Easing the Data Collection Burden on Healthcare Providers

by Strengthening Health Information Systems

USAID
FROM THE AMERICAN PEOPLE

MEASURE Evaluation

Easing the Data Collection Burden on Healthcare Providers

by Strengthening Health Information Systems

USAID
FROM THE AMERICAN PEOPLE

MEASURE
Evaluation

ACKNOWLEDGMENTS

CONTENTS

ABBREVIATIONS

CHW	community health worker
DDU	data demand and data use
DRC	Democratic Republic of the Congo
EHR	electronic health record
EMR	electronic medical record
HEW	health extension worker
HIS	health information system(s)
HISSM	Health Information System Strengthening Model
HMIS	health management information system
ICT	information and communications technology
M&E	monitoring and evaluation
MOH	Ministry of Health
NMCP	National Malaria Control Program
PRISM	Performance of Routine Information System Management
PRS	population registration system
RDQA	routine data quality assessment
RHIS	routine health information system
SOP	standard operating procedure
USAID	United States Agency for International Development
WHO	World Health Organization

BACKGROUND

Health information systems (HIS) represent a significant investment for global, international, and subnational groups and organizations that require evidence for accountability and informed decision making. However, despite such a compelling need for robust evidence of HIS function, these systems have not traditionally been a subject for rigorous study and evaluation. That lack limits learning, sharing, and cultivating best practices that can be shared more widely.

MEASURE Evaluation, a five-year cooperative agreement with the United States Agency for International Development (USAID), helps countries improve HIS management, governance, and performance. In July 2014, USAID asked MEASURE Evaluation to implement activities to justify and build an evidence base for which investments in HIS are effective and useful. In response, we developed an HIS Learning Agenda,[1] to explore what works to strengthen HIS. For the Learning Agenda, we seek to answer questions such as these: What are the factors and stages of progress in HIS performance and how are they measured? And what are the characteristics of a strong HIS? The project is also implementing activities to build the evidence base on HIS strengthening. We hope our efforts will contribute to evidence-informed global work to strengthen HIS and health outcomes.

INTRODUCTION

We can define a well-functioning HIS as one that delivers good-quality data in an accessible and useful format to decision makers (Health Metrics Network, 2012)—from the most aggregated data for policymakers to more discrete data that are of use to facility-based healthcare providers. When data are collected and used for decision making at all levels of the health system, they prove their utility and, presumably, decision makers are more motivated to allocate sufficient resources and investments for supervision and training to support healthcare providers to collect the data.

Therein lies a fundamental problem. In many cases, collecting high-quality data to drive a functioning HIS benefits policymakers as they make decisions about a health system but the burden of collecting data is the responsibility of people who also have the responsibility to provide high-quality health services. Many healthcare providers, especially in low-resource settings, may lack the time, motivation, understanding, or skills required for the additional responsibilities of data collection or data entry. This additional burden may make their jobs more difficult and have no tangible benefit if the data they generate are not of good quality, are not transmitted in a timely fashion, and are not useful or used by decision makers.

HIS cannot be effective without good-quality data. Therefore, as countries around the world invest or are encouraged to invest in HIS strengthening, it is important to consider how to support providers in their role to collect the necessary data.

This paper—one of a series developed by MEASURE Evaluation—explores how to improve HIS to address the burden of data collection that falls to healthcare providers. The aim is to discover ways to help providers

---

[1] MEASURE Evaluation. (2015). Learning agenda. Chapel Hill, NC, USA: MEASURE Evaluation, University of North Carolina at Chapel Hill. Retrieved from https://www.measureevaluation.org/resources/publications/fs-15-142

collect good-quality data without compromising the care they give to their clients. This paper reviews what we can discern thus far.

METHODS

Given the lack of documentation of HIS strengthening activities and outcomes, and the dearth of reporting on the topic in the peer-reviewed literature, for this synthesis we chose to blend evidence from published literature with evidence from our own work. We reviewed what we know about the burden of data collection for providers, examined interventions that have worked to mitigate or reduce this burden, and examined the factors and conditions that seem necessary to support providers in their role as data collectors.

To explore this topic, we conducted a literature review on the data collection experiences of healthcare providers and available evidence linking HIS strengthening to reduction in provider burden in data collection. We looked at PubMed, Web of Science, Scopus, Global Health, Embase, Google Scholar, and relevant papers cited by articles for studies published from 2002 onward. We used combinations of the following search terms: HIS, health care provider (including clinicians, community health workers, and health volunteers), data collection or data entry (including paper-based and electronic), provider burden, and provider motivation.

The studies that emerged directly examined data collection or interventions designed to improve data collection for providers. We focused on studies from low- and middle-income countries (LMICs) and looked both at paper-based and electronic system interventions affecting facility- and community-based healthcare providers.

We then turned to a consideration of all MEASURE Evaluation activities from 2015 to the present, through a review of quarterly reports and annual workplans, to identify activities that directly addressed data collection by providers and that met the following criteria: were implemented in specific countries (as opposed to global activities), were in the implementation stage (i.e., beyond planning), and offered examples of interventions with different types of healthcare workers. We also communicated with staff working on these activities to learn more about why each activity had been proposed, the steps taken in implementation, the barriers faced and how they were overcome, and how progress was measured.

The activities we selected to highlight are the following:

1. Integrating health information systems in Mali
2. Centers of Excellence for monitoring and evaluation (M&E) in the Democratic Republic of the Congo (DRC)
3. Strengthening the electronic management information system (e-MIS) in the health sector in Bangladesh

Mapping to the HIS Strengthening Model

Part of MEASURE Evaluation's HIS Learning Agenda has been the development of a health information system strengthening model (HISSM) (Figure 1). The model is a starting point for framing how HIS work and what we know now. It is useful in illustrating the parts of the HIS that specific investments target and in identifying knowledge gaps, because these are opportunities to learn more about HIS strengthening.

This model is divided into several areas: the human element, the enabling environment (HIS leadership and governance and HIS management), information generation (data sources, data management, and information products and dissemination), HIS performance (data quality and use), and contextual factors. One of the premises of the model is that an HIS serves the larger health system and can only be as strong as the system it supports. In this synthesis, we suggest how interventions to reduce provider burden on data collection map to this model, so we can learn if there are aspects of HIS that are an especially effective focus in attempts to mitigate provider burden.

