HEALTH COMMODITY MANAGEMENT INFORMATION SYSTEM: PRACTICE, DATA QUALITY AND CONTRIBUTING FACTORS IN PUBLIC HEALTH FACILITIES OF ADDIS ABABA, ETHIOPIA

By

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This is to certify that the thesis prepared by Kalkidan Endeshaw, entitled: *Health Commodity Management Information System: Practice, Data Quality and Contributing factors in Public Health Facilities of Addis Ababa, Ethiopia* and submitted in partial fulfillment of the requirements for the Degree of Master of Science complies with the regulation University and meets the accepted standards of with respect to originality and quality.

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Abstract

Health Commodity Management Information System: Practice Data Quality and Contributing factors in Public Health Facilities of Addis Ababa, Ethiopia

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Information technology is valuable in managing the supply chain of pharmaceuticals. The quality and utilization of information system are challenge. The aim of the study was to assess the quality of data, the utilization practice of the health commodity management information system and to identify contributing factors. The research was conducted in selected public health facilities at Addis Ababa, Ethiopia from April 10 to June 10, 2019. The design of the study was a descriptive cross sectional study in which a mixed-method approach using quantitative and qualitative methods was employed. Five data quality dimensions: accuracy, completeness, timeliness, validity, and consistency were used to assess reports within the previous one year and utilization practice was also assessed. Data was collected using pre-tested questionnaires, through document reviews, in-depth interview, and key informants interview. Analysis was performed by using Statistical Package for Social Science version 25 software where descriptive statistics mainly: percentage, frequency, mean and standard deviation, and inferential statistics like spearman rho correlation was computed. Qualitative data were analyzed thematically. Twenty facilities were included in the study, where the overall data quality was 66.61%. All the studied facilities use the system for recording of activities. The average utilization of all the regular reports was 39.17%. There were moderate positive correlations between data quality with the period of implementation (r_s = .512, P=.021, N=20) and database characteristics (r_s =.567, P=.001, N=30) and also, utilization practice with organizational factors (r_s = .601, P=.000, N=30). Health facilities need to improve their data quality and utilization practice.

Keywords: Data, quality, dimension, use, utilization, contributing factors, HCMIS

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Abbreviation and Acronyms

AACAHB	Addis Ababa City Health Administration Bureau
APTS	Auditable Pharmaceutical Transaction System
EPSA	Ethiopian Pharmaceutical Supply Agency
FMOH	Federal Ministry of Health
HB	Health Bureau
HC	Health Center
HCMIS	Health Commodity Management Information System
HMIS	Health Management Information System
HPMRR	Health Post Monthly Report and Resupply
IFRR	Internal Facility Report and Resupply
JSI	John Snow Inc.
LIAT	Logistics Indicator Assessment Tool
LMIS	Logistics Management Information System
LSAT	Logistics System Assessment Tool
PFSA	Pharmaceutical Fund and Supply Agency
RRF	Report and Requisition form
WHO	World Health Organization

CHAPTER ONE

1. INTRODUCTION

This research focused on the Health Commodity Management Information System data quality, practice and contributing factors in public health facilities of Addis Ababa Ethiopia. In this chapter background of the study, statement of the problem, research questions, objective of the study, significance of the study, scope of the study, and organization of the paper are explained.

1.1 Background of the study

Information is the central engine that drives the logistics cycle so that the logistics system runs smoothly (USAID, 2011a). The information system helps to collects data from the health sector and analyses the data. The system also ensures the overall quality, relevance and timeliness of data and converts the data into information which can be used for health related decision making (WHO, 2016). Using information systems can have a significant role in managing and integrating data and information within the supply chain (Omary and Kalinga, 2017).

Information technology is important to handle the supply chain of pharmaceuticals which the technology helps to run number of tasks and activities on a daily basis that are related to pharmaceuticals. The technologies have an operational focus on automating activities such as quantification, planning for procurement and delivery schedules, warehouse reporting, inventory management, purchasing, dispensing and patient tracking (Hawkin *et al*., 2009).

In supply chain management, there is a growing demand for up to the minute and quality data. Electronic information systems provide better visibility into the logistics information system and enable key stakeholders to make required decisions with that data. Electronic logistics management information system (eLMIS) also increases the quality of logistics data, as a result improving supply chain management performance and commodity availability at public health facilities, which ultimately leads to enhanced patient health outcomes (USAID, 2015b).

Logistics management information system (LMIS) designed to support supply chain decisions and actions, and the system helps to captures data like receipt items from suppliers, requisition quantities from dispensing units and issued, inventory status of medicines, and lead times from multiple sources and helps to aggregates the data. The data are then used to make informed decisions on the supply chain management after being analyzed which will improve the service provided to customers (USAID, 2011a; Hawkin *et al*., 2009; Shewarega *et al*., 2015).

Through the informed decision and actions the managers take using the logistics management information systems, the quality of the service provided and the health outcomes would be improved. Increasing the responsiveness of the supply chain and reducing the total costs in order to fulfill customer's demand are critical roles of the LMIS. But managers working on supply chain face challenges on accessing real time data for making appropriate decision these challenge force managers to depend on the past experience, especially in developing countries (Shiferaw and Nfor, 2016).

In Ethiopia, the health commodity information system comprises a framework which place logistics records at primary place. As per the implementation of Integrated Pharmaceutical Logistics System, various recording and reporting formats were designed and introduced for use at different levels of the healthcare supply chain. At public health facility level, bin cards, stock cards, Internal Facility Report and Resupply Form (IFRR), Health Post Monthly Report and Resupply Form (HPMRR) and Report and Requisition Form (RRF) were introduced to record health commodity transactions and report needed quantities for resupply (PFSA, 2015). The record formats are used to capture logistics data and the recorded logistics data are combined to form logistics reports. It is mandatory for each health facility to report a minimum set of health commodity information data on a bi monthly basis to the next level. The reported data are used to determine resupply quantity, for forecasting and also for procurement decisions making (Shewarega *et al*., 2015).

Health Commodity Management Information System (HCMIS) is an automated inventory and logistics management information system in health facilities. The database captures all transactions: receives, issues, transfers, orders and other features at facilities. Starting from 2009,

HCMIS has been implemented in more than 750 health facilities in Ethiopia to improve supply chain performance (USAID, 2018). The HCMIS is expected to produce quality information and has important role of reporting at all levels. Automation of LMIS can help strengthen and consolidate data that are generated from facilities and the data can be visible for each level of the supply system so that it can be used for timely and rational decision making and action (USAID, 2011b).

In summary, health commodity information system with good quality is essential to the success of health information system and the overall health system. However, studies show that information within health information systems reports is often of poor quality and use of the information system is not in its full purpose (Adejumo, 2017; USAID, 2017). Despite the intensive efforts to improve the efficiency of information systems, the quality and utilization of the system is still a big challenge. Therefore, the purpose of this study was to assess HCMIS practice, data quality and contributing factors of the information system at public health facilities in Addis Ababa, Ethiopia.

1.2 Statement of the problem

Among the various challenges that health supply chain faces, the one related to information is data quality, use and the information system (USAID, 2017). All data are subject to a number of limitations associated to quality, such as omitted values, bias, quantity miscalculation, and individual errors in data entry and computation. (Alipour, and Ahmadi 2017).

The electronic LMIS is important for the supply chain management and its functionality is wide-ranging. However, considering the extensive purpose of the system, the utilization of the information system by the systems' full potential is not like expected (Bhattarai, 2011). In Ethiopian public health facilities, even if the system is improving the recording and collection of essential logistic data and reporting of the logistics information used for decision making, the need for continuous improvement to fulfill evolving and diversified customer and system requirement in improving the functionality and features is a challenge (Taddesse, 2015).

According to USAID (2016) DELIVER project Ethiopia report, developing and installing information systems improved the visibility, quality, and timeliness of data which can be used to construct decisions. But there are still challenges at the public health facilities with the quality of data accuracy including timeliness of data and also gaps in the capacity of users to use the system in its full purpose to manage inventories. Generally, data contained within the HCMIS is occasionally unreliable, inconsistent, or incomplete; and data are not used routinely enough for decision making. According to AIDS Free project, Ethiopia's main health care supply chain challenges were listed by Ministry of Health and the Ethiopian Pharmaceutical Supply Agency. From a variety of challenges, data quality, use and information system related was among the cited problems (USAID, 2017).

Therefore, to ensure high quality data in routine health information systems and to utilize the system in its full capacity, the root causes of poor data quality, utilization practice and the factors had to be identified. There is paucity of studies on health commodity management information system. Hence assessing the current HCMIS practice, data quality and related contributing at health facilities is decisive.

1.3 Research objective

1.3.1 General objective

- To assess the HCMIS utilization practice, data quality and contributing factors among selected public health facilities of Addis Ababa, Ethiopia.

1.3.2 Specific objectives

- To assess the HCMIS data quality in terms of completeness, accuracy, timeliness, consistency and validity.
- To assess HCMIS utilization practice.
- To identify contributing factors for poor HCMIS utilization practices and data quality.

1.4 Research question

1. What is the status of HCMIS data quality in terms of completeness; accuracy; timeliness; consistency and validity?
2. What is the practice of HCMIS utilization?
3. What are the contributing factors for data quality and utilization practice?

1.5 Significance of the study

The findings of this study will be used to improve the information management system of health facilities. The findings of this study will be important to relevant sectors: Federal Ministry of Health (FMOH), Ethiopian Pharmaceutical Supply Agency (EPSA), Health Bureaus (HBs), Non-governmental organizations (NGOs), Universities. Most importantly for health facilities under the study to be acquainted with their practice and data quality status with the contributing factors so that appropriate interventions can be made to improve health facilities evidence-based practice. This study will also help in improving the quality of data being reported and would help to increase the utilization of the system. The findings will benefits public health facilities to apply the out coming possible recommendations based on the findings of the research. The research paper can serve as a reference material to researchers. Finally the research outcomes will be helpful resources for the general public and scholars by providing information about the level of data quality and practices of HCMIS from the study point of view.

1.6 Scope of the study

The scope of this study was to assess the practice and data quality of HCMIS in public facilities of Addis Ababa. It was limited to public health facilities on regard to data quality, utilization and contributing factors. Whereas data quality dimensions were varied, this study focused on five dimensions of data quality: completeness, accuracy, timeliness, consistency and validity. Yet, there was not a comparison made with other public health facilities out of Addis Ababa.

1.7 Operational definition

- **Accuracy:** refers absence of discrepancy between the balances stated on the reporting form (electronic RRF) and record card (bin card). Accordingly, the report is said to be accurate if zero discrepancies are calculated and by considering the non accurate, the percentage of accuracy was calculated. (USAID, 2008)
- **Completeness**: refers all data elements are filled in the reported format and for the format to be complete all the report formats column needs to be filled. Percentage of the completeness was calculated considering each column of each item (tracer medicine) in the RRF completeness with the total expected completed columns. (PFSA,2014)
- **Consistency**: refers number of expected reports versus number of actual reports that are completed and sent to next level within the defined reporting schedule during a given time period. (Batini C, *et al.*, 2009)
- **Data quality**: it is the quality of data based on defined dimensions: accuracy, completeness, timeliness, consistency and validity of logistics data to make informed decision. (Batini C, *et al.*, 2009)
- **Functional HCMIS**: refers facilities that have implemented HCMIS and currently in mature status meaning which can operate by themselves.
- **Timeliness**: refers the number of reports that are sent from reporting facilities to next level according to schedule during a given time period. (PFSA,2014, Batini C, *et al.*, 2009)
- **Validity**: refers to all the completed by, approved by and verified by columns are filled by the responsible person. (PFSA,2014

1.8 Organization of the study

The whole thesis is presented in five different chapters. The first chapter gives an outline of the general background of the study. This chapter also explains the statement of the problem, research question, objective of the study, significance of the study followed by the scope and operational definition. The second chapter is the literature review chapter; which give a theoretical, empirical concepts and conceptual framework on which this research work intends to be carried out. The third chapter is the research methodology chapter; where an elaboration of the design of the

research work is given including the study design and methodology, sample and sampling methods; tools, procedures and sources of data collection, and data analysis. The fourth chapter mainly concerned with the analysis of data collected and the discussion of the thesis based on the findings of the study. The last chapter which is chapter five presents the summary, conclusion and the recommendation drawn from findings of the data in addition with implications for further research.

