DATA USE STUDY REPORT

The Drivers and Barriers to Improved Information Use for Decision-Making: Interpretative qualitative study at the point of health service delivery in Yeka, Akaki-Kaliti, and Ledeta sub-cities, Addis Ababa, Ethiopia

Report prepared by: Biruk Abate and Hibret A Tilahun

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EXECUTIVE SUMMARY

In 2015, the Ethiopian Government enacted an ambitious five-year initiative, the Health Sector Transformation Plan (HSTP), to transform its health sector, including the health information system. Information Revolution (IR) emerged as one of the priories of the HSTP with the aim of creating a culture of information use in the health sector at all levels, digitization of priority health interventions, and strengthening governance of the health information system. Over the past four years, the Ministry of Health and the Regional Health Bureaus partnered with local universities to support the health system at all levels using a capacity building and mentorship program that is based on the information revolution agenda. Accordingly, the Addis Ababa University has been supporting three sub-cities; Yeka, Lideta, and Akaki-Kaliti, out of a total of ten sub-cities under the Addis Ababa City Administration.

This study aims to assess the barriers and facilitators to data use and data quality using a theory of change, prepared for this particular purpose. The theory of change describes the effect of interrelated factors categorized under human capacity, systems and processes, and data visualization that contribute to improved data quality and data use at health facility level.

The cross-sectional study used grounded theory and analyzed qualitative data that were collected through 40 key informant interviews (KIs), six focus group discussions (FGDs), and observations in ten health centers in three sub-cities of Addis Ababa: Yeka, Akaki-kaliti, and Ledeta. In all of the selected health centers, the head, deputy head, health information technician (HIT), and a health professional that provides maternal and child health services participated in the study. The research team performed a word-by-word transcription from Amharic to English and used the qualitative data analysis software package, Atlas ti-7, to code and to identify frequency and patterns in the study participants' responses.

Study participants indicated the improvements seen in ensuring data quality to create trust in the data. They cited the following as key reasons that led to improvements; capacity building in health information system; leadership engagement; establishment of Performance Monitoring Teams (PMT) at health facilities; use of motivational incentives for those who perform well in data quality and data use; regular mentorship visits; and application of the tools and strategies of the Connected Woreda Strategy.

Although the improvements are generally appreciated, study participants have emphasized that there is more to be done to create a culture of information use. A few of the barriers to optimal data use practices that were frequently cited by study participants are: use of duplicating data collection tools, infrastructure-related challenges, lack of leadership commitment, limited technical capacity of health information technicians and health workers, inadequate staffing structure for data management at the health facility level, and unfavorable health worker attitudes toward data.

Moving forward, the following are recommended to strengthen data quality and use, particularly at service delivery level: building capacity of leaders on health information system, offering continuous need-based technical capacity building for all who are involved in service provision and data management, implementing interventions that help to change the mindset of health workers on data, revisiting the staffing structure for health information systems at the health facility level, and improving health information system infrastructure through a deliberate investment guide by a road map are recommended.

(I)   INTRODUCTION

Ethiopia's health service delivery is organized into three tiers. The first tier is primary-level care, which is mainly provided by primary hospitals, health centers, and health posts in the rural and pastoralist areas and by primary hospitals, health centers, and urban health extension professionals in the urban areas. The majority of health care services are provided at this level with selected cases referred to the 2nd tier health service delivery point that is provided by general hospitals. A 3rd level of care is provided for selected cases that need specialty care at specialized referral hospitals (1, 2).

In 2015, the Ethiopian Government enacted an ambitious five-year initiative, the Health Sector Transformation Plan (2015-2020). The top priorities of the plan included; woreda transformation; transforming quality and equity; creating a compassionate, caring, and respectful health workforce; and an information revolution. The Information Revolution agenda focused on creating a culture of information use in the health sector at all levels, digitization of priority health interventions, and strengthening governance of the health information system (1).

The country achieved major accomplishments over the past five years, using the Information Revolution Roadmap (IR) that was prepared to guide the implementation of priority health information system interventions. A major focus of the IR has been defining strategies that can help to create a culture of information use, particularly at the health facility level. This shift in culture is premised to enhance the use of data collected by health workers to improve access to quality health services for the community that they service [3].

Ethiopia's IR is a strategy designed to transform and enhance the culture of data use to positively impact the population's health and health system performance through evidence-based decision-making at all levels of the health system. It promotes change in the data use culture at the point of collection, or where service delivery occurs. The comprehensive initiative includes organizational strengthening, system design, accelerated system expansion, capacity building, and cultural change for more and better data use (3 & 4).

The overarching goal of the IR is to improve and sustain health system performance through the effective use of quality data for decision-making at all levels of the health system. For this significant transformation to occur, there needs to be improved access to and availability of high quality data. Without addressing both access and availability, it is unlikely that effective data use will emerge. Secondly, the IR aims to establish a culture of data use in the health system, with a particular focus among health system actors that work at the point of health care delivery. This shift in culture requires cultivating the commitment to and ability in evidence-based decision-making at all levels of the system. The third goal is establishing effective and appropriate Health Information System (HIS) governance, which focuses on the legal and policy framework as well as the coordination and alignment of actors and investments to support health information system integrity, functions, and performance (1, 3, 4).

Since the launch of the Health Sector Transformation Plan in 2015, Ethiopia has introduced different initiatives to achieve the IR agenda. One initiative is the Connected Woreda Strategy (CWS) that aims to operationalize the IR at the woreda and health facility levels through instituting a tiered pathway for facilities and woredas to achieve the highest standards in data quality and use. The CWS is about connecting woreda-level health institutions and people with better information in order to improve health system performance and ultimately, health outcomes. The Connected Woreda involves communities, patients, health workers, administrators, and decision-makers—from communities and health posts to clinics and hospitals to administrative offices at the woreda level (3, 4).

