computers are connected to a Wide Area Network (WAN).

### ***Key Concepts***

**Local Area Network (LAN):** typically describes a network where all the hardware and software are managed by a single organization, with coverage often limited to a single building or nearby buildings. A peer-to-peer LAN exists when all the connected devices (e.g., personal computers) are equivalent with respect to data processing functionality. Computers connected on a peer-to-peer network can share data by passing files from one to another. A client/server LAN describes a local area network where the connected devices have different roles and responsibilities with respect to data sharing and processing functionality. Client computers share data by accessing a common server that acts as an information repository.

**Wide Area Network (WAN):** describes a network spanning multiple geographic locations that may or may not be part of a single organization. It can use publically available ICT infrastructure to connect LANs in different locations and under different organizational ownership.

### ***Discussion Items:***

1. What barriers or opportunities are there for network communications across regional offices?
2. If a reliable computer network is not available, how might you conduct effective data exchange via paper or removable media?
3. What other organizations would you like to exchange data with over a computer network?
4. What was the most important factor(s) that influenced your group’s response to this question?

**Question 2.8**

***How does your organization typically exchange information with partners?***

- Organization exchanges non-electronic information (via paper, mail, phone conversations, etc).
- Organization exchanges machine transportable information (via fax, email, removable media, etc.).
- Organization uses web-based systems, uploads via file transport protocol (FTP), or export/import routines requiring human interpretation or action.
- Organization uses systems that support machine to machine data exchange requiring no human action.

***Key Concepts***

These concepts were developed to describe different levels of data structuring for exchange and interoperability (Public Health Informatics Institute). Non-electronic data has obvious limitations for data exchange and interoperability. Machine transportable information refers to documents that are similar to paper-based information but can be sent or moved efficiently via machine-based methods. Web-based systems, FTP, and export/import refers to accessing more structured data suitable for computer processing routines (e.g., database tables), but some direct human intervention and manual tasks are required. Finally, machine to machine exchange refers to the ability of one information system to send data to another information system and the receiving system's ability to process the data, all without direct intervention from a user. This phrase is often used as an expression equivalent with the term interoperability.

***Discussion Items***

1. If your organization is exchanging data with partners, which organizations and what data or information is being exchanged?
2. Are there barriers that keep your organization from engaging in machine to machine data exchange? How might you develop alternative procedures for effective data exchange?
3. What was the most important factor(s) that influenced your group's response to this question?

## Appendix D: Interoperability Workshop for Kenya's HIS

### Overview

On April 10<sup>th</sup>, several key stakeholders (Appendix A) gathered to discuss aspects of interoperability between Kenya's health information systems. The objectives of this meeting were to:

1. Review the findings from the interoperability assessments
2. Discuss the recommendations and get stakeholder feedback
3. Learn about ongoing interoperability activities in Kenya's health sector
4. Discuss how best stakeholders can operationalize the recommendations.

### *Interoperability Assessments*

The findings from two interoperability assessments – one conducted by AfyaInfo and one by the Public Health Informatics Institute (the Institute) – were presented. AfyaInfo conducted an assessment of various health information systems, including the District Health Information System (DHIS-2), the Master Facility List (MFL), iHRIS, KEMSA, the Malaria Information Acquisition System, FIS, the Kenya Health Workforce Information System (KHWIS), and HSSF. Systems were assessed for integration in the areas of technology, data, business, physical infrastructure and governance, as well as their incentives for integration. Overall, functional and business integration were weak. Data integration was very weak, with weak data and system governance. This assessment recommended a standardized approach with stakeholder engagement to develop an enterprise architecture and data sharing platforms.