CHAPTER TWO

2. RELATED LITERATURE REVIEW

This chapter focused on related literatures on the study. The chapter is presented under the following sections: Theoretical literature review dealing with the definitions given by different scholars on the term of data quality and its dimensions, utilization and contributing factors, followed by empirical review, which focuses on the relevant literature relating to data quality and utilization practice. The conceptual framework of the study is also addressed in this chapter.

2.1 Theoretical literature review

2.1.1 Data quality

Data quality in health has diverse meanings from different perspectives. These are: "timely and reliable data essential for core functions at all levels of government" (Institute of Medicine, 2003), and "Quality data represent what was intended or defined by their official source, are objective, unbiased and comply with known standards" (WHO, 2003). "Fitness for use in the context of the users of data" (CIHI, 2009). Good quality data is said to be when the information available fits or meets the intended goals of its users (Adejumo, 2017).

In order to say data quality is maintained and fulfills the requirements, the data needs to be measured based on number of quality dimensions. These dimensions of data quality represent construct or an aspect of data quality (Chen *et al*., 2014) and data quality is a multidimensional concept. There is no agreement on the dimensions of data quality but there are cross cutting dimensions identified by the literature. In a study to review the data quality assessment methods for public health information systems and also standards, identify the following dimensions of data quality from different studies: completeness; accuracy; timeliness; validity; periodicity; relevance; reliability; precision; integrity; confidentiality; comparability; consistency; concordance; granularity; repeatability; usability; objectivity; accessibility; transparency and representativeness (Batini C, *et al.,* 2009; CIHI, 2009; Chen *et al*., 2014).

World Health Organization (WHO) also identifies the following as dimensions or components of data quality: accuracy and validity; reliability; completeness; legibility; currency and timeliness; accessibility; meaning or usefulness; and confidentiality or security (WHO, 2003).

From all data quality dimensions most commonly reviewed dimensions in literature are completeness, accuracy, and timeliness (Chen *et al*., 2014). Although there is no clear agreement on the correct number of data quality dimensions and their relationships, there are some basic dimensions that have to be considered (Batini C, *et al.*, 2009). These basic dimensions include the accuracy, timeliness, completeness, validity and consistency, which in turn effect on improving processes. Accordingly the study will focus on basic dimensions in the literature.

2.1.2 Utilization of information system

Some attributes were used to define the concept of use in the literature. These were: system use or usefulness of the system, intention to use, user satisfaction, information or data dissemination, extent of data source recognition and specific uses of data, and existence of information strategies and also contents of the strategies, and practice (Petter and Fruhling, 2011; Chen *et al*., 2014).

Davis (1993) in the route of Technology Acceptance Model (TAM) clarified the associations between system design features, perceived ease of use, perceived usefulness, actual usage behavior and attitudes towards using. The model is mainly used to explain the impact of system characteristics and end user behavior on the actual system use. TAM provides a more holistic account of why an online project submission system, has become successful. Their findings revealed that TAM measures of perceived usefulness and perceived ease of use were effective predictors of information system success.

2.1.3 Factors determining data quality and system utilization

The factors affecting data quality identified in health information systems were organizational, behavioral, systems based and technical (Ahanhanzo *et al*., 2014). The organizational factors include availability of proper data collection tools and equipment, quantity and quality of human resources for health information systems and use of technology; the behavioral factors include health staff motivation, presence of incentives or disincentives; and the systems factors include level of data demand and use, feedback mechanisms within health administrative levels, routine

data quality checks and availability of robust routine health information system policies and technical factors include complexity of the collection tools in their format and procedures for use and complexity of the technologies used (Aqil *et al*., 2009; Ahanhanzo *et al*., 2014).

System use and quality are the desirable characteristics of information system. For instance: ease of use, system reliability, system flexibility, and ease of gaining knowledge, as well as system features of flexibility, complexity, and response times. System quality is measured by the two instruments called user friendliness and ease of use. For this information system is success measuring system quality involved items: ease of use, data quality, ease of learning, user requirements, system features, system accuracy, complexity and integration (Petter *et al*., 2008).

Literature shows that health information system utilization can be affected by organizational factors (Shaikh, 2005) and technical and behavioral characteristics of health workers (Aqil *et al*., 2009). From the influential factors, factor that are markedly associated with utilization of health information system are health workers' skills, regular supervision, and feedbacks (Teklegiorgis *et al*., 2014).

In organizational factors, two variables are suggested: top management support, and end-user training. Management support refers to the perceived stage of general support given by top management level. For instance: management is aware of the benefits that can be achieved with the system use, management constantly supports and promotes the system use for work-related activities, management provides most of the needed help and resources to make possible people to use system, management is really keen to see that people are happy with using system, management provides access to hardware resources while workers need them, and management offers access to various types of software when considered necessary (Igbaria *et al*., 1997).

Environmental factors sometimes interfered with system functioning; power interruption which shut down the system. In addition, when the internet is poor, the reception of data makes the system slow (AIDSFREE, 2018).

2.2 Empirical literature review

2.2.1 Electronic system data quality and utilization practice

USAID (2011b) Deliver Project handbook describes logistics activities within public health in developing countries as "*the operational component of supply chain management, including quantification, procurement, inventory management, transportation and fleet management, and data collection and reporting*". To have an effective supply chain, there is therefore a need for reliable information to support coordination of actions.

Health information systems usually involve not only data but also information technology, processes and people. The extent of data in the systems can cover individual, institutional as well as population data (WHO, 2010). Data quality concerns occur in all of these data categories due to various sources, incompatible formats of data and meanings (Lee *et al.*, 2002). Automation of both the physical flow and the flow of information has proved to be one successful way to achieve goals in the logistics system. Different technologies exists that can progress hospital internal logistics and important knowledge and skills is found within and outside the healthcare sector. The trouble is in finding the exact type and level of automation to go with the needs and physical and organizational fundamentals (Granlund and Wiktorsson, 2013).

The accuracy, completeness, and timely flow of data among primary public health care facilities, hospitals, and a central information center determine the effectiveness of the health care programs. Eventually, effective information use has been recognized as a key element in the success of major efforts that have achieved main health improvements (FMOH, 2014). Given specific requirements of data users, data of various types is collected, stored, and utilized as inputs into an information system designed and implemented for practical applications. After data processing (i.e. a series of operations on the data inputs), the information system should produce desired outputs (or rather, information) for a certain application, and intermediate outputs that serve as advanced contributions for other planned data functions (Fu and Easton, 2018).

Even and Shankaranarayanan (2009) have stated the importance of data quality in information system as higher quality of data makes the organizational data sources become more usable and

consequently increase the benefits gained from the data. This will contribute to the efficiency and effectiveness of business process which also increase faith in information system. High quality data on the services provided by health facilities are essential to make informed decisions concerning resource allocation, forecasting, and programming. Nevertheless, this potentially rich foundation of data is often overlooked in low and middle income countries, for the reason that it is assumed to be of limited accuracy, completeness, timeliness, and representativeness. Low assurance in the quality of routine health data unconstructively impacts its use by program administrators and other decision makers (Hagan *et al*., 2017; Adejumo, 2017). Facility based routine data are often incomplete and of doubtful quality, and the collected data are not simply available for use in analysis and interpretation. Training health professionals on the use of data and information system is inadequate at all levels of the health system with weak connections to the use of information for program improvement (Hazel *et al*., 2017).

According to the study in India, the LMIS software's functionality is wide-ranging. Utilization of the system by the systems full potential was found low and it was demanding mainly because of the difficulty of changing the mindset of users who have worked with manual systems for so long (Bhattarai, 2011). Study done in Tanzania indicates that the eLMIS provide sufficient information to generate the required reports, the eLMIS provides information that is easy to understand, and the reports in the eLMIS system is available whenever wanted to use so as to improve user's satisfaction with eLMIS (Omary and kalinga, 2017).

A study conducted by Wanjiku (2015) in Kenya to assess the quality of data and information use of the health information system had put grading criteria for data quality; accordingly, the overall quality of data was very good. The study assessed the accuracy of data for three months aggregated data which was found 85 percent. The study results in Zambia overall indicate that reporting rates have improved, with three program areas scoring above 90 percent. There has been a noticeable increase in reporting rates (frequency) since the introduction of eLMIS (electronic logistic management information system), for those facilities that reported using eLMIS, 51 percent were actually on time. The study also showed an increase in both data and reporting accuracy, reporting two functions in the eLMIS that can reduce human error. First, the automatic calculations reduce the likelihood that a wrong number will be manually calculated or entered.

Second, the error messages ensure that data match logically and are correct before submission. This reduces the ability of users to input incorrect or inaccurate data. The study reported that these checks and balances in the system allow only valid data (AIDSFREE, 2018).

2.2.2 Contribution factors of data quality and system utilization practice

In sub-Saharan Africa, routine health data of suitable quality that fulfill the requirements are frequently unavailable and underutilized. Data collected through routine reporting from health facilities are rarely complete and usually not representative. Moreover, routine health related reporting is often of limited quality due to several factors such as lack of supervision, inadequate feedback, poor motivation, and overburdening of staff by multiple program specific reporting requests (Ohiri, 2016; Adejumo, 2017). Even if the focus is to increase the visibility of data, the importance and emphasis of data quality and use, governance of eLMIS, and the integration of eLMIS within the larger health information system architecture and are the fundamental (Mchau *et al.,* 2017).

Rwanda electronic LMIS report identifies common problems related to eLMIS like poor recordkeeping: incomplete or not updated stock and consumption records. Poor reporting: incomplete, delayed and poor quality reports. Data not moving in the system up or down: facilities not reporting to districts, districts not sending information to central, central not providing feedback to health facilities. Data not used for decision making (Ntirenganya, 2017). Furthermore, Malawis report on LMIS indicate that, external factors have a negative impact on the LMIS, including inadequate financing of health commodity, trained personnel with supply chain responsibilities are not enough at the facility level, health workers are overburdened and inadequately supervised, limited internet availability disrupt the timely submission of reports. Besides, the lack of clear measures and devoted property for information technology support including renovation or substitution of non-functioning hardware, performance of maintenance and security updates, and purchases and maintenance of software licenses to enable these updates affects the security and integrity of data, on top of the accessibility and dependability of computers for use with supply chain manager software or any eLMIS (Wright *et al.,* 2013).

2.3 Conceptual framework of the study

The figure below shows the relationship between dependent and independent variables of this research. It shows that data quality and utilization practice are dependent variable. On the other hand Socio-demographic characteristics of personnel, background characteristics, HCMIS database characteristics, external factors, internal factors and technical factors are independent variables. Accuracy, completeness, Timeliness, Consistency and Validity indicates the dimensions of data quality.

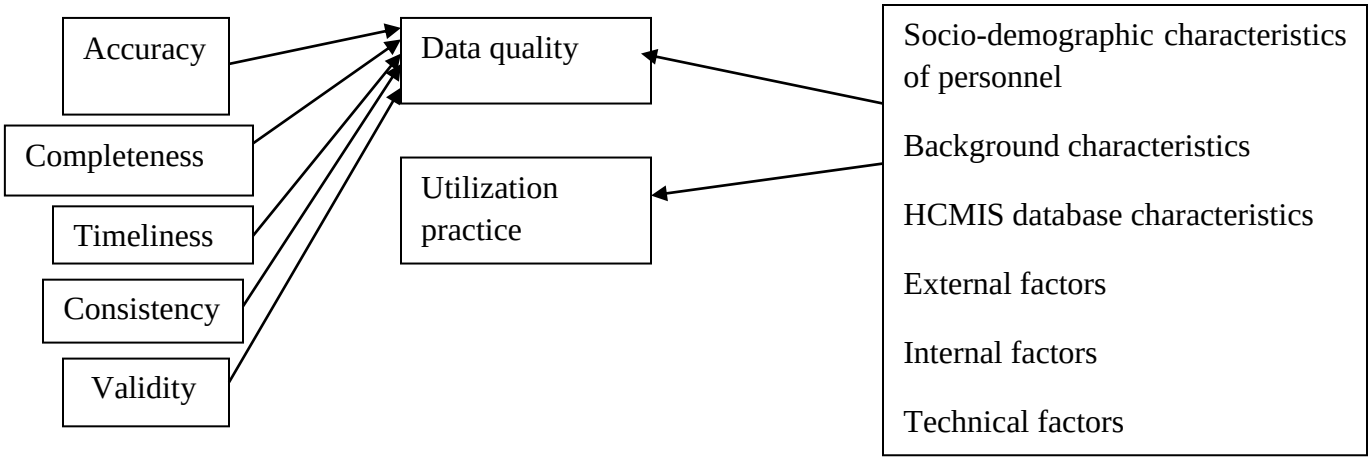

Figure 1: Conceptual framework to HCMIS practice, data quality and contributing factors, Addis Ababa, Ethiopia, June 2019

2.4 Identified literature gap

Studies dedicated to assess HCMIS practice and quality data in public facilities of Ethiopia are limited. To Researcher's knowledge no studies were found to assess data quality, utilization practice of HCMIS and also the contributing factors in public health facilities in Ethiopian setting. But, other studies conducted in developing countries in other information systems helped a lot in framing the methodology for this study. In addition, there are also no studies that comprehensively assessed the quality of HCMIS in Ethiopia in terms of data quality dimensions. There is a paucity of research in the utilization practice of the system in a systems' component manner either in Ethiopia or in the global level. This study will try to fill the empirical gap found from literatures on the quality, utilization practice and contributing factors of the HCMIS particularly on tracer medicines in the studied public health facilities.

