WORKING PAPER

Enabling and Expanding the Scope of Public Health Decision Making in Uganda to Reduce Maternal Mortality

Concept Note and Use Case

August 2019

USAID
FROM THE AMERICAN PEOPLE

MEASURE Evaluation

WORKING PAPER

Enabling and Expanding the Scope of Public Health Decision Making in Uganda to Reduce Maternal Mortality

Concept Note and Use Case

Manish Kumar, MPH, MEASURE Evaluation

Timothy Eunsoo Kim, PhD, Gillings School of Global Public Health, University of North Carolina

Elizabeth Millar, MPH, MEASURE Evaluation

Kavita Singh Ongechi, PhD, MEASURE Evaluation

William Weiss, DrPH, United States Agency for International Development

August 2019

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, North Carolina 27516 USA
Phone: +1 919-445-9350
measure@unc.edu
www.measureevaluation.org

This publication was produced with the support of the United States Agency for International Development (USAID) under the terms of MEASURE Evaluation cooperative agreement AID-OAA-L-14-00004. MEASURE Evaluation is implemented by the Carolina Population Center, University of North Carolina at Chapel Hill in partnership with ICF International; John Snow, Inc.; Management Sciences for Health; Palladium; and Tulane University. Views expressed are not necessarily those of USAID or the United States government. WP-19-233

ACKNOWLEDGMENTS

The United States Agency for International Development (USAID)-funded MEASURE Evaluation project thanks USAID for its support of this work.

We thank Dr. Carl Leitner, technical director of Digital Square, a PATH-led initiative funded and designed by USAID and the Bill & Melinda Gates Foundation, for his comments and suggestions about the use of appropriate standards to enable data exchange.

We thank MEASURE Evaluation's knowledge management team for editorial, design, and production services.

Suggested citation:

Kumar, M., Kim, T. E., Millar, E., Ongechi, K. S., & Weiss, W. Enabling and Expanding the Scope of Public Health Decision Making in Uganda to Reduce Maternal Mortality: Concept Note and Use Case. Chapel Hill, NC, USA; MEASURE Evaluation, University of North Carolina.

CONTENTS

TABLES

FIGURES

ABBREVIATIONS

HMIS	health management information system
ID	identifier
MMR	maternal mortality ratio
POS	point of service
PPH	postpartum hemorrhage
SDG	Sustainable Development Goal
UBOS	Uganda Bureau of Statistics
UDHS	Uganda Demographic and Health Survey
UN	United Nations

MATERNAL MORTALITY IN UGANDA

In Uganda, the maternal mortality ratio (MMR) was 336 maternal deaths per 100,000 live births in the seven-year period preceding the 2016 Uganda Demographic and Health Survey (UDHS) (Uganda Bureau of Statistics [UBOS] & ICF, 2018). This is a notable decrease from the MMR of 438 maternal deaths per 100,000 live births in the seven-year period preceding the 2011 UDHS (UBOS & ICF International, 2012). Even so, the country's MMR is still much higher than the target for 2030 set by Sustainable Development Goal (SDG) 3 (United Nations [UN], 2015): fewer than 70 maternal deaths per 100,000 live births globally, and around 111 for Uganda (UN, 2015). Much work needs to be done in Uganda to close this significant gap and achieve the SDG 3 there.

Maternal Mortality Because of Postpartum Hemorrhage in Uganda

A major cause of maternal mortality is postpartum hemorrhage (PPH) (Partnership for Maternal, Newborn & Child Health, 2011). Deaths owing to hemorrhage at a facility could perhaps be attributed to a stockout of uterotonics or lack of a provider trained to give a uterotonic. Typically in the low- and middle -income countries, a health management information system (HMIS) does not provide data on stockouts and training of health staff, yet these are important data elements. Data on maternal complications and cause of maternal mortality are also vital but rarely collected. These are important for understanding what types of complications and causes of death are most common in a particular area, which is helpful when planning trainings and delivery of commodities. As can be seen, preventing maternal mortality involves many aspects of a health system, and thus data from the different elements are needed to inform programs and policies.

