WORKING PAPER

Integrating Family Planning Data in Uganda's Health Management Information System

Stephen Ojiambo Wandera, PhD
Betty Kwagala, PhD
Olivia Nankinga, MSc
Patricia Ndugga, MSc
Allen Kabagenyi, PhD

February 2018

USAID
FROM THE AMERICAN PEOPLE

MEASURE Evaluation

WORKING PAPER

Integrating Family Planning Data in Uganda's Health Management Information System

Stephen Ojiambo Wandera, PhD
Betty Kwagala, PhD
Olivia Nankinga, MSc
Patricia Ndugga, MSc
Allen Kabagenyi, PhD

February 2018

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 W Franklin St Suite 330, Chapel Hill, NC 27516
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-18-202

USAID
FROM THE AMERICAN PEOPLE

MEASURE
Evaluation

ACKNOWLEDGMENTS

We would like to thank the United States Agency for International Development (USAID), which funded the research through the MEASURE Evaluation project.

We also acknowledge the support of Benjamin Kachero, of the Office of the Prime Minister, Kampala, Uganda, during the data collection exercise. We acknowledge the support of John Eyers, of the United Kingdom (UK), and Alice Ladur, a PhD student at Bournemouth University, UK, during the systematic review process.

We are grateful to the key informants from the Ministry of Health; Programme for Accessible Health Communication and Education; Reproductive Health Uganda; Marie Stopes Uganda; United Nations Population Fund; health facilities in Jinja and Hoima; district officials from Kampala, Jinja, and Hoima; and multi-stakeholder workshop participants.

We appreciate the technical support of Bridgit Adamou, of MEASURE Evaluation, University of North Carolina at Chapel Hill, and the project's knowledge management team for editorial and production services.

CONTENTS

TABLES

ABBREVIATIONS

CDC	United States Centers for Disease Control and Prevention
DHIS	district health information system
DRC	Democratic Republic of the Congo
EMR	electronic medical record
FP	family planning
HIS	health information system(s)
HMIS	health management information system(s)
ICPD	International Conference on Population and Development
ICT	information and communication technology
IDI	Infectious Disease Institute
IP	implementing partner
IT	information technology
KII	key informant interview
NGO	nongovernmental organization
MeSH	medical subject headings
METS	Monitoring and Evaluation Technology Support
MHIS	mental health information system(s)
MOH	Ministry of Health
MRO	medical records officer
MSD	multistakeholder dialogue
MSU	Marie Stopes Uganda
MTN	Mobile Telecommunications Network
mTrac	mobile tracking
MUREC	Mildmay Uganda Research and Ethics Committee
PACE	Programme for Accessible Health Communication and Education
PDA	personal digital assistant
PRISM	Performance of Routine Information System Management
RH	reproductive health
RHIS	routine health information system(s)
RHU	Reproductive Health Uganda
SSA	sub-Saharan Africa
TASO	The AIDS Support Organization
UHMG	Uganda Health Marketing Group
UNCST	Uganda National Council of Science and Technology
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
WHO	World Health Organization

EXECUTIVE SUMMARY

Background: Uganda's health management information system (HMIS) was established in 1985 to collect and analyze national data on morbidity from communicable and noncommunicable diseases, reproductive health, family planning (FP), and immunization (Kintu, et al., 2004). The routine health data reporting system has evolved to the current platform known as the district health information system, version 2 (DHIS 2), which began in 2011 in a few districts and was rolled out to all districts in Uganda in 2012 (Kiberu, et al., 2014).

Few studies have explored the mechanisms for integrating FP data from the public and private health sectors in Uganda's national HMIS. This study aimed to investigate the barriers, facilitators, and best practices of integrating these FP data in the district and national HMIS in Uganda.

Methods: We conducted a qualitative study in Kampala, Jinja, and Hoima Districts. Primary data were collected from 16 key informant interviews (KIIs) and a multistakeholder dialogue (MSD) workshop comprised of 11 participants. The KIIs included three Ministry of Health (MOH) officers, three HMIS focal persons at nongovernmental organizations, four HMIS focal persons who were district biostatisticians or medical records officers, and six providers who were medical records officers at public and private health facilities. We conducted a systematic review of the HMIS in sub-Saharan African countries that are FP priorities for the United States Agency for International Development (USAID). The systematic literature review covered 2008–2016.

Results: The technical facilitators for integrating FP data from public and private facilities in the national and district HMIS were user-friendly software; web-based and standardized reporting; government support for FP; availability of resources, including computers; and stakeholder engagement in HMIS design. Organizational facilitators were prioritizing FP data, training staff in HMIS, supportive supervision, and quarterly performance review meetings. Key behavioral facilitators were motivation and competence of HMIS staff. Collaborative networks with donor-funded implementing partners, such as the United Nations Population Fund and Marie Stopes Uganda, that can provide training, financial support, and technical assistance in designing HMIS forms are essential for improved performance and sustainability of the HMIS.

Notable best practices of HMIS implementation in Uganda were an integrated reporting system, routine performance reviews, compliance enforcement, stakeholder engagement in designing HMIS forms, and review and collaboration by the MOH and implementing partners.

The most substantial technical barriers were limited supply of computers at lower health facilities, complex HMIS forms, double entry of HMIS data, and web-reporting challenges. Organizational barriers were limited HMIS human resources, high levels of staff attrition in private facilities, limited training, poor culture of information, and stockouts of paper-based HMIS forms. Behavioral barriers were low motivation of healthcare providers to collect FP data, low use of FP data for planning purposes by district and health facility staff, and low motivation of staff to ensure data quality.

Conclusion: Family planning data collection and reporting are integrated in Uganda's district and national HMIS (DHIS 2). However, limited priority and attention is given to FP data collection at the facility and national levels. Data are not used by the health facilities that collect them. We recommend reviewing and strengthening HMIS data collection forms and FP commodities, ensuring forms are available at health facilities, and training all staff involved in HMIS data reporting so they can support their units and track FP data inclusion. It is important to encourage HMIS staff and health facility in-charges to use FP data for decision making.

INTRODUCTION

Health management information systems (HMIS) are instrumental in addressing health delivery problems and strengthening health sectors to generate credible evidence about the health status of clients (Ndabarora, Chipps, & Uys, 2013). They are also essential for decision making at every level of the health system (Aqil, Lippeveld, & Hozumi, 2009; Braa, Monteiro, & Sahay, 2004). HMIS are designed to collect and manage epidemiological as well as administrative information with the district as a basic unit at the subnational level. The purpose of the HMIS is the consistent and systematic compilation of data, as well as the provision of regular analysis and interpretation of the given data to guide key decision making and intervention programs (Kintu, Nayunja, Nzabanita, & Magoola, 2004; MOH, 2010). It is through an effective and functional HMIS that the burden of disease and utilization of services can be appropriately identified (Mbonye, et al., 2014).

Several countries in sub-Saharan Africa (SSA) have established national HMIS (Hotchkiss, Aqil, Lippeveld, & Mukooyo, 2010). The district is considered a self-contained geography entity that presents a better opportunity for integration of multiple health programs. Countries have, however, had different experiences with their national HMIS (Aqil, et al., 2009; Braa, et al., 2004). Tanzania's health information system (HIS) was introduced in 1993 (Wilms, Mbembela, Prytherch, Hellmold, & Kuelker, 2014). Uganda's HIS is more established, formed in 1985 to collect and analyze national data on morbidity from communicable and noncommunicable diseases, family planning (FP), reproductive health (RH), and immunization (Kintu, et al., 2004). Reproductive health and FP data collection and reporting was initially paper-based, but is now both paper- and web-based (Hotchkiss, et al., 2010; Kiberu, et al., 2014; Kihuba, Gheorghe, Bozzani, English, & Griffiths, 2016). The routine health data reporting system has evolved to the current platform, known as the district health information software, version 2 (DHIS 2), which began in 2011 in a few districts and was rolled out to all districts in Uganda in 2012 (Kiberu, et al., 2014).

All public and private health facilities in Uganda are mandated to report health data to the district through the HMIS. Both private and public health facilities are expected to report to the districts, and the data are aggregated and submitted to the national level for analysis. However, there is special surveillance for any outbreaks and epidemics, with reports being submitted directly to the national level. In public health facilities in Uganda, FP services are usually provided by the government through the national healthcare system. In private health facilities, FP services are provided by private for-profit facilities and private not-for-profit providers, including faith-based organizations and nongovernmental organizations (NGOs) (Kiberu, et al., 2014; MOH, 2010).

HMIS programs in SSA, including the one in Uganda, face diverse challenges such as poor infrastructure; inadequate human resources; logistical issues; inadequate office equipment, including computers and software; and uncoordinated collection and use of health information (Ishijima, Mapunda, Mndeme, Sukums, & Mlay, 2015; Kiberu, et al., 2014; Macharia & Maroa, 2014; Thompson, Castle, Lubeck, & Makarfi, 2010; Verbeke, Karara, & Nyssen, 2015; Wilms, et al., 2014). This often results in incomplete and inaccurate reports, which compromise health service delivery and the ability to use the data to inform decisions (Jawhari, et al., 2016; Kiberu, et al., 2014; Kihuba, et al., 2016; Kintu, et al., 2004).

There are also several facilitators and best practices for strong HMIS. Examples include user friendly HMIS systems, availability of equipment and supportive trainings for staff. Challenges and facilitators can both be grouped in technical, organizational, and behavioral factors. In addition, factors related to HMIS processes, such as data collection, transmission, processing, analysis, display, quality, and feedback, affect the quality and efficiency of an HMIS (Aqil, et al., 2009; Hotchkiss, et al., 2010; Kiberu, et al., 2014; Maokola, et al., 2011; Sadoughi, Kimiafar, Ahmadi, & Shakeri, 2013; Shiferaw, Zegeye, Assefa, & Yenit, 2017).

Uganda has registered an improvement in its RH indicators, as modern contraception prevalence increased from 8 percent in 1995 to 35 percent in 2016. Nonetheless, Uganda lags behind other countries in East African (Demographic and Health Survey Program, 2017). Sustaining the momentum of this progress requires, among other interventions, regular generation of complete and accurate FP information to facilitate appropriate programming and policy making.

Study Rationale

The public and private sectors independently report RH information to the national level (Aqil, et al., 2009; Braa, Heywood, & Sahay, 2012). In low-income countries, the private sector is often perceived to be more efficient, accountable, and sustainable than the public sector. However, studies have shown that RH information, including FP, is not yet integrated in some countries (Ashraf, et al., 2015; Kiberu, et al., 2014). Available evidence in Uganda mainly focuses on the public sector (Kiberu, et al., 2014).

In Uganda, FP information was captured separately from the private and public sectors until a new integrated information system focusing on immunization, HIV/AIDS, and FP services was recently adopted (Driessen, et al., 2015; Hotchkiss, et al., 2010; Kiberu, et al., 2014; Kiwanuka, Kimaro, & Senyoni, 2015). However, some government and private health facilities have not been included in this new system facilities.

Few studies have explored possibilities for integrating FP data from the public and private health sectors in the national HMIS in Uganda. Therefore, this study aimed to investigate the facilitators, best practices, and barriers related to HMIS performance from integrated data sources (i.e., the public and private health sectors) in Uganda. More specifically, the objectives of this study were:

1. To review evidence of the experiences and best practices of integrated FP/RH information systems in sub-Saharan African countries
2. To explore the facilitators and best practices of integrating FP data from public and private health facilities in Uganda
3. To explore the barriers of integrating FP data from public and private health facilities in Uganda
4. To investigate the feasible options for integrating FP data from public and private health facilities in the district and national HMIS in Uganda

Research Questions

The key research questions in this study were:

1. What are the facilitators of integrating FP data from the private and public sectors in the national HMIS in Uganda?
2. What are the best practices for developing an integrated national HMIS in sub-Saharan African countries?
3. What are the barriers to integrating FP data from private and public health facilities in the national HMIS in Uganda?
4. What options are feasible for integrating FP data from the private and public sectors in the national HMIS in Uganda?

METHODS

Study Design

This was a cross-sectional, qualitative study based on key informant interviews (KIIs), a one-day participatory workshop, and a desk review. The study was conducted in Kampala (a national level assessment), Jinja, and Hoima Districts. Jinja and Kampala are urban, while Hoima is mostly rural.