CHAPTER THREE

3. METHODOLOGY OF THE STUDY

In this chapter, the research approach to be used in the study is presented. It explains the research methodology utilized and its justification for the purposes of this study. The chapter discusses procedures and activities under taken, focusing on the study's research design, data collection, and sampling design, data processing and analysis. It further addresses issues of reliability and validity and concludes with the ethical considerations of the study.

3.1 Description of the study area

The study was conducted in Addis Ababa City Administration; the capital city of Ethiopia which covers an area of 540 km^2. It is administratively sub-divided into 10 sub-cities (Addis Ketema, Akaki, Arada, Bole, Gulele, Lideta, Kirkos, Kolfekaranyo, Nefas Silk Laphto and Yeka). Addis Ababa has a total population of 3,604,000 (1,703,000 males and 1,900,000 females) according to the population projection for 2019 based on the 2007 National Population and Housing Census of Ethiopia (CSA, 2013). There are 11 hospitals and 102 health centers owned by government (AACAHB, 2018).

3.2. Research design

As this study aimed to examine the utilization practice, data quality of HCMIS and contributing factors, institutional-based cross-sectional descriptive study design was carried out using both quantitative and qualitative research methods in public health facilities of Addis Ababa, Ethiopia.

3.3 Research approach

The study employed mixed method approach using quantitative and qualitative data collection methods to analyze the data quality of reports, utilization practice and contributing factors. Combination of the two methods was used for a better understanding of a research problem than either research approach alone. The data collection period was from April 10, 2019 to June 10, 2019. Records starting from one year prior to data collection were reviewed (from April 1, 2018 – March 31, 2019).

Quantitative data was collected from health facilities using document review by modified logistics Indicator Assessment Tool (LIAT) data abstraction format (USAID, 2008)(Annex I). Pharmacy professionals who have work experience on HCMIS collected the data by using the customized tool after taking one day training. And also, self - administered questionnaire was deployed for self-completion by respondents.

Qualitative data was collected by the principal investigator through in-depth interview by using modified logistics System Assessment Tool (LSAT) (USAID, 2009) (Annex I) to understand the HCMIS data quality, utilization practice and contributing factors. Pharmacy heads and store managers in the selected health facilities were approached using structured questionnaire and also for the in-depth interviews. Key informants from Health Bureau, JSI and EPSA were interviewed in order to triangulate evidences for issues raised from the in-depth interview and the quantitative findings.

Interview guide was first prepared in English language, and translated into Amharic and then back to English to check message consistency. The Amharic version was used for the interview with key informants. Digital voice recorder was also used for the interview after getting consent from participants and the information was transcribed after the interviews. Verbatim transcription was done by playing back the audio and writing the transcript.

The variables used to describe and correlate the HCMIS data quality, utilization and contributing factors include background of the facilities, socio-demographic characteristics, usage level perception and HCMIS utilization perception (for description). Total work experience, period of HCMIS utilization, reminder notification, HCMIS characteristics, organizational and external factors (for correlation).

Number of factors that could contribute for data quality and utilization were identified by exploring theoretically which helps for developing the conceptual framework. The study proposed four theoretical factors which were HCMIS database characteristics, external factors, internal factors and technical factors which were taken as independent variables.

3.4 Population and sampling design

3.4.1. Target pupation

The population of the study encompassed all public health facilities in Addis Ababa, Ethiopia. The study population consisted of public facilities that have been implementing HCMIS. There are 50 functional health centers and 5 hospitals using HCMIS as routine commodity data management tool.

3.4.2. Sample size determination

The numbers of public health facilities included in the study was determined by using the Logistic Indicators Assessment Tool (LIAT) (USAID, 2008). LIAT recommends a minimum of 15% of the targeted health facilities to be included in the study and according to WHO manual to evaluate pharmaceutical sectors (2007), twenty facilities are recommended to generalize the findings. At the time of data collection, a total of 5 public hospitals and 50 health centers were using HCMIS for managing their pharmaceuticals. Of these, 16 health centers and 4 hospitals were selected which is in line with USAID and WHO recommendation.

3.4.3. Sampling procedure

A multi-stage sampling technique was employed to select eligible health facilities. The sampling frame for the first stage comprised all health facilities which were implementing HCMIS and then functional in status of implementing the system. Then based on the location of the sub city, health centers were selected proportionally. The hospitals were selected based on their administrative status. Two hospitals were selected randomly from those under Addis Ababa City Administration Health Bureau (AACAHB) and two hospitals from those under Federal Ministry of Health (FMOH). The total study sample included sixteen health centers and four hospitals. From each health facility, pharmacy head and pharmacy store person was approached. The study had a total of thirty health professionals (respondents) working in the selected hospitals and health centers for the quantitative method.

Tracer medicines were used from the list of tracer medicines for health facilities in Addis Ababa, developed by Federal Ministry of Health. The Tracer medicines that were used in this study include 25 items; from this eight program medicines were selected that should be available all the

time at health facilities (Annex 2). RRF and reports of HCMIS for managing the tracer medicines were selected for data quality analysis starting from one year prior to the start of the data collection.

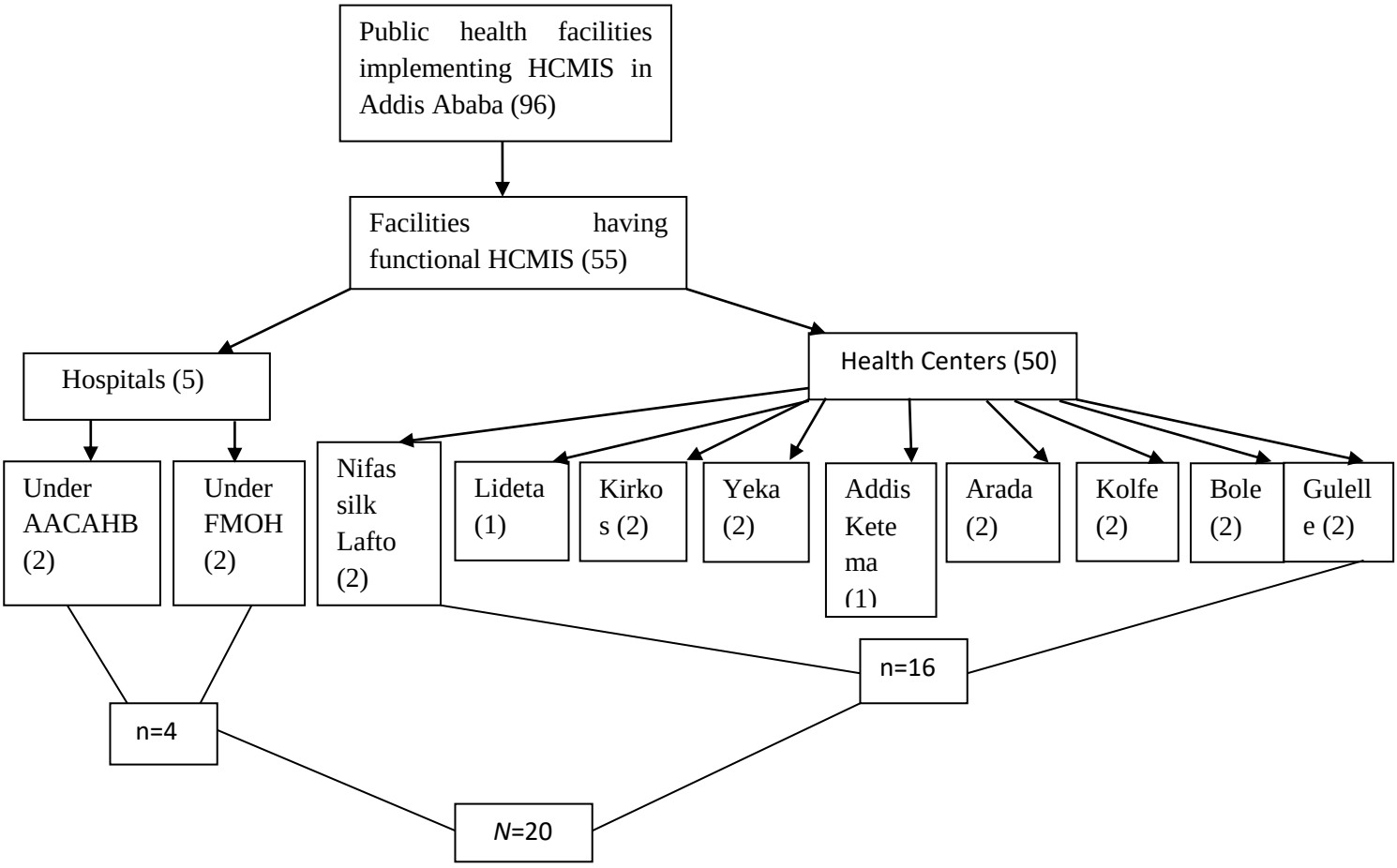

Figure 2: Schematic sampling presentation of study facilities, June 2019.

3.4.4. Inclusion and exclusion criteria

For the quantitative method, all health facilities having functional HCMIS were included. Health facilities that had implemented HCMIS for at least a year in Addis Ababa were included. All health facilities that were inactive, on and off, intensive in HCMIS status were excluded from the study. For the qualitative method, pharmacy head and store managers who were available and willing to participate at the time of data collection were included.

3.6 Reliability and validity test

3.6.1 Validity

To ensure the validity of the study tools pretest of the prepared tools was performed in two health facilities and the facilities was excluded from the study. Accordingly, some modifications were made on the data collection tool. The data was collected from reliable sources, from respondents who were more responsible from the study point of view. The principal investigator supervised the data collection process through spot checking and reviewed completed questionnaires to clarify any data inconsistencies. The principal investigator checked the data for completeness. To ensure trustworthiness of the data collected using in-depth interview, an immediate transcription of the manual transcript for those who were not willing to be taped and repeatedly listening for verification of the manual transcripts by audio record was done after data collection for those data that were recorded. The data collectors were trained on the data collection instruments and processes for a session of one day.

3.6.2 Reliability

The reliability of instruments deals with the consistency of the instruments. Creswell (2009) considers the reliability of the instruments as the degree of consistency that the instruments or procedure demonstrates. The reliability of a standardized test is frequently articulated as a correlation coefficient that measures the strength of association between variables. The coefficients vary from -1.00 to +1.00 with the earlier showing that there is a perfect negative reliability and the second shows that there is perfect positive reliability.

To prove that the survey scale is consistent and reliable, the Cronbach-alpha test was carried out to specify amounts of random errors that exist in the instruments using SPSS and the result is presented in Table 1 below. The reliability of coefficient for each individual variable was 0.76 for contributing factors of HCMIS data quality, 0.82 for utilization practice, 0.74 for quality of data. And the total Cronbach-alpha is 0.72. All constructs in the study had the alpha values greater than the guideline of 0.70, so it can be concluded that the reliability is acceptable and the measurements can be applied for analyses.