Figure 1. HIS Strengthening Model
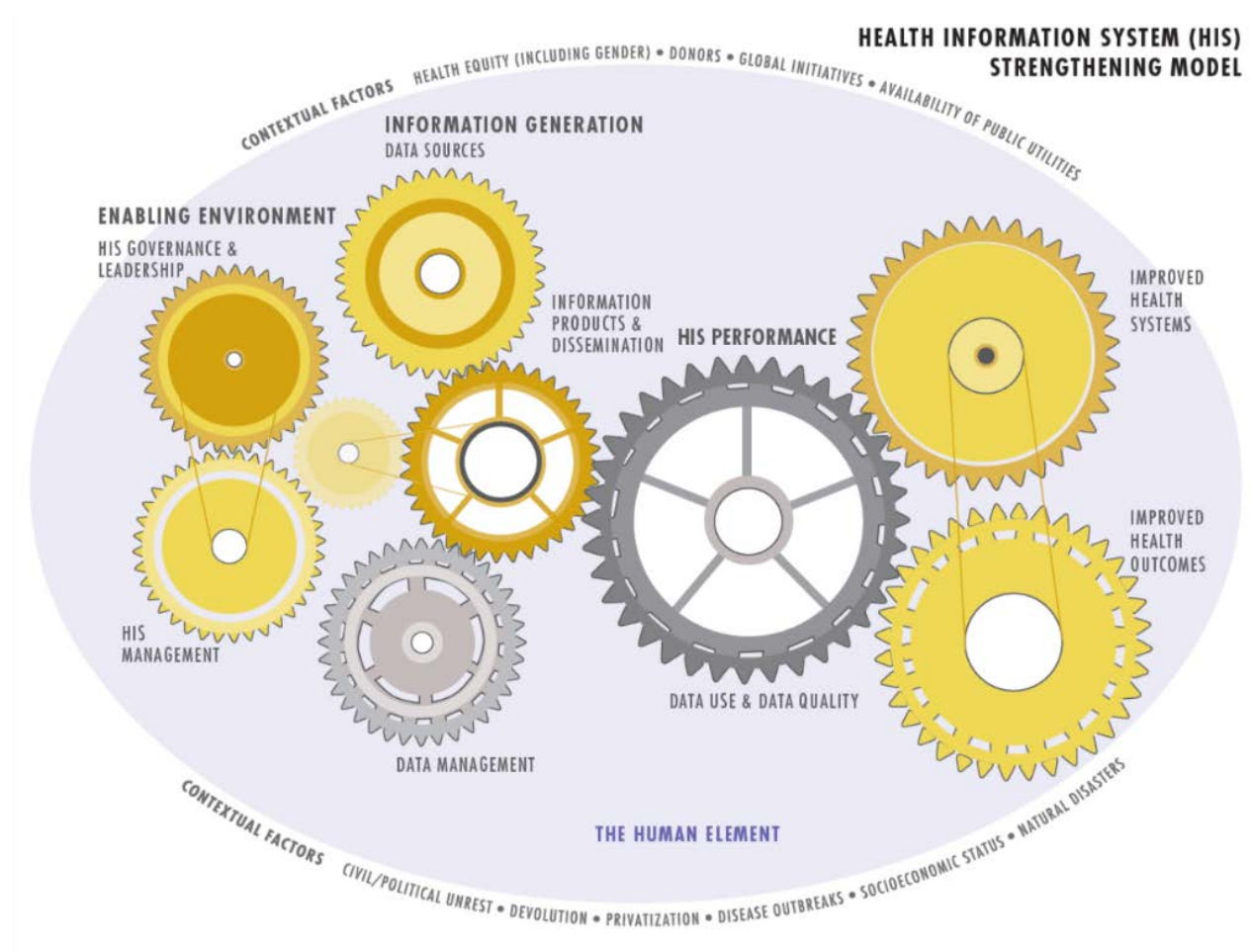
WHAT WE LEARNED FROM THE LITERATURE REVIEW

Rigorous studies that employ a counterfactual or involve prospective data collection or other techniques are rare in studies of HIS interventions in LMICs. Our examination of peer-reviewed literature confirmed that only a limited number of studies that assess the direct impact on providers of interventions to strengthen HIS have been published. This is the case because most HIS interventions are designed to meet real-time needs in the field and have not themselves been the subject of rigorous study. Observational and qualitative study methods are most common. Those are useful for capturing contextual factors and representing provider points of view on what does and does not work well.

The most common study outcomes reported in the literature cluster around these issues:

- Provider perceptions of the data collection process (Ramsey, et al., 2013; Bender, Ammenwerth, Nykanen, & Talmon, 2006; Heeks, 2002)
- Provider job performance and motivation (Mitchell, Hedt-Gauthier, Msellemu, Nkaka, & Lesh, 2013; Lee, Chib, & Kim, 2011)
- Time spent capturing data and time with patients (Biradavolu, Blankenship, George, & Dhungana, 2015; Hernandez-Avila, et al., 2013; Chang, et al., 2013; Fetene, et al., 2016)
- Accurate clinical diagnoses (Were, et al., 2010; Hernandez-Avila, et al., 2013; Biradavolu, et al., 2015).

Other studies look at data quality as an outcome of HIS strengthening interventions. While data quality could be a proxy for reducing provider burden, most of these studies do not provide enough information about how data quality was improved and whether the improvements required providers to spend more time capturing data and less time with patients. Therefore, we excluded these.

Provider Burden for Information Generation

Provider Motivation for Data Entry

A 2006 synthesis of case studies from LMICs found that the data collection agendas were often driven by donors rather than local priorities. The researchers also found that much data go unused and unanalyzed—or, if they are analyzed, they remain meaningless to those doing the collecting (D'Souza & Sadana, 2006). Without a useful feedback mechanism, data collection may feel like a hindrance to spending time providing care to patients.

Distant data use also inhibits motivation for providers who collect data. Interventions aimed at improving data *use* often target the regional level, and focus on data *accuracy and completeness* for facilities and providers. Therefore, data use in decision making is more likely to increase at the district or regional level, and not at the facility level (Aqil, Lippeveld, & Hozumi, 2009). Another study put it this way: Provider involvement with data in-country often is limited to collection; data may travel a long distance from the source before they are made useful through analysis (Ramsey, et al., 2013). This distant use of data perpetuates the practice that facility personnel do not receive skills-building help, because they are not involved in data analysis or in the development of data tools and methods. They may never see the data used in ways that are relevant to their daily job responsibilities. In addition, factors such as adequate job descriptions and training, appropriate data collection tools, and ongoing technical support affect whether providers are well-equipped to record data and

whether data collection becomes a complementary aspect of service provision or an overwhelming and unwelcome task (Piette, et al., 2012).