Sampling

The study participants were designers of HMIS templates, users of the templates or forms, and FP data users. The sample size was determined based on maximum variation focusing on potential sources of data. Two districts where the DHIS 2 is being implemented (i.e., Hoima and Jinja) were purposively selected (Kiberu, et al., 2014). A similar approach was used in Zambia (Mutemwa, 2006). From these districts, we selected three public and three private health facilities. Kampala District was included since that is where key informants from the MOH are based. The study recruited 27 participants, including 16 key informants and 11 multistakeholder dialogue (MSD) workshop participants. A similar approach for recruiting MSD participants has been used elsewhere (Ashraf, et al., 2015). Five members of the research team participated in the MSD workshop.

Inclusion and Exclusion Criteria

The inclusion of study participants was based on their knowledge and experience with Uganda's HMIS. Participants were selected from the MOH department in charge of HMIS, medical record officers (MROs) from the MOH and health facilities, FP organizations, district biostatisticians, and records officers working on the HMIS. For the MSD workshop, participation was based on being a key informant in the study or being a policy or program stakeholder closely linked with HMIS in Uganda.

Data Collection

Secondary Data Sources

To achieve the first objective, we conducted a systematic review of the HMIS in the U.S. Agency for International Development (USAID) FP priority countries. These were Democratic Republic of the Congo (DRC), Ethiopia, Ghana, Kenya, Liberia, Madagascar, Malawi, Mali, Nigeria, Rwanda, Senegal, Tanzania, Uganda, and It was an oversight to exclude Mozambique, which is also one of the FP priority countries.

Medical subject headings (MeSH) on the PubMed website and their synonyms were identified to extensively search and retrieve relevant literature on experiences and best practices of national HMIS in the selected sub-Saharan African countries. We included articles written in English and published from 2008 to 2016. Each country was pre-selected based on whether it was a USAID FP priority country or signatory to the Ouagadougou Declaration. The following search terms or strings were used: "health information system" OR "health management information system" OR "routine health information system" OR "district health information system" OR "electronic medical records" AND "family planning" OR "reproductive health."

Databases searched were PubMed/Medline, Biomed Central, Elsevier/Scopus, the Cochrane Library, CINAHL (EBSCO), Google Scholar, PDQ-Evidence, World Bank, the United Nations Population Fund (UNFPA), and the Development Experience Clearinghouse at USAID. We used smart text searching in the EBSCO search engine. Two reviewers independently screened the titles and abstracts of all retrieved

studies, and disagreements were referred to a third reviewer to resolve. Once studies were selected, full articles were retrieved, they were reviewed for quality of study design, and relevant information was extracted.

We included articles focused on the 14 selected sub-Saharan African countries: Democratic Republic of the Congo OR DRC OR Ethiopia OR Ghana OR Kenya OR Liberia OR Madagascar OR Malawi OR Mali OR Nigeria OR Rwanda OR Senegal OR Tanzania OR Uganda OR Zambia. Priority was given to articles focused on Uganda. They had to be open-access or free full-text, peer-reviewed articles and had to be about FP or RH. Those published in French or any other language were excluded because the researchers did not have expertise in additional languages. A total of 31 studies were identified **(Appendix A).**

In addition, we analyzed the contents of the HMIS data collection forms from both private and public health facilities for consistency, and to identify gaps in FP content. The aim was to assess the feasibility of merging the forms, how the information is collected, whether private and nongovernmental data are integrated, and facilitators and barriers to the process.

Primary Data Sources

Primary data sources included KIIs and the one-day MSD workshop. The KIIs were conducted to achieve objectives two through four using a KII guide (**Appendix B**). The KIIs were conducted between October 2016 and February 2017. Sixteen key informants were interviewed, including district officials, MOH officials, staff from public and private health facilities, and employees of donor-funded implementing partners (IPs). There were slightly more men than women (**Table 1**).

Three MOH officers were interviewed from the HMIS, RH, and records departments. The interviews were conducted to access and analyze the MOH's updated FP/RH data collection form; assess whether data from the two sectors are integrated for planning purposes; determine the feasibility of integrating public and private FP data; and examine the consistency of data capturing in public and private sectors, facilitators and barriers of the process, lessons learned, and recommendations with respect to integration.

Three program personnel from multi-lateral organizations and NGOs working in FP were selected. These were one staff member from UNFPA, one staff member from Reproductive Health Uganda (RHU), and one staff member from the Programme for Accessible Health Communication and Education (PACE). The researches collected expert views on the feasibility of integrating public and private FP data.

Four biostatisticians, six MROs, and two HMIS focal persons were interviewed to establish the existence and utilization of HMIS data collection forms in the private and public facilities in the districts, the facilitators and barriers involved, and whether data from the two sectors are integrated for planning purposes (among other issues).

Six health facility-based MROs at public and private facilities that provide FP services were interviewed to assess the contents of data collection forms from the various providers for comprehensiveness and consistency, and to determine whether FP data are actually collected. This involved three public facilities and three private facilities in two districts.

Table 1. Descriptive characteristics of key informants

	District	Gender	Institution
1	Jinja	Female	District office
2	Jinja	Female	District office
3	Jinja	Male	District office
4	Jinja	Female	Private not-for-profit facility
5	Jinja	Female	Public regional referral hospital
6	Jinja	Female	Public facility
7	Kampala	Male	MOH
8	Kampala	Male	MOH
9	Kampala	Male	MOH
10	Kampala	Male	PACE
11	Kampala	Female	RHU
12	Kampala	Male	UNFPA
13	Hoima	Male	District office
14	Hoima	Male	Private not-for-profit health center
15	Hoima	Male	Public regional referral hospital
16	Hoima	Female	Private for-profit health center

The one-day MSD workshop was conducted to answer research questions two through four using a guide (**Appendix** C). The workshop involved 11 participants, all of whom were key informants and key public and private FP stakeholders. Key informants were engaged to discuss motivations/facilitators and barriers to integrating FP data from the public and private sectors. We used adult facilitation approaches such as visualization tools for participatory planning for interactive plenary sessions. This included brainstorming and use of cards for idea generation, clustering, prioritizing, and discussion. Small group discussions (UNICEF, 1993) were used to collect information on content, approaches, barriers, facilitators, best practices, and recommendations for public-private FP/RH HMIS data integration.

Data collection was conducted between October 2016 and February 2017. This time frame demanded a hectic schedule involving contact with key informants, booking of interview appointments, travel between the study sites, and actual data collection. Interviews were conducted in English and lasted between 30 and 45 minutes. All team members, with assistance from two hired research assistants, took on the role of moderating the interviews and the MSD workshop. Verbatim note-taking was done by the research assistants.

Interviews were audio recorded with a digital recorder upon obtaining voluntary informed consent from each of the study participants. Participants were informed of their freedom to participate in the study; withdraw at any point; or choose not to respond to questions, without negative consequences. Participants were assured of confidentiality and anonymity. Neither their names nor their specific job titles were recorded alongside their responses; generic job titles, such as "biostatistician" or "records officer," and location were used instead. Each interview was saved on a password-protected computer, backed up on a USB drive, and deleted from the digital recorder before its subsequent use.

Data Analysis

We conducted a systematic review of secondary articles using recommended methods and performed content analysis of the HMIS data collection tools or forms. The audio recordings were transcribed verbatim by team members and professional transcribers and were checked for accuracy by the research team. Deductive and inductive thematic data analyses were used to code the transcripts using Atlas Ti (version 7) qualitative analysis software. The Performance of Routine Information System Management

(PRISM) framework was used to guide the analysis (Aqil, et al., 2009; Hotchkiss, et al., 2010). Framework analysis also guided the data coding process (Seitio-Kgokgwe, Gauld, Hill, & Barnett, 2015).

Ethical Clearance

Ethical approval was obtained from the Mildmay Uganda Research and Ethics Committee (MUREC), which is a local institutional review board. Research clearance and registration approval was granted by the Uganda National Council of Science and Technology (UNCST) on August 15, 2016, with registration number SS 5028.

RESULTS

This section presents the results of the study categorized by three themes: facilitators, best practices, and barriers to FP/RH integration in HMISs in SSA in general and Uganda specifically. Technical, organizational, behavioral, and process-oriented factors are addressed under these themes.

Systematic Review of HMIS Literature

For the secondary data collection, we reviewed 31 articles that met the selection criteria. Initially, the systematic search retrieved 5,804 articles (**Appendix A**). A summary of the full-text articles reviewed is presented (**Appendix D**).

An assessment of the facilitators for an effective HMIS found that technical, organizational, and behavioral factors played a large role in facilitating HMIS operations. Technical factors included use of user-friendly HMIS forms, consultations during health information system design (Ahuja, et al., 2016), and availability and use of technology such as computers, data analysis and reporting software, and mobile health devices (Asangansi & Braa, 2010). Organizational factors included trainings on HMIS, data utilization workshops, finances, and other resources (Aqil, et al., 2009; Braa, et al., 2012; Ishijima, et al., 2015; Kiberu, et al., 2014; Makinde, Mami, Oweghoro, Oyediran, & Mullen, 2016; Ojo & Popoola, 2015; Were, Siika, Ayuo, Atwoli, & Esamai, 2015). Lastly, the positive attitudes of the information specialists and data managers, as well as information and communication technology (ICT) competencies, played an important role among behavioral factors.

The best practices that facilitated HMIS data were mobile health technologies, which permit the collection and transfer of data in real time. The successes in some programs were attributed to the use of personal digital assistants (PDAs) for electronic data capture (Aqil, et al., 2009; Asangansi & Braa, 2010; Ishijima, et al., 2015; Kihuba, et al., 2016; Maokola, et al., 2011; Thompson, et al., 2010), having skilled and well-trained information specialists (Asangansi & Braa, 2010), and trainings on HMIS (Aqil, et al., 2009; Braa, et al., 2012; Ishijima, et al., 2015; Kiberu, et al., 2014; Makinde, et al., 2016; Ojo & Popoola, 2015; Were, et al., 2015). The inclusion of ICT skills in the training of health workers was deemed important for successful long-term implementation. Though the best practices were similar to the facilitators, they remained the major attributes of the successful systems highlighted in some countries.

Barriers to successful implementation of the HMIS included unfriendly software, technology issues, and limited supply and poor maintenance of computers (Adeleke, Lawal, Adio, & Adebisi, 2015; Aqil, et al., 2009; Asangansi & Braa, 2010; Chiba, Oguttu, & Nakayama, 2012; Ishijima et al., 2015; Jawhari et al., 2016; Kiberu, et al., 2014). Shortages of human resources for health, particularly HMIS staffing, and limited specialized training to enhance improved service delivery negatively affected HMIS implementations (Jawhari, et al., 2016; Kiberu, et al., 2014; Kiwanuka, et al., 2015; Monawe, Chawani, Kapokosa, & Moyo, 2015; A. S. Nyamtema, 2010a; Upadhaya, et al., 2016; Verbeke, et al., 2015). Lack of adequate technical support supervision, as well as behavioral and individual factors linked to personality and attitudes toward learning and adopting new technologies, remained a hindrance to the system (Bagayoko, Dufour, Chaacho, Bouhaddou, & Fieschi, 2010; Chiba, et al., 2012; Jawhari, et al., 2016; Makinde, et al., 2016; Mutale, et al., 2013; Upadhaya, et al., 2016; Verbeke, et al., 2015). Data accuracy and completeness affected reporting and utilization. Issues around lack of logistical support for the different units were key hindrances to data capture and reporting (Bagayoko, et al., 2010; Chiba, et al., 2012; Jawhari, et al., 2016; Makinde, et al., 2016; Mutale, et al., 2013; Upadhaya, et al., 2016; Verbeke, et al., 2015).

Several studies made recommendations for improving HMIS in Africa. These included reviewing HMIS forms to make them user-friendly (Monawe, et al., 2015), maintaining an adequate supply of computers (Tilahun & Fritz, 2015), using mobile technologies such as PDAs in data collection, addressing software challenges (Asangansi & Braa, 2010; Jawhari, et al., 2016), and improving Internet connectivity (Kiberu, et al., 2014). There is also a need to continuously train (Driessen, et al., 2015; Mutale et al., 2013), motivate (Kihuba, et al., 2016; Kiwanuka, et al., 2015), and supervise staff. In addition, the training curriculum for health workers needs to include HMIS and ICT skills (Bagayoko, et al., 2010; Makinde, et al., 2016; A. S. Nyamtema, 2010a; Were, et al., 2015). Furthermore, a culture of information should be promoted, (Hotchkiss, et al., 2010), the PRISM framework should be used to evaluate HMIS (Aqil, et al., 2009; Hotchkiss, et al., 2010; Maokola, et al., 2011), health workers need regular feedback, and data-use stakeholder workshops should be conducted (Braa, et al., 2012) as part of the effort to address challenges for sustainability of HMIS (Ahuja, et al., 2016; Chiba, et al., 2012).