The interoperability assessment conducted by the Institute had two key activities – the interoperability self-assessment and the key informant interviews. The self-assessment was based on a capability maturity model and assessed capability to support interoperability in the areas of policy and infrastructure. Participants represented Kenya's health professional regulatory boards and councils, the national Department of Nursing in the Ministry of Medical Services, and three district level hospitals. On a scale of 0-4, scores for institutional policies to support interoperability ranged from 1.1-1.8. Participants identified a lack of established governance, policies and partners for data exchange. For infrastructure to support interoperability, scores ranged from 1.4-2.8. Participants noted that while their organizations did not have dedicated ICT support staff, data analysts or automated data exchange, they were better equipped with ICT infrastructure and network connectivity. This assessment activity recommended the assessment tool be used to engage leadership to understand, prioritize and select specific areas for improvement. Finally, it recommended that policies developed address data standards, such as ICD-10, ISCO, SDMX-HD and HL7.

The key informant interviews engaged MOMS department chiefs, MOPHS division heads, the HR Department and partners developing health information systems. The interviews sought to identify health managers' data needs, management decisions supported by greater data exchange, and barriers to and opportunities for data sharing. While MOMS needed data to

support health care worker recruitment, deployment, retention and forecasting, MOPHS needed data to inform service provision, quality of care, priority health interventions and health commodities. MOMS relied heavily on KHWIS, IPPD and iHRIS for their data needs, but was not currently accessing DHIS-2, despite their stated need for burden-of-disease data. MOPHS gathered their data from several HMIS systems, including DHIS-2, MFL, DDSR, KEMSA, Laboratory Information Management System (LIMS), and several division-specific systems. Of note, MOPHS staff did not have access to an HRIS, and reported being blind to the deployment of Kenya's health care workers. While the majority of data needed were being collected, data access was limited to the division or department collecting the data and housing the system. Key data gaps to be addressed through greater data sharing included basic health care worker data, health worker qualification and specialty, burden of disease and workload data, facility services and status data, and data on continuing professional development for health workers. Overall, participants felt that greater interoperability would facilitate improved data access, promote timely decision making, reduce the time burden of sharing data, enable more complex analyses, and transition away from vertical systems. Recommendations included expanding user access to existing systems.

### ***Interoperability Recommendations***

The recommendations from the interoperability report were presented to participants for feedback. The recommendations asked that key HIS stakeholders be engaged to:

1. Establish data sharing agreements and procedures
2. Address data standards collaboratively
3. Develop a shared information model and enterprise architecture
4. Develop a minimum HRH data set and method for exchange
5. Increase data support staff
6. Train data support staff

Overall, participants were very supportive of the recommendations and felt they were relevant to advancing interoperability.

To address data standards collaboratively, participants felt that it was necessary for funding agencies to provide guidance on information system development standards. In addition to the ISCO, ICD-10, and SMDX-HD standards listed, participants recommended including HL7. They also noted the importance of funding for interoperability activities, recommending that funding agencies allocate a percentage of information system project funds to be applied to interoperability activities.

### ***Interoperability Activities***

During the plenary session, several groups, including DHIS-2, AfyaInfo, Emory KHWP, Futures Group, Capacity Kenya and I-TECH, made presentations on interoperability activities in which they are currently engaged.

#### **DHIS-2**

This system ([www.hiskenya.org](http://www.hiskenya.org)) functions as a data collection and analysis tool for burden-of-disease data. In terms of integration, it currently receives data from IQ Care (an EMR), as well as

the Division of Leprosy, TB and Lung Disease. OpenMRS is also looking to integrate. An API has been developed for MFL to send data to DHIS-2, as well, but this has yet to be activated. Further, they are also in discussions with iHRIS to develop an API so HR data can be collected from the HR department, as opposed to the facilities. A key policy-level question that needs to be answered is "Should DHIS-2 be the default data service layer?" DHIS-2 is being asked to house increasingly greater amounts of data, which strains the HMIS system. DHIS-2 found that the more data elements it collects and houses, the weaker the quality of the data.

While the system has broad user access – currently, all of the data is highly accessible to anyone – DHIS2 is working to upgrade security for the system and provide different levels of access based on user rights in the future.