Table 1: Measurement of reliability

Constructs	Cronbach's Alpha	Number of items
Contributing factors of HCMIS data quality and practice	0.760	41
Utilization Practice	0.817	36
Quality of data	0.737	45
Reliability of total scale	0.718	122

Source: Computation from survey data, June 2019

3.7 Method of data analysis

The quantitative data was entered and analyzed using the Statistical Package for the Social Sciences (SPSS) version 25 and Microsoft Excel. Descriptive statistics was used to calculate (mean, standard deviation, frequencies and percentage) and results were presented using tables and graphs. The qualitative study was transcribed and summarized in thematic form with quotations. A study conducted by Wanjiku (2015) in Kenya to assess the quality of data and information use of the health information system had put grading criteria for data quality. Accordingly, quality of data was classified as excellent when it is 91% and above, very good when it is 81- 90%, good when it is 71- 80%, fair when it is 61- 70%, poor when it is less than 60%.

The analysis of qualitative data was done manually. All interviews were conducted, audio-recorded and transcribed verbatim in Amharic and translated to English except one respondent who was not willing to be audio recorded. Each transcript was early coded line by line, concurrently with data collection and after multiple readings of the text, detailed coding were made to themes and relevant quotations were used to demonstrate themes in the presentation of study findings. Inductive type of thematic analysis was used to allow the data to determine the themes.

Inferential statistics was computed like spearman's rho correlation tests were run to determine the correlation of data quality and utilization practice with the independent variables. A critical values $p < .05$ was considered as statistically significant. The assumptions for Spearman correlation

analysis such as the data to be interval or ratio level or ordinal and the 2 variables are monotonically related met during the analysis.

3.8 Dissemination of results

As this work is part of Master of Science thesis, it will be publicly defended in the school. In addition the findings of this study will be submitted to all concerned bodies that can make use of the study findings including Addis Ababa Public Health Research and Emergency Management Core Process. As well as publication to journals will be facilitated. All efforts will be done to present the study results to available forums, workshops and conferences.

3.9 Ethical considerations

Ethical approval was acquired from the School of Pharmacy ethics review committee of Addis Ababa University. In addition, permission to conduct the research was obtained from the administrative office of AACAHB (Addis Ababa City Administration Health Bureau) and FMOH. The study participants were informed about the purpose of the study and the significance of their contribution in the study. The study subjects were also informed that they can skip question/s that they do not want to answer fully or partly and also to quite the process at any time if they want to do so and their participation is voluntary. After assuring the confidentiality nature of responses and obtaining informed consent from the study subject, the in-depth interview was conducted. Tape recorder was used for the interview after obtaining informed consent from participants.

CHAPTER FOUR

4. RESULT AND DISCUSSION

Generally, this chapter is organized in the following manner: socio-demographic characteristics of professionals were presented followed by background characteristics of the facilities. The results of descriptive analyses were presented, followed by the results of spearman's rho correlation. Also interview results are presented followed by discussion of the findings.

4.1 Result

4.1.1 Socio-demographic characteristics of pharmacy professionals

The majority of the respondents, 16 (53.3%) were Female. Twenty eight (93.3%) of the respondents had service year of less than 5 years. Two third, 22 (73.3%) of the staff were working in the store and 8 (26.7%) were serving as pharmacy head. Almost near half of pharmacy professionals were between the ages of 26-30 (46.7%) (Table 2).

Table 2: Socio-demographic profile of pharmacy professionals working in public health facilities of Addis Ababa, Ethiopia June 2019

Variable N=30	Description	Frequency	Percentage
Gender	Male	14	46.7
	Female	16	53.3
Age	20 to25	8	26.7
	26 to 30	8	46.7
	31 to 35	4	20.0
	36 to 40	2	6.7
Current Position	Pharmacy Head	8	26.7
	Store Manager	22	73.3
Experience in current position	1 to 5	28	93.3
	6 to 10	2	6.7

4.1.2 Background characteristics of the health facilities

A total of 20 public health facilities were included in this study. There were 2 (10.0%) federal-specialized hospitals, 2 (10.0%) city administration hospitals and 16 (80.0%) health centers. Out of this health facilities, 13(65.0%) were implementing HCMIS for more than 5 years.

4.1.3 Data quality

Data quality at facility was calculated after cross-checking the balance of the HCMIS print out RRF with hard copy bin card starting from prior to one year from the start of the data collection, for each of the selected tracer products. Initially percentage of each data quality dimensions were calculated by dividing total number of medicines (accurate and complete) with the total number of tracer assessed and total number of reports, which was 8 and 6 respectively. Other data quality dimensions were calculated by dividing total number of reports (timely, valid and consistent) with total number of reports. After that, percentage of data quality for that facility was calculated by adding the percentage of each data quality dimensions result then dividing by the total number of the data quality dimensions.

Accordingly, out of 960 RRF examined about 733 (76.33%) of RRF data were accurate. Regarding completeness of the data 676 (70.43%) of RRF data were complete. Besides, the study showed that the timeliness of health facility report to next respective level of health system were 48 (45.28%), 49 (46.23%) and 9 (8.50%) reports until the 5^{th} day, until the 10^{th} day and after 10^{th} day of the reporting period respectively. The validity of data for “completed by” was (87.50%), “approved by” was (76.67%) and “verified by” was (84.17%). The average overall consistency of reports that the HCMIS generates was (55.49%).

As can be seen from the figure 3 below, the average of hospital and health centers assessed both the accuracy and completeness of the data was good 76.33% and 70.43% respectively. The timeliness and the consistency of the assessed data was poor 45.0% and 55.49% respectively. The validity of the data was found to be 82.78%. And the overall data quality of the facilities was found to be fair 66.61%.

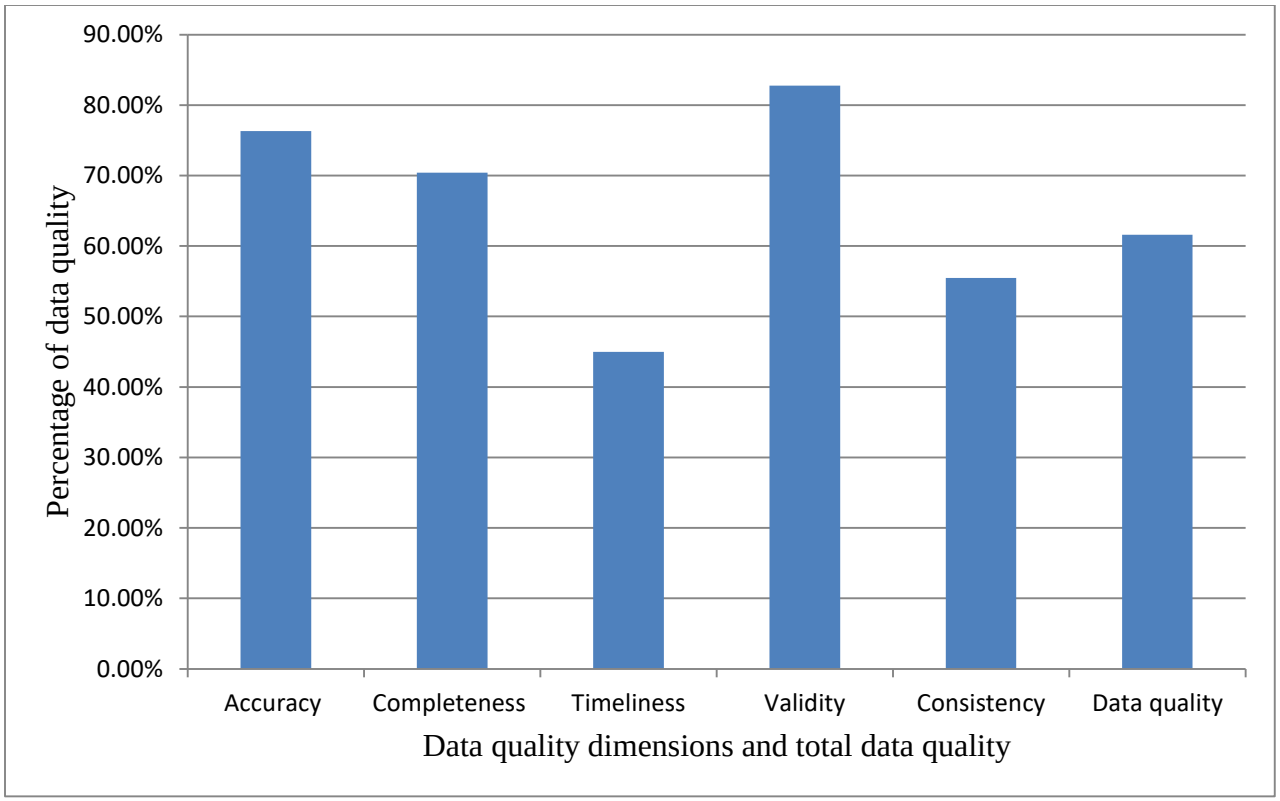

Figure 3: Dimensions of data quality and total data quality of HCMIS in public health facilities of Addis Ababa, Ethiopia June 2019

4.1.4 HCMIS utilization practice and usage level perception

Practice of utilization is described in terms of the purpose of the HCMIS, the use for recording and reporting of activities, and the perception of respondents for system usage. HCMIS can be used for different activities related to health commodities. All of the facilities use the HCMIS for the purpose of daily activity registration, reporting, follow up of items, planning, and inventory management. Only eight (40.0%) of the facilities use the HCMIS for performance management.

Other use of the HCMIS is to record transactions, all the facilities use the HCMIS to record receive, issue and loss/adjustment which are routine activity for managing inventory.

Regarding regular reports 6(30%), 5(25.0%), 5(25.0%), 6(30%), 6(30%) of the studied facilities use for stock status report, over stocked items report, stock out report, near expiry report, and expired products report, respectively to report on schedule to higher level and almost all the facilities 19(95.0%) use RRF to report on a regular basis by using the HCMIS. The average utilization of all the regular reports is 39.17% (Figure 4).

In all the studied health facilities it was also found that there was no linkage of the HCMIS with other data collection systems such as the Health Management Information System (HMIS).

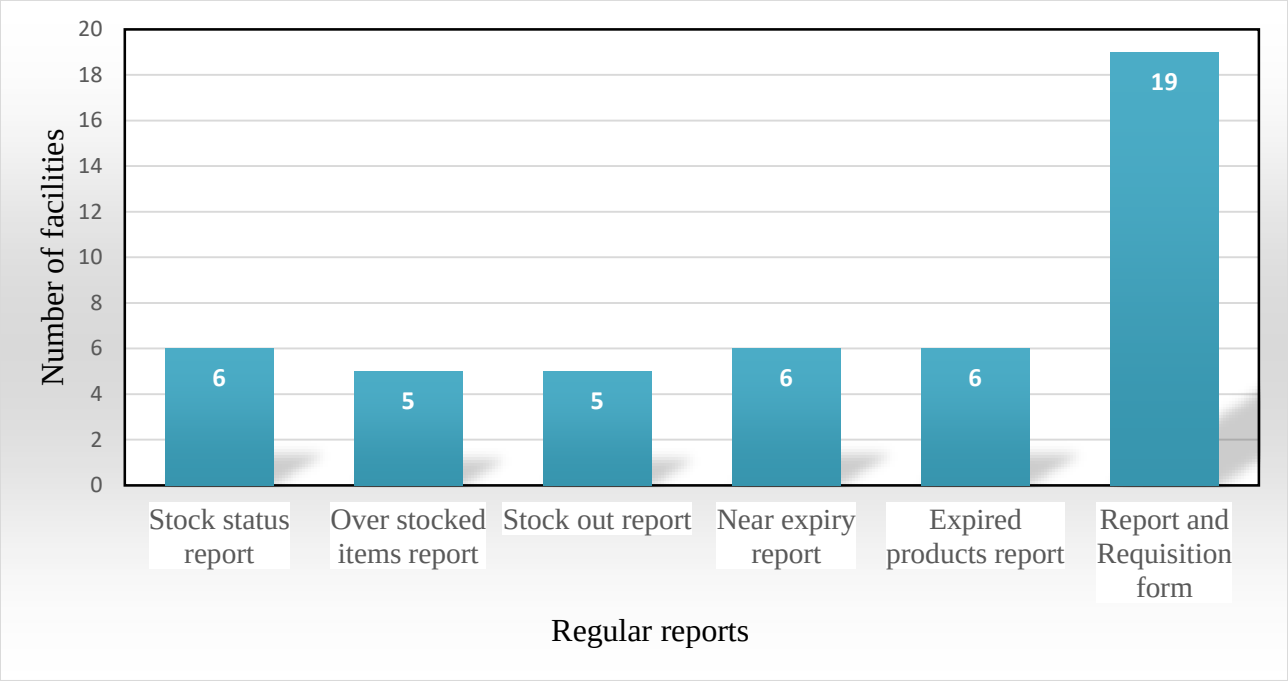

Figure 4: HCMIS utilization practice for regular report among public health facilities in Addis Ababa, Ethiopia June 2019 (N=20)

The overall practice of HCMIS was assessed by using Likert scale of respondent's perception ranging from always (5pt) to never (1pt). From the activity log of the system respondents perceive stock transfer, inventory, loss/adjustment, receive and issue are mostly used. The system generates variety of reports, respondent's perceptions of use on which reports they generate were asked. All the activity log variables have high mean score which indicate the logs are used on day to day basis. From the report the HCMIS generates most has high mean score except for reports: price only report (1.27±0.521), consumption trend by dispensary unit (1.67±1.093), cost report (1.90±1.062), consumption trend report (1.93±1.048), Loss /adjustment report (3.17±1.341) and AMC report (3.30±1.489) which has low mean score. From all the summary reports the system generate the highest mean score was for stock status summary (3.57±1.317) and all the other summary reports has low mean score (Table 3).