Paper-Based Data Collection

Systems that depend on multiple funders and partner organizations in healthcare provision are likely to have multiple and possibly duplicative reporting requirements. A 2014 review of select LMICs by the World Health Organization (WHO) found cumulative reporting requests requiring upwards of 600 indicators (WHO, 2014). In addition, organizations tend to define indicators differently and to use different formats and timelines for collection. Technical inconsistencies related to procedures and terms lead to further fragmentation (Chilundo & Aanestad, 2004).

We found three noteworthy studies of interventions that sought to manage provider burden in data collection, by improving paper-based systems for data capture.

One of these—the Ghana Essential Health Intervention Project (GEHIP)—aimed to simplify the collection of health management information and ensure its use for decision making through a simple information-capturing system for use by CHWs (Mutale, et al., 2013). A baseline time-use study at the inception of the GEHIP found that workers were spending more time on paperwork than on client care (Frimpong, Helleringer, Awoonor-Williams, Yeji, & Phillips, 2011), suggesting that data collection was impeding their ability to provide healthcare services. GEHIP worked with district and subdistrict managers to redesign and implement improved data capture registers, aiming to reduce the reporting burden in primary care settings. Registers were redesigned to capture only data fields deemed essential for district-level planning, reducing the number of registers used by CHWs from 27 to five. Data entry fields are now regularly reviewed to keep them up-to-date and aligned with those collected by the Ghana Health Service. This study is ongoing, but preliminary qualitative data suggest that CHWs have welcomed the reduced documentation burden and the additional time freed up for service and outreach that was achieved by simplifying data entry fields.

The newer registers, however, have introduced new supply costs. In some cases, inflexible budgets mean there is a disconnect between the new process and the financial resources provided, threatening the intervention's sustainability.

Another project—Project Connect, in Tanzania—also introduced new registers for CHWs in an intervention to strengthen and integrate community-level data with routine HIS at facility and district levels. This intervention experienced notable challenges (Ramsey, et al., 2013). Project Connect worked with the Tanzania Ministry of Health (MOH) to introduce community registers in three rural districts. Two community registers were developed: one for service delivery outputs and another for community mobilization and health education. The registers provided simple project indicators aligned with existing HIS modules. CHWs recorded aggregate data from their registers each month on summary forms developed for reporting to supervisors and the Project Connect team. The project found that although simplified registers made it easier for health workers to record and aggregate data, the registers did not capture household or client information, and so did not help CHWs to use data to make decisions about client care and so did not provide any incentive for them to collect high-quality data. To remedy this, the project introduced booklets that remain in each village household. CHWs use these to log visits and notes, thereby increasing their ability to use the data to inform provision of care. This remedy has, however, come at a high financial and logistical cost, owing to a

lack of stakeholder coordination on printing the booklets and inflexible budgets to pay for them. This fact limits the sustainability of household booklets and their continued use by CHWs.

The third study, in South India, assessed the impact of simplified data collection tools designed for and implemented by female sex workers in an HIV-prevention program. The sex workers acted as peer educators on HIV prevention and were also charged with counting the number of condoms distributed. A secondary analysis of qualitative data revealed that even a well-conceptualized, user-friendly tool is not sufficient to manage provider burden if it does not consider the attitudes of end users. Interviews with the sex workers revealed that the new registers and new protocols for counting condoms ignored their local knowledge and counting skills. As a result, they felt that data collection was a way for supervisors to monitor them and they expressed no ownership of the data or any articulation of how data collection could support program planning (Biradavolu, et al., 2015).

Electronic Health Records

Our literature review found several studies of interventions using digital solutions. Individual electronic medical records (EMRs) and electronic health records (EHRs) offer a means to aggregate health data and opportunities to improve efficiency in data collection, as well as availability and readability of patient records, computerized clinical decision support, and digital order entries (for medicines or other commodities for routine healthcare). However, electronic systems often cover a variety of functions, such as data flow and transmission of collected data, which—along with consideration of end-user needs—can make implementation complex (Bender, et al., 2006) and prone to failure (Heeks, 2002). Implementation of new computerized information systems requires planning, policies, equipment, and user training. Evaluation of such systems is an added challenge.

Five studies from Mexico, Tanzania, Kenya, Uganda, and India following the implementation of EMRs have shown favorable views of electronic systems, most commonly identifying the benefits of time saved through system appointment reminders (Svoronos, et al., 2010), improved clinical decisions (Merrell, Merriam, & Doarn, 2006), and reduced medical error (Hernandez-Avila, et al., 2013; Were, et al., 2010). Perceived disadvantages have included concerns over patient confidentiality, frustration with complex disease classification schemes (Hernandez-Avila, et al., 2013), and opinions that such systems are a way for supervisors to monitor workers (Biradavolu, et al., 2015; Hernandez-Avila, et al., 2013).

mHealth

Several interventions have capitalized on the portability of mobile technology for use by CHWs. Mobile devices in pilot studies often are equipped not only with data collection capability but also with additional functions, including appointment reminders, clinical care prompts, and portals for accessing medical information or contacting medical professionals. The mixed functions of mHealth data collection make it difficult to isolate the effect on provider burden. It is difficult to generalize any study findings, because so many application varieties exist.

However, some well-documented studies offer opportunities to identify areas needing assessment. For example, most evaluations of mHealth seek to measure general improvements in efficiency among CHWs, but the literature provides no clear consensus as to what constitutes the definition of and best measures for health worker efficiency (Braun, Catalani, Wimbush, & Israelski, 2013). More work is needed in this area.

One study in Malawi defined and measured improvements in efficiency as savings in cost, time, and increased work capacity. In this pilot program, mobile phones with Frontline SMS were used by 75 CHWs over six months, with a savings of approximately 2,048 fewer hours of worker time spent collecting data (a cost savings of US$2,750 in fuel and operations) and CHWs able to serve double the number of clients in the same amount of time (Mahmoud, Rodriguez, & Nesbit, 2010).

In Tanzania, an evaluation of a mobile job aid for family planning workers collected qualitative data that showed CHWs felt the job aid simplified their work and improved data management over the paper forms used before. CHWs were particularly satisfied with the ability to report data on an ongoing basis and receive real-time feedback. In addition, they reported that the mobile devices improved the quality and timeliness of services, because of the client follow-up reminders and the ability to have client interactions in convenient locations (Braun, et al., 2016).