### **AfyaInfo**

Kenya's national health information system has four key domains: HR (e.g. iHRIS, KHWIS, IPPD, GHRIS), finances (e.g. NHIF, IFMIS, HSSF), service delivery (e.g. DHIS-2, CHIS/COBPAR, KePMS), and logistics (e.g. DRH and KEMSA). AfyaInfo is seeking to create a data bank with a portal to access essential types of health data. First, minimum data sets for the various types of health data have to be identified (e.g. HR, commodities, etc.), with the corresponding system to supply each data element. Policies must also be developed to support data sharing and access. Finally, there have to be standards for systems to communicate and exchange data. AfyaInfo is working with the NHIS-ICC, which has a policy-level task force discussing systems integration and a technical working group (TWG) comprised of six organizations. It was NHIS-ICC task force and the TWG need to be expanded to include more stakeholders working in the HIS sphere. AfyaInfo is also in the process of identifying a subcontractor to develop an HIS enterprise architecture, including the identification of minimum data sets and the development of a data service layer.

### **Emory KHWP**

Emory developed the web-based KHWIS that was handed over to the Ministries of Health in September 2012, and is currently developing a web-based regulatory HRIS (rHRIS) with Kenya's health professional councils. The rHRIS is harmonized with the MFL. Emory is working with AfyaInfo to develop an integrated regulatory module so the rHRIS can update facilities in the MFL in real time. The Joint Regulatory Committee (JRC) is also working to develop a data sharing policy to increase data access across several types of users, including the departments and divisions in the Ministries of Health, as well as the public.

### **Futures Group**

The Futures Group has developed an EMR middleware solution, which automates reporting to DHIS-2 from an EMR, IQ Care. The facility configuration includes the MFL code. IQ Care uses SDMX-HD standard to upload data to DHIS-2, using class codes from DHIS-2 to direct where the data should go. The person uploading the data is responsible for ensuring quality control and can check to verify that the data have been uploaded. This locally developed middleware solution, IQ Care, relies on Open Source tools and is customizable to meet reporting needs.

### **Capacity Kenya**

Capacity deployed iHRIS Manage in the Ministries of Health HR Department. iHRIS is web-based and hosted in the ministry data center. They are in the process of constituting a TWG on iHRIS (or HRIS), as well as a steering committee. Currently, iHRIS is implemented at headquarters, with plans to be piloted in eight counties. Plans for sustainability include the development of a support desk and transition to the counties. iHRIS has also been deployed in parastatal and

private facilities, including Kenyatta, Kijabe, Kikuyu and Moi. DHIS-2 integration is not yet operationalized, but plans continue. Capacity plans to support integration through the National Steering Committee, the TWG, and outreach to stakeholders.

### **I-TECH**

Developed by I-TECH, in collaboration with CDC, KEMRI, and ICAP, Open EMR Connect (OEC) facilitates interoperability at the facility level. The systems in play include the HDSS (demographic systems in Siaya and Bondo), CPAD (an EMR from ICAP), ADT, and LIS (the OpenLab Information System). It uses HL7 and CDA standard protocols and was developed as an Open Source solution for exchanging patient information between facilities. It uses MIRTH connect to configure the channels for data exchange between systems, using common separated files (CSV). One challenge has been to develop a unique identifier for patients, highlighting the need for a master person index. Finally, OEC integrates existing systems to exchange facility-level data, a key strength.

### **Way Forward**

Given the findings of the interoperability assessments, discussion of the recommendations, and ongoing interoperability activities among partners, participants were asked to consider how best to operationalize key activities to advance HIS interoperability in Kenya.

#### **1. NHIS-ICC Task Force and Technical Working Group**

Participants recommended expanding the policy task force (TF) and technical working group (TWG) to include more members, specifically key stakeholders who were present at the interoperability workshop. AfyaInfo, which is working directly with the NHIS-ICC, agreed to facilitate the new membership.