Within the Connected Woreda (3 & 4); communities are expected to be connected with better information about services available and their own health, Health Extension Workers (HEWs) and clinicians will have access to better data about their patients and communities and use it to deliver better care, Woreda administrators will have information and tools to support resource planning and supervision/mentorship within the primary health care unit (PHCU) and across the woreda, and supervisors at the health centers use a Performance Monitoring Team (PMT) processes to improve PHCU performance (4). Similarly, decision-makers at higher levels understand the state of health across the woreda and can effectively support policy and planning for equitable, effective, and safe health care delivery.

In this regard, the Ministry of Health and Regional Health Bureaus partnered with local universities to support woredas to achieve 'model' status in information systems through a capacity building and mentorship program by using the connected woreda strategy. Accordingly, the Addis Ababa University has been supporting three sub-cities, Yeka, Lideta, and Akaki-Kaliti, out of a total of ten sub-cities in the Addis Ababa City Administration.

Based on the recommendations of the CWS, the 1st step is to define the baseline of a health facility/woreda to understand the implementation status of health information system. Based on the bassline measure, the health facility/woreda will be classified as; an "emerging facility" (i.e., facilities scoring less than 65% against the criteria), a "candidate facility" (i.e., facilities scoring between 65% and 90% against the criteria), or a "model facility" (i.e., facilities scoring at least 90% or above against the criteria) (5, 8). A continuous support (e.g., technical assistance) is provided to candidate or emerging facilities over six months in conjunction with developing a tailored action plan that is informed by the findings of the baseline assessment. After the six-month period, these facilities are re-evaluated using the same checklist and their level will be updated accordingly. When facilities within a woreda are enabled to communicate or exchange data using an electronic system, then the health facilities/woreda will be considered a connected facility/woreda (4).

One of the strategies that is recommended to be tailored and implemented in the health facilities as part of the Connected Woreda Strategy is the Performance Monitoring Team (PMT). This is a team of diverse experts from the different service delivery units of the health facility who meet at least once a month to review their data, assess for quality, and use it for decision-making. The PMT is expected to conduct a root cause analysis to understand the main cause of problems, and develops and implements a tailored action plan, based on the identified root causes (3 & 4).

Thus, the primary purpose of this study is to assess the various technical, organizational, and behavioral factors that facilitate improvements in data quality and use that in turn, is expected to improve access to quality health care for better health outcomes.

(II)   LITERATURE REVIEW

From a review of local and global evidence and based on our experience in Ethiopia, the factors that facilitate or hinder data quality and data use can be categorized into; Human capacity; Leadership; Infrastructure; Systems and processes; and Data visualization. We believe these interrelated factors play a role in determining the level of data quality and data use at different levels including at the point of health care delivery (7 - 13).

(1) Human capacity

Human capacity includes the development and application of data use training and mentorship to strengthen health manager and health worker capacity in data analysis, interpretation, and application of evidence for decision-making (e.g., planning, targeting, monitoring, tracking defaulters, and assessing quality). Capacity building cannot be achieved through a one-time classroom training unless it is complemented with regular on-the-job skill reinforcement and mentorship provided by trained professionals (7, 8, 9).

A few studies have documented the effect of skill gap in data management and use as an important barrier to data use. A study conducted in the Amhara region showed the lack of data analysis skills as a key barrier to the use of routine health information data (7). Another study done in the Oromia region showed staff capacity and motivation as one of the determinants of data use (8). A study conducted in Nigeria showed knowledge and skill as one of the key determinants of the strength of the Health Management Information System (HMIS) (9).

(2) Leadership

Several studies have demonstrated the effect of leadership in data quality and data use (11, 20, 21). A study conducted in Malawi showed that the lack of full commitment by management at many levels has been a major obstacle to implement the health information systems. The perceptions and attitudes of senior management towards HIS design and implementation determines the level of information use (11).

(3) Infrastructure availability

A systematic review conducted in LMIC settings showed that lack of infrastructure (office space, supplies, equipment, computers, printers, and alternate power) and shortage of electricity were the most prominent infrastructure barriers. Communication challenges due to limited internet services, poor telecommunication network and limited access to phones, and the lack of functional system were the main determinants of health information use for decision making (11).

A study conducted in Nigeria showed that the lack of infrastructure support and resources for Health Information System (HIS) were determinants of poor performance of HMIS (9). A study conducted in Amhara region showed lack of infrastructure as a reason for low functionality of health information system (7).

(4) Systems and processes

Application of systems and processes that help to monitor data quality, data use, and data verification practices are central to the production of quality health data. Shared accountability for data quality must be integrated into the data culture. Once these preconditions are met, individuals and teams are expected to adopt data quality assurance mechanisms and processes and be integrated into working norms.

A systematic review conducted in LMIC settings showed lack of effective coordination, management, and supervision among organizational departments and professional hierarchies created communication gaps and management issues that affected effective HIS implementation (11). Similarly, a study done in the Amhara region showed that the lack of supervision and regular feedback were associated with poor HIS performance (7).

(5) Data visualization

Investment in making data accessible and appealing through digitization and visualization is expected to facilitate improvements in data use. Designing and testing data visualization formats with different user groups, introducing new tools, techniques and skills, and using new or existing software platforms will enable data producers to package and communicate data to decision-makers in ways that facilitate understanding, interpretation, and use. As better accessibility and visualization emerges as a norm, trust in data will begin to grow as well as experience and comfort with data use. This process can help to improve pathways to establish a data use culture through increased demand for data among health workers, managers, and policy makers [5 & 13].

(III) THEORY OF CHANGE

This study used a theory of change (TOC) that is customized for this particular research. The TOC was first developed through the collected input of high-level health information system technical experts during a consultative workshop (6). It was then further customized using local and global evidence.

