College of Medicine

Assessment of the Effectiveness of Health Management Information System Training in Malawi: A Case of Lilongwe District

By

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DECLARATION

I, Jime P. Tambala, hereby declare that this thesis is my original work and has not been presented for any other awards at the University of Malawi or any other university.

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CERTIFICATE OF APPROVAL

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ABSTRACT

Health Management Information Systems remains the fundamental systems in the medical sector to support patients' data and data for decision making. However, despite capacity rendered by different stakeholders to improve HMIS systems infrastructure, there exist data quality issues which affecting effective delivery of health care services in all districts of Malawi, Lilongwe included. As such, the study investigated the effectiveness of HMIS user Training in improving data quality in health systems in Malawi, a case of Lilongwe District. This was a cross-sectional study which used a mixed approach of both qualitative and quantitative methods, a total of 60 health workers participated in the study. In-depth interviews were conducted to analyze the perception of health workers towards HMIS training and to determine the factors that affect effectiveness of training of HMIS in Malawi. A semi-structured questionnaire was used to assess whether the structure and mode of delivery of HMIS training respond to the training needs. The study also measured quality of data by assessing four data dimensions; accuracy, completeness, timeliness and consistency. The study findings showed that good coordination in data management, data ownership, good documentation and team work were perceived as effects and benefits of HMIS training. While data verification, data analysis and use of electronic systems such as EMR and DHIS2 were perceived as skills acquired through HMIS trainings. Key data quality dimensions influenced by HMIS trainings were completeness, correctness while timeliness and consistency had some gaps which warrant for further investigations. According to this study HMIS training is clearly showing to be effective on HMIS performance. However further consideration should be given to how participants are selected, training duration, refresher trainings, staff retention, monitoring and supervision.

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ABBREVIATIONS AND ACRONYMS

HIS	Health Information System
WHO	World Health Organization
HMIS	Health Management Information System
MOHP	Ministry of Health and Population
CMED	Central Monitoring and Evaluation Division
DHIS2	District Health Information System 2
SDG	Strategic Development Goals
ICT	Information Communication and Technology
IT	Information Technology
HAS	Health Surveillance Assistant
ANC	Antenatal Clinic
CHAM	Christian Health Association of Malawi
DHO	District Health Officer
MEHIS	Monitoring, Evaluation and Health Information System
COMREC	College of Medicine Research Ethics Committee
STATA	Statistics Analysis
DQR	Data Quality Review
EMR	Electronic Medical Records
BCG3	Bacillus Calmette–Guérin 3
EPI	Expanded Programme on Immunization
SD	Standard Deviation

USA	United States of America

CHAPTER 1: BACKGROUND INFORMATION AND INTRODUCTION

1.1 Introduction

Health information is regarded as very important, a critical and strategic resource for management and monitoring of health sector performance [1]. Health information sometimes is equated with monitoring and evaluation as it provides alerts and early warnings, trends analysis, reporting and communication [2]. Government agencies and non-governmental organizations responsible for human health require reliable health information for decision making and policy formulation. Therefore, a good functional Health Information System (HIS) is not an option.

A Health Information System is important for monitoring health, evaluating and improving the delivery of healthcare services and programs. The World Health Organization (WHO) defines a Health Information System as a system that integrates data collection, processing, reporting and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services [3]. WHO describes Health Information System as one of the key health system building blocks [4]. Therefore, HIS has much to offer in managing healthcare and improving quality of care.

Health Management Information System (HMIS) is a component in Health Information System. HMIS is a data collection system specifically designed to support planning, management, and decision making in health facilities and organizations. HMIS collects data on routine health activities including services provided by health facilities.

Data in many developing countries struggle with quality problems resulting in incomplete, inaccurate and untimely information which is not useful for health decision making. Reliable and quality data necessitates health facilities to make informed decisions regarding resource allocation, planning, and programming [5]. However, many studies have concluded that HIMS face several challenges to perform efficiently and effectively. Many studies have agreed that poor performance of HMIS contributes to poor data quality and unreliable system including failure of health workers to appreciate the importance of the system [6–8].

A well performing HMIS is needed to improve evidence-based decision making and health system performance. This can only be achieved if the system is able to produce quality, reliable, accurate, complete and timely data. Therefore, documenting the actual quality of HMIS data is an important step towards improving quality. In this regard, several countries around the world have developed HMIS to support planning, management, and decision making in health facilities and organizations.

Malawi through the Ministry of Health (MOH) introduced HMIS in 2002 [9] to remedy the inability of Health Information System in providing timely information and in a format which can be used for decision making. Furthermore, HMIS aimed at resolving the issue of numerous parallel reporting structures existed within the health system [9].

There are several factors that affect the quality of HMIS data. Several studies reported that the frequency and quality of supervision conducted on HMIS, the presence of HMIS focal person responsible for the day to day HMIS activities, knowledge of the HMIS concepts affects the

quality of HMIS data, attitude of health workers towards HMIS and lack of commitment and accountability of the poorly supervised health workers [6, 10].

National assessment of data quality and associated systems-level factors done in Malawi by R. O'Hagan indicated that infrequent data quality checks, staff training and unreliable supervision affects the performance of HIMS in Malawi [5]. While an assessment done by J. Haugen highlighted on missing data as a risk factor to Malawi HMIS despite improvements in completeness [11]. However, the missing data might be observed at district level in the District Health Information System 2 (DHIS2) while at the source, the health facility data is conceivably available.

In this regard, several studies have recommended the Malawi Ministry of Health to put effort on HMIS training to health workers at all levels of the health system, improve HMIS-focused supervision, ensuring internal data quality reviews, and encouraging data use to inform programming [5, 12].

In response to the recommendations made by different studies, the Central Monitoring and Evaluation Division of the Ministry of Health has made tremendous efforts since the introduction of HMIS in 2002 to train health workers in data management and use. These trainings were implemented independently with technical and financial support from different partners. No national standard curriculum was used for such trainings until 2018 when MOH introduced HMIS training curriculum with the support from Kuunika Project.

The aim of these trainings are to ensure improved HMIS performance and production of quality data. However, little is known about how effective these trainings are in improving HMIS performance and data quality. It is in this regard that this study assessed the effectiveness of Health Management Information System training in Malawi particularly Lilongwe district.