Facilitators of HMIS Performance from Integrated Data Sources

Technical Factors

The HMIS in Uganda is a standardized and integrated national reporting system that includes data from both private and public health facilities. All health facilities (i.e., public, private for-profit, and private not-for-profit), regardless of their affiliation, are required to use the MOH's standardized forms to avoid duplication of data and reduce overload of reporting. Records from community health workers are captured at the nearest health facility. Procedures for compiling data need to be correctly followed, and data need to be continuously cross-checked to eliminate errors. As mandated, these forms are submitted to the district biostatistician's office.

The HMIS forms include all key health services that are provided at the health facility. Using one set of forms reduces the workload of records assistants who previously had to fill in several forms, lessens compilation errors, and improves the consistency of the reporting system. This further facilitates the smooth running of the central databank at the MOH since all data from the different programs are processed at one location. An example of this is HMIS Form 105 (**Appendix E)**, which reports the monthly attendance figures for maternal and child health and FP visits, diagnoses for the outpatient department, laboratory tests, HIV and AIDS service data, stockouts of essential drugs and supplies, and financial data (MOH, 2014). At a lower-level health facility, a records officer observed the following:

> *Everything is incorporated within that user form. It is integrated and so FP data is catered for.*

Similarly, a national-level stakeholder observed:

> *All facilities use standardized forms for reporting; the individualized and special reporting by health facilities was abolished. Thus, there is less confusion and less workload given the similar tool used in data collection at all levels.*

Most HMIS personnel at the district level had access to computers and found the DHIS 2 software appropriate and user-friendly. IPs such as The AIDS Support Organization (TASO) provided computers to their partner health centers (at levels III and IV) in Jinja. The introduction of DHIS 2 by the MOH, with provisions for web-based reporting, strengthened district-based and national-level reporting. This is a key facilitator since it does not require district officers to submit data in hard copies and reduces transportation and stationary costs. Web-based reporting eases sharing of health data with all stakeholders who have rights of access to the system and allows IPs and donors to monitor and scrutinize the quality of data being collected. A national-level key informant narrated his experience with HMIS:

> *It is an online system that captures all the paper forms as electronic and data is sent electronically. It is a server and at the same time entry point. Biostatisticians run through the data to rectify errors. Some errors are rectified automatically*

but others are sent back to the facility. Web-based reporting is an innovation which does not require district HMIS officers to submit data to the ministry in hard copies, hence reducing on the transportation costs as well as minimize paper use.

Another stakeholder (medical personnel) from Hoima District explained:

It is one of the best data collection systems we have in the country. I have had experience overseeing Buhanguzi Health Sub-District, which comprises 26 facilities. The system is easily adopted by the officers, and work is made easy in reporting. In particular, since 2013, there have been tremendous changes [in reporting] to date.

Organizational Factors

The government of Uganda prioritizes FP, as shown in its commitment to international and regional conventions (e.g., International Conference on Population and Development [ICPD] 1994, FP2020). Owing to this commitment, much effort has been put into improving FP service provision and consequently collecting FP data. According to a respondent from the MOH, FP and other sectors receive equal attention since each functional area in the HMIS has a corresponding department or unit for which performance is assessed and that attracts development partners. In addition, FP is among the country's priority sectors since the contraceptive prevalence rate is monitored at the national level. FP data are analyzed monthly, quarterly, and annually. FP data collection has been enhanced by its integration in other services (i.e., HIV and AIDS, immunization, antenatal care).

The MOH requires that renewal of licenses for private health facilities is contingent on regular submission of HMIS reports to the districts. This has facilitated participation of private and nongovernmental health facilities in the HMIS. Private not-for-profit health facilities perform better than public facilities with respect to submission of data because of strict rules enforced by their governing institutions, such as the Uganda Muslim Medical Bureau, Uganda Catholic Medical Bureau, and Uganda Protestant Medical Bureau.

Availability of HMIS forms in registered and licensed health facilities (i.e., private, NGO, public) facilitated the HMIS in Uganda. These forms are required to submit HMIS data to the districts and, thereafter, to the MOH. All licensed health facilities are expected to access the standardized forms from the district-level HMIS focal person or biostatistician. FP data from community outreach by private or NGO providers are captured using government health facility registers. A national-level informant noted:

The forms are available especially in the public health facilities. You find forms in all health facilities. Even recently, in the remotest health facility in the Karamoja Region, they had the HMIS forms.

Training of designated staff in HMIS data management is a critical facilitating factor. While Hoima District reported universal training coverage, Jinja's training coverage ranged from 50 to 90 percent. Many officers reported receiving training in HMIS data management several times (as recently as 2016). Trainees included personnel from both the public and private sectors. Refresher trainings occur annually, which has been consistent over past years. Trainings address computer literacy, DHIS 2, data analysis, and updates on the forms and their contents. In Hoima District, all health staff attending to outpatients had been trained on HMIS data collection, including FP. The trainings ranged from one week to four months. One biostatistician pointed out:

There is improvement in quality. I am not saying that [it] is very good data, but there is improvement of quality because of this regular training and introduction of this web-based reporting. I think these contribute to quality because before they would collect all the data and bring to the ministry to enter and you know what it means—and now documents from the district—sometimes the data entry is done at the facility.

We network with a number of implementing partners that have supported our work through capacity building, trainings, services delivery, and commodity provision. All these implementing partners do have access to the DHIS 2. For instance, World Vision focuses on maternal neonatal and child health while Infectious Disease Institute (IDI) supports HIV programs in all health centers three and four.

Supportive supervision is among the key activities of the HMIS. Health facilities receive quarterly visits, mainly from district officials, and supportive visits from MOH officials. IPs such as the World Health Organization (WHO), the United States Centers for Disease Control and Prevention (CDC), and World Vision support and participate in supervision and training and are usually available for consultation. Facility-level records officers receive supervisory visits from district HMIS focal persons and organizations and donors such as USAID, WHO, World Vision, PACE, TASO, and IDI. The MOH, through the Regional Performance Monitoring Team, conducts quarterly visits to the districts and occasionally to health facilities. Visits are followed by review meetings on how to improve service delivery. The team supports the networks and linkages between IPs and health facilities.

In general, the HMIS was reported as having adequate human resources, facilities, software, and forms. In addition to their government and USAID support, districts mobilize resources through collaboration with IPs. Such IPs support capacity building, training, service delivery, and commodity provision. Examples of IPs associated with FP programs in Uganda are RHU, Marie Stopes Uganda (MSU), World Vision (which focuses on maternal, neonatal, and child health), and IDI (which supports HIV programs in all third- and fourth-level health centers). Monitoring and Evaluation Technology Support (METS)—a project based at the Makerere University School of Public Health that is interested in data—supports the printing of DHIS 2 forms for all health facilities and monitoring of all data-related issues. TASO receives data from the 17 higher-level health facilities it supports. TASO staff receive free data bundles from Mobile Telecommunications Network (MTN) that facilitate access to the MOH website.

Behavioral Factors

A high level of appreciation and motivation of data users and managers is a key factor for good HMIS performance in Uganda. IPs provide financial incentives to biostatisticians and HMIS focal persons in both Hoima and Jinja Districts. Users and managers rate the HMIS as one of the best data collection and health management systems covering different health aspects. All respondents except one were motivated to work with the system because of their interest in data analysis (if granted access), data management experience, and desire for quality data to use for planning. A national-level officer from an NGO observed:

No work documented is no work done. People should be encouraged to document what they have exactly done.

Health personnel have generally been competent and cooperative in executing HMIS tasks. Relevant personnel have been flexible and willing to adapt new methods and the addenda included in the HMIS forms. The personnel involved value their jobs. Since training programs entail assessments, personnel work hard to protect their names and jobs. In addition, team work is promoted among the HMIS personnel, which contributes substantially to the quality of the outcomes. A national-level and a district-level respondent, respectively, said:

Team work is key. Where staff work together in generation, entry and discussion of the reports has yielded quality data. In some districts, district health teams meet every end of the month to check data quality.

We do our work then at the end of the month, we sit on a round table. We compile, analyze, and then submit. If there are any errors, again we talk about them and you know. It is not a one man's business.

Collaboration or networking with other districts or actors is beneficial to the process of data management. Partnerships have made work easier and contributed to improvements in meeting reporting timelines.

Process-Related Factors

With respect to consistent use of the forms, national informants noted that public health facilities are more consistent with health information reporting because staff's access to the forms is granted and ensured. Unlike private facilities, public facilities receive regular supervision. One key informant (i.e., an MOH stakeholder) mentioned that low coverage of HMIS forms at private facilities is attributed to fewer trained staff at those facilities:

> *But now in the private sector, reporting is less than 25 percent. Because even the providers at the private facility, apart from recording the name and date of review or re-attendance, nothing much is done in the private facility. They need to be brought on board, to be trained and then mentored on how useful it is to capture data.*

Health facilities receive reminders from the district office when reports are due. All health facility records staff (from both private and public facilities) are expected to prepare HMIS reports for submission as stipulated in the HMIS health unit procedure manual (MOH, 2010). Under this manual, each health unit keeps a register of all patients (Form 031) that is updated daily. From the register, tally sheets are used to populate the HMIS reporting forms. A records officer reported that:

> *Data are captured on a daily basis at the health facilities using the 031 form. Weekly, we report on surveillance, and that is Form 033B. We also have a monthly report and this is usually on the general condition in the facility like drugs, store medical, theatre, etc., and this is HMIS 105 for outpatient and 108 for the inpatient. Quarterly, we compare three months' information and it's done manually. Then we have the annual report that is HMIS 107 where we generate all months and come up with one report. Finally, we have the financial year report.*

Reporting is done weekly using mobile tracing (mTrac)—a health system strengthening tool using text messaging. Data reported via text through mTrac are immediately made available within DHIS 2 for further analysis. A parallel system entails submitting hard copies of the tally sheets to the facility HMIS focal person. He or she prepares a monthly report and submits it to the district HMIS officer by the seventh of the following month for compilation and entry in DHIS 2. Monthly reports contain detailed health information from all health facilities. The district HMIS office submits all reports electronically to the MOH Resource Centre by the twenty-eighth of the following month. The MOH Resource Center disaggregates data by district, health center, and type of health facility (i.e., private or public). A records assistant from Hoima reported:

> *We used even to take it on the weekly basis but right now we no longer report on the weekly basis because we are provided with the mTrac system. So that one, we can use our phones to send. Now for the weekly report, we send using [the] mTrac system using Internet on our phones.*

Standardized and convenient data transmission procedures are used. Personnel involved in data transmission are trained in reporting procedures. Furthermore, the online reporting form makes it easy to catch mistakes. The process has been simplified with the mTrac system enabling mobile phone users to send data for weekly reports. Health facility in-charges are advised to allow records personnel to submit data directly to the district since they must receive feedback from the district on their submissions. Data in the national database can be easily retrieved and used for decision making.

Feedback at the various levels is both bottom-up and top-down. Districts provide supportive supervision to health facilities and advise staff on areas for improvement. District teams help health facilities address challenges and facilitate a process in which the worst-performing health facilities can learn from the best-performing ones. The DHIS and IPs communicate concerns about data accuracy and reporting time.

Reports are graded and marks displayed, which is a motivator for better performance. IPs also give feedback and suggest recommendations for improvement. This was particularly the case in Jinja District. IPs regularly share information with relevant district staff. The MOH gives feedback to districts on the quality of reports, data cleaning issues, reporting rates, timeliness, system issues, and performance. Coaching visits are conducted, in which district personnel coach and obtain feedback from health facility personnel, and vice versa. Performance review meetings, conducted quarterly at the national level, also provide feedback.

Best Practices for an Integrated HMIS

Integrated Reporting System

Uganda's HMIS is an integrated reporting system containing all relevant health information, including FP, in one place. Consequently, there is one set of forms and no duplication of reporting. This reduces the workload of records assistants (who previously had to fill out several forms), lessens compilation errors, and improves the consistency of the reporting system.