As presented in figure 1, to create a culture of data use at the point of health care delivery, three changes need to happen— 1) health workers should be motivated and an accountability structure in place; 2) health workers and managers' capacity on data analytics, interpretation, and making insights need to be developed; and 3) a health workforce that demands quality data should be created.

For these changes to happen, a process that promotes interaction, discussion, and problem solving, like a PMT or quality improvement team, should be established and made functional. Through this process, important barriers to effective data use, needs to be assessed, identified, and solved. Skills and capacity need to be developed among those who collect, organize, interpret, use, and make insights using the data. Multifaceted efforts (including training, mentorship/coaching, supervision, etc.) should be enacted to create the needed capacity at the health facilities and woreda level. Ensuring; data quality, digitizing and visualizing it can promote easy access to the data and it will encourage health workers and managers to use it (6, 14, 15).

In summary, the key pillars for more and better data use at the point of health care service delivery are deliberate investment at that health facility and woreda level to establish functional processes and systems for data use, in addition to building human capacity on data analytics and use and promoting data visualization.

Figure 1: Theory of Change: Drivers of improved data use at point of health care delivery
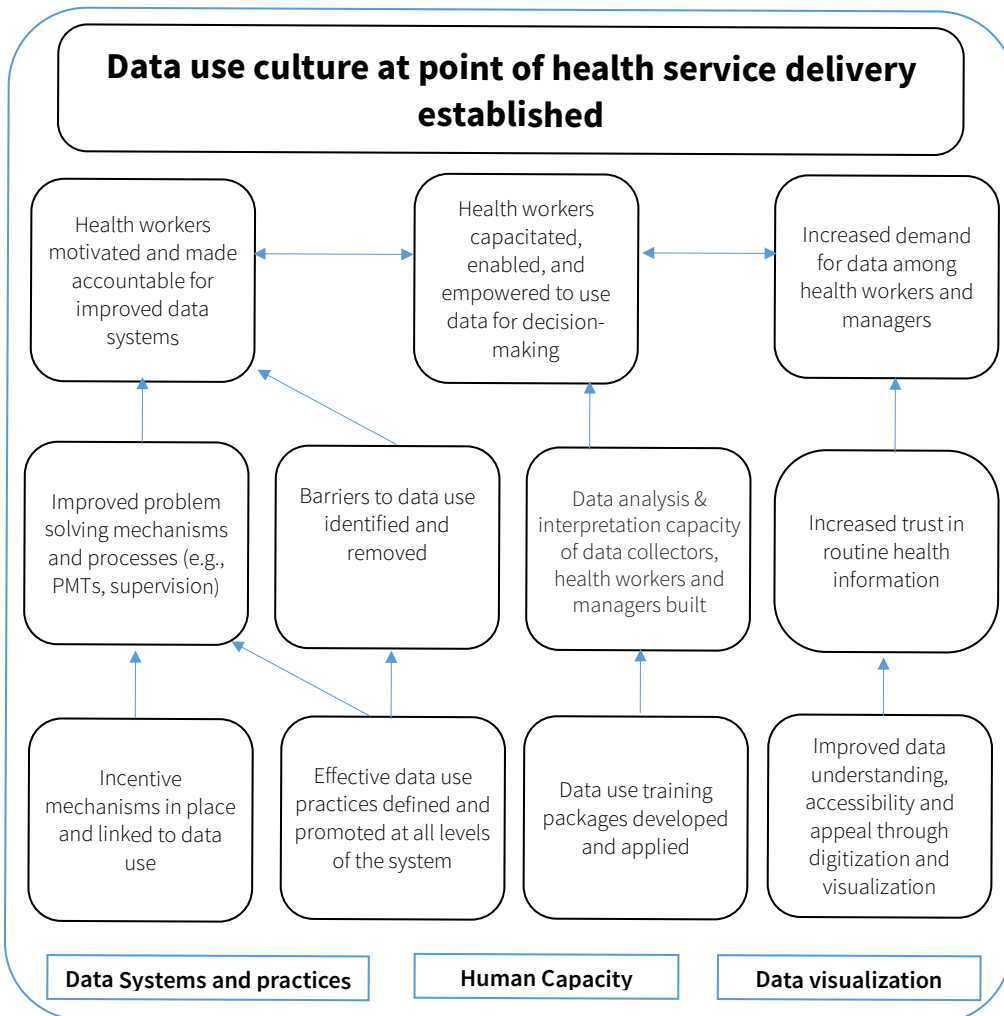
(IV) OBJECTIVES

The main focus of this study is to qualitatively explore drivers and barriers to improved data quality and data use practices at the point of health care delivery.

In this regard the study assessed:

1) The drivers and barriers of data use at the point of health service delivery.
2) The effect of capacity building on data quality and data use.
3) The effect of Performance Monitoring Teams or similar processes in promoting use of quality data for informed decision-making.
4) The role of leadership in improving data quality and data use.

(V) METHODOLOGY

Study design

This is a cross-sectional study that applied interpretive qualitative technique by using data that is collected through; key informant interviews, focus group discussions, and observations.

Study area

The study is conducted in three sub-cities of the Addis Ababa city administration; Yeka, Akaki Kaliti, and Ledeta sub-cities. The reason these three sub-cities were selected is because of the special support they have been receiving from Addis Ababa University School of Public Health through the Capacity Building and Mentorship Program (CBMP). Eleven health centers, a mix of those that showed improvement and those that did not, were purposefully selected to be included in the study.

Table 1. List of health centers selected for data collection

Name of Health Center	Sub-city
Woreda 1	Yeka
Kality	Akaki Kality
Akaki	Akaki Kality
Hidase Fire	Lideta
Woreda 4	Yeka
Woreda 12	Yeka
Kilinto	Akaki Kality
Woreda 8	Yeka
Woreda 5	Yeka
Woreda 9	Yeka
Beletishachew	Lideta

Study participants

The study participants were health workers, health information technicians (HITs), and managers that work in the selected health centers in Addis Ababa.