1.2 Research Problem

Despite that HMIS is important for evidence-based decision making for the appropriate use of scarce resources particularly in resource limited countries such as Malawi, its implementation leaves a lot to be desired. Several studies reveal that HMIS in the developing countries are inefficient and ineffective due to several reasons. First, the lack of clear understanding of the system by health service providers contributes to poor data quality, including the lack of emphasis on HMIS in pre-service syllabuses [13]. Second, lack of sensitization to staff results into poor utilization of data for decision making at point of collection such as health centers [14]. To ascertain the quality of HMIS, studies have emphasized that health workers responsible for handling data and decision makers should be provided with adequate HMIS training. Malawi through the Central Monitoring and Evaluation Division (CMED) has conducted a series of HMIS trainings for health workers across the country. However, very few studies have been carried out to investigate the effectiveness of the HMIS training on the performance of HMIS system. This study will help to bridge the gap in knowledge of how resources invested in HMIS trainings have the impact on performance of HMIS and the data quality.

Despite that HMIS is important for evidence-based decision making for the appropriate use of scarce resources particularly in resource limited countries such as Malawi, its implementation

leaves a lot to be desired. Several studies reveal that HMIS in the developing countries are inefficient and ineffective due to several reasons. First, the lack of clear understanding of the system by health service providers contributes to poor data quality, including the lack of emphasis on HMIS in pre-service syllabuses [13]. Second, lack of sensitization to staff results into poor utilization of data for decision making at point of collection such as health centers [14]. And the major factor affecting HMIS quality is the absence of training and motivation.

To ascertain the quality of HMIS, studies have emphasized that health workers responsible for handling data and decision makers should be provided with adequate HMIS training. Malawi through the Central Monitoring and Evaluation Division (CMED) has conducted a series of HMIS trainings for health workers across the country. The goal of these trainings was to see improvements on HMIS performance and data quality in the facilities where health workers have been trained on HMIS. However, there was little knowledge to how effective are these trainings in improving the performance of HMIS and data quality. Therefore, this study will investigate and help to bridge the gap in knowledge of how resources invested in HMIS trainings have the impact on performance of HMIS and the data quality.

1.3 Rational

Since the introduction of HMIS by the Ministry of Health, several HMIS trainings have been provided to health facility staff. However, little is known about their effectiveness of the trainings, including the degree to which the HMIS trainings could influence the data quality. Therefore, this research investigated the effectiveness of trainings on the data quality and use of the HMIS.

The study could assist decision makers at district and national level, policy makers and non-governmental organization to review and put in place new guidelines to improve the quality of HMIS trainings. The findings will also inform the best approach of the HMIS training to ensure their effectiveness. The findings could also provide information to improve the quality of health care delivery in general and Lilongwe health facilities in particular. The main beneficiaries of the result could be hospital clients because high quality data and proper use of HMIS directly affects treatment outcomes. Finally, the study bridges the gap in knowledge about the actual effectiveness of HMIS in the Malawian context.

1.4 Aim of the Study

To investigate the effectiveness of HMIS trainings in improving data quality in Lilongwe district, Malawi

1.4.1 Specific Objectives

1. To analyze the perception of staff towards HMIS training;
2. To assess whether the structure and mode of delivery of HMIS training respond to the training needs;
3. To evaluate the effectiveness of the trainings on performance of HMIS using data quality metrics;
4. To determine the factors that affect effectiveness of training on HMIS in Lilongwe.

1.4.2 Research Question

1. Does HMIS training improve the performance of HMIS among health workers?

2. What are the perceptions of HMIS staff towards HMIS trainings?
3. Do HMIS trainings respond to training needs for health workers in Malawi?
4. What are the factors that affect effectiveness of training in Malawi?

1.4.3 Hypothesis of the Study

HMIS training has an effect on data quality, usability and overall performance and perception towards HMIS.

Chapter 2: Literature Review

2.1 Health Management Information System

Health Information Systems is the foundation of a health system. It is one of the six core building blocks of a health system, it plays a major role of providing data needed for the other components of the health system. HMIS is a component of Health Information System. Every component of the six building blocks of health system requires information and that information is provided by Health Management Information System (HMIS).

Health Management Information Systems are organized systems which are used for data collection, processing, storage, reporting and use in the health systems [15]. It is designed to assist managers to undertake evidence-based decision making at all levels of the health care service delivery system. The HMIS covers the entire spectrum of the health care delivery system right from the health facility level, district, regional up to the national level [14]. Data delivered through HMIS come from service delivery reports and administrative records kept as part of routine transactions at health facilities and management offices.

The goal of HMIS is to provide quality, timely and accurate information leading to better health care planning and improved health services for an entire population. The introduction of the HMIS in many countries was aimed at ensuring the availability of accurate, timely and relevant data to decision makers in the health sector for purposes of planning and decision-making. Therefore, every HMIS system is designed in manner of ensuring that data which is being collected is relevant for planning and decision-making.

The information generated from HMIS is used to continuously monitor health services and make necessary interventions during health care delivery practice. HMISs are designed to help manage all hospital, medical and administrative information in order to enable health professionals perform their duties effectively and efficiently. HMIS assists managers and supervisors of different health programs in gathering information. The information which help determining the effectiveness of services, identifying problems, taking reasonable corrective measures and planning future strategies and activities [16]. It helps to monitor progress, identify problems in implementation and shows whether a health program is having any effect on health status.

In public health programs, HMIS is primarily concerned with health care delivery issues such as antenatal care, immunization, disease control programs and administrative issues. Some of the administrative issues include reporting, inventory management, financial management, and vehicle and personnel management issues [16]. Therefore, maintaining a good HMIS is an essential part of running an effective health system.

2.2 Importance of HMIS

Recommendation by WHO requires that every country should have a functional HMIS in order to generate quality healthcare data and improve decision-making at all levels. There are several reasons why different countries adopted HMIS. A study in India by Krishnan (2010) reported that health managers needed HMIS to monitor regularly the status of the population, medicines, vaccines, requirement and utilization patterns, equipment availability and status [16].

A study by Bodavala (2009) indicates that development of effective information system is necessary for managerial improvement. It generally helps in decision making which includes managerial aspects such as planning, organizing and controlling health care facilities at the national, state and institution levels and clinical aspects which can be subdivided into providing optimal patient care, training of medical personnel to generate appropriate human resources and facilitate research and development activities in various fields of medicine [17].