Routine Performance Reviews

Performance review meetings are conducted routinely to ensure that collection and reporting of HMIS data is in line with HMIS data collection and reporting procedures. During performance review meetings, district HMIS focal persons and health management team members review the performance of each health facility. They then request staff from facilities that are performing well in terms of timely reporting to share with other facilities to facilitate adoption of good practices. Similarly, staff from facilities that are not performing well are requested to share their experiences, why their performance is not up to standard, and how they can be assisted. One stakeholder from Jinja District explained:

> *There is what we call performance review meetings. We normally do it quarterly and we call it quarterly review meetings sometimes but due to lack of money or facilitation, we do it once. We look at how facilities have performed in different areas. Sometimes we spot out the best-performing facilities and the worst-performing facilities and we look at how the best ones have been managed and then we look at the worst-performing ones and what has caused them not to perform so that they tell us because of: say, "It is hard to reach," "We are at the island so getting there," "The boat got a problem and we took two weeks." We share that in review meetings.*

Compliance Enforcement

All health facilities (i.e., private and public) are required to submit HMIS reports to the district HMIS office. For private facilities that are not reporting consistently or fail to report, a condition stipulates that prior to the renewal of their health facility license, they must submit all missing reports to the HMIS district office. For public health facilities, when submission of HMIS reports from any one district is delayed, the records assistant receives follow-up phone calls from the district HMIS focal person asking him or her to explain the delay. At the end of the year, penalties are imposed upon districts with very poor performance.

Stakeholder Engagement in the HMIS Forms Design and Review

Every five years, the MOH invites all HMIS stakeholders (e.g., UNFPA, PACE, MSU) and health unit staff (e.g., biostatisticians, records assistants) to a meeting to provide input on improving the HMIS forms. One national-level informant described:

> *We sit with partners and other stakeholders to harmonize the forms. If they accept, then they go through the management levels and finally get approved.*

Collaboration between the MOH and IPs

Although the MOH oversees HMIS implementation within the districts, it works in close collaboration with IPs that support HMIS work through capacity building, training, service delivery, supervision, and commodity provision. Such IPs include USAID, CDC, WHO, UNICEF, Marie Stopes, PACE, and IDI. Companies, such as MTN, support the HMIS by providing free data bundles to HMIS staff. This facilitates communication and results in faster access to MOH websites and improved use of DHIS 2 software. According to a national-level information officer and a records officer, respectively:

> *These partnerships have somehow "made life easy." It is easy to address challenges, there is improvement in timelines in reporting, [and] IPs also offer financial support.*

> *I receive supervisory visits from USAID, PACE, and IDI staff often, though at different times. I also receive monthly visits from the district HMIS focal person. The Ministry of Health, in collaboration with the district, does carry out irregular visits like thrice in a year.*

Barriers to HMIS Performance from Integrated Data Sources

Technical Factors

The complexity of the HMIS reporting form and procedures is a challenge. Respondents noted that the reporting form is too long (i.e., many pages and indicators) and lacks adequate space to fill in data. Some codes used for FP data on the form are not available in Ugandan health facilities. There is also no reference on the form specifying exactly what the codes mean (**Appendix E**). Furthermore, some of the pages on the form do not pertain to lower-level facilities. A district level informant intimated:

> *The reporting form is not user-friendly. It has many pages with lots of information required. This makes it hectic, so often times, staff submit incomplete and inaccurate forms.*

Records persons are sometimes asked to collect and enter information that is not on the printed form, and reporting is not as user-friendly as it is purported to be. This leads to submission of incomplete and inaccurate forms. The volume of the tool and manual is huge, which is a disincentive to staff.

The reporting forms and platforms have not been standardized. The paper-based HMIS form for FP is not harmonized with other reporting forms and the online reporting system. Some of the data captured on the paper-based HMIS forms are not incorporated in the online DHIS 2 and thus are not used.

Although regular revision of forms is a good practice, it takes time for records personnel to become familiar with the revised forms. Three versions of the FP form were designated for different levels of health facilities. The implication is that if a facility uses an older version of the tool, some information is missed or not filled in.

Although two-step data entry could have value with respect to quality control, double entry of HMIS data makes the procedures strenuous. Records assistants are required to fill out hard copies of the forms that are later submitted to the district biostatistician for entry in DHIS 2. It would take less time if data were entered directly in the system and thereafter verified by the biostatistician or HMIS focal person. Some of these records officers reported that they were trained in information systems and can handle the online system.

Besides using a lengthy form, which requires time to fill and submit, some health facility personnel found the DHIS 2 software slow in generating reports. The form usually does not upload when there are missing data.

Despite the availability of computers at the district level, some lower-level facilities at the sub-district level still lack computers. This presents a challenge for data entry and verification. The lack of computers increases the workload of the district biostatistician and HMIS focal person. Most facilities use traditional client registers to extract data and populate the HMIS reporting forms, which are later submitted to the district HMIS focal person. At the district level, most of the computers have old versions of computer software, lack antivirus protection, and are poorly maintained.

There are problems with Internet connectivity, which delays the transmission of data to the MOH HMIS dashboard. Similarly, inconsistent power supply at the district level delays data transmission to the MOH servers. Not all facility- or district-level staff have access to the MOH dashboard. Sometimes people who have access to the system and dashboard (e.g., IPs, district officers) are busy and cannot give information when it is required.

Organizational Factors

Staffing for the HMIS is inadequate. A senior biostatistician from the MOH reported that only five of the 15 national-level staff are available to supervise the HMIS. This is a limited number given the workload and the effort needed for effective implementation of the system. At the district level, the biostatistician is expected to capture data from all health facilities in the HMIS and perform data assessment, analysis, and validation. This heavy workload affects the timeliness, completeness, and quality of the district reports. In some health facilities, only one nurse provides FP services. With limited human resources, this leads to late and under-reporting of FP data. One district-level informant said:

> *I am one person in this office who enters reports from all those facilities into the system, who does data assessment, who analyzes, validates, and everything.*

Public facilities usually have fewer staff. Therefore, staff on duty may not record FP services because of the heavy workload. Private facilities, on the other hand, may be required to report to other agencies in addition to the mandatory reporting at the district for the MOH, leading to reporting fatigue.

Constant training on the HMIS is required due to high staff turnover or attrition, especially in private facilities. A key informant from Hoima District reported that staff in private facilities frequently leave for better opportunities, resulting in recruitment of unqualified and inexperienced personnel to handle HMIS data. This creates the need to recruit and retrain new records personnel for such facilities, which is both costly and time-consuming. This was confirmed by a national-level key informant:

> *Less than 50 percent of the staff at district level (up to the facility) were trained in HMIS.*

When forms are revised, not everyone is trained on the changes. Some records assistants neither received adequate training nor refresher training. One district-level informant added:

> *I have never heard of nurses and midwives going for refresher training on family planning data in the HMIS.*

Lack of training negatively affects data quality in terms of accuracy and completeness at the district level, because those responsible must learn on the job. According to a district-level informant:

> *There are issues of accuracy and incompleteness of data, particularly among some private health facilities whose records assistants did not receive adequate training.*

Several health facilities were reported to have stockouts of HMIS forms and stationery, which affects reporting. Sometimes stationery is not provided in time and districts have no budget for printing and photocopying for the facilities. Jinja District reportedly went without in-patient registers for a couple of years, and many facilities (both public and private) do not have FP registers. This leads to compilation of

incomplete FP data since some records are not written down when services are provided to clients. A records officer from a public health facility reported:

> *Sometimes we have stockouts of HMIS forms which affect our reporting. The procedure is that we request the districts. Unfortunately, when contacted, we are usually advised to make photocopies without provision of money from the district.*

Registration and coding of facilities by the MOH takes a long time. The district usually monitors and assesses a health facility before incorporating it in the HMIS despite commitments from IPs such as PACE. This contributes to incompleteness of data because the system is not covering all health facilities in a district.

There is lack of support for FP data from management in some religious health facilities. For example, some Catholic health facilities do not provide FP services and therefore leave the FP section blank, which is recorded as incomplete.

Behavioral Factors

There is a general lack of interest in and demand for FP data on the part of IPs. Limited attention is given to FP data at the health facility level. This affects data quality and information use.

Heavy workloads, especially in private health facilities, have the potential to compromise data quality. Sometimes staff at private health facilities do not try to capture information correctly. At such facilities, there are no designated records staff. Health workers, already burdened with heavy workloads, are also responsible for record keeping, which frequently is not prioritized. Opportunities for checking data quality is limited. Some facility-level records persons reported being under pressure to submit the pre-filled forms, yet they usually have more pressure for other data from supporting partners (i.e., donors).

Process-Related Factors

There are challenges in collecting data on FP services provided by village health teams. FP services provided by village health teams during community outreaches are not always recorded by health facilities. In addition, some records assistants have difficulty interpreting the FP codes that are found in the HMIS forms, leading to submission of incorrect data or information. One national-level informant reiterated:

> *A case in point are entries related to condoms. So, one is required to fill in a number. However, the question is whether they are referring to packets or number of individual condoms taken by a person. So, the response expected is not clear and these data remain vague. Some records assistants focus on other indicators compared to FP, so they often have no statistics in the respective entries.*

With respect to completeness of information, informants noted that overall, reporting is around 87 percent for public and private facilities together. However, it is higher in public facilities than private facilities because public health facilities do not expect any penalty resulting from late reporting. The delays are sometimes caused by lack of resources for transporting the paper-based forms to the district office, or by misplacement by the relevant district staff.

Too many reports are required by the MOH, leading to heavy workloads for the HMIS focal person and the district biostatistician. IPs also have too many data demands but are given priority at the district level since they support district programs.

DISCUSSION

Facilitators of HMIS

Technical facilitators of the integration of FP data from public and private facilities in the national and district HMIS included the following: the integrated HMIS (integration of FP in HMIS forms applied to both private and public health facilities), user-friendly software (DHIS 2), web-based reporting, government support for FP, availability of resources such as computers, and stakeholder engagement in HMIS design. Organizational facilitators included prioritization of FP data, enforcement of "re-licensing" to the private sector, HMIS staff training, supportive supervision, and quarterly performance review meetings. Key behavioral facilitators included HMIS staff motivation and competence.

In Uganda, the national and district HMIS are integrated with FP and RH data entered in the same system (DHIS 2). The integrated web-based reporting system addresses challenges presented by parallel systems, one of which is fragmentation of data (Braa, Hanseth, Heywood, Mohammed, & Shaw, 2007). In addition, the integration of data from both private and public hospitals has led to improved health outcomes through the monitoring of health service coverage. However, to achieve full integration, provision of adequate information technology (IT) infrastructure, ranging from first-level health facilities to national referral hospitals, should be rolled out (Karara, Verbeke, & Nyssen, 2015).

The HMIS software was reported to be user-friendly by national stakeholders at the MOH. DHIS 2 is efficient and provides a web-based reporting platform. Several studies reported that user-friendly software improves data collection, transmission, and quality (Ahuja, et al., 2016; Aqil, et al., 2009; Ishijima, et al., 2015; Ojo & Popoola, 2015). On the other hand, HMIS staff at lower levels (i.e., district and health facilities) found online reporting to be problematic. During the peak time for submitting reports, the DHIS 2 platform tends to slow down as several users congest the web traffic. In addition, with errors and missing data, reports are inaccurate and unreliable. This experience becomes challenging for the users (Ahuja, et al., 2016; Aqil, et al., 2009; Ishijima, et al., 2015; Kiberu, et al., 2014; Ojo & Popoola, 2015).

Engaging different stakeholders in HMIS planning and design is essential for its success. Every five years, the MOH invites all HMIS stakeholders, including IPs and health unit staff, to provide input on improving the HMIS forms. This has increased ownership of the HMIS forms among IPs. A study in Ghana and South Africa highlighted the relevance of consultations with different stakeholders in the success of national HMIS (Ahuja, et al., 2016). Study findings revealed that collaborative networks are essential for improved performance and sustainability of HMIS (Braa, et al., 2007).

While our findings show that efforts are made to involve stakeholders in the design of the system and the tools (Mutemwa, 2006), there appears to be a gap between how the adaptation of the tools and processes is perceived at the national level and how the HMIS is perceived at sub-national levels, where some relevant staff find the system challenging.

The success of FP programs and the HMIS must involve collaboration between the public and private sectors (Mukaba, Binanga, Fohl, & Bertrand, 2015). Our findings show collaborative efforts between government, nongovernmental, and faith-based organizations supporting HMIS and FP service delivery (Kayembe, et al., 2015; Mukaba, et al., 2015).