In Uganda, in a mixed-methods evaluation of an mHealth initiative at a community-based HIV/AIDS clinic, CHWs reported that mobile phones improved job efficiency in terms of time and quality of patient care but also felt that more training was needed. Qualitative data revealed the chief perceived benefits were the ability to track patients based on mobile-captured data and the elimination of the need to carry and keep track of several paper forms. Workers also felt that mHealth prompts led to diagnoses that were more precise, although many CHWs expressed unrealistic expectations for what the device could do—such as provide automated diagnoses for all illnesses and conditions (Chang, et al., 2013).

A separate intervention in Uganda used time-motion techniques and provider surveys to evaluate the impact of a mechanism that provided patient-specific, EMR-based clinical summaries to providers taking care of HIV-positive clients. The study found that providers spent more time in the direct care of patients (2.9 minutes vs. 2.3 minutes, p<0.001) and the length of patient visits was reduced by 11.5 minutes. Providers also reported that electronic clinical summaries improved care, reduced mistakes, and were generally accurate. However, it should be noted that the sample size was small (n=22) and the study's observation period short (Were, et al., 2010).

In Tanzania, the evaluation of a personal digital assistant (PDA) device for integrated management of childhood illnesses found mixed results in provider burden. It took staff the same amount of time to complete the electronic version of the questionnaire as the paper version required, but reporting was improved because more staff completed the electronic questionnaires than completed the paper versions and the accuracy in reporting was found to be better. A randomized selection of the providers who had been trained to use the PDA were also observed during at least 20 patient interactions each. Those observations revealed that providers conducted a more complete patient assessment and asked more questions (prompted by the PDA device) in about the same length of time (Mitchell, et al., 2013).

In rural Indonesia, midwives using mobile phones for data collection could access institutional resources on maternal health and communicate with peers and medical professionals. These midwives reported increased self-confidence in their abilities to deliver quality maternal healthcare. Study participants also felt the use of mobile phones enhanced their ability to meet client healthcare needs independently, through timely access to relevant information (Lee, et al., 2011).

Data Use to Improve Performance

Two studies assessed the importance of data use and data analysis skills for healthcare provider motivation and improved health outcomes. A 2016 study in Ethiopia found that districts with better health outcomes also had higher-performing HIS, including better data-use practices among their health extension workers (HEWs) (Fetene, et al., 2016). Based on a decade-long intervention to strengthen Ethiopia's primary healthcare,[2] this study classified districts as higher- and lower-performing, based on data from five indicators. In key informant interviews, HEWs from higher-performing districts reported frequent use of data for problem solving and performance improvement, in contrast to lower-performing districts, which had poorer health outcomes and reported poor data use practices.

In this study, the HEWs from higher-performing districts described regularly using data to improve their job performance. The same districts also described supportive relationships with zonal leaders, regular validation of data, and recognition of best practices and opportunities for scale-up by supervisors. HEWs from lower-performing districts said they lacked support, necessary resources, and training for data collection and use. Although this study was limited in design and scope, it did highlight the ability of HEWs to use data to improve job performance, as well as the importance of a supportive environment for health workers in data collection and use.

In another assessment during the first stage of a process of implementation design for the inSCALE project (Innovations at Scale for Community Access and Lasting Effects), Strachen and colleagues conducted interviews with stakeholders of CHW programs in low-income countries to elicit strategies to increase CHW motivation and retention. One of the strategies cited was improving data collection processes. The improvement suggestions were that data collection processes must be coherent and simple, and that worker motivation could increase if a data collector could meaningfully engage with the data she or he had been asked to collect. Suggested tactics included encouraging CHWs to analyze data and encouraging supervisors to appreciate good performance in data collection. Stakeholders also emphasized the importance of focusing on the person doing the data collecting rather than focusing on the technology involved (Strachan, et al., 2012). inSCALE plans to test these strategies in Uganda and Mozambique, using a randomized controlled trial design.

---

[2] Indicators included coverage of skilled birth attendants, antenatal care, immunizations, household latrines, and health behavior training.

WHAT WE HAVE LEARNED FROM MEASURE EVALUATION'S WORK ON HIS AND MANAGING PROVIDER BURDEN

MEASURE Evaluation works on many global activities for HIS strengthening. We systematically reviewed those to find intervention components focusing, at least in part, on healthcare providers. We sought more information on how our interventions to strengthen HIS may also have potentially mitigated the data collection burden on providers. (However, HIS-strengthening interventions are often part of a larger cluster of interventions and so may not capture the complete picture of what might directly mitigate provider burden.) We selected three activities, described below, to illustrate what the project is learning about easing the reporting burden on healthcare providers. These activities are ongoing; we anticipate additional learnings following their completion.

Integrating Health Information Systems in Mali

Overview

Mali provides an important example of how multiple HIS reporting systems were simultaneously strengthened and integrated while also decreasing the reporting burden for providers. MEASURE Evaluation's work in Mali has supported the National Health Directorate through the Ministère de la Santé et de l'Hygiène Publique (MOH) to integrate the country's previously fragmented health data reporting systems in one platform, using DHIS 2. This ongoing activity has also involved harmonizing and validating indicators, standardizing data collection tools, training, and developing management tools for all levels of the health system. This set of activities formed a strategy to improve the quality and availability of routine health data, logistics management, and important data on malaria and disease outbreak.

The Need that the MEASURE Evaluation Activity Meets in Mali

Prior to transitioning to DHIS 2 as the national platform for data capture, Mali's HIS was an Access-based platform characterized by fragmentation and duplicative reporting requirements. For RHIS data, this meant that additional and separate reporting systems were created over time to respond to emerging health information needs, such as for malaria. Each additional, parallel system had separate reporting tools and duplicate indicators that increased demands on data collectors without a clear path to effective data use at the facility level.

A 2013 Performance of Routine Information System Management (PRISM) assessment revealed that Mali's HIS was producing good-quality data but not enabling timely delivery to the right people. This was owing, in large part, to healthcare workers lacking sufficient time to compile complete, good-quality reports in a timely fashion. Providers at health facilities were completing multiple forms at the end of each quarter, which involved collecting data from a variety of sources, aggregating data, and copying data by hand for each reporting system. This time-consuming aggregation process, coupled with other data-flow bottlenecks, meant that facility-level data would often reach the national level six months later. As a result, data used for planning and allocation of resources was often obsolete.

HISSM: Enabling Environment

Mali undertook a multipronged strategy to align reporting systems better, reduce the burden on healthcare workers, and encourage timeliness. Stakeholders were convened to develop a strategic integration and rollout plan, including a commitment to provide the necessary resources and equipment to support the health system during the transition to the new DHIS 2 system. Partners were engaged in the development of standard tools and procedures for data collection, reporting indicators were harmonized, and the volume of reporting documents was reduced by one-third (from 97 to 65 pages). Standard data collection tools appropriate both for paper and electronic reporting procedures were created and validated. A central cloud-based repository now supports access to data across health programs. Reporting timelines have shifted from quarterly to monthly, reducing the backlog of information at facilities as well as the length of time for data to reach other levels of the health system. A procedures manual was created for data managers at all levels.