A study in Botswana by Ledikwe (2014) explains that HMIS is necessary for monitoring program goals and objectives, guiding evidence based program management, and ensuring appropriate policy formulation and resource allocation [18]. According to Chintu (2013) information management is the basis for the production of knowledge and its translation for health system decision making [19]. Hence, HMIS evidence is needed on effective strategies for linking data with decision making. HMIS is designed to carry both epidemiological information that is health prevalence, incidence, mortality, morbidity statistics and administrative information such as resource inputs and service utilization [20].

Therefore, effective and efficient HMIS will provide decision makers in health at all levels with the information which they require to make effective strategic decisions that improve health status of the population.

2.3 HMIS in Developed Countries

The HMIS is operated by governments through the Ministry of Health (MOH) to routinely collect health information which serves the health sector's planning and management purposes.

Countries which are developed such as China, United Kingdom and United State of America have improved and advanced health information system.

These countries support advanced systems for electronic health records (EHR) such as open electronic health records (openEHR). OpenEHR which is used in countries like United Kingdom, Australia and China use clinical registry which records information about the health status of patients and the health care they receive over varying periods of time. This approach provides the basis for semantic interoperability between clinical registries [21].

China has got the primary health information system as an application system that aims to meet the needs of urban and rural residents for national basic health services. It assists in health record management, basic medical services, health information services and primary health supervision and management. It also facilitates information interoperability which necessitate sharing and business collaboration with regional health information systems, medical institution information systems, medical insurance information systems and drug supply information platforms [22].

In United States of America, the primary health care providers use robust electronic medical records (EMR) as part of health management information system. The routine use of EMR aim at providing all U.S. citizens with good quality, safety, efficiency and affordable health care. Every primary care provider uses an electronic ambulatory information system, including a fully functional electronic medical record which has the ability to access needed clinical information at any time and place of care [23]. These countries have made remarkable investments in health information system technologies. Unlike countries in developing world who are still struggling

with paper based clinical registries due inadequate investments in health information system technologies.

2.4 HMIS in Developing World

HMIS has been adopted in developing countries following the recommendation by WHO [24]. The overall goal is similar to the rest of world that is to provide quality, timely and accurate information for effective and evidence based decision making to improve service delivery. Health system set up is similar in most developing countries. The system has three levels of care: that is primary, secondary and tertiary. For example, in India and Ethiopia, primary health care unit comprises health posts, health centers and primary hospitals. Secondary level includes general hospitals while tertiary level includes teaching and referral (specialized) hospitals [17, 25]. This is similar with Malawi health system set up: it has primary, secondary and tertiary level. HMIS is implemented at all levels of the health care system. Every level record data and produce reports which are submitted to the central level.

Despite that HMIS is aimed at ensuring information use for evidence based health planning and decision making. There is still poor utilization of HIMS data in developing countries. A study conducted in Mozambique indicates that the concerns about the quality of routine administrative data have undermined their use of HMIS data [26]. Mainly because data generated through HMIS in most developing countries are deemed to be incomplete, inaccurate and presented untimely. A lot of data that health workers collect is redundant or never utilized [16]. In addition, there are typically limited human resources available to analyze and translate data into useful information for health managers [26]. Another study which was done in South Africa by Mate et

al. (2009) concluded that routine data cannot be reliable and used to inform efforts to improve PMTCT care [27]. This was mainly because data collected and reported in the public health system was neither complete nor accurate enough to track process performance or outcomes for PMTCT care. A similar study in Nigeria discovered that data in DHIS2 did not often reflect what was in the service registers in health facilities, the data was incomplete, inconsistence over time, between related indicators and with external data source [28].

Public health decision-making is critically dependent on the timely availability of quality data. Developing countries are reported to have a large amount of unreliable health data due to poor human resources and information technology infrastructure [29]. Hence, effective HMIS systems are needed to solve these problems. In developing countries, data quality and utilization of health information remains weak, particularly at primary health care facilities and district levels.

Malawi through the Ministry of Health (MOH) adopted the Health Management Information System and started implementing the comprehensive and integrated HMIS in the year 2002 [9]. Embracing global shift from curative to preventive care, from hospital care to community and public health care, from centralized to decentralized health care, from a specific project approach to a comprehensive sectoral approach [30]. Malawi has restructured the fragmented health information systems into single comprehensive Health Management Information Systems. The aim was to resolve the issue of numerous parallel reporting structures existed within the health system [9],

The Malawi HMIS is mainly used by MOH, development partners, and stakeholders to collect relevant and functional information on a routine basis to monitor the health services and delivery, enable planning, decision making and evaluation of the health care delivery system. It provide program managers and staff with reports on how well each program is functioning and alert the service providers and program managers to take timely necessary corrective actions [31]. And finally the overall goal is to provide quality data that supports evidence-based decision making at all levels of the health care service delivery system in Malawi.

2.5 HMIS Approach

In many countries, HMIS use the mixed approach of paper and technology based paper based is mostly at community and facility level. The technology part concentrate around process, analysis and presentation of information, mostly by the use of electronic databases such as District Health Information System 2 (DHIS2). It is difficult to implement DHIS2 at facility level due to known factor such as lack of electricity and poor telecommunication coverage [32].

All health facilities especially public facilities use standard registers and standard formats to report data. These registers and reporting formats are designed considering services provided at each levels of health facilities. According to Endriyas et al. (2019), in Ethiopia all service delivery points use printed materials for recording [25]. HMIS reports are submitted to district by hardcopy and are digitalized and shared by higher levels through web system. According to Gimbel et al. (2011) Mozambique HMIS is similar to the data system of the other developing countries. It incorporates both paper and electronic elements, depending on the health system level. Patient level information is collected in facility paper-based clinical registries. Thereafter,

data is aggregated into facility reports, which are sent to the district level [26]. In most cases, at the district HMIS reports are entered into electronic database.

Well-organized management of data is difficult in a manual system, and often involves duplication of efforts and time wastage. A computerized management information system is one among the many ways that Information Technology (IT) can help improve the health system. IT can aid the health workers in providing services, data collection, storage, analysis and dissemination of information.

2.6 HMIS Data Quality

High quality health information is critical for addressing global health challenges and improving health service delivery in developing countries. Data quality is a complex concept, which encompasses multiple dimensions including accuracy, reliability, precision, completeness, timeliness, integrity, and confidentiality [18]. However, in many developing countries, ensuring data quality for meaningful interpretation remains a challenge.