Types of Decisions and the Data Sources They Require

The PPH use case presented in this document shows that typically, policymakers and program managers make two types of decisions, and these are based on the sources of data they use for decision making. Some decisions require only a single data source to determine and plan meaningful action. For example, to determine the number of PPH cases in facilities, service delivery data in the facility-level data system are sufficient. Other decisions require exchange and integration of data from multiple sources. For example, if a program manager needs to determine the number of PPH cases in relation to the number of uterotonic medicines available among high-volume facilities with adequately trained providers, relevant data from human resources, medical stock, and service delivery sources must be integrated.

Both types of decisions could be needed in designing and initiating corrective measures to reduce and prevent PPH. For routine program-related decisions, using a single data source is common. For complex decisions, exchanging and integrating data from diverse systems need to be exchanged and integrated. That requires deliberate planning, leadership and governance, technology infrastructure, and workforce and financial resources. For example, data integration and exchange depend on common data standards, data sharing policies, data quality, skilled human resources, financial resources, and commitment by leadership. Furthermore, standards-based data exchange or interoperability among diverse health data systems is necessary to achieve the data integration needed to answer programmatic questions.

From a program's perspective, being able to answer both types of questions by consulting single data sources as well as facilitating data exchange among diverse data systems can enable policymakers and program managers to address maternal mortality-related challenges. For the purpose of this concept note and use case, data integration, data exchange, and data interoperability are used synonymously, and interoperability is defined as the "ability of two or more systems or components to exchange information and to use the information that has been exchanged" (International Organization for Standardization, 2009).[5]

Data Flow in Uganda

In the case of Uganda, DHIS 2 service-delivery data will provide aggregate information about the services provided to patients by facility and/or district, while the human resource information system (HRIS) will provide information about health providers. The logistics management information system (LMIS) at the regional and national level can provide information about stocks. At the facility level, institution-based data sources—such as service delivery data and health data regarding patients, availability of equipment and medicines and availability of provider type, provider skill mix, and salary and training information—are collected. Data collected at this level are usually managed by facility-based data clerks who aggregate the data each month, and then send monthly reports to the facility's district management team. That team then takes the monthly reports from various facilities and enters these data in the DHIS 2 system, which aggregates the data further, as needed, for use by managers at the regional and national levels.

SOLUTION: DATA EXCHANGE

Integrating data enables policymakers and program managers to execute decisions that require interoperability among or integration of data from multiple data sources. Data integration allows these data sources to be linked so that decisions have real use and value in practice. In setting this up, those working in the leadership and governance dimensions become very important, because they define the scope of interoperability among systems, enact policies for data sharing and privacy, offer institutional leadership, and mobilize financial and workforce resources. In the case of postpartum hemorrhage, policymakers and program managers may be interested in learning about the availability of uterotonic medicines in health facilities, whether there are qualified providers to administer the medicine when needed, and the rate at which the uterotonic is actually given to the share of women who need it.

Expanding the Scope of Decision Making for Policymakers and Program Managers

Without data integration, data-based decision making is limited in scope and by design. Most often these decisions focus on only one element or dimension of a problem. For example, stakeholders are able to make only those decisions that are specific to the data elements contained within a single data source. For decisions related to skilled human resources and training, they will retrieve relevant information from the human resource/provider data. For decisions related to the stock of medicines, they could retrieve information from the logistic management information system. Table 1 lists a few example decisions that require only a single data source. They are decisions such as these: (1) How many providers are able to administer uterotonic medicines? (2) How many facilities are experiencing stockouts of uterotonic medicines? and (3) How many cases of postpartum hemorrhage are there in facilities? Using a single data source for decision making is not a problem at all as long as it serves the purpose of the program well. It is a concern only if these decisions with a narrow scope (because the data systems are silos) cannot lead to optimal actions for the program.

In comparison, the scope of decisions made when there is functional data interoperability and integration across multiple data sources is multidimensional. Now, decision making can be more specific (using a single data source) or comprehensive (requiring data elements to be linked to produce useful and actionable information). For example, stakeholders can now answer questions such as these to enable decision-making: (1) Which high-volume facilities are experiencing frequent stockouts of uterotonic medicines? (2) Among high-volume facilities with sufficient stock of uterotonic medicines, how many providers are able to administer uterotonic medicines in relation to the number of hemorrhage cases? (3) Among high-volume facilities with adequately trained providers, how many cases of postpartum hemorrhage are there in relation to the number of uterotonic medicines available?