A total of six focus group discussions and 40 key informant interviews were conducted, which represented a diverse group of study participants, including head, deputy head, health information technician, maternal and child health coordinator, disease prevention and control coordinator. In addition, health information experts from regional health bureau, sub-cities, and from the CBMP of Addis Ababa University were also interviewed. Study participants that are newly hired (those who stayed less than six months in the position) were excluded from the study.

Data collection methods

Data was mainly collected using key informant interviews, focus group discussions (FGD), observation, record reviews, and a review of reports and other supportive documents. The data collection is guided by interview guides prepared in the local language. Each key informant interview lasted about thirty minutes, while each focus group discussion lasted about two hours. Six to ten participants participated in each FGD. Data collection and transcription were completed from February 25 to May 25, 2020.

Data collectors

Data is collected by trained professional data collectors who had previous experience doing similar data collection activities. For each key informant interview and focus group discussion, an interviewer and one note taker were assigned.

Data management

Interviews and focus group discussions were audio recorded in addition to notes taken by the data collectors. All audio recordings were transcribed word-by-word in Amharic and translated to English by the same data collectors. Data is cross-checked with the notes and one comprehensive data set was generated. Data generated from record reviews was organized, based on a template prepared for the analysis.

Data quality assurance

To ensure quality of data, experienced and well-trained data collectors were engaged, data collection tools were tested, interviews were done in a private and comfortable set-up, interviews were conducted in local language, Amharic, and audio recordings were transcribed word-by-word in Amharic and then translated to English.

Data analysis

Data was analyzed immediately after each interview to identify emerging concepts and categories, and to obtain the core contents of initial concepts and categories for subsequent interviews. The transcriptions were rewritten accordingly by repeatedly listening to the tape recorder to understand the concepts of each respondent.

Data was analyzed using a qualitative data analysis software package Atlas ti-7. In the open/initial coding process, the transcripts were analyzed line-by-line, and several codes were developed to assess the data. Finally, the most frequently cited sequence were identified for theme formation. Relevant verbatim quotations were reported to aid the interpretation of the data.

Validity

To ensure validity of the result; interviews were continued until saturation is achieved, triangulation has been applied, discrepant information was removed, and debriefing was done for experts.

Ethical considerations

The proposal and study tools were reviewed by the Ethiopian Public Health Association ethical review committee. All study participants participated voluntarily and verbal consent was obtained from the study participants. The information collected was kept confidential and no personal identifier was attached to the data. Interviewees were allowed to stop their participation in the study at any time.

Conflict of interest

All investigators have declared that they do not have any conflict of interest with this research activity.

Limitations of the study

Findings of this study should be interpreted in the particular context of the Addis Ababa health care system and the findings cannot be generalized to the larger country context. A bigger study with a mixed-method design is recommended.

(VI) RESULTS

A total of 40 key informant interviews and 6 focus group discussions were conducted with a participation of 43 focus group discussants. A total of 8 themes and 45 sub-themes which are directly related to the main objectives of the study were identified and presented below.

I. Data quality

Study participants stressed the importance of ensuring data quality as a necessary precondition to create trust over the data among the users so as they value and use it. It is obvious that data quality has improved from the past as one of the study participants explained it:

> *"We have so many changes compared to last year; for instance, when we see the registration and reporting system in delivery service, (in the past) data was not properly recorded and reported but currently, complete data is recorded."* (FGD Participant)

Consistent capacity building work in the form of a classroom training and through on-the-job mentorships have helped to build capacity that assisted health facilities to move from an "emerging" to "candidate" status, per the Connected Woreda Strategy. This process resulted in a significant improvement in the data quality among others. In this regard, one of the study participants has said the following:

> *"Mentorship has a significant contribution in improving data quality and strengthening the recording system. The majority of the health institutions shifted from "emerging" to "candidate" and from "candidate" to the "model" level. This is because we provided mentorship and support closely through facilitating knowledge and experience sharing. The mentorship was conducted every month and all the necessary corrective measures were taken on the spot and feedback were given to the concerned stakeholders. All the 36 health institutions in the three sub-cities where a strong mentorship have been done are in a good status with regard to data quality."* (Addis Ababa Regional Health Bureau)

The implementation of health insurance, which began in Addis Ababa in 2018, has its own contribution to data quality. Primarily because the complete service information is needed in order for health facilities to be reimbursed, which has served as an opportunity to improve data quality.

> *"Health insurance system became one opportunity for us to ensure data quality because when patients come to our health institute for care, they need to have full information including full medication history for the insurance to cover the cost.*" (Maternal and Child Health Coordinator)

Study participants have stressed the exceptional role of the PMT in promoting data quality. Members of the PMT review the health facility data during the last week of the month for consistency, completeness, and other parameters to validate the quality before it is used for further analysis and decision-making. It is also after this stage that data is reported through the DHIS2 system.

One of the study participants, who is a coordinator of maternal and child health (MCH) explained:

> *"Reports are being reviewed by the PMT members. We also conduct a gap analysis including keeping all responsible individuals accountable for identified gap; this is one of the factors that helped to improve data quality in our facility."* (Maternal and Child Health Coordinator)

One of the best practices mentioned by study participants is the use of a process that starts with identifying data quality gaps and challenges, based on the routine data, before proceeding to explore the root causes of the quality gap. Once the root causes of the data quality problem are identified, tailored solutions are then planned and implemented. This participatory approach helps to create tailored solutions for the context specific challenges.