The quality of the data produced by HMIS in developing countries is often poor and the data are not used effectively for decision-making. According to a study done in Tanzania by Braa et al. (2012) fragmentation and lack of coordination of health programs and tendency by international agencies of maintaining their own vertical systems, lack of shared data standards, unrealistic ambitions and inability of system developers to handle complex organizational has been proven difficult to develop strong health information system [33].

HMIS quality assessment done in several countries like Mozambique, Tanzania, Zambia and Kenya proved that data quality has been poor in different developing countries [13, 14, 20, 26]. As such, use of information for planning and decision-making was found to be weak according to a study done in Malawi by Haugen et al. [11]. Many factors contributed to underperforming of the information systems, such as difficulty in calculating indicators because of poor choices for denominators, errors in HMIS reports, insufficiencies in computerization, human and capital resources and low management [34]. Weaknesses in the areas of standardized case definitions, quality of reporting, analysis, supervision, and feedback [29].

A study in Uganda showed that there was low information use of only 24%, which was consistent with the limited observed skills level to interpret and use information [35]. Limited knowledge of the usefulness of HMIS data was found to be a major factor in low data quality and information use in Kenya [34]. Similarly, a study done in Malawi indicated that health workers lack adequate skills in HMIS and DHIS2. They regularly depend on HMIS officers to extract data and interpret it. HMIS officers receive more training than health managers and coordinators who are actual information users [32]. Most of these factors are influenced by lack of adequate knowledge and skills in Health Management Information System. Therefore, training health workers in HMIS has been highly recommended.

2.7 Challenges of HMIS

Despite implementing the comprehensive integrated HMIS in many developing countries, the system still faces challenges. Several studies have highlighted various factors that affect the implementation of HMIS in developing countries including Malawi.

A study conducted in India reported that absence of feedback affects the quality HMIS. Absence of feedback defeats the purpose of information collection systems based on the principle that input is processed into output and fed back to the input [17]. The information collected from the lower level is never fed back to them after processing at the upper level. It is just supplied to the top levels of administrative hierarchy. This affect the willingness of the people in the lower level to correct the information.

Lack of interest and ownership on the data generated at a health facility by the health workers at the same facility. The principle users and suppliers of the information are the people at the primary health center itself. But usually facility in-charges do not show any interest in verifying the data and trying to reflect on the data and finally using the data to take corrective action on any of the anomalies. They are observed to passively sign whatever is prepared by the data clerk. Health workers collecting the data they do not feel that they own the system.

One major factor affecting HMIS quality is the absence of training and motivation. Studies conducted in Malawi reveal that lack of motivation such as supervisions, knowledge gaps, lack of training and refresher courses affect HMIS [31, 36]. Different levels of staff involved in the HMIS process have series shortfalls as far as training and development efforts are concerned. Most of the times, they are hired and deployed to work at different work places without any formal training.

A study in Uganda concluded several factors that challenge the implementation of HMIS. These include access to computers and internet, inadequate technical support and limited worker force,

behavior of health workers not registering or tallying patients, recording illegible data, negligence, manipulating for competition, poor competency and lack of experience sharing, lack of commitment.[25]. And finally workload, poor supervision, no or poor feedback, poor data quality assessment, turnover and lack of tools [25].

A study in Mozambique by Chilundo highlighted that HMIS is weakened by lack of ownership within facilities, lack of training, duplicate, parallel reporting channels and insufficient capacity to analyze and use data for decision making [37]. Lack of interest in data concurs with observations from a study in Zambia by Mutemwa (2009), who observed that decision-makers gather information and ignore it, they make decisions first and look for the relevant information later [20]. This indicates that they do not trust their own data so that they can use it for decision making.

Similar findings are also reported in studies which were conducted in Malawi. Haugen and Roll-Hansen (2017) reported that missing data caused by negligence of facility staff by not registering data [11]. A study by O'Hagan (2017) identified the following weakness in the Malawi HMIS, lack of availability, completeness, and accuracy of data for family planning, HTC, and ARI services, no data quality checks at the facility level, poor comprehensiveness and reliability of HMIS supervision and lack of staff training for HMIS at the facility level [5]. A study by Kasambara (2017) reported HMIS problems ranging from use of different tools for data collection, missing data, untimely reporting, human resource constraints, and poor infrastructure at the district level. Unreliability of HMIS for effective program planning and decision making due to poor quality in terms of accuracy, completeness, consistency and timeliness [36].

2.8 The Effectiveness of HMIS Data Training

HMIS training provided to frontline health care worker is deemed as one way of improving health information systems. Studies have been carried out to evaluate the impact of such trainings. A study was conducted in Nigeria to assess the effect of training health care workers on HMIS in primary health care. The study was quasi-experimental with baseline, intervention and end point components. It had two groups, study group which received the training and a control with no training. There was gathered evidence that training intervention was effective in improving the data management practice, by showing increased accuracy rate, completeness of reporting, timeliness rate of reporting and feedback after the intervention by 20.8%, 36.4%, 27.2% and 54.5% respectively. The study is similar with this study because it is also assessed the effectiveness of HMIS training through evaluation of data quality after the intervention. However, this study did not apply quasi methodology since there was no collection of baseline data prior the training.

A study conducted in KwaZula-Natal, South Africa proved that data improvement interventions such as training health workers on HMIS improve data quality. The aim of the study was to evaluate the effect of an intervention to improve the quality of data used to monitor the Prevention of Mother-to-Child Transmission (PMTCT) of the Human Immunodeficiency Virus (HIV). The intervention used was data training and feedback, monthly data reviews and data audits at health-care facilities. Data completeness and proportion of data considered accurate increased after the intervention from 25% to 64% and 37% to 65% respectively. Similarly, the correlation between data in the information system and those from facility registers rose from

0.54 to 0.92. Almost similar approach was applied to this study by establishing correlation coefficient between source information on registers and data on report forms.

Another study was done in Brazil where the quality of care provided by health workers who were trained in management of childhood illnesses (IMCI) were compared with those who had not received IMCI training. The study stratified health facilities into three strata: high IMCI training coverage those with 50% or higher of health workers trained in IMCI, low IMCI coverage with at least one health worker trained in IMCI and no IMCI covered with no health workers trained in IMCI. The average annual reduction in infant mortality rate were 6.0 in high IMCI training, 3.7 in low IMCI training and 4.2 in no IMCI training. Overall it was found that IMCI training does not reduce significantly the mortality rate in infant. The results clearly indicate that there could be other underlining factors contributing to the infant mortality which cannot be mitigated by IMCI training, such as delays in care seeking by infant guardians. However, stratifying health facilities according to health worker training coverage is a good approach if the measuring factor can be that directly influenced by the health workers. As such in this study similar approach was applied where facilities were assessed according to presence of frontline health workers trained in HMIS. We anticipate the higher the number of trained personnel at a facility the better the data quality.