Table 3: HCMIS usage perception of respondents at public health facilities in Addis Ababa, Ethiopia, June 2019 (N=30)

HCMIS data components	Never used	When asked	Some of the time	Most of the time	Always	Mean	Standard deviation
Activity log							
Issue	0	1	0	1	28	4.87	0.571
Receive	0	1	2	1	26	4.73	0.740
Loss/adjustment	0	1	2	5	22	4.60	0.770
Inventory	0	4	3	4	19	4.27	1.112
Stock transfer	0	2	9	3	16	4.10	1.062
Reports							
Electronic bin card	1	2	0	2	25	4.60	1.037
Stock status report	0	1	3	7	19	4.47	0.819
RRF	1	3	1	2	23	4.43	1.165
Near expiry report	0	2	2	7	19	4.43	0.898
Stock out items report	0	1	6	6	17	4.30	0.951
Expired products report	1	2	4	6	17	4.20	1.126
Overstocked items report	1	1	6	5	17	4.20	1.095
AMC report	3	10	2	5	10	3.30	1.489
Loss /adjustment report	3	8	7	5	7	3.17	1.341
Consumption trend	12	12	3	2	1	1.93	1.048
Cost report	13	10	3	2	1	1.90	1.062
Consumption trend by dispensary unit report	18	8	2	0	2	1.67	1.093
Price only report	1	21	6	1	1	1.27	0.521
Summary reports							
Stock status summary	1	7	4	6	12	3.57	1.317
Cost summary	10	15	3	0	2	3.03	1.402
Receive summary	5	15	5	3	2	2.40	1.102
Issue summary	5	15	5	3	2	2.40	1.102
Stock expiry summary	2	10	4	7	7	2.97	1.331

** Responses ranged from never used (1) to always (5)*

4.1.5 Contributing factors of HCMIS data quality and practice

A. Reminder notification

Seven (35%), 13(65.0%), 10 (50.0%) of the study facilities received reminder notification from AACAHB or EPSA to check the accuracy of reports, to fill reports completely, and to send reports on timely basis, respectively. The average reminder notification was found 50.0%

B. Supervision and feedback support from top level management

Nineteen (95.0%) of the study facilities had received supportive supervision, and 11 (55.0%) of the facilities had received a feedback report. Among the facilities that received supportive supervision, 5(25.0%) receive from EPSA, 9(45.0%) from AACAHB, 2(10.0%) from FMOH and 16(80%) from JSI (Figure 5).

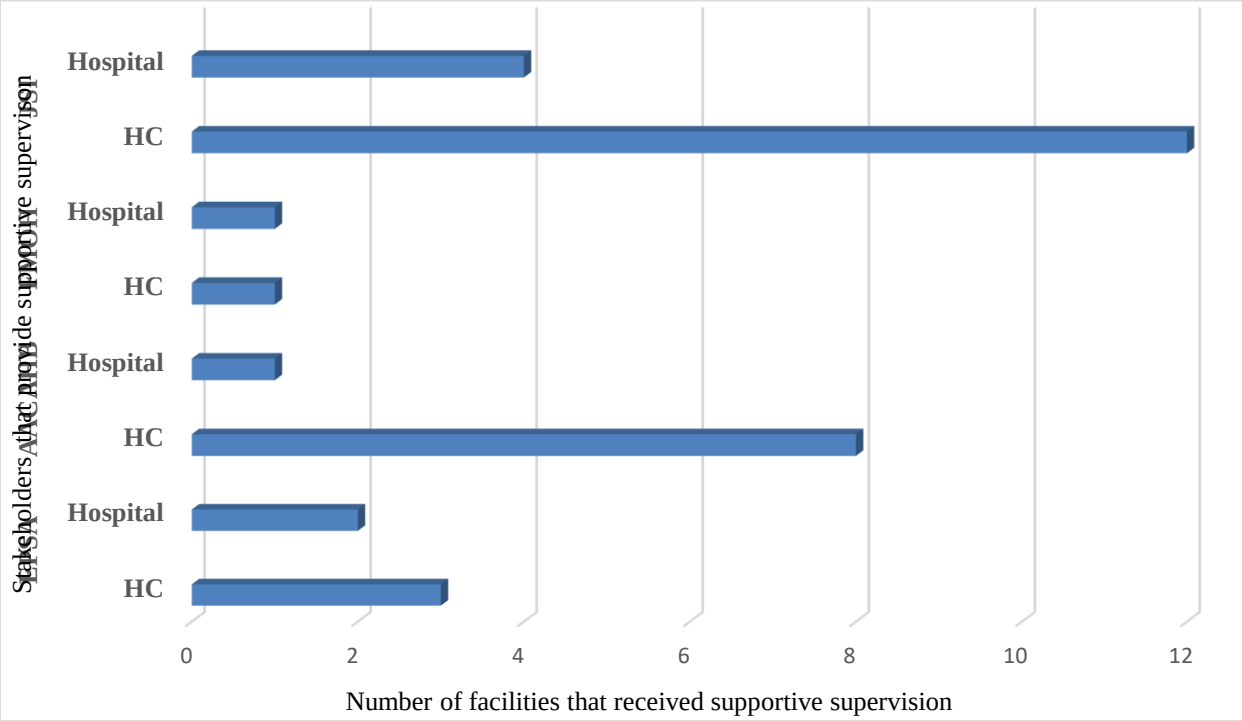

Figure 5: Number of health facilities that received supportive supervision on HCMIS from different stakeholders, June 2019 (N=20)

From facilities that received supervision 9 (45.0%) of them received within the last month, 5(25.0%) 1 to 3 months ago, 6(30%) 3 to 6 months ago.

Based on the type of facility, 15 (93.75%) of the health centers and all of the hospitals had received the supervision. Two (50.0%) and 3 (18.75%) of the hospitals and health centers had got supervision from EPSA, 1 (25.0%) and 8 (50.0%) of the hospitals and health centers had got supervision from AACAHB, 1(25.0%) and 1 (6.25%) of the hospitals and health centers had got supervision from FMOH, 4 (100%) and 12 (75.0%) of the hospitals and health centers had got supervision from JSI respectively. Two (50.0%) of the hospitals had received feedback from the EPSA and JSI, and 9(56.25) health centers from AACAHB and JSI (Figure 6).

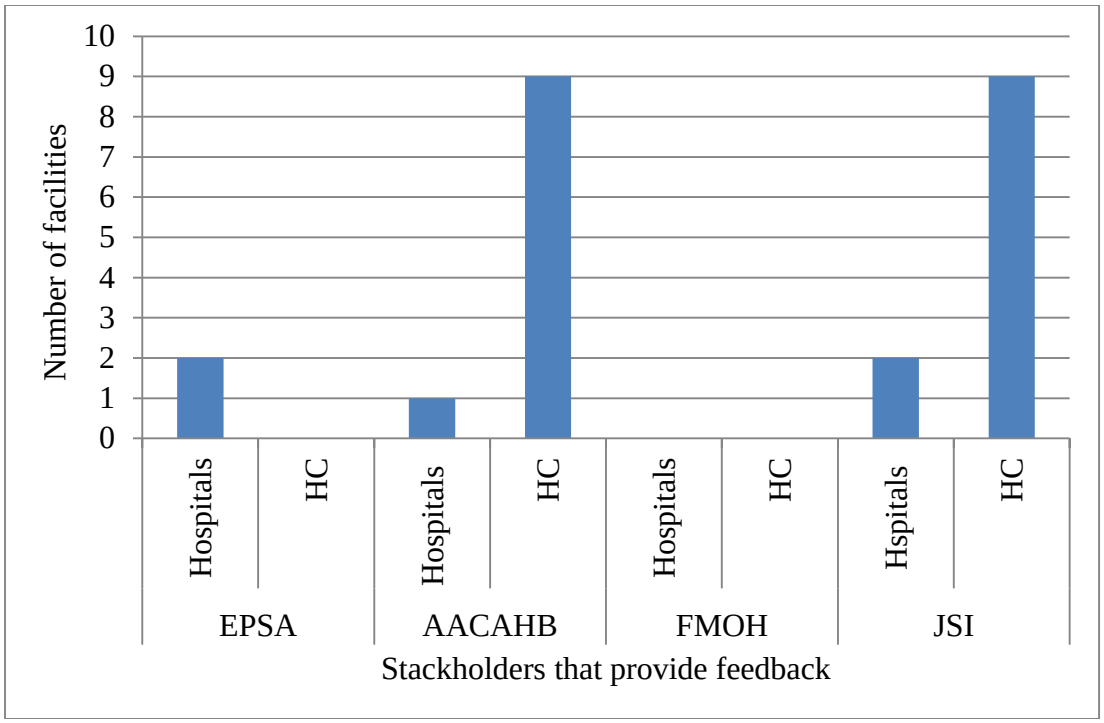

Figure 6: Number of facilities which obtained feedback from different stakeholders among selected public health facilities in Addis Ababa, Ethiopia, June 2019

C. Training of professionals on HCMIS

Twenty (70.0%) of the respondents had training on HCMIS. Sixteen (53.3%) of the respondents receive follow up mentorship after the first training. From the trained respondents, 5 (16.7%) of them took on the job training, and 10 (33.3%) of them took off the job training. From the respondents who didn't get the training 7 (23.3%) learn to use the HCMIS used at the facility by guidance of other colleagues and 2 (6.7%) by reading the manual.

D. Perceived contributing factors of HCMIS data quality and practice

Health professionals involved in HCMIS activities were asked for their perception about contributing factors of data quality and utilization using 5 point Likert scale ranging from strongly agree (5pt) to strongly disagree (1pt). From the total eleven items used to assess HCMIS database characteristics, greater portion of the respondents disagree on the stated contributing factors. Regarding the mean score, the factors which had the highest mean score and thus showed the

most commonly perceived contributing factors by respondents were "*the HCMIS benefit/improve the facilities supply chain*" with a mean score of (4.83±0.379), "*the software is adaptable to the working environment*" with a mean score of (4.70± 0.466) and "*the HCMIS contain all the features necessary for health commodities management*" with a mean score of (3.57±1.341).

Among the four items used to assess the external factors, all perceived contributing factors had low mean scores. The lowest mean score was "*there is ongoing support by government organizations*" (1.83±0.531) followed by "*there is a pay for performance initiatives*" (1.97±1.033).

Regarding organizational factors the highest factors with mean score was "*The data is useful for activities other than reporting*" with a mean score of (4.33±0.802), "*computer is always accessible for operating the HCMIS"* with a mean score of (4.17±1.020), "*the information system fits well with the working practices*" with a mean score of (4.07±0.828), "*The capacity of the computer is enough to export report"* with a mean score of (3.87±0.973) and the "*data presented is always used by decision makers*" with a mean score of (3.70±1.088). Most of the factors from the eleven items used to assess organizational factors had low mean sore. "*There is a records back-up system that ensures easier retrieval of data*" has the lowest mean score from all the items (2.13±0.819).

All of the technical factors had high mean score and almost all the respondents perceived that they strongly agree or agree on having "*computer skill*" (4.33±0.606), "*enough knowledge to operate on the HCMIS*" (4.17±1.088) and "*efficiency to use the system*" (3.97±1.088).