Concerning FP, the availability of contraceptives is an incentive for health workers to support demand creation. Interventions addressing FP could therefore be instrumental in improving FP data generation. For example, where the "Friends of Children's Hospital Association" Project operates in Jinja, FP data have improved.

Our findings are consistent with the literature demonstrating that on-the-job training, with respect to Uganda's HMIS, improves performance through timely and increased reporting of key health indicators (Kiberu, et al., 2014). A similar study in Uganda examining the effectiveness of the PRISM tool found it to be user-friendly, reliable, and valid. The study further demonstrated that the PRISM methodology can be used effectively by routine health management information system (RHIS) (Hotchkiss, et al., 2010).

Barriers of HMIS in Uganda

Key technical barriers included limited supply of computers at lower-level health facilities, complex HMIS forms, double entry of HMIS data, and web-reporting challenges. Among the organizational barriers were limited HMIS human resources, high records of staff attrition in private facilities, limited training, poor culture of information, and stockouts of paper-based HMIS forms. The key behavioral challenge was the low motivation of healthcare providers to collect FP data.

This study reported complex HMIS forms, double entry of HMIS data, and web-reporting challenges as the most critical technical challenges. The HMIS tool was found to be long. Not all the FP data codes reflected the commodities available on the market. There was no place to indicate if the FP client was male or female, which is critical for programs working to address male engagement in FP. Double entry of HMIS data on the online DHIS 2 platform and paper-based versions was a demotivating factor to health personnel who have limited time for data entry (Jawhari, et al., 2016; A. S. Nyamtema, 2010a; Verbeke, et al., 2015).

Our findings indicate that FP data from the HMIS are not utilized at health facilities. Priority is given to data collection and reporting to the national level. Additionally, despite efforts aimed at standardization and training of staff, the culture of data collection at sub-national levels is yet to take root. Several studies have reported a poor culture of information sharing and use related to HMIS data (Mutemwa, 2006), especially at facility and district levels. This is attributed to heavy workloads, as service providers double as record officers and analysis usually takes place at a higher level, where data collectors lack access.

The importance of the various categories of data collected under FP needs to be explained to data collectors. When data quality is poor, the generated data are not trusted and therefore can be neglected or inadequately used where symbolic rather than functional use applies (Mutemwa, 2006). A study in Tanzania reported a similar finding in which HMIS data are not used at the health facility level (Wilms, et al., 2014). Successful HMIS tend to be action-led where collected data are used to inform local decision making before being reported to the national level. Our findings show that use of data for planning by district and facility staff is limited (Braa, et al., 2007).

Although reviewing FP data collection forms is beneficial, it should also include removing reporting requirements for contraceptive commodities and services that are not applicable in the national context or at various facility levels. It is important to ensure that systems collect essential rather than "nice-to-know" information (Braa, et al., 2007).

Our study found human resource constraints regarding HMIS implementation. The major human resource problem is more pronounced in the private for-profit health facilities, where in some cases records officers are not hired or attrition is high (Mutemwa, 2006). Similar challenges have been reported in Tanzania (Wilms, et al., 2014). Although national stakeholders are generally satisfied with the tools and reporting process, facility- and district-level staff report heavy staff workloads (A. S. Nyamtema, 2010a). HMIS is a laborious and prolonged reporting system (Angelo S. Nyamtema, 2010b) that involves both double counting and exclusion of data.

Study Limitations

The KIIs and MSD workshop were based on a small and purposive sample. As a result, the informants' views may not be representative of all HMIS officers and users in Uganda. Finally, there was limited literature on HMIS and FP, in Uganda specifically and in SSA in general.

Strengths of the Study

This study provides important preliminary insights into many factors that shape the HMIS FP data integration process in Uganda. In addition, we interviewed different HMIS stakeholders, including those from the MOH, UNFPA, NGOs, and public and private health facilities within purposively selected DHIS 2 implementing districts. Varied perceptions were explored. A further strength in this study was triangulation of methods using the novel MSD workshop to validate the findings of the key informants.

RECOMMENDATIONS

Based on the barriers discussed and respondents' perceptions of the HMIS, we developed the following recommendations:

The HMIS forms should be reviewed regularly and tailored to the Ugandan context so they are easier to understand, correspond with the available FP commodities on the market, and are designed according to the FP services provided at the health-facility level. The HMIS forms should include all FP methods provided by the health facilities and other NGO providers. Similarly, methods that are not provided in the country should be excluded from the HMIS forms. All the required information for decision making at the health-facility level should be included in the forms to minimize missing or under-reported data. Key stakeholders should be included in reviewing the HMIS forms to address emerging interests and areas needing correction.

Data collection forms should provide more clarity on the FP codes used to collect HMIS data. During trainings, emphasis should be placed on ensuring service providers have a sound understating of the codes.

Feedback should be provided to HMIS program designers to address missing data. This should be done to reconcile data collected on paper-based forms with data in the online HMIS forms. A review in Malawi concluded that one of the three core recommendations for improving HMIS is strengthening data collection tools (Monawe, et al., 2015).

The MOH HMIS department should ensure availability of forms at the district level. This includes creating a budget to produce copies of forms for all public and licensed private facilities. Supervision and monitoring efforts at the district and facility levels should include extra copies of the forms. Furthermore, the districts should ensure that all health facilities (including private ones) use HMIS forms. In addition to hard copies, soft copies of the HMIS forms in easily downloadable formats should be made available on the MOH website for public- and private-sector program personnel to download or use.

For ease of data capturing, it may be necessary to extend the computer-based system to the lowest-level health facilities (Karara, et al., 2015). A computerized HMIS would facilitate analysis of data and would also address issues of double entry (paper-based and online). Development partners should be encouraged to support the HMIS program, by providing computers to all eligible health facilities. Servicing of computers and replacements, where needed, is essential.

Strategies to recruit required MRO staff at the national level and at private for-profit facilities should be devised to address the heavy workloads resulting from inadequate staffing. Approaches for motivating and incentivizing staff should be devised if staff are to perform well.

To address the lack of uniformity in staff training across the country, districts such as Jinja with less coverage should be specifically targeted for initial and refresher training. The private sector should equally benefit from the training. In addition, continuous on-the-job training of health staff in all cadres is essential to enhance performance of the HMIS, particularly when there are revisions to the HMIS forms. The MOH should train more staff in addition to the records assistants and in-charges at both public and private health facilities. Pre-service trainings should integrate HMIS concepts well (Wilms, et al., 2014), and HMIS should be included in the curriculum (A. S. Nyamtema, 2010a). Persons involved in data collection at the community level (e.g., village health teams), as well as nonclinical facility-based staff, should be thoroughly trained on the data collection forms, especially for public health facilities (Wilms, et al., 2014).

Trainings should aim to improve technical skills, such as IT skills (Bagayoko, et al., 2010; Kiwanuka, et al., 2015; Mutale, et al., 2013) and comprehensively address HMIS processes (Shiferaw, et al., 2017). The Government of Uganda should consider reviewing the training curriculum for health professionals to integrate IT skills, as was suggested and implemented in Nigeria (Makinde et al., 2016). These efforts will build the health human resources capacity and, therefore, data quality (Monawe et al., 2015). HMIS centers of excellence, partnerships, and collaborations can be formed to deliver such trainings (Were, et al., 2015). Such innovations will train clinical and nonclinical staff who will appreciate the need for quality FP and HMIS data.

Motivation, mentorship, and supervision strategies should be devised to ensure that the records personnel, including staff at private facilities, appreciate the need for accurate, adequate, conclusive, and timely FP data in the district and national HMIS. Including the private health sector has been recommended in Uganda (Kiberu, et al., 2014; Kiwanuka, et al., 2015).

For better FP data quality and motivation, FP stakeholders should participate in supervisory visits to health facilities. This would help generate interest in FP data for programming purposes by taking advantage of the diversity of FP stakeholders through the consortium of FP organizations. In particular, key FP stakeholders like the RH department in the MOH, UNFPA, RHU, Uganda Health Marketing Group (UHMG), and MSU should take the lead not only in providing guidance and support to the sector but also in encouraging data demand and use by other stakeholders. Coaching visits to data and records officers at level-four health centers, including the in-charges, are critical. In addition, it is important to encourage the in-charges to take interest in the data.

The Government of Uganda, through the MOH, should ensure both the provision of a wide range of FP commodities at all levels and the training of staff to provide all methods so that they can ably support the units and track FP data inclusion in the district and national HMIS.

Delays in submitting forms to the districts could be addressed by improving IT hardware, software, and Internet connectivity (Kiberu, et al., 2014).

Access to the MOH system should be managed well, to avoid making changes that may affect data quality, but should also be broadened to allow wider use.

There is a need for more efforts to promote a culture of information use and sharing among health facilities, especially at the lower levels. A Ugandan study alluded to this need (Hotchkiss, et al., 2010). Regular data-use workshops have been identified as one of the best ways to promote HMIS data use (Braa, et al., 2012). HMIS personnel should be sensitized about the importance of the FP data generated and should be monitored for compliance with recommendations from the district and higher levels.

CONCLUSION

Family planning data collection and reporting is integrated in Uganda's district and national HMIS. However, limited priority and attention is given to FP data collection at both the health facility and national levels. Even when the data have been collected, they are not utilized by the health facilities that have collected it. Similarly, HMIS web reporting seems to be a user-friendly system, as reported by national-level stakeholders. Stakeholders at the national level (i.e., MOH staff), and even district officers, were impressed by Uganda's HMIS. However, the users of the system at lower levels, such as MROs, reported experiencing technical challenges (e.g., lack of access to functional computers, slow report generation, Internet connectivity problems).

Based on the barriers discussed and respondents' perceptions, we recommend reviewing and strengthening HMIS data collection forms and FP commodities with all HMIS stakeholders engaged. The Government of Uganda should ensure that HMIS forms are available at health facilities and that all staff involved in HMIS data reporting are trained, so that they can ably support the units and track FP data inclusion. In addition, it is important to encourage HMIS staff and health facility in-charges to have interest in the FP data.

REFERENCES

Adeleke, I. T., Lawal, A. H., Adio, R. A., & Adebisi, A. A. (2015). Information technology skills and training needs of health information management professionals in Nigeria: A nationwide study. *Health Information Management Journal, 44*(1), 30–38. Retrieved from http://journals.sagepub.com/doi/abs/10.1177/183335831504400104?journalCode=himd

Ahuja, S., Mirzoev, T., Lund, C., Ofori-Atta, A., Skeen, S., & Kufuor, A. (2016). Key influences in the design and implementation of mental health information systems in Ghana and South Africa. *Global Mental Health (Cambridge), 3*, e11. Retrieved from https://www.cambridge.org/core/journals/global-mental-health/article/key-influences-in-the-design-and-implementation-of-mental-health-information-systems-in-ghana-and-south-africa/DD11E388FB2FFE1E2E7C9D9DF2885E99

Aqil, A., Lippeveld, T., & Hozumi, D. (2009). PRISM framework: A paradigm shift for designing, strengthening and evaluating routine health information systems. *Health Policy Planning, 24*(3), 217–228. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2670976/

Asangansi, I., & Braa, K. (2010). The emergence of mobile-supported national health information systems in developing countries. *Studies in Health Technology and Informatics, 160*, 540–544. Retrieved from https://www.researchgate.net/publication/46273479_The_emergence_of_mobile-supported_national_health_information_systems_in_developing_countries

Ashraf, S., Moore, C., Gupta, V., Chowdhury, A., Azad, A. K., Singh, N., . . . Labrique, A. B. (2015). Overview of a multi-stakeholder dialogue around Shared Services for Health: The Digital Health Opportunity in Bangladesh. *Health Research Policy and Systems, 13*(1), 74. Retrieved from https://health-policy-systems.biomedcentral.com/articles/10.1186/s12961-015-0063-2

Bagayoko, C. O., Dufour, J. C., Chaacho, S., Bouhaddou, O., & Fieschi, M. (2010). Open source challenges for hospital information system (HIS) in developing countries: A pilot project in Mali. *BMC Medical Informatics and Decision Making, 10*(1). Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-10-22

Braa, J., Hanseth, O., Heywood, A., Mohammed, W., & Shaw, V. (2007). Developing health information systems in developing countries: the flexible standards strategy. *MIS Quarterly*, 381–402. Retrieved from http://aisel.aisnet.org/misq/vol31/iss2/9/