2.9 Malawi HMIS Training

A comprehensive and well managed HMIS is a paramount to the production of quality data. To achieve this, systems must design strategies and be observant to maintain data quality. One

recommendation is to ensure all system handlers acquired excellent skills to run the system. Therefore, training health workers in HMIS is the first step.

The provision of training to health workers strengthens HMIS so as improving health system. An assessment done by Ledikwe (2014) suggests several simple and practical capacity development approaches to strengthen HMIS. Among the suggestions was decentralization of training and mentoring initiatives from the national to the district level for health workers delivering services at health facilities. Since the training and mentoring has been shown to be an effective approach for strengthening monitoring and evaluation (M&E) capacity and ensuring data quality within a national health system [18]. A study by Teklegiorgis (2016) concluded that factors which affect data quality were lack of training, lack of decision based on supervision, and lack of feedback. To improve the data quality at the health facility level managers should supervise and give feedback on time. In addition continuous training should to be provided to health care providers [29].

Apart from studies which have recommended the Malawi MOH to provide capacity building in HIS through HMIS training in order to strengthen the health system, Malawi National Health Information System Policy has clearly stated that an appropriate training program with respective training manuals shall be developed and incorporated into the respective curricula to impart necessary knowledge and skills to carry out the information management functions. Therefore, health workers shall be trained in HMIS. Skilled personnel trained in HIS shall be fully dedicated to HIS functions at the national and referral hospitals, and district levels. A fully trained focal point shall be designated for each basic health care facility [1].

In this regard the Ministry of Health in Malawi through Central Monitoring and Evaluation Division adopted HMIS training curriculum developed by Kuunika Project. The project was funded by Bill and Melinda Gates foundation. Kuunika Project consolidated CMED HMIS training curriculum with other HMIS training curriculums implemented by several other partners that are executing initiatives in the health sector. The curriculum has been developed in order to fulfill the National Information System objective as follows: to generate quality data (accurate, complete, timely, relevant, and reliable) and make them accessible to intended end users through standardized and harmonized tools across all programs that avoid duplication and reduce workload on already stretched human resources at the facility level [1]. The curriculum is structured in eight modules that can be delivered using methods like workshop, e-learning and mentorship sessions. The content of the modules includes topics on HIS concepts, management of health data, data quality, data analysis, interpretation and use [38].

Chapter 3: Methodology

3.1 Type of Study

This was a cross sectional study. A cross section study according to Gordis (2014) determines the exposure and outcome simultaneously [39]. It views a snapshot of the population at a certain point in time. This was a cross-sectional study because it involved participants at a specific point in time to investigate and measure the study objectives. This type of study was chosen because it required few resources and little time to complete.

The study employed a mixed approach using both qualitative and quantitative research methods to fulfill its objectives. Qualitative research approach is aimed at understanding a phenomenon from the view point of the study participants in relation to specific social and institutional context [40]. Therefore, qualitative research method was applied to understand the perception of health facility staff towards HMIS training and to determine factors that are perceived impeding the effectiveness of training on HMIS.

Using quantitative research method, the study evaluated the effectiveness of HMIS training by assessing the quality of HMIS data collected from three programs namely maternal health, immunization and malaria which were measured by using data quality metrics.

3.2 Study Place

The study was conducted in Lilongwe district since it is one of the districts where HMIS trainings were conducted using the revised HMIS curriculum developed by CMED under

Kuunika Project. Lilongwe is located in the central region of Malawi bordering Dedza, Dowa, Mchinji and Salima districts. According to Malawi Population Housing Census 2018 the district has a population of 2,626,921 people [41]. The district has a total of 41 health facilities, 1 central hospital, 0 district hospital, 4 hospitals, 4 rural hospital and 30 health centers [42].

Specifically, the study was conducted in health facilities supported by the Malawi government and Christian Health Association of Malawi (CHAM) across Lilongwe district. Representatives from almost in all government and CHAM facilities surrounding Lilongwe district have been trained in HMIS. Private hospitals were excluded in the study because many of private clinics especially those in Lilongwe urban were not consistently report their data into DHIS2. As such CMED HMIS trainings were emphasized on staff from government and CHAM facilities.

Figure 1: Map of Malawi Showing Lilongwe District

3.3 Study Population and Sampling

The unit of analysis was health facilities, staff and key informants. The study population was health facility staff trained in HMIS using CMED HMIS curriculum developed under the Kuunika Project. Health facility staff and key informants responded to in-depth interviews and answered the semi-structured questionnaire. These included 1 CMED and Kuunika key staff who were responsible for delivering HMIS trainings and 1 Lilongwe HMIS coordinator who was the overall in-charge of HMIS in the district.

Two sampling techniques were used to select health facilities to participate in the study. A convenient sampling method was applied to select facilities where A semi-structured questionnaire was administered to health facility staff trained in HMIS. The convenience of a health facility was considered by factors such as easy accessibility, geographical proximity and distance from Lilongwe city center.

Purposive sampling method was used to select health facilities where data review and in-depth interviews was conducted. The study purposively selected health facilities that had at least one data clerk, nurse and in-charge trained in HMIS. The study involved only four health facilities due to resources and logistical challenges since this was a self-sponsored study.

3.4 Sample Size

The interviews for qualitative data were conducted to health facility staff and key informants from CMED, Kuunika and Lilongwe DHO's offices. The interviews targeted three departments at each facility administration, nursing and HMIS since these were key departments involved in

HMIS at health center level. Therefore, the study interviewed nurses, facility in-charges and data clerks or data statisticians. A total of 13 interviews were conducted in the study after reaching data saturation.