As shown in Table 1, these programmatic questions require information from two or more data sources to enable decision-making. For instance, the first of the three questions requires that information be sourced from patient/facility data and medical stock data. The second and third questions require information to be sourced from patient/facility data, medical stock data, and human resources/provider data. To be useful, the information from various data sources needs to be shared using a common data exchange standard and linked with unique identifiers (Grove & Kalasa, 2018). However, depending on the type of information architecture in place, these considerations may or may not be feasible.

Information Architecture Required for Optimal Data Use

Expanding the scope of decision making by enabling integration or exchange of multiple data sources calls for an appropriate information architecture. Sometimes, data are recorded at the point of service (POS), transferred or shared to a central data repository where they are aggregated by unique identifiers, and then extracted to meet information needs. In other cases, data at the POS might automatically be converted to indicators for reporting without the ability to separate the numerators and denominators, or data elements may be sent to a central place for calculation of aggregate indicators without individual identifiers. With this type of architecture, it may be difficult to reverse the indicators back to the data element form if the raw data are not stored and managed in an organized manner. Hence, in designing or choosing an information architecture, it is also important to think about properly maintaining the raw data elements and the time point at which data should be combined and indicators calculated.

In addition, the information architecture should ideally be flexible so that the information needs of the providers at the POS (met by individual patient data systems) and the information needs of the managers (met by aggregate data) are jointly served. The architecture should also be able to cater both to providers and managers at various levels and allow data access through different interfaces. Raw data elements as well as the associated unique identifiers (Grove & Kalasa, 2018) will ideally remain in the source system untampered.

Enabling Program Improvement

Enabling specific and comprehensive decision making can lead to targeted interventions. For example, if certain high-volume facilities with sufficient stock of uterotonic medicines are still having trouble treating postpartum hemorrhage, program managers can develop provider training for these facilities. Or conversely, if certain high-volume facilities do have adequately trained providers but are nevertheless having trouble treating postpartum hemorrhage, ensuring sufficient stock of uterotonic medicines can be a strategy to reduce mortality from postpartum hemorrhage. Moreover, geographic locators can help identify which specific areas need focus.

Table 1. Comparing decisions requiring only a single data source and decisions requiring data exchange

Stand-Alone Data Systems			Data Exchange-Enabled Environment		
Example decisions	**Data sources**	**Data elements**	**Example decisions**	**Data sources**	**Data elements**
1. What is the distribution of trained providers who can administer uterotonic medicines?	Human resources/ provider data	Number of providers among categories with authority to administer uterotonic medicines	1a. Which (high-volume) facilities should get an urgent shipment of uterotonics this week? 1b. Are there (low-volume) facilities that we can transfer stock from in the interim?	Facility/patient data + Medical stock data	Facility unique identifiers/ geographic locators + Patient volume + Availability of uterotonic medicines
2. Which of the facilities require immediate supply of uterotonic medicines and which facilities can meet the immediate supply needs?	Medical stock data	Number of facilities with stockouts	2a. Among (high-volume) facilities with sufficient stock of uterotonic medicines, which facilities need providers with authority to administer uterotonic medicines to treat hemorrhage cases? 2b. Are there (high-volume) facilities from which we can transfer or depute providers with authority to administer the uterotonic medicines to treat hemorrhage cases in facilities with a shortage of trained providers?	Facility/patient data + Human resources/ provider data + Medical stock data	Facility unique identifiers/ geographic locators + Patient volume + Availability of uterotonic medicines + Number of providers who are authorized to administer uterotonic medicines + Number of cases with postpartum hemorrhage in facilities
3. What is the hemorrhage case load across all the facilities?	Facility/ patient data	Number of cases with postpartum hemorrhage in facilities	3a. Among (high-volume) facilities with adequately trained providers, which of the facilities are effectively administering available uterotonic medicines to treat hemorrhage case? 3b. From which facilities (low volume to stock ratio; and/ or no one authorized to provide uterotonic medicines) are we able to transfer available uterotonics to facilities needing immediate re-supply? 3c. To which facilities (medium to high volume without an authorized person to provide uterotonics) should we transfer a midwife on a short-term basis?	Facility/patient data + Human resources/ provider data + Medical stock data	Facility unique identifiers/ geographic locators + Patient volume + Availability of uterotonic medicines + Number of providers who are authorized to administer uterotonic medicines + Number of cases with postpartum hemorrhage in facilities