Generally, majority of the respondents strongly agree or agree that the system improve the facilities supply chain and it is adaptable, the data is useful for activities other than reporting, computer is always accessible for operating the HCMIS and the information system fits well with the working practices (Table 4).

Mean of variables were extracted to enable exploration of the existence and importance variables. Making use of the Likert scale from strongly disagree (1pt) to strongly agree (5pt), as shown in Table 4, technical factors were highly ranked (that is strongly agreed). The measure used sum and a mean value, whereby if obtained factors is more than or equal to 3.2 then the level of agreement

with the statements measuring a certain variable is high. If it is less than or equal to then the level of agreement with the statements measuring a certain variable is low.

Table 4: Contributing factors of HCMIS utilization practice and Data quality at public health facilities of Addis Ababa, Ethiopia, June 2019

** Strongly disagree=SDA, Disagree=DA, Neutral=N, Agree=A, Strongly Agree=SA, Mean ± Standard Deviation= M±SD*

Variables	SDA	DA	N	A	SA	M±SD
HCMIS Database Characteristics						
The HCMIS benefit/improve the facilities supply chain	0	0	0	5	25	4.83±0.379
The software is adaptable to the working environment	0	0	0	9	21	4.70±0.466
The HCMIS contain all the features necessary for health commodities management	1	11	1	9	8	3.57±1.341
The HCMIS is not prone to computer virus	2	8	11	6	3	3.00±1.083
There is no risk of the system being hacked into and data being corrupted	3	11	10	5	1	2.60±0.968
Error in transaction carried out by the system doesn't result business inefficiency	8	16	2	4	0	2.13±0.944
It is important to add other features helping for facilitating the transaction and reporting process	8	17	2	3	0	2.00±0.871
The HCMIS allows to add/delete new/outdated items	4	24	2	0	0	2.00±0.587
				Mean and standard deviation		**3.054±0.343**
External factors						
The reported data is interpreted and used by suppliers for logistics activates like forecasting, distribution, procurement	0	9	6	10	5	3.30±1.119
There is regular monitoring and evaluation system	5	16	3	6	0	2.33±0.994
There is a pay for performance initiatives	12	11	3	4	0	1.97±1.033
There is ongoing support by government organizations	7	21	2	0	0	1.83±0.531
				Mean and standard deviation		**2.358±0.519**
Organizational Factors						

The data is useful for activities other than reporting	0	0	2	14	14	4.33±0.802
Computer is always accessible for operating the HCMIS	0	4	1	11	14	4.17±1.020
The information system fits well with the working practices	0	2	3	16	9	4.07±0.828
The capacity of the computer is enough to export reports	0	5	1	17	7	3.87±0.973
The data presented is always used by decision makers	0	6	5	11	8	3.70±1.088
The cost of maintaining and upgrading the system is high	1	4	16	4	5	3.27±1.015
There is high turnover of staff who are qualified in the operation of the system	4	8	2	13	3	3.10±1.296
Management involvement and support is in place	3	11	5	8	3	2.90±1.213
The computer has access to reliable internet connectivity	6	15	1	5	3	2.47±1.279
Access to electricity supply doesn't interrupt the ongoing job by the HCMIS	6	18	1	5	0	2.17±0.950
There is a records back-up system that ensures easier retrieval of data	5	19	3	3	0	2.13±0.819
				Mean and standard deviation		**3.287±0.435**
Technical Factors						
I have computer skill to use HCMIS	0	0	2	16	12	4.33±0.606
I am efficient to use the HCMIS	1	0	3	15	11	4.17±0.874
I have enough knowledge and information to operate on the HCMIS	0	2	6	13	9	3.97±0.890
				Mean and standard deviation		**4.155±0.698**

** Responses ranged from strongly disagree (1) to strongly agree (5).*

4.1.6 Correlation of data quality and utilization practice with independent variables

A spearman's rho correlation coefficient was used to assess the relationship between data quality and utilization practice with the independent variables. As shown in Table 6, there were moderate positive correlations between data quality with the period of HCMIS implementation (r_s = .512, P=.021, N=20) and HCMIS Characteristics (r_s =.567, P=.001, N=30). And also there were

moderate positive correlations between utilization practice with organizational factor (r_s = .601, P=.000, N=30) (Table 5).

Table 5: Spearman's rho correlation test for correlation of data quality and utilization practice with independent variables at selected public health facilities of Addis Ababa, Ethiopia, June 2019

Independent Variables	**Data quality**	**Utilization Practice**
Spearman r		
Total work experience		
Correlation coefficient	.079	**.386[a]**
Significance (2 tailed)	.676	**.035**
N	30	30
Period of HCMIS implementation		
Correlation coefficient	**.512[a]**	.276
Significance (2 tailed)	**.021**	.238
N	20	20
Reminder notification		
Correlation coefficient	**.367[a]**	.451
Significance (2 tailed)	**.046**	.143
N	20	20
Supervision		
Correlation coefficient	.316	**.452[a]**
Significance (2 tailed)	.089	**.012**
N	30	30
HCMIS Characteristics		
Correlation coefficient	**.567[a]**	**.364[a]**
Significance (2 tailed)	**.001**	**.048**
N	30	30
External Factors		
Correlation coefficient	**.420[a]**	.360
Significance (2 tailed)	**.021**	.051
N	30	30
Organizational factors		

Correlation coefficient	**.377[a]**	**.601[a]**
Significance (2 tailed)	**.040**	**.000**
N	30	30
Technical factor		
Correlation coefficient	**.042[a]**	.206
Significance (2 tailed)	**.021**	.275
N	30	30

[a] Correlation is significant at the 0.05 level.

4.1.7 Qualitative findings

In-depth interviews were held with store persons of the health facilities, pharmacy case team leaders and focal persons from other stakeholders (a total of 33). Majority of key informants were males (51.51%). Majority of them were in the age group of 26 to 30 (27.2%) years with bachelor degree. The work experiences of the respondents ranged from 1 to 5 (87.87%) years. In-depth interviews were conducted to gather information about the current practice of HCMIS, contributing factors of data quality and utilization practice and suggestions for improving HCMIS.

4.1.7.1 Importance of the system and the practice

Response from the key informants shows that the HCMIS has helped to manage the overall supply chain of pharmaceuticals, especially the inventory management of commodities at the facility level and has eventually minimized the time it takes to prepare reports especially bi monthly report. And the system helps them to control the level of expiry, recurrent over stock and stock outs. This is in line with the quantitative finding.

"From the stock status, I know which medicines are stocked out and I am able to make a decision, for example, to borrow from another facility or do an emergency order. For overstocks, I will be able to inform the managers for possible redistribution to other facilities, thus avoiding wastage and expiries." — HC 03, Store manager

"The system makes my work easy, and I can make an informed decision at the end of the day." — HC 07, Store manager

Almost all the interviewee showed importance of the system in providing quality data. Moreover, importance on having high data quality due to the reason that the data found in the system is used in critical decision making. The HCMIS provides information to generate the required reports and the reports in the HCMIS are available whenever needed. With regard to the quantitative finding, even if the system provides quality data, the finding shows that the quality of data was not excellent.

"The HCMIS helps to have quality data…. It's what we provide for the system that results poor quality" — HC 09, Pharmacy head

"One of the gaps which were identified by the supportive supervision we did was related to data quality. Printing the RRF from the HCMIS may help the facilities to improve the quality of the data that are reported to higher levels." — Stakeholder 02

According to the respondents the most frequently used log was activity log where issues and receive acts are carried out. This makes the daily activity of the store manager easier. Transaction logo was not used frequently. From the reports, RRF is generated every two month constantly. This finding was in line with the quantitative findings where RRF utilization was 95%. The respondents mention that stock status reports, near expiry report and expired products reports used to be sent to sub cities and health bureaus but there was no feedback and the significance of sending the report wasn't feasible afterwards. One of the respondents expressed the issue like this;

"I have been sending reports other than RRF to health bureaus like near expiry reports and also stock status reports every month but the feedback obtained from them is almost none. Emphasis is not given by higher officials to reports other than RRF." — HC 05, Pharmacy head

Another respondent from one of the hospitals mention that:

"The hospital have different stores in different places where products are mixed in all stores and using the HCMIS for generating reports was difficult because the diverse stores. This makes difficult to use the system for regular reporting of activities." — Hospital 04, Store manager

4.1.7.2 Factors affecting data quality and utilization practice

From the qualitative study, it was also obtained that supportive supervision and technical support were weaker than what was expected by the higher government organizations. Less developed accountability and system for monitoring and evaluation of performances and gaps in the system remains a concern. Respondents' states that the management lack appropriate focus to HCMIS at hospitals unlike other systems for instance APTS (Auditable Pharmaceutical Transaction System).

"I think managers need to be accountable and should take responsibility for their health facilities… And making sure that what they are signing off on a bi monthly basis is correct …" — HC 2, Store manager

Furthermore, institutional ownership of the system is still problematic. Neither the facilities nor other government organizations have the ownership of the system. Respondents point out that when the system corrupts, partners give response but it is not immediate. And also upgrading and addition of features are done by them.

"I have a fear that if the project phase-out, the system practicability will be on question. Updating and managing during system interruption and annual inventory time will be difficult without them. I suggest FMOH or EPSA should take over the ownership of the database." — Hospital 01, Pharmacy head

"Due to accountability issue and also negligence, timely transaction is not done at facilities … turnover of skilled personnel without skill transfer is another issue that created technical gaps…. manual preparation of reports due to power interruption.… so that overburden of work occurs. " — Stakeholder 01

4.1.7.3 Database related factors

The system needs modification in order to make it useful for the whole inventory activity. Respondents' states that the visibility of the database at dispensary units helps to avoid manual work to fill the IFRR which helps to improve data quality obtained from each unit. However the practice is not like that. From the reports, AMC (Average Monthly Consumption) report was not flexible to adjustment of dates. It only works from the day of request to backward of the last 3 months.

"From the reports, because it doesn't generate the previous periods AMC, we weren't able to use the AMC report. It only works from today to the last three month data which makes it difficult to see seasonal variations during forecasting." — HC 14, Store manager

Besides to this the system didn't allow to print out vouchers. Which indicates that the system was not fully automated and manual works were still in place. One of the respondent states this condition as:

"When we receive medicines from EPSA, we are unable to use the system for printing the vouchers …. So the models are prepared manually." — HC 10, Store manager

Moreover, the system was not feasible to integrate with other systems and the facilities health information system (HMIS) was not linked. Whenever the database is updated the system misses access to previous year data.

"We were trying another database besides the HCMIS. But it was difficult to use both databases at the same computer…... So we were forced to restrict the additional database to dispensary only…. by excluding the store." Hospital 01, Pharmacy head

"The data base has some limitation with regard to integration with other systems…. We are collecting feedbacks from facilities in order to make it more feasible…." — Stakeholder 03

4.2 Discussion

The health commodity management information system is designed to support inventory control, and logistics management information at public health facilities of Ethiopia. To accomplish this, the system should be monitored regularly, so that limitations, barriers, strength and facilitators of the system are identified. This study examined the data quality, utilization practice and contributing factors of the HCMIS.

Inconsistency and discrepancies were observed between data on the RRF and on the bin card even if computerized recording and reporting system enhances the logistics management information

system performances through reducing errors & task burden, saving time, and improving reporting rates (Mochache, 2011). Of the total sampled RRF, 76.33% were accurate, 48.0% were timely reported and 70.43% of the reports were found to be complete and from the reports the HCMIS generates 55.49% were consistent. The findings are slightly lower than the assessment conducted by AIDSFREE in Zambia and Wanjiku in Kenya wherein the timeliness of their reports were 51% and reporting rate was above 90% (AIDSFREE, 2018) and the accuracy of data were 85% (Wanjiku, 2015). This indicates weakness of the studied health facilities' performance in recording their logistics data and reporting to the next higher level. The health centers are expected to send their reports, till 5th day, to the sub city to compile and send the reports to EPSA. Therefore, on-time reporting rates often look low even if the reports were sent to the sub city before the 10th day.