HISSM: Information Generation

Implementation of the DHIS 2 platform included adapting the software and its accompanying data collection tools and guides to the Malian context of information needed and data sources required. MEASURE Evaluation trained a multidisciplinary team of stakeholders who would be using the new system to customize DHIS 2 for Mali. Components of the data sources for logistics management, malaria monitoring and evaluation, and a module for immunization data have also been integrated. Each component was accompanied by a training of trainers for staff from the central level and an opportunity for feedback before widespread implementation. Regular data quality audits, using MEASURE Evaluation's routine data quality assessment (RDQA) and PRISM tools are planned to track data quality progress over time and to encourage data quality and data use. MEASURE Evaluation has also supported the MOH in conducting supportive supervision visits, during which health facility staff receive mentoring to improve data quality and overcome observed barriers to data collection, management, and reporting.

To enhance implementation of DHIS 2 in health facilities and to prepare for additional enhancements to the HIS, the project has proposed piloting the use of electronic registers in two Malian health facilities. For this purpose, DHIS 2 will be customized for reproductive health and child immunization data. These registers will track clients and automatically generate aggregate reports while providing health workers with useful information on such topics as their weekly and monthly schedules, active pregnancies, overdue visits, and clients who missed their appointments. The selected facilities will be equipped with digital tablets and Internet connection.

HISSM: Expected Effects on HIS Performance

Measures of a strong HIS are data quality and data use. In Mali, we expect that the customized data collection platform and improvements in regular data quality assurance will lead to improvements in data quality, measured as the completeness, timeliness, and accuracy of reporting. Planned RDQAs and PRISM assessments will track progress along these measures and highlight areas for improvement. Increased documentation of data use for decision making at all levels of the health system will be another indicator of success. Plans include the development of a training package for facility-level data users to increase provider engagement in data analysis and data use in decision making.

HISSM: Expected Effects on Health Outcomes

The expected outcome looked for, following the introduction of DHIS 2, is optimum client care resulting from less time spent in reporting requirements and forms. The streamlined data collection process for providers will require less time for data collection and reporting, which will be measured by tracking reporting timeliness. MEASURE Evaluation is also working to support Mali's MOH in developing methods to increase data use at the provider level. Planned workshops should increase providers' ability to analyze and use data to support clinical decision making, increase their understanding of the data collected, and improve their ability to make decisions around clinical care.

It will be important to carefully document the two pilots of electronic registers. These additional registers will require strategic rollout and coordination with the existing system to avoid further complicating the reporting requirements for providers. The electronic registers offer the potential to increase efficiency in data collection and introduce automated feedback mechanisms to support data use at the facility level. The planned workshops to increase provider ability to analyze and use data should complement this process, but care must be taken to address provider concerns about security and loss of autonomy in their job responsibilities.

Challenges

Potential barriers include inflexible or diminished funding streams that aren't responsive to emerging needs, high staff turnover, and frequent additions of new modules or indicators within the system that drive the number of reporting requirements up once again. One barrier noted during the implementation process was a delay in printing and distributing the new data collection forms for health facilities. Health service providers continued to use old forms, causing incompatibility issues when data were entered into the new system. Additionally, some partners within the health system have been hesitant to shift to a new system, suggesting potential resistance to the new electronic registers.

Centers of Excellence for Monitoring and Evaluation in the DRC

Overview

In 2011, five of 12 subregions in the DRC were considered to have nonfunctioning HIS. This resulted in multiple sources of uncoordinated data collection and fragmented information. DRC's Ministry of Public Health (MOPH) began implementing DHIS 2 in 2013, with the goal of creating a more unified national HIS. The MOPH and the National Malaria Control Program (NMCP) have been working to improve data quality and increase systematic use of malaria information at all levels of the health system.

MEASURE Evaluation has helped to develop DRC's first M&E capacity-building action plan at the national level and to initiate practices that promote data demand and data use (DDU) in nine provinces. In Year 2 of this effort (2015–2016), MEASURE Evaluation supported the MOPH in developing four centers of excellence (COE) to demonstrate the benefits of specific M&E interventions and to model facility-level best practices for improved data management and data use. This activity included coordinated planning of work within the enabling environment and the information-generation areas of the HISSM to support collection and use of quality data while also creating models of data collection through the COEs.

The Need that the MEASURE Evaluation Activity Meets in the DRC

Malaria is a major public health problem in the DRC. In 2015, it led to more than 39,000 deaths, accounting for a major proportion of the world's malaria cases. Good-quality information is essential to target and track malaria to allocate resources and measure the success of interventions. So far, timely and accurate data has been lacking, leading to inefficient resource allocation and lack of ability to tackle outbreaks when and where they occur.

HISSM: Enabling Environment

During the design and implementation of the COEs, MEASURE Evaluation supported the NMCP to bring together all malaria partners to establish a national coordinating body to oversee malaria M&E efforts. This body meets quarterly and has worked to develop a set of malaria indicators and inform national strategic planning. Provincial groups were also created to review malaria data quality.

COEs were established in health centers that had at least a basic level of existing infrastructure and technical skills that could be expanded to create regional M&E experts. Staff have received ongoing training in M&E fundamentals, along with logistical support (i.e., necessary furniture, computer kits, and solar power) to provide quality data. The COEs will serve as a resource for other health centers and be models of potential scale-up in additional regions. EHR systems were established along with an Internet connection at each site. A central database was created, using the DHIS 2 platform, that includes data from all partners to better support decision making. COEs now hold regular data validation meetings to review and update data results. An important piece of gaining buy-in from local health workers is that the COEs were set up in existing health facilities and local staff were engaged and equipped to become repositories of information and resources for the surrounding area.

HISSM: Information Generation

Ongoing training for all staff, including facility personnel, information technology professionals, and NMCP staff has been an important part of COE implementation. The sites were also supported through the printing and distribution of standardized registers, data collection forms, and ongoing technical support. Supportive supervision visits and RDQAs will continue to provide data quality assurance and highlight best practices and areas for growth at COEs. In 2016–2017, providers received training on the use of smartphones to transmit malaria data to the DHIS 2.