One of the study participants from the Addis Ababa University explained the process as follows:

> *"The data quality improved significantly when we involved owners of the data in the problem identification and to resolve it. What we did recently is that we invited heads and case team coordinators from a health facility who thoroughly discuss and assess their own problem during a consultative session organized by us, which was found to be fruitful. While they are discussing about their problems, we [Addis Ababa University team] comment or propose ideas for their considerations. Once they are back to their facilities, we follow their progress in addressing the identified challenges and I think this is an innovative idea."* (**Addis Ababa University**)

Some of the study participants reported that Addis Ababa University supports this process and they call it "KAP Stone". A study participant from the University also confirms:

> *"We implement KAP-stone project in three sub cities: Yeka, Akaki-Kality and Lideta where health facilities identify problems on data quality and information use and intervene to solve them and we have three teams composed of people from sub-city level and responsible to implement and do research on KAP-stone project intervention."* (**Addis Ababa University**)

As explained by the study participants, experts from higher levels who conducted supportive supervision visits have helped to solve challenges that compromised data quality. These challenges include shortage of checklists and associated tools, interruption of connectivity and the DHIS2 system, gaps in understanding data and indicators. Having structured and regular supportive supervision visits, guided by a checklist was key to sustained data quality improvement, according to participants. One study participants explained:

> *What we do to prevent data quality problems is, first we give on-job training and second we also conduct supervision. During the supervision, verbal and written feedback is provided on issues needing improvement.* (**Disease Prevention and Health Promotion Coordinator**)

Another technique applied to assure data quality is the use of Lot Quality Assurance Sample (LQAS). Every month, after the collection of monthly data from all departments, the health information technician will organize the data and present it to the PMT. The PMT will then randomly identify a few sample data, like tuberculosis or immunization, and do a detailed review for accuracy and consistency, including cross-checking with the source data. This technique has been integrated into the routine work of the health facilities to routinely address data quality issues. A health information technician explained:

> *We sit for a PMT meeting and we conduct LQAS. When we usually sit for the PMT meeting, we sit having the report they submitted, the report I entered in the DHIS because I might also make a mistake while entering the data; most of the time they submit the report from day 21-22 of the reporting month and I usually finalize my report on 23rd -24th. Then, if EPI (expanded program on immunization) room is selected for the LQAS, we got to the department, and we check the source data including the tally sheet, my report. This is how we try to check the quality and solve the problem.* (**Health Information Technician**)

II. Data use practices and facilitators to improved data use at health facility level

Overall, study participants explained that compared to the past, there are improvements in data use at the health facility level. Different departments in the health facilities collect and use their data to guide their work and to track their performance.

> *Generally, what we do is highly related to data; starting with forecasting of drugs, estimating budget. Similar to this, in the different departments decision are made based on data. For instance, if there are still births which are increasing in the health facility, we ask for justification. When the top ten diseases are listed, it is based on data that we do ABC analysis, vein analysis, and that essential drug lists are also defined by looking at which diseases are common, which is also based on data; so we use the data for many activities.* (**Health Center Medical Director**)

Study participants cited the followings as the main drivers of the change in data use:

1) Human capacity.
2) Leadership engagement.
3) Performance Monitoring Team (PMT).
4) Motivational incentives.
5) Mentorships.
6) Tools and strategies of the connected woreda strategy.

1) *Human capacity*

All study participants confirmed that building the technical capacity of health workers on how to collect, organize, analyze and use data was a key factor for a successful data use practices at the point of health care delivery, and in particular, building the technical capacity on data analysis and interpretation.

Most study participants confirmed that while they lack the capacity in advanced data analysis and interpretation, they can use basic Excel to organize, present, and use their data. One of the study participants explained:

> *"We use excel for analysis and to organize a monthly, quarterly, and annual data; both service and disease reports. We prepare tables and charts to make it easily understandable by users."* (A Sub-city Mentor)

A consistent capacity building effort has helped health facilities to progress from an "emerging" to "candidate" status as they engaged in the model woreda and health facility development process of the Connected Woreda Strategy. This process resulted in a significant improvement in promoting data use at health facilities. A study participant said the following:

> *"Capacity building has a significant contribution in improving data quality and data use and in strengthening the recording system. The majority of the health institutions shifted from "emerging" to "candidate" and from "candidate" to the "model" level. This is because we provided mentorship training through facilitating knowledge and experience sharing."* (Addis Ababa Regional Health Bureau)

2) *Leadership engagement*

Study participants associated better data use at the health facilities with leadership commitment. In health facilities where the leadership is committed to improving data quality and use, there was better performance in both, compared to health facilities where there was no meaningful leadership engagement.

In some health centers, the leadership, specifically medical directors of health centers, made a special commitment to ensure the regular convening of the PMT meeting and to design and implement innovative monitoring systems, which have helped to improve data use and quality.

> *"For instance, in our catchment the two health centers are much better, but the others have problems; this is mainly because of leadership commitment."* (FGD participant)

Leadership commitment that was demonstrated in some health facilities, specifically by health facility heads, included random, on-site check-ins on the different health units; providing written feedback at the end of the visit; publicly sharing the visit outcomes to all staff members; organizing regular management level meetings to review data; and using every opportunity to advocate for data, among others. A health information technician of a health center said:

> *"The medical director here need to be praised for her commitment in making the performance monitoring team strong and active unlike other places; this is because of the medical director's contribution."* (Health Information Technician)

3) Performance Monitoring Team (PMT)

The main data use platform at health facilities is the PMT. Chaired by the head of the health facility, the PMT reviews the monthly routine health information data to check for data quality and to monitor performance of the health facility.

> *"Mainly, the performance monitoring team gives attention to data use which is the ultimate goal of a functional PMT. The members of the PMT are represented from all core processes and case teams and decision makers' including the health center medical director. The PMT passes decisions based on data."* (Health Information Technician)

When the PMT observes data quality gaps, they will do further analysis to understand the contributing factors through a quality improvement process.