Despite the increase in the HCMIS coverage over the period, the fluctuations in the reporting of the data elements raise concerns and the inaccuracy of the reported data. With reference to data quality of reports, it has substantial impacts on the quality of health care and even on government budgets for the maintenance of health services. Therefore, every public health facility in a supply chain needs to improve its data quality and timely share the data to maintain health care at most favorable level (WHO, 2017). Overall, the study findings show that the data quality of the HCMIS in Addis Ababa public health facilities was fair (66.1%). This finding contradicts with the study done in Kenya which found the quality of the information system very good (Wanjiku, 2015). The difference may be due to the Kenyan study used three quality dimensions only (completeness, accuracy and timeliness). Besides to this the selected community health units were model community of the country. Generally, quality indicator provides information on how accurately the facilities were tracking their inventories, and discrepancies of more than ten percent should cause concern and may require efforts to improve data quality (John Snow Inc. /DELIVER, 2005).

In Ethiopia, the number of health facilities using automated logistics management information system, has expanded. HCMIS is enabling the supply system to strength, allowing for increased visibility of data at facilities, improved inventory management, reduced waste and ultimately improved supply chain performance from time to time (USAID, 2015b). Despite the HCMIS

containing valuable information that can be used for commodities management, this study found that the average utilization of the system is low. This would be due to lack of awareness of the professionals about the HCMIS and due to most of the reporting are not a must task. According to Omary and kalinga (2017), the eLMIS provide sufficient information to generate the required reports, the eLMIS provides information that is easy to understand, and the reports in the eLMIS system are available whenever needed for use.

As per specified on the standard operating procedure of the integrated pharmaceutical logistic system and the working book of the HCMIS all computerized public health facilities are expected to produce their every two month Report and Requisition Form from the system. Within one financial year the facilities are expected to produce six RRFs (USAID, 2017; PFSA, 2014). Regarding regular reports utilization, the study finds out 95% of the facilities use RRF which may be due to the system EPSA follows that is "no report no pharmaceuticals" principle. Such principle pushes the facility to prepare and submit their reports bi-monthly for the supplying agency timely to supply the facilities need. The finding is similar to the national IPLS survey where RRF use was assessed by comparing usage at electronic and paper-based facilities. Public health facilities with HCMIS accomplished greater in RRF use compared to paper-based health facilities. In the survey, hospitals RRF use was 100% for computerized facilities and in health centers RRF use was 89% for facilities with HCMIS (EPSA, 2019). The study revealed the utilization practice for performance evaluation was 40% which may be due to the focus for daily and routine activities.

The study found all of the facilities use the HCMIS for the purpose of daily activity registration, reporting, follow up of items, planning, and inventory management. The finding is parallel with Mudzteba's finding, almost all facilities use the system to determine consumption and issue quantity. The automation of the logistics system facilitated the drug supply management of the HCs (Mudzteba, 2014).

However, for stock status, overstock, stock out, near expiry and expired products reports the finding was low 30%, 25%, 25%, 30% and 30%, respectively which may be due to lack of regular follow up by government organizations. The finding is similar with the study done in Addis

Ababa health centers on the pharmaceutical logistics system, more than two third of the studied facilities use the HCMIS to manage pharmaceuticals but only nine point five percent of the facilities use the system for ABC analysis (Mudzteba, 2014). It was also found that there was no linkage of the HCMIS with other data collection systems such as the HMIS. The HCMIS used for informed logistics decision making and the HMIS used to report service data. This finding is similar with Taddesse's finding which is done in public sectors providing anti retroviral service (Taddesse, 2015).

The LMIS software's functionality is quite extensive. Using the full potential of the system is challenging primarily because of the difficulty of changing the mindset of users who have worked with manual systems for so long (Bhattarai, 2011). The poor utilization of HCMIS reports might be for the reason that lack of awareness about the reports, frequent power interruption, and lack of follow up by higher level. The reason might be a variation in the level of dedications by higher officials in providing regular supportive supervision and feedback on the health facilities performances.

The discrepancies have been ascribed to several factors such as insufficient support from government organizations, inadequate training on HCMIS tasks, irregular monitoring and evaluation, and ownership of the system by the management. Wagenaar *et al*, (2015) also found that an intervention consisting of data audits, supportive supervision and feedback from higher levels, data trainings, and performance enhancement meetings focused on improving use of data for decision making can result rapid improvements in data concordance in public health facilities. The finding of the study indicates almost half (55.0%) of the facilities had received a feedback report. However according to EPSA, the overall information system includes a mechanism for providing feedback to lower level facilities from upper level facilities. From the feedback reports, the health facilities will be able to identify their performance compared to other health facilities in their area and will be able to assist stock transfer (PFSA, 2014).

The study done in India (Bhattarai, 2011) indicates that the system was not fully digitalized. Consumption data from manually maintained registers were totaled and manually uploaded to the eLMIS. The uploading process was slow and entering data-in opens the likelihood for errors.

Factors including availability of both electronic and manual recording system might also be significantly affecting the data quality of HCMIS in the present study. Also Rwandan study supports electronic LMIS report with poor recordkeeping. Data not moving up or down the system: facilities not submitting to districts, districts not sending reports to central, central not providing feedback to health facilities (Ntirenganya, 2017). Malawi's report on LMIS also supports that, external factors have a negative impact on the LMIS, including inadequate financing of health commodity, trained personnel with supply chain responsibilities are not enough at the facility level, health workers are overburdened and inadequately supervised, limited Internet availability disrupt the timely submission of reports (Wright *et al.*, 2013).

CHAPTER FIVE

5. SUMMARY, CONCLUSION AND RECOMMENDATIONS

In this chapter summary of major findings, conclusion of the study and recommendation for future improvement are presented based on the findings of the study.

5.1 Summary

- Only 76.33% and 70.43% of the reports were accurate and complete respectively. Only 48.0% and 55.49% maintained timeliness and consistency. Only 82.78% of the data was valid. And the overall data quality of the facilities was found to be 66.61%.

- Use the HCMIS for the purpose of daily activity registration, reporting, follow up of items, planning, and inventory management. And to record receive, issue and loss/adjustment which are routine activity for managing inventory. Only eight (40.0%) of the facilities use the HCMIS for performance management.

- Regular reports 6(30%), 5(25.0%), 5(25.0%), 6(30%), 6(30%), 19(95.0%) of the studied facilities use for stock status report, over stocked items report, stock out report, near expiry report, and expired products report, respectively to report on schedule to higher level. The average utilization of all the regular reports was 39.17%.

- Usage perception: price only report (1.27±0.521), consumption trend by dispensary unit (1.67±1.093), cost report (1.90±1.062), consumption trend report (1.93±1.048), Loss /adjustment report (3.17±1.341) and AMC report (3.30±1.489) which had low mean score.

- Seven (35%), 13(65.0%), 10 (50.0%) of the study facilities received reminder notification from AACAHB or EPSA to check the accuracy of reports, to fill reports completely, and to send reports on timely basis, respectively. The average reminder notification was found 50.0%.
- Nineteen (95.0%) of the study facilities had received supportive supervision, and 11 (55.0%) of the facilities had received a feedback report. Among the facilities that received

supportive supervision, 5(25.0%) receive from EPSA, 9(45.0%) from AACAHB, 2(10.0%) from FMOH and 16(80%) from JSI.

- Twenty (70.0%) of the respondents had training on HCMIS. Sixteen (53.3%) of the respondents receive follow up mentorship after the first training. From the trained respondents, 5(16.7%) of them took on the job training, and 10(33.3%) of them took off the job training. From the respondents who didn't get the training 7(23.3%) learn to use the HCMIS used at the facility by guidance of other colleagues and 2(6.7%) by reading the manual.

- Perceived contributing factors: From the total eleven items used to assess HCMIS database characteristics, greater portion of the respondents disagree on the stated contributing factors. Among the four items used to assess the external factors, all perceived contributing factors had low mean scores. Most of the factors from the eleven items used to assess organizational factors had low mean sore. All of the technical factors had high mean score.

- Generally, majority of the respondents strongly agree or agree that the system improve the facilities supply chain and it is adaptable, the data is useful for activities other than reporting, computer is always accessible for operating the HCMIS and the information system fits well with the working practices.

5.2 Conclusions

Data quality is a multidimensional concept and attempts to improve data quality should consider each dimension of quality. Interventions to address the quality of data must approach the problem from multiple angles while also considering the systems level implications of HCMIS improvement. The study was helpful in pointing out discrepancies between RRF and bin cards at selected public health facilities. Moreover, the study also identified which reports were sent to the higher level on a regular basis in addition to their timely submission. Generally, the study identified that the quality of data in public health facilities of Addis Ababa was fair. The top three dimensions of data quality that had low value were consistency of reports, timeliness of reports and accuracy of reports. The study also intended at assessing the utilization practice of the information system. The studied facilities use the system for all activities that are routinely done. However, the utilization for the purpose of performance measurement was found low. Moreover, there is a significant problem in terms of ownership of the system and if not addressed on time, it will pose a threat to future sustainability of the system. Generally, we concluded that the facility report quality and utilization of the system require improvements. In order for the data quality and utilization practice to improve, higher and health facility level managers need expanded skills to allow for full involvement in the process of evaluating their data and system use. In general, factor like the period of HCMIS implementation, HCMIS Characteristics and organizational factor had moderate positive correlations with the data quality and utilization practice.

5.3 Recommendations

The following recommendations are made based on the findings of this study:

- A data quality system should be in place that ensures routine data quality checks and assessments across all the repositories of data within the health information system. External checks should be conducted by FMOH, EPSA and HBs. Internal processes for checks at the health facility should be instituted within the facility. For the facility, verification of collated summaries must be validated and signed off by senior staff and summaries also discussed before submission to higher levels. This will ensure that a facility based health information system is in place to provide a base for the good functioning of the overall health information system.

- Health facilities should improve their data quality by routinely checking the accuracy of reports, by sending reports timely and consistently, and by filling all components of the reports.
- Utilization practice of reports should be consistent. The facilities should have a habit of reporting all necessary reports to higher level in a scheduled manner.
- Proper training should be given for pharmacy professionals working on HCMIS in order to improve the data quality of reports and also the utilization of the system.
- Technical and supportive supervision, with appropriate feedback should be given for health facilities in a regular basis by higher government organizations.
- A strong partnership or a common plat forum should be established among key stake holders (HFs, HB, FMOH, EPSA and partners) to have regular discussion on HCMIS data quality and utilization practice of the system.
- Monitoring and evaluation system should be in place by the management of the facility and also by higher stakeholders.
- Good quality data produced by health facilities should be recognized in a nonfinancial incentives programme. Thus, creative non-monetary mechanisms should be put in place as a means to enhancing the performance of human resources working on generating data for the health commodity management information system.
- It is better if the ownership of the data base is transferred to government organizations to avoid the risk of interruption following phase out of a project.
- Similar studies with a larger scope should be conducted so as to get the full picture of HCMIS data quality and utilization practice in Ethiopia.

Limitation of the study

Since there is limited data on HCMIS data quality and utilization both locally and globally the study was compared with other related literatures on information system. Because of budget and time constraints, the present study was limited to the evaluation of commonly and consistently used documents in the health facilities for decision-making. This study didn’t evaluate an information system from the supplier points.