A semi-structured questionnaire was used to collect the quantitative data. A sample size of 80 participants from health facility staff were supposed to be enrolled in the study. The sample size was obtained using the single population proportion formula demonstrated below. This figure factored in the 10% of non-response rate. This rate was by assumption that 10% of the participants might not be available at the facility for the study.

$$n = \frac{\left(Z_{\alpha/2}\right)^2 \bar{p}(1-\bar{p})}{E^2}$$

Where p= Population estimate of 5%; Z=Value from normal distribution when significance level is 0.05(1.96) and E= marginal error of 5%

Considering the following assumptions: 5% prevalence of health facility staff trained in HMIS in Lilongwe district level, 95% level of confidence, 5% of margin of error, a design effect of 1. The study used 5% prevalence because less than 10% of health facility staff were trained in HMIS under new curriculum. The formula was adopted because it has all the necessary factors as described by Gardner [43] that sample size is a function of three factors, the significance level, power, and magnitude of the difference (effect size). The formula is also recommended for cross sectional studies [44]. However, the study managed to recruit 63 participants from the 80

due to COVID 19 measures whereby health facility staff were working in shifts. Therefore, the study could not find the expected number of staff at a facility.

3.5 Study Period

The study reviewed and investigated the quality of HMIS data from data collected for a period of six months from January 2020 to June 2020. The study took eight months to complete from the date of approval, that is, from pretesting of the questionnaire guides, data collection, analysis, report writing to the final submission.

3.6 Data Collection

The study was conducted to assess the effectiveness of HMIS training in Malawi particularly in Lilongwe district. The study employed three data collection methods, in-depth interviews, semi-structured questionnaires and data review checklist. Three data collection instruments were used to collect data for the specific objectives outlined in the study.

1. An interview guide *(Appendix 3 section A)* was used to conduct interviews on key informants and health facility staff (that include nurses and Data clerks) and decision makers (that include Facility In-charges, HMIS Coordinator, CMED and Kuunika staff). The interview guide collected views and attitudes of staff which helped to analyze the perception of health facility staff towards HMIS training. The interviews also gathered ideas from health facility staff and key informants that helped to determine factors that affect the effectiveness of training on HMIS. The interviews were conducted by two people, the note taker and the interviewer. At

every interview, notes were taken supported by an audio recording to ensure all proceedings were correctly captured.

2. Semi-structured questionnaire *(Appendix 3 section B)* was administered to a population of health facility staff (that includes nurses and Data clerks) who received HMIS training across the district. The questionnaire captured data on participant's demographics, responses if they were satisfied with the structure and mode of HMIS training delivery, perception towards HMIS training and their overall opinion and comments on the structure and mode of delivery. The questionnaire was a self-administered with a mix of closed and open ended questions. The closed ended questions were comprised of dichotomous questions of yes or no and likert scale questions seeking the degree of respondent agreement to a specific statement. The open ended included questions requiring respondents to briefly express their notions. The questionnaire helped assess whether the structure and mode of delivery of HMIS training respond to their training needs.

3. Data review checklist *(Appendix 3 section C)* was used to collect data for measuring the effectiveness of HMIS using four data quality domains: timeliness, correctness, completeness and consistency. The study adopted a set of Data Quality Review (DQR) tool kit developed by WHO, in conjunction with the Global Fund, Gavi, USAID/ MEASURE Evaluation [45]. DQR focuses on the assessment of the quality of the actual data that are generated by HMIS.

   Completeness, the DQR methodology measures completeness of data by examining whether all entities that are supposed to report are in fact reporting. It also measures

the completeness of data elements in submitted reports which is identifying the missing data. This study evaluated the extent to which facility registers and reports include all the required data.

Timeliness, the DQR measures timeliness by examining the number of reports submitted in time from one level to the next level compared to the expected number of reports at a particular time.

Consistency measures the coherence of data being evaluated. The DQR examine coherence between the same data items at different points in time, coherence between related data items and comparison of data in source documents and in national databases.

Correctness measures the verification ratio. This is the ratio between total recount data in the original source and total recorded on facility report. This could also compare directly to the report in DHIS2. In this study verification ratio was calculated by comparing register totals with totals recorded on reports in DHIS2 to understand errors as they were transmitted from the health facility to the district.

These dimensions were chosen based on what Monitoring, Evaluation and Health Information System Strategy (MEHIS) 2017-2022 referred as challenges in data quality in Malawi. MEHIS states that HMIS data quality is affected by completeness, consistency and correctness of data [46].

All data collection instruments were pretest for validity and reliability. Area 18 health center was selected where all data collection tools were tested. This facility was not part of the facilities participating in the study. Validity of the questions was checked by asking respondents to mark

questions which seemed irrelevant to the topic. Reliability was checked if different respondents were demonstration similar understanding to the questions. All necessary corrections were made before commencement data collection.

3.7 Data Management

Microsoft Excel spreadsheet was used to store and manage quantitative data. Data was reviewed to resolve all errors before entered into MS Excel. Data cleaning process was done to eradicate inconsistencies, type errors and missing values. If any form of error appeared during data cleaning, a hardcopy of the corresponding questionnaire was being retrieved and reviewed for appropriate corrections. The MS Excel spreadsheet was password protected. The MS Excel was installed on a computer which was also password protected. All quantitative data was exported to statistical package of STATA version 14 for data analysis.

Source documents for qualitative data collected in the study was in a form of interview notes and audio recordings. A verbatim transcription was done to all recordings in a language in which the interview was conducted, thereafter all the transcripts were translated into English. Transcripts was validated by comparing the audio to the transcript. Interview notes were transformed into a Microsoft Word documents. The notes were compared to the transcript for consistency and correctness. The audios, interview notes and transcripts were kept in a password protected computer.

3.8 Data Analysis

To assess HMIS data quality four data domains: timeliness, correctness completeness and consistency were analyzed. Data from three clinical programs maternal health, immunization and malaria was used to evaluate the quality of HMIS data. A quantitative data analysis was also used to assess whether the structure and mode of delivery of HMIS training respond to the training needs. Descriptive analysis was applied to calculate central tendencies, proportions, frequencies and tabulations. The results were presented in graph and table format.

Interview notes and transcripts were read repeatedly to generate sense of the meanings. Using thematic content analysis meanings from the data was interpreted and views and general consensus was generated. Perception of respondents towards HMIS training was analyzed by categorizing imaging themes into attitude towards HMIS training, skills acquired, practice and views on quality, benefits and effects of HMIS training. Narratives were written to present the findings, where necessary an aide of a quote was to present emerging views.