Braa, J., Heywood, A., & Sahay, S. (2012). Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania. *Améliorer la qualité et l'utilisation des données grâce aux ateliers d'utilisation de données : l'expérience du Zanzibar., 90*(5), 379sa–384. Retrieved from http://www.who.int/bulletin/volumes/90/5/11-099580.pdf

Braa, J., Monteiro, E., & Sahay, S. (2004). Networks of action: Sustainable health information systems across developing countries. *MIS Quarterly*, 337–362. Retrieved from http://www.idi.ntnu.no/~ericm/misq.pdf

Chiba, Y., Oguttu, M. A., & Nakayama, T. (2012). Quantitative and qualitative verification of data quality in the childbirth registers of two rural district hospitals in Western Kenya. *Midwifery, 28*(3), 329–339. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21684639

DHS Program. (2017). STATCompiler: The DHS Program. Retrieved 15 Sep, 2017, from http://www.statcompiler.com/en/

Driessen, J., Settle, D., Potenziani, D., Tulenko, K., Twaha, K., & Wadembere, I. (2015). Understanding and valuing the broader health system benefits of Uganda's national Human Resources for Health Information System investment. *13*, 1–9. Retrieved from https://human-resources-health.biomedcentral.com/articles/10.1186/s12960-015-0036-0

Hotchkiss, D. R., Aqil, A., Lippeveld, T., & Mukooyo, E. (2010). Evaluation of the Performance of Routine Information System Management (PRISM) framework: Evidence from Uganda. *BMC Health Services Research, 10*, 188. Retrieved from https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-10-188

Ishijima, H., Mapunda, M., Mndeme, M., Sukums, F., & Mlay, V. S. (2015). Challenges and opportunities for effective adoption of HRH information systems in developing countries: National rollout of HRHIS and TIIS in Tanzania. *Human Resources for Health, 13*(1). Retrieved from https://human-resources-health.biomedcentral.com/articles/10.1186/s12960-015-0043-1

Jawhari, B., Keenan, L., Zakus, D., Ludwick, D., Isaac, A., Saleh, A., & Hayward, R. (2016). Barriers and facilitators to Electronic Medical Record (EMR) use in an urban slum. *International Journal of Medical Informatics, 94*, 246–254. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27573333

Karara, G., Verbeke, F., & Nyssen, M. (2015). The Role of Hospital Information Systems in Universal Health Coverage Monitoring in Rwanda. *Stud Health Technology and Informatics, 216*, 193–197. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26262037

Kayembe, P., Babazadeh, S., Dikamba, N., Akilimali, P., Hernandez, J., Binanga, A., & Bertrand, J. T. (2015). Family Planning Supply Environment in Kinshasa, DRC: Survey Findings and Their Value in Advancing Family Planning Programming. *Global Health: Science and Practice, 3*(4), 630–645. Retrieved from http://www.ghspjournal.org/content/3/4/630?utm_source=TrendMD&utm_medium=cpc&utm_campaign=Global_Health%253A_Science_and_Practice_TrendMD_0

Kiberu, V. M., Matovu, J. K., Makumbi, F., Kyozira, C., Mukooyo, E., & Wanyenze, R. K. (2014). Strengthening district-based health reporting through the district health management information software system: the Ugandan experience. *BMC Medical Informatics & Decision Making, 14*(1), 1–17. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-14-40

Kihuba, E., Gheorghe, A., Bozzani, F., English, M., & Griffiths, U. K. (2016). Opportunities and challenges for implementing cost accounting systems in the Kenyan health system. *Global Health Action, 9*(1), 30621. Retrieved from http://www.tandfonline.com/doi/full/10.3402/gha.v9.30621

Kintu, P., Nayunja, M., Nzabanita, A., & Magoola, R. (2004). Development of HMIS in Least Developed Country Settings: the Case for Uganda. *Development of HMIS in Least Developed Country Settings: the Case for Uganda/AHIMA, American Health Information Management Association.* Retrieved 02 February 2018, from http://library.ahima.org/doc?oid=58653#.WnPcoKiWbIU

Kiwanuka, A., Kimaro, H. C., & Senyoni, W. (2015). Analysis of the acceptance process of district health information systems (DHIS) for vertical health programmes: A case study of TB, HIV/aids and malaria programmes in Tanzania. *Electronic Journal of Information Systems in Developing Countries, 70*(1), 1–14. Retrieved from http://onlinelibrary.wiley.com/doi/10.1002/j.1681-4835.2015.tb00508.x/abstract

Macharia, J., & Maroa, C. (2014). *Health management information systems (HMIS) implementation characteristics that influence the quality of healthcare in private hospitals in kenya.* Paper presented at the 2014 IST-Africa Conference and Exhibition, IST-Africa 2014. Retrieved from https://www.researchgate.net/publication/271457886_Health_management_information_systems_HMIS_implementation_characteristics_that_influence_the_quality_of_healthcare_in_private_hospitals_in_kenya

Makinde, O. A., Mami, M. I., Oweghoro, B. M., Oyediran, K. A., & Mullen, S. (2016). Investing in health information management: The right people, in the right place, at the right time. *Health Information Management Journal, 45*(2), 90–96. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27105478

Maokola, W., Willey, B. A., Shirima, K., Chemba, M., Armstrong Schellenberg, J. R., Mshinda, H., . . . Schellenberg, D. (2011). Enhancing the routine health information system in rural southern Tanzania: successes, challenges and lessons learned. *Tropical Medicine and International Health, 16*(6), 721–730. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/j.1365-3156.2011.02751.x/abstract

Mbonye, M. K., Burnett, S. M., Colebunders, R., Naikoba, S., Van Geertruyden, J.-P., Weaver, M. R., & Ronald, A. (2014). Disease diagnosis in primary care in Uganda. *BMC Family Practice, 15*(1), 165. Retrieved from https://bmcfampract.biomedcentral.com/articles/10.1186/1471-2296-15-165

MOH. (2010). Health Management Information System: District/HSD Procedure Manual. Kampala, Uganda: Ministry of Health.

MOH. (2014). *The Health Management Information System Volume 1 Health Unit and Community Procedure Manual 2014*. Kampala, Uganda: Ministry of Health Retrieved from http://library.health.go.ug/publications/health-information-systems/hmis/health-management-information-system-volume-1-health.

Monawe, M., Chawani, M. G., Kapokosa, G., & Moyo, C. (2015). *Strengthening Health Management Information Systems in Malawi: Gaps and opportunities.* Paper presented at the 2015 IST-Africa Conference, IST-Africa 2015.

Mukaba, T., Binanga, A., Fohl, S., & Bertrand, J. T. (2015). Family Planning Policy Environment in the Democratic Republic of the Congo: Levers of Positive Change and Prospects for Sustainability. *Global Health: Science and Practice, 3*(2), 163–173. Retrieved from http://www.ghspjournal.org/content/3/2/163

Mutale, W., Chintu, N., Amoroso, C., Awoonor-Williams, K., Phillips, J., Baynes, C., . . . Sherr, K. (2013). Improving health information systems for decision making across five sub-Saharan African countries: Implementation strategies from the African Health Initiative. *BMC Health Services Research, 13 Suppl 2*, S9. Retrieved from https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-13-S2-S9

Mutemwa, R. I. (2006). HMIS and decision-making in Zambia: Re-thinking information solutions for district health management in decentralized health systems. *Health Policy Planning, 21*(1), 40–52. Retrieved from https://academic.oup.com/heapol/article/21/1/40/746919

Ndabarora, E., Chipps, J. A., & Uys, L. (2013). Systematic review of health data quality management and best practices at community and district levels in LMIC. *Information Development, 30*(2), 103–120. Retrieved from http://journals.sagepub.com/doi/abs/10.1177/0266666913477430

Nyamtema, A. S. (2010a). Bridging the gaps in the Health Management Information System in the context of a changing health sector. *BMC Med Informatics and Decision Making, 10*, 36. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-10-36

Nyamtema, A. S. (2010b). Bridging the gaps in the Health Management Information System in the context of a changing health sector. *BMC Medical Informatics and Decision Making, 10*(1), 36. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/1472-6947-10-36

Ojo, A. I., & Popoola, S. O. (2015). Some correlates of electronic health information management system success in nigerian teaching hospitals. *Biomed Informatics Insights, 7*, 1–9. Retrieved from http://journals.sagepub.com/doi/abs/10.4137/BII.S20229

Sadoughi, F., Kimiafar, K., Ahmadi, M., & Shakeri, M. T. (2013). Determining of factors influencing the success and failure of hospital information system and their evaluation methods: A systematic review. *Iranian Red Crescent Medical Journal, 15*(12), e11716. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/24693386

Seitio-Kgokgwe, O., Gauld, R. D. C., Hill, P. C., & Barnett, P. (2015). Development of the National Health Information Systems in Botswana. *Online Journal of Public Health Information, 7*(2). Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4576446/

Shiferaw, A. M., Zegeye, D. T., Assefa, S., & Yenit, M. K. (2017). Routine health information system utilization and factors associated thereof among health workers at government health institutions in East Gojjam Zone, Northwest Ethiopia. *BMC Medical Informatics & Decision Making, 17*, 1–9. Retrieved from https://bmcmedinformdecismak.biomedcentral.com/articles/10.1186/s12911-017-0509-2

Thompson, A., Castle, E., Lubeck, P., & Makarfi, P. S. (2010). Experience implementing OpenMRS to support maternal and reproductive health in Northern Nigeria. *Studies in Health Technology and Informatics, 160*, 332–336. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20841703

Tilahun, B., & Fritz, F. (2015). Comprehensive evaluation of electronic medical record system use and user satisfaction at five low-resource setting hospitals in ethiopia. *JMIR Medical Informatics, 3*(2), e22. Retrieved from https://medinform.jmir.org/2015/2/e22/

UNICEF. (1993). VIPP: visualisation in participatory programmes: A manual for facilitators and trainers involved in participatory group events. Dhaka: UNICEF, Dhaka, Bangladesh.

Upadhaya, N., Jordans, M. J., Abdulmalik, J., Ahuja, S., Alem, A., Hanlon, C., . . . Gureje, O. (2016). Information systems for mental health in six low and middle income countries: cross country situation analysis. *International Journal of Mental Health Systems, 10*, 60. Retrieved from https://ijmhs.biomedcentral.com/articles/10.1186/s13033-016-0094-2

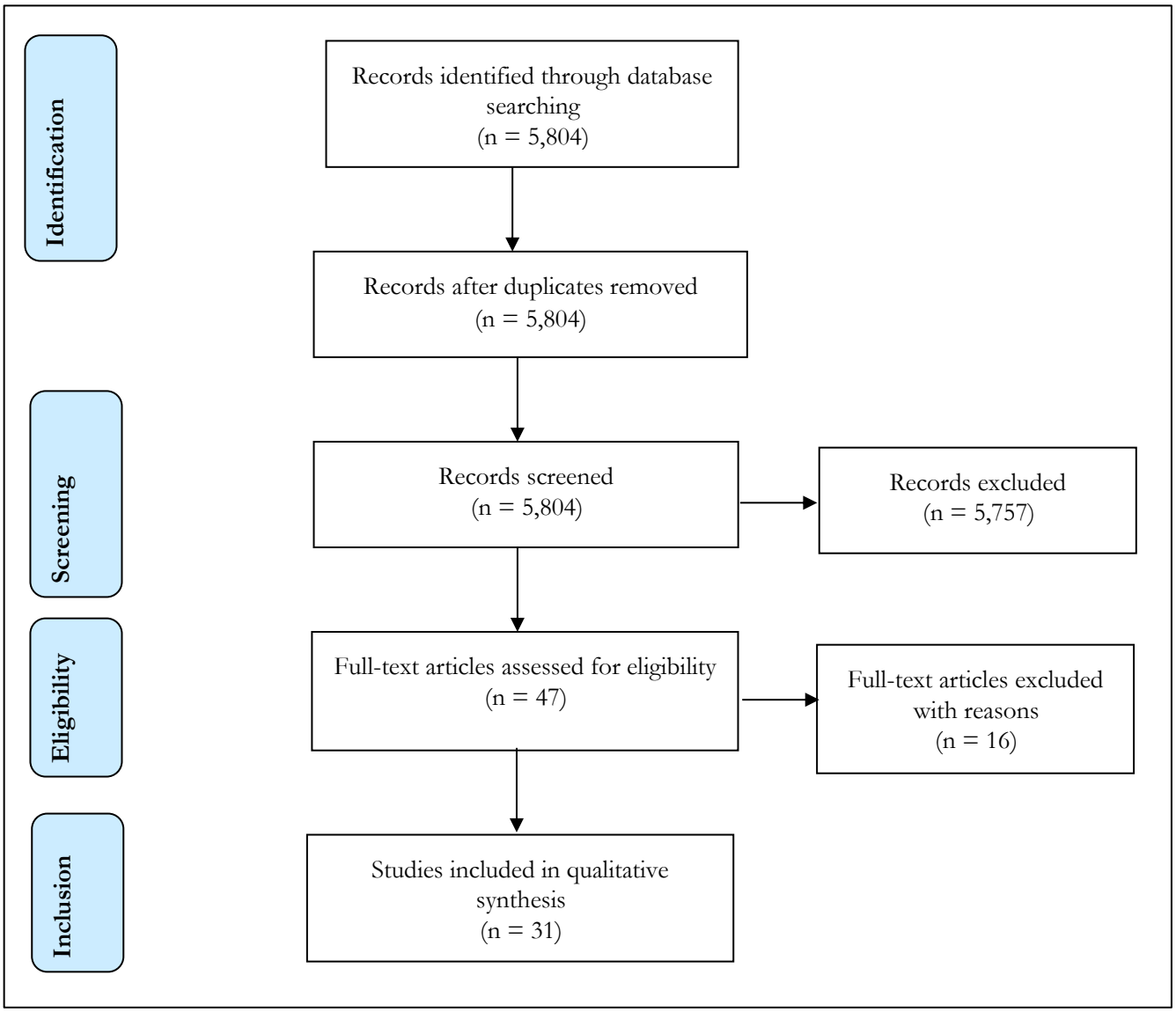
Verbeke, F., Karara, G., & Nyssen, M. (2015) Human Factors Predicting Failure and Success in Hospital Information System Implementations in Sub-Saharan Africa. *Vol. 216. Studies in Health Technology and Informatics* (pp. 482–486). Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26262097