RECOMMENDED APPROACH TO ENABLE DATA INTEROPERABILITY

Create Appropriate Health Information Architecture

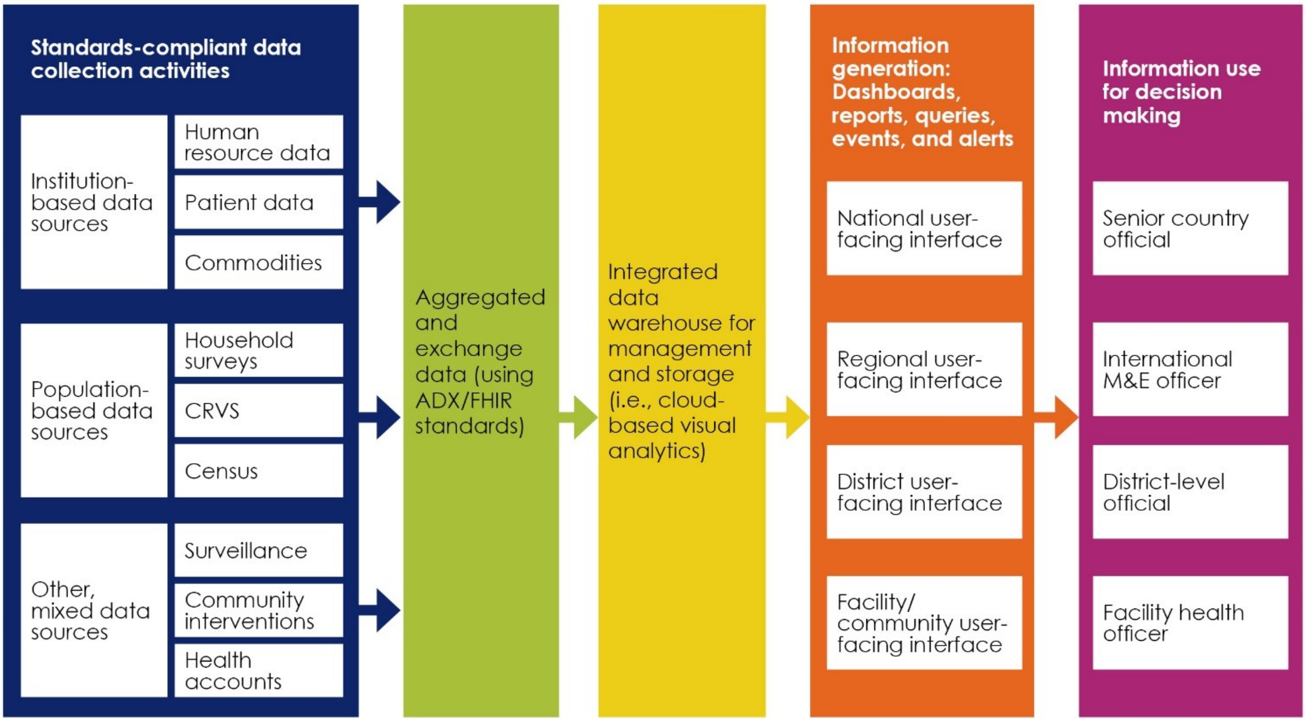
As discussed in the earlier section of this document, an appropriate information architecture is necessary to enable data exchange and to support decision making by diverse stakeholders (especially policymakers and program managers) at different levels of the healthcare system. An appropriate architecture will allow collection, sharing, and use of data beyond the point of data collection and enable local innovations that cater to specific health information needs.

At national and subnational levels (especially regions and districts), comprehensive analysis demands stakeholders to consult such population-based data sources as the UDHS as well as the routine census for supplementation and comparison. Other mixed data sources can be considered, as well (see Figure 1). Typically, the stakeholders involved in the process of data collection, data management, data analysis, and data use are policymakers and program managers, healthcare providers, patients, and health information system staff.

The decision support system comprising policymakers and program managers will allow queries of aggregate information from facilities about patients, stocks, and health providers to inform decisions. To deliver patient healthcare services, a provider will need access to clinical, pharmacy, laboratory, and diagnostic data for individual patients.