3.9 Ethical Considerations

In this study ethics was considered right throughout all the study procedures. Participation in the study was strictly voluntary through a written consent *(Appendix 2)*. Since the study involved the participation of human subjects, therefore approval was obtained from College of Medicine Research and Ethics Committee (COMREC). Permission was also obtained from the Lilongwe District Health Officer to conduct the study in the district health facilities. In addition, at every health facility prior to every study procedure permission was sought from the facility in-charge.

3.10 Constraints

The study did not manage to cover all the health facilities in Lilongwe district due to the financial and time constraints. The study also did not meet all the intended participants due to COVID 19, as a preventive measure health facility staff were working in shifts in almost all health facilities. Therefore, the study could not find the expected number of staff at a particular facility.

Chapter 4: Results

4.1 Socio Demographics Characteristics of the Respondents

A total of 63 respondents participated in the study. This comprised of 60 health facility staff and 3 key informants from Central Monitoring and Evaluation Division (CMED), Kuunika and the Lilongwe District Health Office. 50 participants responded to a semi structured questionnaire while 13 participants partook in the in-depth interviews.

The socio demographic characteristics are given in figures provided below. Figure 3 indicates that majority of the respondents were male 64% while 36% were female. The health facility staff ranged from nurses 10%, facility in-charges 5%, Statistical clerk 15%, Data clerks 41%, Registry clerks 19% and HSAs 10% as illustrated in Figure 5.

On average, the respondents had 5 years of experience working in the health sector, almost 39% of the respondents had an educational level up to tertiary level in various professional diplomas as shown in Figure 4. However, none indicated to hold a degree except one key informant from Kuunika. 88% of the respondents stated that they had received an HMIS training in the past 12 months. This is demonstrated in Figure 2 where 88% had received a formal HMIS training while 12% were oriented to HMIS through on job training.

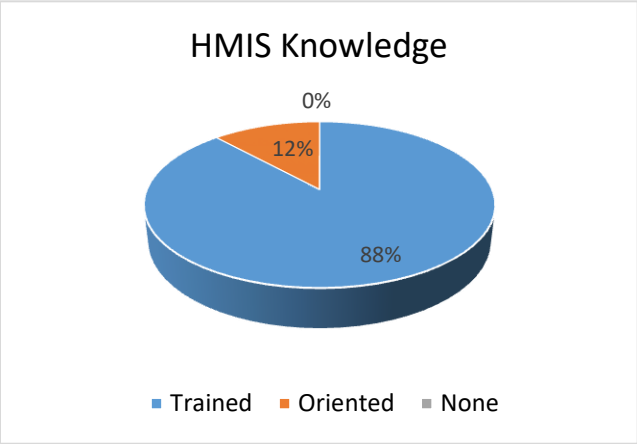

Figure 2 Graph showing HMIS knowledge of the respondents

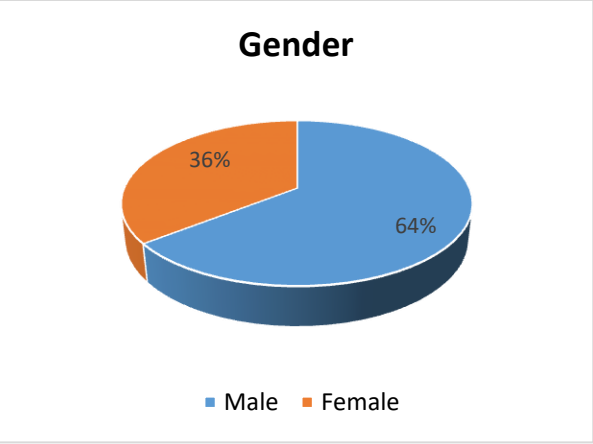

Figure 3 Graph showing gender of the respondents

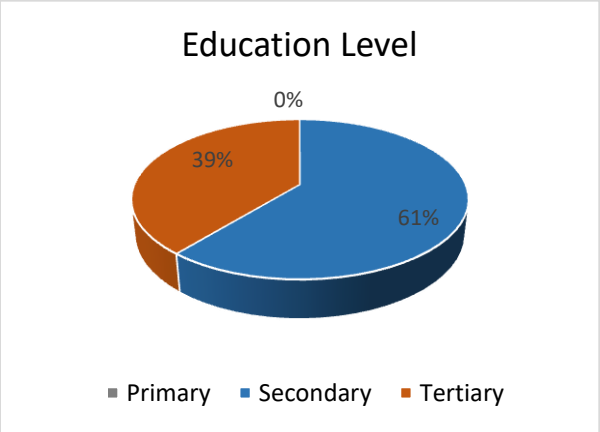

Figure 4 Graph showing education level of the respondents

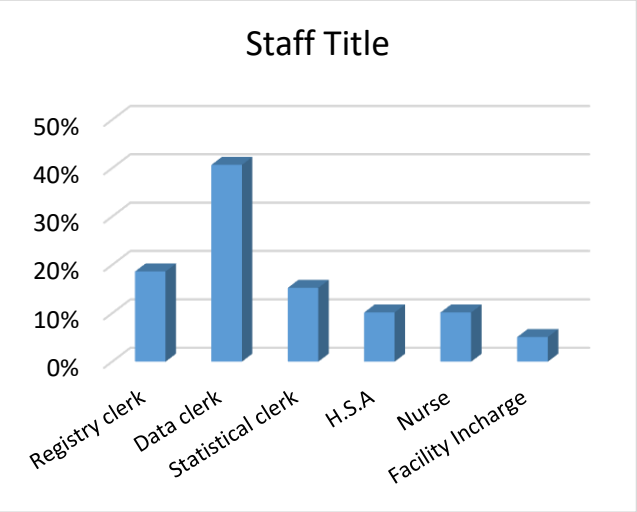

Figure 5 Graph showing cadres of the respondents

4.2 Perception of Health Workers towards HMIS Training

Perception of health workers towards HMIS training was assessed by analyzing the health workers' attitude towards HMIS training and what the participants perceived as skills acquired through HMIS training and the effects and benefits of HMIS training.