HISSM: Expected Effects on HIS Performance

Data quality and data use are hallmarks of performance. Follow-up assessments have shown that in the two longest-established COEs, data quality has improved in terms of completeness, timeliness, and frequency of reporting. The assessments also revealed some gaps in data use, which have since become a focus for COE improvement. A strategic DDU plan was developed to address the gaps and included supportive and ongoing training and integration of tools designed to increase health worker engagement in data: frameworks, dashboards, and guidelines for end users.

HISSM: Expected Effects on Health Outcomes

Health providers in COEs are now equipped to conduct data analysis, manage stock levels, and make decisions based on the data they collect, which will improve health outcomes for their clients. The new SMS

data application allows staff members to submit data directly to the DHIS 2 from a mobile phone, reducing the number of steps for data collection and aggregation and further reducing the data collection burden. The DHIS 2 software serves as the EHR platform, but it's important to note that the software's role is secondary to the methods used in engaging and training staff in successful use. The SMS application itself will not increase reporting quality or completeness. The success of this pilot will rely on the continued capacity of the COEs, which ongoing logistical support and staff training have helped to build.

Challenges

During 2016–2017, political instability had a negative impact on COE implementation in certain regions. Additional barriers to success were failures in equipment, lack of Internet connectivity, and lapses in technical support or funding streams supporting supervision and equipment for the project. In addition, relying too heavily on the technology could be challenging for healthcare providers and negatively impact data. As additional COEs are established throughout the DRC, it will be important to monitor their progress and closely follow plans to increase data use at the facility level.

RHIS Initiatives in Bangladesh

Overview

An intervention called "Strengthening RHIS in Bangladesh" is one part of a nationwide initiative to strengthen the M&E system in the public health sector to provide evidence for healthcare decisions. To make RHIS data more robust and to ensure they are used for decision making, Bangladesh implemented a digital data capture system through a pilot program, including a population registration system (PRS). In the Tangail and Habiganj districts, MEASURE Evaluation, along with implementing partners—International Centre for Diarrhoeal Disease Research, Bangladesh (icddr b), MaMoni Health Systems Strengthening, and Systems for Improved Access to Pharmaceuticals and Services—has supported the Ministry of Health and Family Welfare to train and equip CHWs with digital tablets to collect both population-based data and data on family planning, immunization, and maternal services. The tablets also support CHWs in their work, by providing real-time access to archived data and access to training modules and health resources, which have been uploaded to the CHWs' devices.

The Need that the MEASURE Evaluation Activity Meets in Bangladesh

This activity has strengthened methods for collecting and using data at the community level, built a more robust HIS, and supported both population-based and RHIS information. CHWs can now easily collect both health service and demographic data while conducting routine home visits. Health workers were already capturing much of this information, but they are now able to access summary information about their clients, both in individual and aggregate form, enabling easier planning for health services and client visits.

HISSM: Enabling Environment

In Bangladesh, the process of improving RHIS is the continuation of a previous phase. That effort sought to improve the capacity of the units for management information systems (MIS) of the Directorate General of Health Services (DGHS) and the Directorate General of Family Planning (DGFP). The goal was to generate timely and reliable information, streamline MIS tools to minimize gaps and duplication, reduce the burden of

data collection, improve use of information at the local level, and increase evidence-informed decision making throughout the health system.

Under this activity, the Government of Bangladesh has benefited from mobile technology to support both a large community-based health workforce and the overall HIS. This activity has involved ongoing collaboration engaging multiple agencies that meet regularly to review progress, identify potential data bottlenecks, and address technical or program issues. Specific to the PRS database, regular communication is planned with the civil registration and vital statistics (CRVS) secretariat to coordinate the exchange of birth and death data. The PRS rollout was first piloted in a single subdistrict *(upazila)*, and lessons learned were incorporated in planning for expansion sites.

Following the introduction of PRS, additional interoperable tablet modules were developed for use in health facilities that offer primary healthcare, family planning, and attended deliveries. All RHIS partners participated in a workshop during the first year of implementation to develop a technical document describing each of the modules and to further refine module details and data dashboards that should be developed. Applications were developed that CHWs could use to record immunization data digitally, replacing paper-based data collection. Partners discussed business processes and requirements for the national Expanded Program on Immunization (EPI). Meanwhile, introduction of PRS continued in additional subdistricts in both Tangail and Habiganj districts. PRS is now fully implemented in Tanguil district.

HISSM: Information Generation

Comprehensive cascade trainings prepared CHWs and health managers for the implementation of the PRS and mobile data collection. Accompanying guidelines, standard operating procedures (SOPs), and policies have been developed to accompany the scale-up of mobile data collection in additional subdistricts. To address connectivity issues, the application is available offline, with a web-based application to automatically upload data every 24 hours.

The web-based data warehouse provides data accessibility at all levels of the health system, including to CHWs. In addition, automated dashboards easily display data to inform planning services and commodities. The data entry system also allows for data quality review even as information is entered, through automated prompts and required data fields. Once fully implemented, PRS will contribute to full CRVS coverage, which was previously lacking in this region and is essential for sound healthcare planning.

HISSM: Expected Effects on HIS Performance

All households in the Basail upazila—the first one in Tangail to implement PRS—are now registered, providing complete population data. As of 2017, the remaining 10 upazilas are implementing PRS but have not completed the work. PRS data provide a more complete picture of the subdistrict, while also providing improved population denominators for routine data. This improved data quality is a hallmark of HIS performance. Further, health system managers feel that that the digitized system has increased transparency and will benefit the ministries in understanding the size of the population, geographic distribution, and demographics of the country, which will assist in data use. PRS also helps track health outcomes and trends in health conditions and healthcare services.

HISSM: Expected Effects on Health Outcomes

Digital tablets provide real-time access to data for those providing care, which means care can potentially be improved for clients. CHWs no longer must carry large register books from house to house, and so they can visit more houses and see more clients per day. Tablets make it easier to plan what services are needed, when, and for whom. Tablet data aggregation and feedback mechanisms enable services planning to be information-based, reducing guesswork. The system has also helped to track healthcare commodities, preventing stockouts and delays in delivering health services. Managers report that budgeting for medical equipment and services is more efficient. These factors combine to reduce provider burden, enabling better provision of healthcare and improved health outcomes.

Challenges

Many of the implementation regions have power and connectivity issues related to mobile devices. Although the applications are designed to work offline, sometimes recharging devices is a problem. Additionally, the coordination and implementation of the interoperable modular system is complex and challenges arise with the ongoing design of applications and modules requiring regular adaptation and refinement.