The information architecture should offer flexibility so that both the managers and the providers will be able to access the type of data they need to make decisions, through a user interface appropriate to their needs. Data elements collected at the POS will be stored and managed in a different way than the data element (often aggregate versions of data elements collected at the POS) used at the district or national level. Managers could also choose to use data coming into the information system from external surveys and the census, as needed.

Figure 1. The guiding information architecture for data exchange and data use



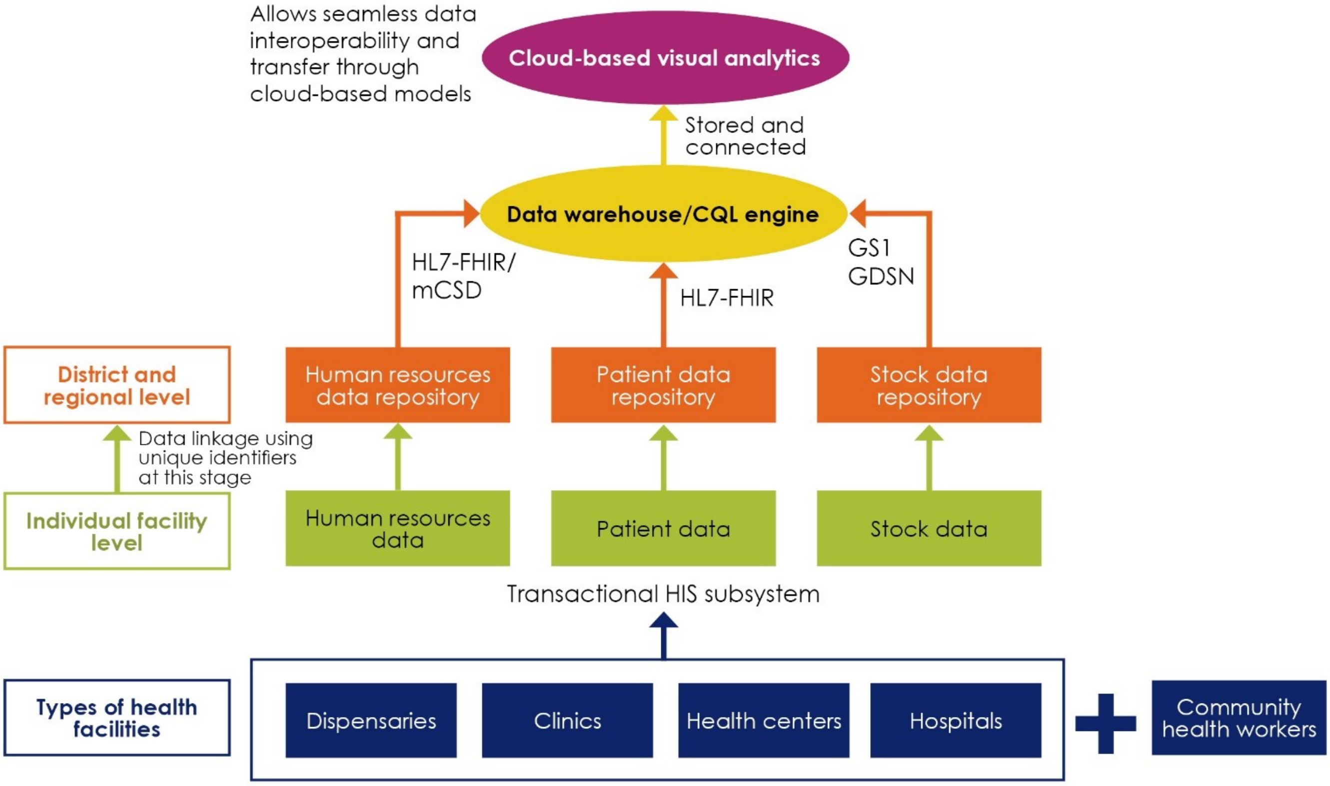
Abbreviations: CRVS—civil registration and vital statistics; ADX—aggregate data exchange; FHIR—Fast Healthcare Interoperability Resources