> *"For example our quality improvement process identified card room as needing improvement and as a result, we assessed the problem and assigned a competent worker, we procured shelves, and allocated about 1 million Birr to construct a new building for card room."* (Disease Prevention and Control Coordinator)

4) Motivational incentives

Overall study participants recognized the effect of incentives on health worker motivation to collect and use data. Some health facilities have used non-monetary incentives, like providing certificates, publicly recognizing high performing health workers, and providing training opportunities. In one health facility, they used monetary incentives to the best performing staff members. In summary, study participants agreed that incentives have a key role to motivate health workers to use their data, but it needs to be contextually designed and implemented in a way that will not demotivate others nor create dependency. One of the study participants explained:

> *"There were three high achievers, who ranked from 1 to 3, and they were given certificates in recognition of their performance, in addition, money was provided to them; surprisingly it was the same individuals who perform high every time. There is some level of motivation because of the incentive but we are also concerned about the sustainability of the incentives since we don't have enough budget to do it every time."* (Maternal and Child Health Coordinator)

5) Mentorship

A pool of mentors was trained on selected data quality and data use topics. These topics were identified from a needs assessment that was conducted to assess skill gaps. Mentors visit health workers regularly to provide on-site technical support to improve data use practices. Although mentors are committed on guiding their mentees, a gap remains, as some mentees are reluctant to translate the knowledge they acquire through the mentorship into practice.

> *"Health workers have changed astonishingly in their value for data because of the mentorship…. there are institutions that didn't have active PMT but after mentorship, as mentors provided support about the importance of PMT, leaders started to actively take part when the PMT plans activities, identify gaps and evaluate progress."* (Addis Ababa University)

6) Tools and strategies of the connected woreda strategy

Study participants conveyed that the tools and checklists, used to facilitate the implementation of the Connected Woreda Strategy, are currently being employed to assess the status of health facilities and to guide the information revolution at health facilities. A study participant from Addis Ababa Regional Health Bureau explained:

> *"There is a validated standard checklist to assess the progress of health institutions in data use. Using that checklist, we assess and classify the level of the health facilities. Higher level experts from Ministry of Health validate our assessment and if it is confirmed by them then the health facility will be recognized as a model health facility in data use. For instance, Trunesh Bejing Hospital in Addis Ababa has become a model hospital through this process. We conduct experience sharing among health facilities to share their best practices to others."* (Addis Ababa Regional Health Bureau)

III.   Barriers to data use

Although the improvements experienced in data quality and use are appreciated, study participants emphasized that there is more to be done to create information use culture at health facilities.

> *"I think data use culture is poor and we don't know exactly how they (health workers) use data for decision making since we don't participate in management meeting. We see that case team coordinators and core process owners meet with health center management and we don't have knowledge whether they use it as input for management decisions. We submit data to management on monthly basis and I don't know if they use it or not and it is better if they can engage us in the management meeting so we can be resources for them in providing the necessary data."* (Health Information Technician)

Barriers to optimal data use practices that were frequently cited by study participants were:

1) Duplicating data collection tools in use.
2) Health information system infrastructure not well developed.
3) Lack of leadership commitment.
4) Inadequate technical capacity of health information technicians and health workers.
5) Inadequate staffing structure for data management at health facility level.
6) Health workers' attitude towards data not encouraging.

1)   Duplicating data collection tools in use

Because data collection tools (registers, reporting templates, etc) other than the standard HMIS tools are being used, health workers have found it challenging to ensure consistency in the collected data. This issue created a burden among the health workers and further discouraged them to value and use the data.

One of the discussants from the FGDs explained the situation as follows:

> *"There are many registration books to fill. For instance, in the OTA report we usually find the mismatch between weekly and monthly report. When we tried to do it again, we find that there are many different registrations that are used as source document. For instance, there is the main registration itself, there is risk assessment registration at OPD and there is PICT."* (FGD   Participant)

2)   Health information system infrastructure not well developed

Other major cited challenges to properly collecting, organizing and using data was poorly organized medical recording units with limited space and a lack of necessary furniture, computers, and shelves. Insufficient working infrastructure also created concerns of potential vulnerabilities to the data's security and confidentiality. A key informant interview participant from the Addis Ababa regional health bureaus explained:

> *"The other challenge is on the medical record unit; there is interruption of network (internet), workload in the archive unit and the rooms are confined, there is space problem, privacy and confidentiality problem since many people have access to the computers."* (Addis Ababa Regional Health Bureau)

> *"What the MRU (medical recording unit) were having as a challenge is lack of shelves and because of this patient medical records were being placed everywhere."* (Health Center Medical Director)

In addition, the instability of the DHIS2 system, due to connectivity issues and other related challenges like slow processing time to generate analysis, has been a major challenge and created frustration among the health workers who fully depend on it for their day-to-day data use work.

An expert that is responsible for disease prevention and health promotion work and a health center medical director explained the challenge as follows:

"We use the software (DHIS2) for; compiling, analyzing and for using the data that we collect for decision making. The challenge that is related with the DHIS is the connection problem; I remember, it was interrupted for weeks once, and we could not use it." (Disease Prevention and Health Promotion Coordinator)

"Another challenge was recurrent interruptions of DHIS2, it was down for long time and we couldn't even analyze ten top diseases, we did it manually. There are also problems of getting help when we need maintenance service." (Health Center Medical director)

Because the DHIS2 system is not reliable, higher level bodies who need data tend to repeatedly ask the health facilities to send them data through other means rather than accessing the data from the DHIS2 system. One FGD participant described the situation:

"Currently a very important but difficult thing is the DHIS2 system. However; we are asked by different bodies; for example, sub-city is asking the same data in five ways which means they don't see DHIS-2 report. And, if someone needs data, he/she calls us instead of getting the data from DHIS2. In this modern time, we are behind technology; even we cannot exchange report from OPD through computer." (FGD Participant)

3) Lack of leadership commitment

Study participants consistently mentioned that the lack of appropriate leadership guidance from the heads of health facilities as a major bottleneck to improved data use practices. In areas where there are poor data use practices, health facility leaders are often not motivated to follow-up on the health information system. This lack of motivation could be attributed to not being well trained or because of a reluctance to be held accountable for their poor performance.