DISCUSSION

Conclusions from the Literature Review

The decision of what data are to be collected by whom, when, and where depends on the information needs identified at different levels of the health system and by different actors and partners. Despite reform efforts to harmonize processes and data collected for HIS, health facilities may face different reporting requirements from each donor or supporting nongovernmental organization (NGO). Partnerships across government and NGOs and international partnerships result in long lists of indicators. While most agencies agree on the value of harmonizing indicators, the cumulative reporting burden is often substantial.

Many of the interventions to reduce or streamline the data collection burden for providers involve technology and process. However, evidence from the literature and from our own activities shows that **technology on its own provides little to no benefit unless supported by effective training, institutional capacity, and ongoing technical support. Technology also is ineffective without buy-in from users, stakeholders, and policymakers willing to align budgets to sustain these investments.**

Our literature review showed evidence suggesting the following:

- **Reducing the data collection burden for providers can positively affect health outcomes.**

- **HIS interventions and tools can mitigate provider burden.**

- **Investments in HIS not only reduce provider burden but also strengthen data quality for HIS performance.**

- **EHRs and mHealth initiatives may reduce data collection burden, improve job efficiency, save costs, and improve provider ability to use data**, when implemented alongside comprehensive training and management.

Additionally, this synthesis found that **provider engagement with data use or data analysis correlates with the perceived burden of data collection**. When data are not used at provider locations and when providers never or rarely see how their data are used, they are less motivated to collect data. The key may be helping providers to see their crucial role in the overall performance of the HIS. This can be accomplished with training on how data are used and, even better, some engagement with data analysis and use. Data management practices such as data reviews, data review meetings, and mentoring for data use were valued by providers. And the opportunity for analysis of data and use for clinical decision making may increase provider motivation for data collection. For example, HEWs in Ethiopia who worked in higher-performing districts reported frequent use of data for solving problems and improving performance, in contrast with lower-performing districts, which had poorer health outcomes and reported poor data use practices.

However, information on the enabling environment and its effect on provider burden is scarce in the literature. Aspects such as stakeholder coordination, funding streams, and development of standards for data collection and data collection processes are not frequently mentioned.

Conclusions from MEASURE Evaluation's Experience

Examination of the MEASURE Evaluation activities provided richer information about the areas of the HISSM where interventions work to improve HIS performance, specifically data quality and data use. We highlighted the breadth of work to strengthen HIS in areas such as leadership, governance, management, and

information generation necessary to manage provider burden. These aspects map to our HISSM and are missing in the peer-reviewed literature. Still needed is more evidence of what constitutes effective packages of HIS strengthening activities that help manage provider burden.

When it comes to making data collection easier for providers, our review found that **interventions within the enabling environment, such as strategic planning to coordinate and standardize data collection tools and their rollout** and up-front **financial and logistical commitments from stakeholders to provide necessary materials** on an ongoing basis, can ensure that providers are well-equipped and supported in their role as data collectors. When stakeholders meet regularly to review data, as they did in Bangladesh, they are able to address technical and program issues. In addition, **documenting strengths and challenges that arise during piloting of new data collection tools and processes allows for more informed rollout of tools** in any additional regions.

Our review of MEASURE Evaluation activities found that **interventions within the HISSM's information generation area—such as simplified data entry mechanisms and use of electronic or mobile devices—reduce the burden for healthcare workers**, especially CHWs. Making data easier for providers to access, such as through the **use of web-based data warehouse, can also increase provider engagement with data and encourage data use, thereby increasing provider motivation** to collect high quality data.

Interventions seeking to reduce provider burden and improve outcomes need to account for possible unintended consequences of the intervention. For example, methods to reduce provider burden often include new materials (registers, mobile phones, etc.) and logistical issues can delay or derail the intervention. If users or stakeholders resist change, more time may be taken up in data collection as they continue to use parallel systems. If indicators aren't harmonized, the burden may increase or data collection may become too confusing to execute.

Table 1. MEASURE Evaluation Interventions to reduce provider burden in data collection, by HISSM subareas

Factor	Illustrative Examples
HIS governance and leadership	Partnerships, coalition, and coordinating bodies within and across government agencies to oversee and review data collection standards, procedures, and tools; harmonized indicators; strategic plans to rollout new tools and procedures
HIS management	Financial resources to support data collection, sufficient resources and infrastructure including technology, in-service and continuous training
Data sources	Web-based databases for accessible data, and resources and technology to support each data subsystem
Data management	Standard operating practices, standard guidance for data managers, data quality assurance practices, data collection tool development, production, and distribution, data quality assessments (DQAs)/RDQAs, supportive supervision
Information products and dissemination	Feedback and reporting mechanisms such as dashboards and appointment reminders, effective pathways for dissemination

Overall, through interventions supported by MEASURE Evaluation, we expect to see improvements in provider time spent collecting data, more accurate and timely reporting, and an increased ability to use data for planning and client care among providers. Our review of literature and activities illustrates that **HIS strengthening interventions are made up of several components that can be mapped to areas of the**

HISSM, but organizing or grouping interventions by areas such as those articulated by the HISSM is not common. Because of this, building consensus on what constitutes effective HIS-strengthening activities and documenting the value of HIS interventions sufficient to encourage further investments is difficult.

More-rigorous evaluations could help provide evidence of how interventions can address both HIS and provider burden and, further, what areas of the HISSM are most fruitful to address when attempting programs to manage provider burden.

REFERENCES

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

Bender, J., Ammenwerth, E., Nykanen, P., & Talmon, J. Factors influencing success and failure of health informatics systems—a pilot Delphi study. (2006). *Methods of Information in Medicine*, 45 (1), 125–36. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/16482383

Biradavolu, M. R., Blankenship, K. A., George, A., & Dhungana, N. (2015). Unintended consequences of community-based monitoring systems: Lessons from an HIV prevention intervention for sex workers in South India. *World Development*, 67, 1–10. Retrieved from http://www.sciencedirect.com/science/article/pii/S0305750X14002915

Braun, R., Catalani, C., Wimbush, J., & Israelski, D. (2013). Community health workers and mobile technology: A systematic review of the literature. *PLOS One*, 8 (6). Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0065772

Braun, R., Lasway, C., Agarwal, S., L'Engle, K., Layer, E., Silas, L., … & Kudrati, M. (2016). An evaluation of a family planning mobile job aid for community health workers in Tanzania. *Contraception*, 94 (1), 27–33. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/27039033

Chang, L.W., Njie-Carr, V., Kalenge, S., Kelly, J. F., Bollinger, R. C., Alamo-Talisuna, S. (2013). Perceptions and acceptability of mHealth interventions for improving patient care at a community-based HIV/AIDS clinic in Uganda: A mixed methods study. *AIDS Care*, 25 (7), 874–80. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23452084