Were, M. C., Siika, A., Ayuo, P. O., Atwoli, L., & Esamai, F. (2015) Building Comprehensive and Sustainable Health Informatics Institutions in Developing Countries: Moi University Experience. *Vol. 216. Studies in Health Technology and Informatics* (pp. 520–524). Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/26262105

Wilms, M. C., Mbembela, O., Prytherch, H., Hellmold, P., & Kuelker, R. (2014). An in-depth, exploratory assessment of the implementation of the National Health Information System at a district level hospital in Tanzania. *BMC Health Services Research, 14*(1), 1–23. Retrieved from https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-14-91

APPENDIX A

PRISMA (2009) Flow Diagram for Barriers, Facilitators, and Best Practices of HMIS in Uganda and Selected Sub-Saharan African Countries



APPENDIX B

KII Guide

Experiences with HMIS

1. What is your experience with or observations about HMIS?
2. What is your experience with or observations about FP information within the HMIS?
3. What is the coverage of HMIS tools at public health facilities?
    a. What about private health facilities?
4. How consistently are the HMIS tools used in health facilities? *(Probe for public versus private.)*
5. Comment on the completeness of information generated from the tools. (*Probe for public versus private.*)
    a. Comment on the completeness of FP information generated from the tools. *(Probe for public versus private).*
6. Compared to other themes within the HMIS tool, what attention is given to FP? How does this affect:
    a. Information collection?
    b. Integration?
    c. Analysis and reporting?
7. What proportion of designated staff has been trained in HMIS data management?
    a. How does this affect the outcome?
8. What proportion of the designated staff exists at facility, district, and national levels?
    a. How does this affect the quality of data generated?

Integration experiences and challenges

9. How are the **data** from public and private health facilities synthesized and integrated for reporting at district and national levels? [*Request for samples of reports that have synthesized and integrated FP information.]*
    a. How are **FP data** from public and private health facilities synthesized and integrated for reporting at district and national levels?
10. What challenges do you experience in **capturing** the FP information? *(Probe for public versus private facilities.)*
11. What challenges do you experience in **integrating** FP data from public versus private facilities?
12. What challenges do you experience in **reporting** FP data from public versus private facilities?

Approaches for integration

13. What are the **best approaches** for integrating FP data from public and private health facilities?
14. Provide examples where integration of public and private FP data has successfully taken place at the:
    a. Facility level
    b. District level
    c. National level
15. In your view, what **facilitated the integration** of public and private FP data?
16. What can **facilitate the integration of FP data** from public and private health facilities?
    a. How should this be done?
    b. Who should take responsibility (for personnel, equipment, finances if necessary)?
    c. How feasible are these approaches?

APPENDIX C

MSD Workshop Guide

1. What **a**re the best practices for the integration of family planning data in the HMIS in Uganda?
2. What are the facilitators of family planning data generation and integration in the HMIS in Uganda?
3. What are the barriers to generation and utilization of family planning data in the HMIS?
4. What are the recommendations for family planning data generation and integration in the HMIS?

APPENDIX D

Systematic Review of Facilitators and Barriers of HMIS in Selected African Countries

Authors	Country	Title	Methods	Barriers of HMIS integration	Facilitators	Best practices	Suggestions to improve
Adeleke, et al. (2015)	Nigeria	Information technology skills and training needs of health information management professionals in Nigeria: a nationwide study	Cross-sectional structured questionnaire to determine the IT skills and training needs of health information management professionals who have leadership roles in the nation's HISs (n=374)	Limited usage because of lack of IT skills and computers			Continuing professional development education, especially in health IT; government intervention in the provision of IT infrastructure in order to put into practice a computerized HIS
Ahuja, et al. (2016)	Ghana and South Africa	Key influences in the design and implementation of mental health information systems in Ghana and South Africa	Intervention research for 5 years; data collected using semi-structured interviews with key stakeholders and reviews of key documents and secondary data from the improved mental health information system		Influences on the design and implementation of mental HIS interventions in Ghana and South Africa related to resources, working approaches (including degree of consultations during the design stage and communication during implementation)	Introducing computerized HMIS perceived as effective in Ghana	HMIS strengthening interventions can consider three policy implications: enhancing consultations during the intervention design, better consideration of implementation challenges during design, and better recognition of relations between different influences

Ansangaansi & Braa (2010)	Nigeria	The emergence of mobile-supported national health information systems in developing countries	Network of action methodology—case study of Nigeria and India	Use-oriented, technical and socio-political challenges; shortage of equipment (e.g., computers, servers) and poor maintenance	Introduction of mobile health technologies—easy to implement	Mobile health technologies—easy to implement with users	Support the development of an "integrated mobile-supported health information infrastructure"
Aqil, et al. (2009)	NA	PRISM framework: a paradigm shift for designing, strengthening and evaluating RHIS	PRISM framework diagram	Technical, organizational, and behavioral factors	Technical, organizational, and behavioral factors		
Asangansi (2016)	Nigeria	Is m-Health disrupting the status quo? Evidence from implementations highlighting network vs. hierarchical institutional logics	Succinct, empirical vignettes from two action-research projects involving the use of m-Health technology to improve data collection for the HMIS in Nigeria	Interaction among the logics leads to a potential conflict in which the logic embedded in networked technologies (e.g. m-Health) disrupts and challenges the existing hierarchical logic in a bureaucracy, like the MOH); it threatens not only to unsettle existing practices and norms in the organization but also to restructure (i.e., flatten) the organization due to resistance, loss, or changes in some pre-existing roles	Mobile technology		Practitioners and implementation researchers need to be sensitive to potential hierarchical and network-centric forces that are involved in implementing m-Health in traditional hierarchical settings, particularly with regards to the unintended side effects that may arise in the process

Bagayoko, et al. (2010)	Mali	Open-source challenges for hospital information system in developing countries: a pilot project in Mali	After reviewing several open-source tools in the field of hospital information systems, Mediboard software was chosen for our study	Cultural and behavioral factors limit adoption of computerized systems (e.g., ego problems that hinder learning, resistance to change)			Improve technical skills (e.g., IT skills)
Braa, et al. (2012)	Tanzania	Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania	Action research		Data-use workshops with data users actively engaged can improve HISs overall and enhance staff capacity to use information, present, and do analysis for decision making		Regular data-use workshops with self-assessment, peer critique, and discussion of the data presented provide a powerful means of building a strong evidence base for HMIS improvements
Chiba, et al. (2012)	Kenya	Quantitative and qualitative verification of data quality in the childbirth registers of two rural district hospitals in Western Kenya	Data categories and instructions were examined qualitatively to assess the relevance, completeness, and accuracy of the data; semi-structured interviews conducted with key informants to capture their views and factors that influence data quality	Influential factors were primarily organizational and technical, which may have had an adverse effect on midwives' record-keeping behavior			Data quality of the registers can be improved by re-examining technical challenges and organizational impediments at different levels; midwives' awareness of data quality needs to be increased by sharing the purpose of the childbirth registers; strong political commitment is also indispensable for putting these findings into action

Driessen, et al. (2015)	Uganda	Understanding and valuing the broader health system benefits of Uganda's national Human Resources for Health Information System investment	Case study design—Uganda				Train staff
Dusabe-Richards, et al. (2016)	Ethiopia	Women health extension workers: capacities, opportunities and challenges to use eHealth to strengthen equitable health systems in Southern Ethiopia	Mixed-method baseline data collection using quantitative questionnaires (n=57); purposively sampled qualitative face-to-face semi-structured interviews (n=10) and focus group discussions (n=3)		Mobile technology is user-friendly	Mobile technology; eHealth technology presents a new opportunity for the Ethiopian health system to improve data quality and community health	Empowering health extension workers, supporting them, and responding to the challenges they face will be an important part of ensuring the sustainability and responsiveness of eHealth strategies
Hotchkiss, et al. (2010)	Uganda	Evaluation of the PRISM framework: evidence from Uganda	Facility- and worker-level data collected from 110 health care facilities in 12 districts in Uganda in 2004 and 2007 using records reviews, structured interviews, and self-administered questionnaires				Promotion of a culture of information influences the self-efficacy of RHIS tasks, the competence and motivation of RHIS tasks, and that self-efficacy and the presence of RHIS staff have a direct influence on the use of RHIS information

Ishijima, et al. (2015)	Tanzania	Challenges and opportunities for effective adoption of HRH information systems in developing countries: national rollout of HRHIS and TIIS in Tanzania	Case study design	Inadequate computer skills and unsatisfactory infrastructure for ICT	Using local experts to develop the systems, involving system users to make the system user-friendly, positive attitudes among users, focus on routine work of the system users, and provision of operations and data-utilization trainings	Together with other activities, the rollout process included conducting system operation training and data utilization training for evidence-based planning	
Jawhari, et al. (2016)	Kenya	Barriers and facilitators to electronic medical record (EMR) use in an urban slum	A descriptive qualitative method to explore staff perceptions about a recent open-source EMR deployment in two primary care clinics in Kibera, Nairobi; participants interviewed using open-ended, semi-structured questions; content analysis used when exploring transcribed data	Three major themes—systems, software, and social considerations— with sustainability concerns prevailed. Although participants reported many systems (e.g., power, network, Internet, hardware, interoperability) and software (e.g., data integrity, function confidentiality,) challenges, social factors (e.g., identity management, training, use incentives) appeared the most important impediments to sustainability			Although the promise is great, there are several unique system, software, and social challenges that EMR advocates should address before expecting sustainable EMR use in resource-constrained settings

Kiberu, et al. (2014)	Uganda	Strengthening district-based health reporting through the district HMIS software: the Ugandan experience	Compared data on completeness and timeliness of outpatient and inpatient reporting for the period before (2011/12) and after (2012/13) DHIS 2 was introduced	Implementation challenges included limited access to computers and Internet (34%), inadequate technical support (23%), and limited worker force (18%)	Trainings		Continued onsite support supervision and mentorship and additional system/infrastructure enhancements, including Internet connectivity, are needed to further enhance the performance of DHIS 2
Kihuba, et al. (2016)	Kenya	Opportunities and challenges for implementing cost accounting systems in the Kenyan health system	Review of policy documents, field observations, and semi-structured interviews with key informants in the health sector; adapted human, organization, and technology fit framework to analyze the components and standards of a cost accounting system	Practical challenges in the design of the system, including lack of a framework to guide the costing process, lack of long-term investment, lack of appropriate incentives for ground-level staff, and risk of overburdening the current HMIS	Opportunities for a viable cost accounting system, including a supportive broad policy environment, political will, availability of patients' clinical and resource-use data good implementation experience with EMR systems, and presence of national data-reporting architecture		To facilitate the implementation of cost accounting in the health sector, the design of any proposed system needs to remain simple and attuned to the local context
Kiwanuka, et al. (2015)	Tanzania	Analysis of the acceptance process of DHIS for vertical health programs: a case study of TB, HIV/AIDS and malaria programs in Tanzania	Data were collected through interviews, document review, and observation	Inadequate human resources for HIS, data quality and information flow issues, and existence of separate monitoring and evaluation systems for the vertical health programs	Having a consensus on which vertical health program indicators to include in the DHIS, existence of infrastructure including the RHIS, and support from development partners		Integration or interoperation of DHIS with vertical health program systems, creating a pool of resources for HIS, training, and motivating human resources for HIS