"As to me it is good to start working towards the concept of data use at leadership level because the majority of people who are in the leadership role don't have adequate knowledge towards data use including me. Therefore; in the future, training should be provided to all concerned bodies starting from the leaders about data use and evidence based decision making. Data is important for decision, budget allocation, and political decision so knowledge of data use is crucial for leaders and all other concerned stakeholders. Thus training will be organized and given to all leaders and other stakeholders to utilize data properly for decision making and this should be given due emphasis in the future." (Addis Ababa Regional Health Bureau)

4) Inadequate technical capacity of health information technicians (HITs) and health workers

Multiple staff are involved in data collection, interpretation, analysis, and use at the health facility level, though involved staff can vary, depending on the complexity of the health facility. Involved staff can include a medial registration unit worker, health information technicians, nurses, and other health workers that operate in the different units. Study participants stressed that capacity gaps at all levels, particularly with the medical registration unit workers and HITs, as a key factor in affecting data quality and the use of data.

In particular, a major capacity gap is reported in the disease reporting system. Health workers and HITs lacked the capacity to properly understand and use the national disease classification.

5) In adequate staffing structure for data management at health facility level

Another major barrier expressed by study participants is the lack of an appropriate staffing structure that is adequate to handle the expected amount of data management work at the health facility level. Most health facilities are currently suffering from a shortage of HITs because some are attending college to upgrade their diploma level training to bachelor's degree. As a government initiative, this opportunity allows HITs to keep their salary and position at the health facility while they are attending the program. This limits the health facility from hiring a replacement staff to cover the role until the HIT completes the long-term training program, which can take from two to three years.

"We have only one HMIS officer now and another one went to higher education and we can't recruit a replacement. We have no option except waiting until she completes her education but this has influence on data use work, which means the data use activities will be handled by one expert." (Health Center Medical Director)

6) Health workers' attitude towards data not encouraging

Overall, the major barrier mentioned repeatedly by the study participants is health workers' unfavorable attitudes, perceptions, and commitments. Often, health workers were more focused on providing care for patients and less so on properly recording and reporting data. Further efforts that target to improve data use at health facilities should emphasize addressing this challenge by focusing on changing the mindset of health workers towards health information use.

> *"There is an attitude problem (among health workers). Sometimes the performance monitoring team didn't utilize data properly. Even some of the health professionals didn't fill the patient profile as per the standard and this is due to attitude problem and negligence."* (Addis Ababa Regional Health Bureau)

To strengthen data quality and use, particularly at the service delivery level, study participants recommended the following:

1) **Encourage leaders to give attention to data:** train, mentor, and support health facility leadership with a particular attention to the heads.

2) **Provide regular capacity building:** regular (quarterly at the minimum) needs-based training on data quality and use for all who are involved in data collection and use. Improve the way pre-service training of HITs and other health workers is provided to also help address the problem sustainably.

3) **Change the mindset of health workers:** design and implement interventions that help to promote a positive attitude and behavior, targeted at health workers and others who work on data so that they give the necessary attention to collecting and using quality data.

4) **Revisit staffing arrangement:** assess the current staffing arrangement and devise a revised staffing plan that can sustainably facilitate data collection, analysis, and use at the health facility level.

5) **Improve the health information system infrastructure:** make the required deliberate investment to improve the information technology system and infrastructure at all levels of the health system. Ensure the stability of the DHIS2 system by assessing and addressing the HealthNet connectivity and other challenges the system is facing.

(VII) DISCUSSION AND IMPLICATIONS

This study assessed the key drivers and barriers to data use practices at the health facility level by focusing on health centers, using a qualitative methodology to better understand the pathways and the relationships among the different variables.

In this regard, we conducted focus group discussions, key informant interviews, and observations in a mix of health facilities that were considered low, average, or high performers.

Based on the completed 40 key informant interviews and six focus group discussions, six major factors were identified as contributors to the improvements made in data use practice. These contributors included human capacity, leadership engagement, PMTs, motivational incentives, mentorships, and the use of tools and strategies that were prepared to guide the implementation of the Connected Woreda Strategy.

Some of the factors that were identified as facilitators to data use could also serve as barriers. For example, leadership was cited as both a facilitator and barrier; in health facilities where strong leadership was exhibited, it was attributed as a key factor for success. However, in other under-performing health facilities, the lack of leadership commitment was cited as a major reason to inhibit data quality and use.

In addition, the challenge of using multiple registers and data collection tools; poor health information system infrastructure, including internet connectivity; suboptimal technical capacity among the health workers and HITs; an inadequate health information system staffing structure; and health workers' mindset towards data were found to be the major bottlenecks.

Ethiopia embarked on an ambitious initiative that committed to creating a culture of information use at the service delivery point, where it significantly matters. While creating this culture at the lower level does not require complex technology, it does; however, require trained and committed health workers and data experts in addition to user-friendly tools, and a committed leadership that inspires workers to be motivated to use data for action all the time (16). If we wait until we have the digital technologies and optimal health information infrastructure, then this will take an unprecedented time for Ethiopia to achieve its goal (17). While technology helps to improve data quality and can simplify data collection and analysis and make reporting more efficient, we can still bring about major improvements in data use at the point of service delivery while Ethiopia continues to heavily invest in the digitization of priority health services, based on the national eHealth architecture (18).