- Participants felt that the NHIS-ICC TF and TWG would be the ideal bodies to provide guidance to implementing partners on interoperability activities. These groups could endorse certain standards deemed essential to advancing interoperability. Partners could then align their activities with nationally identified priorities and policies.
- Given that DHIS-2 is being asked to house an ever increasing amount of data, participants felt it was necessary for the TF/TWG to discuss the development of a data service layer, as well as to define parameters for the type of data to be housed in DHIS-2.
- The NHIS-ICC TF and TWG could develop much-needed agreements to facilitate the sharing of data within the Ministry of Health, between various divisions and departments. These policies could guide the development of various data marts (e.g., HR) to populate an NHIS data warehouse.
- These groups might also make recommendations concerning the data support staff required to manage, maintain and utilize such an NHIS. This would include the requisite number of data entry clerks, health records information officers, data coordinators, ICT staff, and data analysts, among others.

## **2. iHRIS Technical Working Group**

Participants felt the newly constituted iHRIS TWG would be the ideal forum to identify a minimum data set for HRH. Key members would include Capacity Kenya, Emory KHWP, and Funzo Kenya, among other HRIS partners and stakeholders. For the minimum HRH data set, the TWG would identify the HRIS best positioned to supply each data element. This HRH data set would then be used to populate the HR data mart for the NHIS. Capacity Kenya is taking the lead to convene the iHRIS TWG.

## **3. Trainings on DHIS and MFL**

The interoperability assessment key informant interviews identified a number of department chiefs and data coordinators within the MOMS that needed training on DHIS-2 and MFL. AfyaInfo is currently developing trainings for both of these systems. The Emory KHWP will send AfyaInfo a list of those to incorporate into their target audience for these trainings. The aim of this activity is to increase access to workload and burden-of-disease data among department chiefs overseeing health care worker deployment.

## **4. Development of a Data Sharing Agreement for the rHRIS**

The Emory KHWP is working with the Joint Technical Advisory Group (JTAG) of the Joint Regulatory Committee (JRC) to develop a data sharing agreement for the rHRIS. This activity is deemed vital to increasing access to health worker data, especially within the Ministries of Health. Thought will be given to levels of data access, as well as to the routine sharing of specific data elements. The Emory KHWP will take the lead on this activity, working hand-in-hand with the JTAG and JRC.

## **5. Update the Interoperability Report Recommendations**

Participants felt that the report recommendations needed to reflect the funding required to support interoperability activities, and to document the need for donor agencies to require implementing partners to develop information systems according to specific standards that support interoperability.

- There is very little funding to support interoperability. The majority of participants were developing some type of health information system, but felt that interoperability had no owner. They indicated that they received very little funding, if any, to support their contribution towards interoperability activities. Participants recommended that all health information system projects allocate a percentage of their budget to work specifically on interoperability activities, so that the systems they are developing can be integrated into Kenya's NHIS.
- Implementing partners developing health information systems currently receive very little guidance, if any, regarding development standards for such systems. Participants recommended that donor agencies provide guidance on development standards, such as the use of ISCO, ICD-10, HL7, CDA, and SDMX-HD, that facilitate information exchange between systems.

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SILVER SPRINGS HOTEL

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## Appendix E: Potential Minimum Data Elements for Assessing Human Resources for Health and Health Services Information

The purpose of proposing minimum data elements are to ensure the data elements (or variables) are captured in such a way as to enable analysis across the various systems and districts. Minimum data elements which specify uniform definitions and criteria will provide a data set for ongoing national level analysis. Stakeholders may wish to collaborate to define a minimum data set to enable a higher degree of rigor around the exchange of data to inform planning, budgeting and policy decisions.

Guidelines for selecting minimum data elements<sup>1</sup>;

1. Data elements and values must relate directly to the health policy and analysis questions the GoK considers most relevant. Data that will not be used routinely should be excluded from the minimum data elements.
2. Ultimately, each variable (data element) should have a description and definition agreed upon by the stakeholders.
3. Data which are very difficult to collect should not be included.

### Overview

Based on interviews with key health leaders in Kenya, the chart below represents a high level overview of the types of data that may be considered for minimum data elements to address the policy and operations questions that were identified by the stakeholders.