Enable Data Integration and Data Use

As discussed earlier in the information architecture subsection, individual-level data for healthcare services, providers, and stocks are collected at such health facilities as dispensaries, clinics, health centers, and hospitals (Figure 2). Each of the registries has unique identifiers linked with a unique patient identifier (ID). So, for example, patient-level data include the facility ID (from the facility), the provider ID (from the health worker), and the patient ID (from client registries). The detailed data model will include the details pertaining to primary and secondary keys connecting data sources, but that is beyond this document's scope. Aggregated human resources data and patient and stock data can be stored and managed at the district or regional level, as determined by the information architecture. The aggregated data from these repositories can be integrated in a data warehouse using standards such as Health Level 7–Fast Healthcare Interoperability Resources and GS1 standards for supply chain.

Integrated data should be available in a relevant way to decision makers through web-based or offline interfaces. This assumes that the stakeholders already have data-sharing agreements as well as the necessary data security and privacy systems in place. One example of a web-based user interface is the "cloud-based visual analytics" system (Grove & Kalasa, 2018). This system is designed to eliminate administrative redundancy and complexity by reducing the steps it takes to collect, enter, retrieve, and analyze data (Grove & Kalasa, 2018). Its major advantage is that it can use the processing power of cloud-based models to make data transfer seamless (Grove & Kalasa, 2018).

Figure 2. Visual illustration of the data flow and the data standards used



Abbreviation: HL7—Health Level 7; FHIR—Fast Healthcare Interoperability Resources; mCSD—Mobile Care Services Discovery; CQL—Clinical Query Language; GS1—GS1 is a not-for-profit organization that develops and maintains global standards for business communication; GDSN—Global Data Synchronization Network (GDSN) is a service provided by GS1; HIS—health information system

Source: **Adapted from** Integrating the Healthcare Enterprise (IHE) Quality Research and Public Health Technical Committee. (2019). *Clinical Quality Language for Aggregate Data Exchange White Paper*. Oak Brook, IL, USA: IHE. Retrieved from https://docs.google.com/document/d/1-9LGv8RK-uNLnvjdoTlikqXynMyLaElY68mxBf6NZFo/edit

REFERENCES

Grove, J., & Kalasa, B. (2018). *Accelerator 6. Data and Digital Health*. Retrieved from https://www.who.int/docs/default-source/global-action-plan/accelerator6.pdf.

International Organization for Standardization (ISO). (2009). Health informatics—Document registry framework. Geneva, Switzerland: ISO. Retrieved from https://www.iso.org/obp/ui/#iso:std:iso:ts:27790:ed-1:v1:en:term:3.39

Partnership for Maternal, Newborn & Child Health. (2011). *Maternal and Child Health: Uganda*. Geneva, Switzerland: Partnership for Maternal, Newborn & Child Health, World Health Organization. Retrieved from https://www.who.int/pmnch/media/membernews/2011/ugandabackgroundpaper.pdf

Uganda Bureau of Statistics (UBOS) & ICF. (2018). *Uganda Demographic and Health Survey 2016*. Kampala, Uganda and Rockville, Maryland, USA: UBOS and ICF. Retrieved from https://dhsprogram.com/what-we-do/survey/survey-display-504.cfm

Uganda Bureau of Statistics (UBOS) & ICF International. (2012). *Uganda Demographic and Health Survey 2011*. Kampala, Uganda and Calverton, Maryland: UBOS and ICF. Retrieved from https://dhsprogram.com/what-we-do/survey/survey-display-399.cfm

United Nations. (2015). Sustainable Development Goal 3: Ensure healthy lives and promote well-being for all at all ages. New York, NY, USA: United Nations. Retrieved from https://sustainabledevelopment.un.org/sdg3

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, North Carolina 27516 USA
Phone: +1 919-445-9350 • measure@unc.edu
www.measureevaluation.org

This publication was produced with the support of the United States Agency for International Development (USAID) under the terms of MEASURE Evaluation cooperative agreement AID-OAA-L-14-00004. MEASURE Evaluation is implemented by the Carolina Population Center, University of North Carolina at Chapel Hill in partnership with ICF International; John Snow, Inc.; Management Sciences for Health; Palladium; and Tulane University. Views expressed are not necessarily those of USAID or the United States government. WP-19-233

USAID
FROM THE AMERICAN PEOPLE

MEASURE
Evaluation