Based on the findings of this study, developing the capacity of health facility leaders on; the concept of Ethiopia's health information system; the Connected Woreda Strategy; basics of data analysis, interpretation, making insights, and other related topics should be a top priority. Because of the turnover in leadership, there needs to be a mechanism by which newly appointed leaders receive an onboarding orientation and training, shortly after they are appointed. In addition to formal trainings, ongoing mentorship, and follow-up support from the higher levels to address recurring challenges will help leaders to develop the confidence in their work. Integrating these trainings in the pre-service training program is also recommended. Several papers have demonstrated the role leadership plays to transform health care by promoting evidence based decision making [20 & 21].

The use of different registers to collect the same types of information will affect the quality of data, create an unnecessary workload, and demotivate health workers. In addition to the tools prepared for the health information system, it is common for the different program experts that work at different levels to introduce their own tools and registration books, which can gradually weaken the attention given to the HMIS and create a devastating impact in the future. Reviewing and addressing any challenges around existing registers, data collection tools, and other materials will help to solve existing barriers and applying a human-centered approach in this process is recommended. The Ethiopia health data quality review done in 2016 has also identified this challenge and it has put a recommendation to consistently use standard tools at all levels (23).

Although significant progress has been achieved in building technical capacity on HIS, it is obvious that there is still more to accomplish. For example, training should be extended to cover all health workers instead of just the HITs and selected individuals that work on data. A customized training should be designed as it applies to the different groups depending on the role they are expected to play. The training modality should be revisited regularly to minimize the time it takes to cover as many types of health work as possible and to minimize the cost. Regular on-the-job training a few hours each day, facilitated by experts from the health center and from the woreda or sub-city can be a good approach. Designing self-learning digital tools is also a good approach to complement the different capacity building initiatives. A paper published by AbouZahr and Boerma emphasized the need for building technical capacity at lower levels as an essential prerequisite to facilitate evidence based decision making. They continued to explain the importance of having a strong health information system for poor counties because they are poor that they cannot afford to be without it. Health sector reform generally comprises decentralization of decision-making and resource allocation to the district level, yet neither the tools nor the capacities for information generation and analysis at this level have been sufficiently developed. Where capacity exists, it is largely concentrated centrally; the paper describes (19).

Another critical area of engagement is changing health workers' attitude towards data, which relates to the cultural transformation that Ethiopia aspires to accomplish. A change in culture requires an innovative design, which should start from understanding why health workers' attitude towards data is poor. A study done in rural South Africa indicated data were occasionally used to inform health education sessions, and there was little understanding of the usefulness of the data, or its applicability with respect to facility management. Data were not used to inform targets or monitor plans, and minimal analysis of data was done. The study associated this with lack of capacity, and less value given to data by health workers (16).

Different intervention packages that can help to improve health worker attitudes towards data could be tested on small scale. Testing could include introducing motivational incentives, exposing health workers to new skills, simplifying the data systems using a human centered design approach, embracing data as part of everyone's responsibility, introducing accountability mechanisms, and other digital innovations. It is important to consider that a shift in culture is complex and needs time to change, so it is important to avoid approaches that go at scale with the ambition of covering the entire country. A phased approach that can be expanded as the learning matures over time would be better suited.

The Ethiopian Ministry of Health and the Regional Health Bureaus have to take aggressive measures to address the challenges associated with the DHIS2 system, which has been mentioned in this study as a major challenge and a source of health worker frustration. This challenge may be attributed to poorly maintained computers used by the health facilities, poor functioning of healthNet or internet connectivity, overall DHIS2 system performance, lack of technical capacity at the lower levels, lack of helpdesk support, lack of troubleshooting support, and other related reasons. A deliberate investment at all levels that is guided by a well thought roadmap is recommended as a top priority to run the DHSI2 system sustainably. In line with this, the staffing and organizational structure of the HIS should be revisited in a manner to allow for the ability to provide the necessary technical, coordination and leadership support in the longer term. A systematic review conducted by Chaudhry et al showed health information technology to be associated with improved quality by increasing adherence to guidelines, enhancing disease surveillance, and decreasing medication errors in addition to the efficacy gain (17). This is a strong evidence to justify the benefits of investing on health information technology. The Ethiopian government should plan to rehabilitate the information technology in the health sector, particularly at health facility and district levels similar to what has happened in other countries (22).

Similarly, lack of computers, VPN connectivity challenges, shortage of data collection and reporting tools, low data analytics capacity constraining effective utilization of data were identified as challenges during Ethiopia's HSTP1 mid-term review which was done in 2018 (24).

Although this study tried to assess the role of data visualization in inspiring health workers to value and use data, this did not emerge as an important factor during the analysis (13). This could be because there is limited work done at the health facilities, or the study participants did not value its potential. Hence, a more concerted effort in introducing data visualization tools and providing trainings on how to use them is recommended.

Additionally, this study assessed the knowledge of the Connected Woreda Strategy among health workers at the health facility level. Although it is evident, as cited by study participants, that the tools and strategies of the Connected Woreda are currently being used, we have observed limited understanding of the strategy itself, particularly among the senior leadership of the health facilities. There is a need for further promulgation of the strategy as it continues to be the model for future investments in the data use space.

Implications

In summary, this study indicated that there have been improvements in data quality and data use due to the implementation of activities under the information revolution initiative of HSTP1. The main drivers of these improvements are from efforts in capacity building, leadership engagement, tools and strategies, motivational incentives for good performers, mentorships, and the role of the PMTs.

Although improvements are appreciated, there is still more to accomplish to create a culture of information use at the health facility level. Future investments should focus on ensuring continuity of the successful interventions in addition to addressing the major bottlenecks, related to health worker attitudes and infrastructure challenges, including DHIS2 system instability.

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