Individual/ Person Related	HRH Training Related	HRH Deployment Related	Health Management Information Systems Related	Commodities Related	Facility Related
<ul style="list-style-type: none"> <li>Professional licensure</li> <li>Re-License</li> <li>Certification status</li> <li>Degree</li> <li>Diploma</li> <li>Training</li> <li>Specialty</li> <li>Station</li> <li>Continuing professional development points</li> <li>Age</li> <li>Qualifications</li> </ul>	<ul style="list-style-type: none"> <li>Training history</li> <li>Courses</li> <li>Specialty</li> <li>Continuing professional development points by Health Care Worker</li> </ul>	<ul style="list-style-type: none"> <li>Deployment by facility</li> <li>Deployment by province</li> </ul>	<ul style="list-style-type: none"> <li>Number of deaths</li> <li>Causes of death</li> <li>Disease prevalence</li> <li>Types of services rendered by facility</li> <li>Mortality by type</li> <li>Morbidity by disease or condition</li> </ul>	<ul style="list-style-type: none"> <li>Type of commodity</li> <li>Distribution of commodities by location</li> </ul>	<ul style="list-style-type: none"> <li>Level/type services rendered by facility</li> </ul>

<sup>1</sup> Adapted from WHO Library: *Data systems: a road safety manual for decision-makers and practitioners*. Chapter 3: *How to design, improve and implement data systems*. pp 49-75. World Health Organization 2010.

Stakeholders may wish to establish a process for creating, vetting and endorsing a minimum data set that meets the needs of data sharing partners. These activities may include<sup>2</sup>

**Step One: Establish a working group** to define objective, ensure overall coordination of effort and to choose the best approach.

**Step Two: Choose a course of action.** The appropriate course of action depends on objectives, the content and quality of available data, the features and functioning of available systems, and available resources.

**Step Three: Make recommendations** of the minimum data elements and definitions. Some such work has been undertaken in other locations. An example is the WHO work on the minimum data elements for HRH in Rwanda.<sup>3</sup>

**Step Four: Develop a plan for improving information systems or designing and implementing a new system** or data collection strategies for strengthening and improving data quality and system performance.

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<sup>2</sup> Ibid

<sup>3</sup> Human Resources for Health Information System. *Rwanda's HRH Information Sources, Business Processes, and Functional Requirements*. Minimum Data Elements (Data Dictionary). Government of Rwanda Ministry of Health. 24 June 2011.

## Appendix F: Key Acronyms and Terms

- CDC: Centers for Disease Control and Prevention
- CHAO: Chief Health Administration Officer
- COC: Clinical Officers Council
- DDSR: Division of Disease Surveillance and Response
- DHIS-2: District Health Information System
- DHMT: District Health Management Team
- DHRIO: District Health Records Information Officer
- GHRIS: Government Health Resources Information Systems
- GoK: Government of Kenya
- HCW: Health Care Worker
- HIMS: Health Management Information Systems
- HIS: Health Information System
- HRIO: Health Records Information Officer
- HRIS: Health Resources Information Systems
- ICT: Information Communications Technology
- IPPD: Integrated Personnel Payroll Database
- KEMSA: Kenya Medical Supplies Agency
- KHWIS: Kenya Health Workforce Information System
- LISI: Levels of Information Systems Interoperability
- MFL: Master Facility List
- MOH: Ministries of Health
- MOMS: Ministry of Medical Services
- MOPHS: Ministry of Public Health and Sanitation
- NCK: Nursing Council of Kenya
- rHRIS: Regulatory Health Resources Information Systems

### Key Terms

- **Interoperability:** the ability of information technology systems from various programs and software applications to communicate; to exchange data accurately, effectively, and consistently; and to use the information that has been exchanged (Public Health Informatics Institute).
- **Capability Maturity Model (CMM):** a framework developed at the Software Engineering Institute located at Carnegie Mellon University (Pittsburgh, Pennsylvania), which provided the foundation for the Public Health Informatics Institute's self-assessment tool for evaluating an organization's capability to develop interoperable health information systems.
- **Vertical data system:** a system whereby different divisions develop their own databases with mechanisms in place to support data collection related to the division's specific goals.