Chilundo, B., & Aanestad, M. (2004). Negotiating multiple rationalities in the process of integrating the information systems of disease-specific health programmes. *Electronic Journal on Information Systems in Developing Countries*, 20 (2), 1–28. Retrieved from http://shawndra.pbworks.com/f/Negotiating%20Multiple%20Rationalities%20in%20the%20Process%20of%20Integrating%20the%20Information.pdf

D'Souza C., & Sadana R. (2006). Why do case studies on national health research systems matter? Identifying common challenges in low-and middle-income countries. *Social Science and Medicine,* 62 (8), 2072-2078. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/16165261

Fetene, N., Linnander, E., Fekadu, B., Alemu, H., Omer, H., Canavan, M. (2016) The Ethiopian Health Extension Program and variation in health systems performance: What matters? *PLoS ONE,* 11 (5), e0156438. Retrieved from http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0156438

Frimpong, J. A., Helleringer, S., Awoonor-Williams, J. K., Yeji, F., & Phillips, J. F. (2011). Does supervision improve health worker productivity? Evidence from the Upper East Region of Ghana. *Tropical Medicine and International Health*, 16 (10), 1225–1233. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21729221

Health Metrics Network. (2012). *Framework and standards for country health information systems*. Geneva: World Health Organization. Retrieved from http://apps.who.int/iris/bitstream/10665/43872/1/9789241595940_eng.pdf

Heeks, R. (2002). Information systems and developing countries: Failure, success, and local improvisations. *The Information Society*, 18, 101–112. Retrieved from http://www.tandfonline.com/doi/abs/10.1080/01972240290075039?journalCode=utis20

Hernandez-Avila, J. E., Palacio-Mejia, L. S., Lara-Esqueda, A., Silvestre, E., Agudelo-Botero, M., Diana, M. L., … Parbul, A. S. (2013). Assessing the process of designing and improving electronic health records in a statewide public health system: the case of Colima, Mexico. *Journal of the American Medical Informatics Association*, 20 (2), 238–244. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3638180/

Lee, S., Chib, A., & Kim, J. N. (2011). Midwives' cell phone use and health knowledge in rural communities. *Journal of Health Communication*, 16, 1006–1023. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/21728781

Mahmud N., Rodriguez, J., & Nesbit, J. (2010). A text message-based intervention to bridge the healthcare communication gap in the rural developing world. *Technology and Health Care*, 19 (2), 137–44. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20495253

MEASURE Evaluation. (2012). *Tools for data demand and use in the health sector*. Chapel Hill, NC, USA: MEASURE Evaluation, University of North Carolina. Retrieved from https://www.measureevaluation.org/resources/publications/ms-11-46

Merrell, R. C., Merriam, N., Doarn, C. (2006). Information support for the ambulant health care worker. *Telemedicine and e-Health*, 10 (4), 432–436. Retrieved from http://online.liebertpub.com/doi/abs/10.1089/tmj.2004.10.432

Miller, R., & Sim, I. (2004). Physicians' use of electronic medical records: Barriers and solutions. *Health Affairs,* 23 (2), 116–126. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/15046136

Mitchell, M., Hedt-Gauthier, B.L., Msellemu, D., Nkaka, M., & Lesh, N. (2013). Using electronic technology to improve clinical care – results from a before-after cluster trial to evaluate assessment and classification of sick children according to Integrated Management of Childhood Illness (IMCI) protocol in Tanzania. *BMC Medical Informatics & Decision Making*, 13, 95. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23981292

Mutale, W., Chintu, N., Amoroso, C., Awoonor-Williams, K., Phillips, J., Baynes, C., Michel, C., … with input from the Population Health Implementation and Training – Africa Health Initiative Data Collaborative. (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). Retrieved from https://www.biomedcentral.com/qc/1472-6963/13/S2/S9

Piette, J. D., Lun, K. C., Moura, L. A., Fraser, H. S. F., Mechael, P. N., Powell, J., & Khoja, S. R. (2012). Impacts of e-health on the outcomes of care in low- and middle-income countries: Where do we go from here? *Bulletin of the World Health Organization,* 90 (5). Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/22589570

Ramsey, K., Hingora, A., Kante, M., Jackson, E., Exavery, A., Pemba, S., … & Phillips, J. F. (2013). The Tanzania Connect Project: A cluster-randomized trial of child survival impact of adding paid community health workers to an existing facility-focused health system. *BMC Health Services Research*, 13 (Suppl 2), S6. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/23819587

Strachan, D. L., Källander, K., ten Sambrook, A. H. A., Kirkwood, B., Meek, S. R., Benton, L., … Hill, Z. (2012). Interventions to improve motivation and retention of community health workers delivering integrated community case management (iCCM): Stakeholder perceptions and priorities. *The American Journal of Tropical Medicine and Hygiene*, 87 (5 Suppl), 111–119. Retrieved from https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3748511/

Svoronos, T., Mjungu, P., Dhadialla, R., Luk, R., Zue, C., Jackson, J., & Lesh, N. (2010). CommCare: Automated quality improvement to strengthen community-based health. *Weston, Mass.: D-Tree International*. Retrieved from https://www.researchgate.net/profile/Theodore_Svoronos/publication/268198360_CommCare_Automated_Quality_Improvement_To_Strengthen_Community-Based_Health/links/5485e4780cf2ef3447892691/CommCare-Automated-Quality-Improvement-To-Strengthen-Community-Based-Health.pdf

Were, M.C., Shen, C., Bwana, M., Emenyonu, N., Musinguzi, N., Nkuyahaga, F., Kembabazi, A., & Tierney, W. M. (2010). Creation and evaluation of EMR-based paper clinical summaries to support HIV-care in Uganda, Africa. *International Journal of Medical Informatics*, 79, 90–96. Retrieved from https://www.ncbi.nlm.nih.gov/pubmed/20036193

World Health Organization (WHO). (2014). *A rapid assessment of the burden of indicators and reporting requirements for health monitoring*. Prepared for the multi-agency working group on indicators and reporting requirements by the Department of Health Statistics and Information Systems. Geneva, Switzerland: WHO. Retrieved from https://www.internationalhealthpartnership.net/fileadmin/uploads/ihp/Documents/Tools/M_E_Framework/Rapid_Assessment_Indicators_Reporting_report_for_WG_revised_03Mar14.pdf

USAID
FROM THE AMERICAN PEOPLE

MEASURE
Evaluation