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Annex 1. Data collection tools

1.1 Data collection Format

Completeness of RRF		Beginning balance is filled	LSOH is filled	Loss/Adjustment is filled	Quantity received is filled
List of tracer medicines	Number of report	R1,R2,R3,R4,R5, R6 (Yes, No)	R1,R2,R3, R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5, R6 (Yes, No)	R1,R2,R3,R4,R 5,R6 (Yes, No)
Oral Rehydration Salts					
Zinc dispersible tablet					
Medroxyprogesteron e Injection					
Ferrous sulphate + folic acid					
TDF/3TC/EFV adult					
RHZE/RH					
Tetracycline eye ointment					
Implanon					

Timeliness of RRF	Is the date of report clearly identified in the registers	Does the facility sent the report on the schedule (until 5th day of the month)	Does the facility sent the report on the schedule (until 10th day of the month)	Does the facility sent the report on the schedule (after 10th day of the month)
Number of report	Yes, No	Yes, No	Yes, No	Yes, No
Report 1				
Report 2				
Report 3				

Report 4				
Report 5				
Report 6				

Validity of RRF	Report indicate completed by	Report indicate approved by	Report indicate verified by
Number of report	Yes, No	Yes, No	Yes, No
Report 1			
Report 2			
Report 3			
Report 4			
Report 5			
Report 6			

Consistency of reports	Expected number of reports	Number of reports sent by the facility
Reports		
1. RRF	6	
2. Near expiry report	12	
3. Loss /adjustment report	4	
4. Consumption trend	4	
5. Cost report	4	
6. Consumption trend by dispensary unit report	4	
7. Stock status summary	12	

Accuracy of RRF		Verified calculated consumption indicated on RRF(CC = beg.bal + QR – SOH+/- Los/Adj)	Verified maximum stock quantity indicated on RRF (CC x 2	Verified quantity ordered indicated on RRF (Maximum stock quantity EB)	Valid beginning balance of this reporting period of RRF Vs Ending balance of pervious RRF report	Valid quantity received of RRF Vs quantity received of STV or model 19	Ending balance of RRF Vs Ending balance of bin card valid	Loss /adjustment of RRF Vs bin card	CC ofRRF Vs quantity issues of bin card valid	DOS of RRF Vs DOS of bin card valid
List of tracer medicines	No. of reports	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)	R1,R2,R3,R4,R5,R6 (Yes, No)
Oral Rehydration Salts										
Zinc dispersible tablet										
Medroxyprogesterone Injection										
Ferrous sulphate + folic acid										

TDF/3TC/EFV adult										
RHZE/RH										
Tetracycline eye ointment										
Implanon										

1.2 Questionnaire

ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCE
SCHOOL OF PHRMACY
DEPARTMENT OF PHARMCEUTICS AND SOCIAL PHARMACY

Dear respondents:

I'm a graduate student at Addis Ababa University College of health science school of pharmacy. Currently, I'm conducting a research entitled ***'Health Commodity Management Information System Practice, data quality and contributing factors in public health facilities of Addis Ababa, Ethiopia'*** as a partial requirement for the award of Masters of Science Degree in Health Supply Chain Management.

The purpose of this questionnaire is to gather data for the proposed study, and hence you are kindly requested to assist the successful completion of the study by providing the necessary information. Your participation is entirely voluntary and the questionnaire is completely anonymous. I confirm you that the information you share will stay confidential and only used for the aforementioned academic purpose, thus not affects you in any way. So, your genuine, frank and timely response is vital for the success of the study. I want to thank you in advance for your kind cooperation and dedication of your precious time to fill this questionnaire.

For comments/questions please contact **Kalkidan Endeshaw** (0913542343) principal investigator for the study and/or advisors Dr.Shiferaw Mitiku (shiferaw.mitiku@aau.edu.et), Mr. Zelalem Tilahun (zelatilahun@gmail.com)

Sincerely yours,

Kalkidan Endeshaw
(Email: kalkidankuki@gmail.com)

Section I: Respondent profile:

1. Age: .....Years
2. Gender ..... Male ..... Female
3. Current position:

   ☐ Store manager ☐ Pharmacy head ☐Officer ☐ other.....

4. Total work experience: .....Years

5. Year of service in the current position: .....Years

SECTION II: Health facility profile

1. Name of the facility ---------- and sub-city.....
2. Level

   ☐ Hospital ☐ Health center
3. Number of items managed

   RDF..... Program .....
4. Total population served.....
5. Period of HCMIS implementation (from the beginning of working by the system) .....years
6. Total number of pharmacy professionals?

   Pharmacists .....

   Druggists .....

   HCMIS data clerk (if any) .....
7. Does the facility keep copies of the HCMIS reports which are sent to higher level?

   Yes..... No.....
8. If Yes to the above question, which report?

   Monthly ☐ Yes ☐ No

   Every two monthly ☐ Yes ☐ No

   Quarterly ☐ Yes ☐ No

   Summary ☐ Yes ☐ No

   Other.....

SECTION III Contributing factors of HCMIS data quality and practice

1. Did you receive a reminder notification in the last three months from AACAHB or PFSA?

1.1 To check the accuracy at least once in the quarter ☐ Yes ☐ No

1.2 To fill the bimonthly reports completely ☐ Yes ☐ No

1.3 Submit the reports by the specified timeline ☐ Yes ☐ No

2. Did you get supervision visit from stakeholders in the last one year?

☐ Yes ☐ No

Question	PFSA(EPSA)	AACAHB	FMOH	JSI	Other NGO (specify)
If yes for Q2, from whom did you get the supervision?					
When did you receive most recent supervision regarding HCMIS and from whom?					
Within the last month					
1-3 months ago					
3-6 months ago					
More than 6 month					
Never received					
Did the supervisors send feedback on the last two supervisory visits? If yes, which stakeholder? ☐ No					
Did the supervisors discuss performance of the health facility based on the HCMIS data? If yes, which stakeholder? ☐ No					

7. Have you been trained on HCMIS?
   ☐ Yes ☐ No
8. If yes to Q 7, have you received any further follow-up mentorship after the first training?
   ☐ Yes ☐ No
9. Where did you get HCMIS training?
   a. During a logistics workshop
   b. On-the-job training
   c. Off the Job training
   d. Other (specify)……..
10. If No to Q 7, how did you learn to use the HCMIS used at this facility?
    a. By reading the Manual
    b. Through guidance of colleagues
    c. With other logistic trainings
    d. Other (specify)…….

For each statement on the left, please tick on one which best describes the level of your agreement (***5= strongly Agree (SA); 4 Agree (A) =; 3=Neutral-N (Neither agree nor disagree); 2= Disagree (D) and 1= strongly Disagree (SD)***

No.	Contributing factors of HCMIS practice and Data quality	SD	D	N	A	SA
	HCMIS data base characteristics					
1	The software is adaptable to the working environment					
2	The HCMIS contain all the features necessary for health commodities management					
3	The HCMIS benefit/improve the facilities supply chain					
4	The HCMIS allows to add/delete new/outdated items					
5	It is important to add other features helping for facilitating the transaction and reporting process					
6	The HCMIS is not prone to computer virus					
7	There is no risk of the system being hacked into and data being corrupted					
8	Error in transaction carried out by the system doesn't result business inefficiency					
	External factor					
9	There is a pay for performance initiatives					
10	There is regular monitoring and evaluation system					
11	There is ongoing support by government organizations					
12	The reported data is interpreted and used by suppliers for logistics activates like forecasting, distribution, procurement					
	Organizational factors					
13	The information system fits well with the working practices					
14	Management involvement and support is in place					
15	Computer is always accessible for operating the HCMIS					
16	The capacity of the computer is enough to export reports from the HCMIS					
17	Access to electricity supply doesn't interrupt the ongoing job by the HCMIS					
18	The computer has access to reliable internet connectivity					
19	There is a records back-up system that ensures easier retrieval of data					
20	There is high turnover of staff who are qualified in the operation of the system					
21	The data presented is always used by decision makers					

22	The data is useful for activities other than reporting					
23	The cost of maintaining and upgrading the system is high					
	Technical factors					
24	I am efficient to use the HCMIS					
25	I have computer skill to use HCMIS					
26	I have enough knowledge and information to operate on the HCMIS					

SECTION IV Practice of utilization

1. For what purpose you use the HCMIS?

   a. For daily activity registration ☐ Yes ☐ No
   b. For reporting ☐ Yes ☐ No
   c. For performance measurement ☐ Yes ☐ No
   d. For follow up of items ☐ Yes ☐ No
   e. For planning ☐ Yes ☐ No
   f. For budget utilization ☐ Yes ☐ No
   g. For inventory management ☐ Yes ☐ No
   h. Other……

2. For what recording the facilities use the HCMIS for?
   a. To record Receive items ☐ Yes ☐ No
   b. To record Issue items ☐ Yes ☐ No
   c. To record loss/adjustment ☐ Yes ☐ No
   d. To perform Inventory ☐ Yes ☐ No
   e. To perform stock transfer ☐ Yes ☐ No
   f. Other……

3. Which reports is/are the facility regularly (on schedule) report to other higher level?

   a. Stock status report ☐ Yes ☐ No
   b. Over stocked items report ☐ Yes ☐ No
   c. Stock out items report ☐ Yes ☐ No
   d. Near expiry report ☐ Yes ☐ No
   e. Expired products report ☐ Yes ☐ No
   f. RRF ☐ Yes ☐ No
   g. Other…….

4. Is the system useful for reporting activities to the management of the facility?
   ☐ Yes ☐ No

5. If yes to Question 4 which reports are not used for within the facility management reporting?

   a. Stock status report
   b. Over stocked items report
   c. Stock out items report
   d. Near expiry report
   e. Expired products report
   f. RRF
   g. Activity reports
   h. Cost report
   i. Other……

6. Is the facility's HCMIS integrated with HMIS?
   a. Yes b. No

7. Does your health facility use HCMIS for any of the following? Please indicate the extent of the use.

Functions	Usage Level				
	Never used	Used when asked	Used some of the time	Used most of the time	Used always
Activity Log					
Receive					
Issue					
Loss/Adjustment					
Inventory					
Stock transfer					
Reports					
Stock status report					
Overstocked items report					
Stock out items report					
Near expiry report					
Expired products report					
RRF					
Loss /adjustment report					
Cost report					
Consumption trend					
Consumption trend by dispensary unit report					
AMC report					
Price only report					
Electronic bin card					

Summary reports					
Stock status summary					
Receive summary					
Issue summary					
Stock expiry summary					
Cost summary					

"Thank you very much for completing the questionnaire"

1.3 Interview

Introduction

I want to thank you for taking the time to meet with me today. My name is Kalkidan Endeshaw. I come from Addis Ababa University, School of Pharmacy attending a post graduate study in Health supply chain management. I am the principal investigator for the study entitled "*Health Commodity Management Information system Practice, data quality and contributing factors in public health facilities of Addis Ababa, Ethiopia"*. The aim of this study is to measure the practice, data quality of HCMIS and contributing factors in selected public health facilities of Addis Ababa, Ethiopia.

Considering that the findings and recommendations emanated from this study will help the policy makers and other organizations to design intervention activities, you are kindly requested to participate in this study. The interview should take less than an hour. I will be taping the session because I don't want to miss any of your comments. Although I will be taking some notes during the session, I can't possibly write fast enough to get it all down. Because we're on tape, please be sure to speak up so that I don't miss your comments. All responses will be kept confidential. This means that your interview responses will only be shared with research team members and we will ensure that any information we include in our report does not identify you as the respondent. Remember, you don't have to talk about anything you don't want to and you may end the interview at any time.

Are you willing to participate in the interview? Yes……. No……..

If yes the interview will continue.

1: Back ground information of the key informant

1.1 Age……
1.2 Highest level of education…….
1.3 Total Work experience……..
1.4 Job title……

2: Guiding questions for in-depth interview with head of pharmacy case team & store person

1. What is the HCMIS utilization practice at your facility?
2. What is the data quality of the system?

3. What are the contributing factors of HCMIS practice?
4. What are the contributing factors for data quality?

3: Guiding questions for in-depth interview with key informants from EPSA, AACAHB and JSI

1. How do you assess the current situation of data quality regarding reports from facilities?
2. What are the factors that contribute for poor data quality in the facilities?
3. How does the data quality is affecting service provision to facilities?
4. How do you assess the HCMIS utilization of facilities? Do they use all the components?
5. What are the situations regarding the ownership of the software? Do facilities have all the access to manage the software?

Annex 2. List of tracer medicines for health centers and hospitals

1. Oral Rehydration Salts
2. Zinc dispersible tablet
3. Medroxyprogesterone Injection
4. Ferrous sulphate + folic acid
5. TDF/3TC/EFV adult
6. RHZE/RH
7. Tetracycline eye ointment
8. Implanon

Annex 3. List of Health facilities assessed

S.No.	Name of the facility	
	Health center	**Sub city**
1	Ginbot 20	Addis Ketema
2	Arada	Arada
3	Janmeda	Arada
4	Bole 17	Bole
5	Bole 17/20	Bole
6	Hidassie	Gulelle
7	Guto meda	Gulelle
8	kirkos	Kirkos
9	Kazanchis	Kirkos
10	Kolfe woreda 1	Kolfe Keranio
11	Kolfe woreda 3	Kolfe Keranio
12	Lideta	Lideta
13	Nifas silk lafto woreda 11	Nifas Silk Lafto
14	Nifas silk lafto Woreda 12	Nifas Silk Lafto
15	Entoto No.1	Yeka
16	Yeka woreda 4	Yeka
	Hospitals	**Administration**
17	Alert Hospital	Federal
18	Blacklion Hospital	Federal
19	Yekatit Hospital	AACAHB
20	Zewditu Hospital	AACAHB