Makinde (2014)	Nigeria	Development of a master health facility list in Nigeria				Unique identifiers are a basic component of any HIS, but poor planning and execution of this key standard can diminish an RHIS' success	
Makinde, et al. (2016)	Nigeria	Investing in health information management: the right people, in the right place, at the right time	Case study	Health information management professionals are responsible for managing patients' health service records and hospital information systems across Nigerien health facilities. Many are unskilled in ICT skills needed for them to play leadership roles in hospital information systems and function effectively; this was traced to a dearth of relevant ICT courses in their academic training curriculum	Training in ICT	Review training curriculum for health professionals to integrate ICT skills	Review training curriculum for health professionals to integrate ICT skills
Maokola, et al (2011)	Tanzania	Enhancing the RHIS in rural southern Tanzania: successes, challenges and lessons learned	Cluster randomized controlled trial, household surveys, community census, facility surveys	Electronic data capture (using PDAs) was successful but did not resolve issues of data complete-ness and accuracy; staffing and logistical problems	Electronic data capture using PDAs	Electronic data capture using PDAs was successful	Use PRISM framework to improve data quality and completeness
Monawe, et al. (2015)	Malawi	Strengthening HMIS in Malawi: gaps and opportunities	Review of existing literature	Still work to be done to improve HMIS in Malawi			Strengthening data collection tools, building human resources for health capacity and data quality

Mutale, et al. (2013)	Ghana, Mozambique, Rwanda, Tanzania, and Zambia	Improving HIS for decision making across five sub-Saharan African countries: implementation strategies from the African Health Initiative		Training alone does not improve data collection and use; ownership of HIS by frontline health workers and managers; filling multiple forms (e.g. 27 registers in Ghana)	Simplified register as data-collection tool in Ghana; standardized data capture with real-time queries and follow-up during monitoring visits in Zambia; facility supervisors; health facility supervisors review feedback in Tanzania; quarterly data quality audits in Rwanda	Simplified register as data-collection tool in Ghana; standardized data capture with real-time queries and follow-up during monitoring visits in Zambia; facility supervisors; health facility supervisors review feedback in Tanzania; and quarterly data quality audits in Rwanda	Engage frontline staff and managers in improving data collection and its use for informing system improvement; in Zambia, train all health workers and supervise closely at the district level; training alone does not improve data collection and use; stakeholder meetings, data reviews, and mentoring do the job better; build HIS in the context of the national HMIS (e.g. mobile technology for EMR in Zambia)
Nnaji, et al. (2010)	Nigeria	The challenges of budgeting in a newly introduced district health system: a case study	A descriptive case study using interviews and focus group discussions of district and local health officers and the district health management team as well as field notes from participant observers and reviews of relevant documents	Capacity for planning is lacking among the district health officers; cross-cutting contextual issues constraining the budget include an inadequate HMIS, a non-functional financial manage-ment system, and an unreliable human resources manage-ment system			Recommend another study

Nyamtema (2010)	Tanzania	Bridging the gaps in the Health Management Information System in the context of a changing health sector	A cross-sectional descriptive study in 11 heath facilities in Kilombero district; semi-structured questionnaire used to interview 43 health workers on their knowledge, attitudes, practices, and factors for change on HMIS; HMIS booklets from these facilities reviewed for completeness	Lack of training for health workers (i.e., clinicians, nurses), inactive supervision, staff workload pressure, and lack of user-friendly HMIS; many booklets and forms to fill with repeating information; poor staff knowledge of HMIS; shortage of healthcare providers; lack of coordination and evaluation; inadequate policies to support a sustainable system			Incorporation of HMIS in ongoing curricula reviews for all cadres of health care providers, development of a more user-friendly system, and use of John Kotter's evidence-based eight-step process for implementing successful changes in this system; 1) create a sense of urgency for change, 2) create a powerful group guiding the change, 3) develop a vision for change 4) communicate the vision and strategy, 5) empower others to act, 6) produce short-term wins, 7) press harder and faster after the first successes, and 8) create a new culture for sustainability
Odit, et al. (2014)	Uganda	Antecedents and dynamics for strategic alignment of HISs in Uganda	296 respondents purposively selected from 39 health facilities across the country to participate in the survey	Health units lack the standards, frameworks, and policies for the strategic alignment of HIS and the funding to support them			Proper planning and training of health workers on the importance of strategic alignment of HIS
Ojo and Popoola (2015)	Nigeria	Some correlates of electronic health information management system success in Nigerian teaching hospitals	Survey research design; study population of 442 health information management personnel in five teaching hospitals		Technical factors (hardware, software, user-friendly system), social factors (knowledge and training among users), organizational factors (top management support), financial factors, and political factors (good policy		

					and government commitment)		
Shiferaw, et al. (2017)	Ethiopia	Routine health information system utilization and factors associated thereof among health workers at government health institutions in East Gojjam Zone, Northwest Ethiopia	Institution-based cross-sectional study conducted at government health institutions of East Gojjam Zone, from April to May 2013; 668 health workers selected from government health institutions using cluster sampling technique	Routine health information utilization for enhancing performance is poor among health workers, especially at the peripheral levels of health facilities	HMIS training, good data analysis skills, supervision, regular feedback, and favorable attitude toward health information utilization were significantly associated with a good level of routine health information utilization among health workers		Comprehensive training, supportive supervision, and regular feedback to improve routine health information utilization among health workers at government health facilities
Thompson, et al. (2010)	Nigeria	Experience implementing OpenMRS to support maternal and RH in Northern Nigeria	Implementation of an EMR system using OpenMRS for the Family Health Unit of the Shehu Idris College in 2009	Harsh computing environment	Open-source software		
Tilahun, et al. (2015)	Ethiopia	Comprehensive evaluation of electronic medical record system use and user satisfaction at five low-resource setting hospitals in Ethiopia	Quantitative, cross-sectional study to assess the usage pattern, user satisfaction level, and determinant factors of an EMR system implemented in Ethiopia	Dissatisfaction caused mainly by poor service quality, the current practice of double documentation (i.e., EMR and paper-based), and partial departmental use of the system in the hospitals			Improve service quality such as power infrastructure, user support, trainings, and more computers in the wards; other departments (especially inter-dependent departments) should then be motivated and supported to use the EMR to avoid the dependency deadlock

Upadhaya, et al. (2016)	Ethiopia, India, Nepal, Nigeria, South Africa, and Uganda	Information systems for mental health in six low- and middle-income countries: cross country situation analysis	Cross-country situation analysis of HMIS in six low- and middle-income countries involved in the emerging mental health systems in low- and middle-income countries (EMERALD) research project	Substantial policy, human resource and health governance challenges for mental health HMIS; few HMIS experts; software-related challenges; infrastructure lacking; inadequate technical support and supervision for junior staff	Specialized courses on HMIS in Uganda		Need for greater technical and resources input to strengthen routine HMIS and develop standardized HMIS indicators for mental health, focusing on indicators of coverage and quality to facilitate the implementation of the WHO mental health action plan 2013–2020
Verbeke, et al. (2015)	Rwanda, Burundi, DRC, Congo-Brazzaville, Gabon, and Mali	Human factors predicting failure and success in hospital information system implementations in SSA	Implementation of open-source hospital information systems in 19 hospitals from 2007 through 2014	Human, cultural, and environmental factors (rather than technical issues)			
Were, et al. (2015)	Kenya	Building comprehensive and sustainable health informatics institutions in developing countries: Moi University experience			Training, learning-by-doing, partnerships, and centers of excellence	Moi University has strategic health informatics partnerships with Regenstrief Institute, Inc. (USA), University of Bergen (Norway), and Makerere University (Uganda), among others; Moi has also created an Institute of Biomedical Informatics to serve as a regional Health Informatics Center of Excellence with divisions in training, research, service, and administration	Health informatics capacity-building approach by Moi University provides a model for adoption by other institutions in resource-limited settings

APPENDIX E

HMIS Form 105: Health Unit Outpatient Monthly Report, Page 5

2.4 EXPOSED INFANT DIAGNOSIS (EID) SERVICES		NUMBER
E1: Exposed infants tested for HIV below 18 months of age	st	
	nd	
	< 2 months	
E2: 1st DNA PCR result returned	Total	
	HIV+	
E3: 2nd DNA PCR result returned	Total	
	HIV+	
E4: Number of DNA PCR results returned from the lab	Total	
	Within 2 weeks	
	Given to	
E5: Number of HIV-exposed infants tested by serology/rapid HIV test at ≥18 months	Total	
	Positive	
E6: Number of HIV+ infants from EID enrolled in care		
E7: HIV-exposed infants started on CPT	Total	
	Within 2 months	

2.5 FAMILY PLANNING METHODS		NEW USERS	REVISITS
F1-Oral: Lo-Femenal	10-19 years		
	20-24 years		
	>=25 years		
F2-Oral: Microgynon	10-19 years		
	20-24 years		
	>= 25 years		
F3-Oral: Ovrette or another POP	10-19 years		
	20-24 years		
	>= 25 years		
F4-Oral: Others	10-19 years		
	20-24 years		
	>= 25 years		
F5-Female condoms	10-19 years		
	20-24 years		
	>= 25 years		
F6-Male condoms	10-19 years		
	20-24 years		
	>= 25 years		
F7-IUDs	10-19 years		
	20-24 years		
	>= 25 years		
F8-Injectable	10-19 years		
	20-24 years		
	>= 25 years		
F9-Natural	10-19 years		
	20-24 years		
	>= 25 years		
F10-Other methods	10-19 years		
	20-24 years		
	>= 25 years		
Total family planning users	10-19 years		
	20-24 years		
	>= 25 years		
F11: Number HIV+ FP users			

2.6 CONTRACEPTIVES DISPENSED	NO. DISP. AT UNIT	NO. DISP. BY CBD	NO. DISP. AT OUT-REACH
D1: Oral: Lo-Femenal (cycles)			
D2: Oral: Microgynon (cycles)			
D3: Oral: Ovrette or other POP			
D4: Oral: Others (cycles)			
D5: Female condoms (pieces)			
D6: Male condoms (pieces)			
D7: IUDs (pieces)			
D8: Injectable (doses)			
D9: Emergency contraceptives			

2.7 MINOR OPERATIONS IN FAMILY PLANNING						
O1: Female sterilization (tubal ligation)						
O2: Male sterilization (vasectomy)						
O3: Implant new	AGE GROUP	I	Z	J	O	TOTAL
	10-19yrs					
	20-24yrs					
	>= 25yrs					
O4: Implant revisits						
O5: Implant removals						

2.8 CHILD HEALTH SERVICES	6 – 11 Months		12 – 59 Months		1 – 4 Years		5 – 14 Years	
CHILD HEALTH SERVICES	M	F	M	F	M	F	M	F
C1-Vit A supplement 1st dose in the year								
C2-Vit A supplement 2nd dose in the year								
C3-Dewormed 1st dose in the year								
C4-Dewormed 2nd dose in the year								
C5-Dewormed 1st dose in schools in the year								
C6- Dewormed 2nd dose in schools in the year								

2.9 TETANUS IMMUNISATION (TT VACCINE)	Pregnant women		Non-pregnant		Immunization in school
Doses	Static	Outreach	Static	Outreach	
T1-Dose 1					
T2-Dose 2					
T3-Dose 3					
T4-Dose 4					
T5-Dose 5					

WORKING PAPER

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 W Franklin St Suite 330, Chapel Hill, NC 27516
Phone: +1-919-445-9359
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-18-202

USAID
FROM THE AMERICAN PEOPLE

MEASURE
Evaluation