4.2.1 Staff Attitude towards HMIS Training

All 100% (n=50) of the participants responded to the semi-structures questionnaire and the 13 participant responded to in-depth interviews felt that HMIS training was very important because they were taught how HMIS as a system works and other sub systems like the DHIS2. The key informants who were the designers and trainers of HMIS training manual also felt that the training has essential contents good for data handlers at basic level. As a health worker and key informant responded:

> *"…. It was important, because we learnt a lot about data, we learnt a lot about the importance of data and how to use our data. Yah that training really helped us" Lumbadzi Health Center HW 1*

> *"Very important, because the trainings were based on the training curriculum that was developed for data managers at basic level. So we followed exactly the curriculum, so we feel it's really beneficial" Respondent at CMED KI 1*

4.2.2 Perceived Effects and Benefit of HMIS Training

Perceived HMIS training effects refer to what were the consequences of HMIS trainings in health facilities whose representatives were trained in one of the trainings. Findings were gathered from series of in-depth interviews which were conducted. The study found the following themes as effects and benefits perceived to have been ensued due to the HMIS training:

A) Coordination in data management. According to participants HMIS training has brought coordination in data management. They felt that the inclusion of staff from other departments to attend the HMIS training rather than HMIS staff only, had brought good coordination in data management. Staff from other departments such as nursing and environmental also attended the trainings, and they later provided support to people responsible for data. Support such as report writing, data collection and follow ups on data issues. As one respondent at Kawale health center during the interview said:

"Y*es, like we nurses were not doing anything concerning reports it was only clerks but after the training at least now the facility has me a nurse helping in data management, because I went to training together with one HSA and one data clerk. But still more we need more people to be trained because here at Kawale we have a lot of data and several reports" Kawale Health Center HW 1*

B) Data ownership tendency. HMIS training instituted data ownership tendency. Participants believed that the HMIS training they attended had fostered change in their perception towards data generated at their facility. Prior to the training they understood data as for high level offices and can only be used for decision making at that high level. After HMIS trainings they realized that data generated at a particular facility is a property of that facility and can as well be used at facility level.

"Previously we thought we write reports for the sake of reporting to the DHO, but now we were told in the training that we need to use that data, that data is ours." Lumbadzi Health Center HW 1

C) Good documentation. There was great improvement in documentation in health facilities as a result of HMIS training. People who had attended the training were taught good data management that included good documentation. After the training staff who attended the training briefed the rest of facility staff on good documentation and ways to improve the documentation. They had introduced several ways such as reviewing what a colleague has written. As one participant stressed that:

"… We are able to correct ourselves where things are wrong. As such every person when doing documentation eg in register is more careful because he or she knows that my friends will also look into this data and use it. This makes everybody able to read and understand every data a person has written without asking the one who wrote it." Area 25 Health Center HW 1

D) Team work. It was concluded that the HIMS training had introduced team work especially during report compilation. Previously in most of the health facilities report writing was deemed as the work for data clerks only. The HMIS training has changed the perception, facility staff from other department now have started getting involved in report writing.

"The hospital benefited for example before we as data people we used to do everything on our own writing reports and sending them without the knowledge of the people on the ground but now we do things together as such people from different departments are able to pick what is missing in the data and areas which did not do well…" Mitundu Hospital HW 1

E) Improvement in reporting rate. Participants agreed that timeliness in reporting has improved tremendously. This was due to the fact that staff from other departments have now started providing support to data clerks. Again the increased number of DHIS2 users has seen most health facilities starting reporting directly into the DHIS2 system. Unlike previously where-by hard copies of reports were being sent to the DHO for entry into DHIS2.

"At district level, the training helped reporting to be available on time, previously the district was complaining to facilities about the issue of timeliness. Facilities were taking long to submit reports. Like here because all the reports were depending on one if not two people to compile" Lumbadzi health center HW 2.

4.2.3 Perceived Skills Acquired Through HMIS Training

Perceived skills acquired in this study refers to skills health facility staff felt to have acquired after attending HMIS training. The study found the following skills to have been acquired through HMIS training:

(a) Data verification skills

96% (n=48) of the participants explained that they have attained expertise in verifying facility data. They have the capabilities of verifying what has been documented in the registers against the actual services provided.

> *"So now we are checking everything if it has been properly documented like the nurse may know that there was an asphyxiated baby so you need to check if in the asphyxia register this has been documented as well as in the maternity register" Kawale health center HW 1*

(b) Data analysis skills

90% (n=45) of the participants confidently stated that through HMIS training they were able to analyse data collected in their respective health facilities. The analysed data is sufficient to provide information which leads to good decision making. Such as ordering the correct number of commodities and facility supplies. The data analysis gives overview of how the facility is performing.

> *"Yah, we are able to do data analysis, that is why we are able to order commodities depending the analysis of our data. We are able to know where we are doing well or not, we are able to know which services require more commodities, all through the analysis of our data" Dzenza health center HW 1*

(c) Skills in using EMR and DHIS2

90% (n=45) of the participants agreed that through HMIS training they could now use EMR and DHIS2. The participant stated that by the time EMR was introduced in their facilities they did not receive proper training. Therefore, they were facing a lot of challenges in using the EMR. Again DHIS2 had few people who could use the system confidently. The training had increased the number of competent DHIS2 system users.

> *"During that training we were introduced to a lot of stuff. For example, by time we were starting work HMIS system had no EMR, now in that training we were taught how to use the EMR, how we can retrieve the reports and how we can submit reports from this facility to higher levels." Kawale Health Center HW 2*

4.3 Factors Affecting the Effectiveness of Training on HMIS

Several HMIS trainings have been conducted to health facility staff in Lilongwe district. In some facilities these trainings yielded good results while in others there are still challenges here and there. 13 in-depth interviews were conducted where the study assessed factors that affected the effectiveness of these trainings on HMIS. Some were positive while some were negative.

4.3.1 Positive Factors

Positive factors denoted factors that had made the trainings to be successful on HMIS. The study found that inclusion of staff from other departments, workshop mode of delivery and experienced facilitators were among the factors that had made HMIS training effective on HMIS.

4.3.1.1 Inclusion of Staff from Others Departments

Participants stated that despite that key personnel to be trained in data management were staff working in HMIS department, the training had included staff from other departments. This had made staff from all departments realize and understand the importance of data and take responsibilities in data managements.

> *"... They took staff from different departments not just from data departments like clinical, maternity and environmental. So these people they took responsibility of orienting their colleagues in their departments, and when there is data issue with a particular department we communicate through them" Kang'oma Health Center HW 1*

4.3.1.2 Workshop Mode of Delivery

Majority of the participant explained that the bringing of training attendees to one place was really effective. Staff who had come from different health facilities were able to learn from each other. They shared experiences and expertise from different people of different facilities and set ups.

> *"It brought together people from different facilities, where we shared experiences. It is not everything that we do at our facility is correct, we also learnt from friends the way they do things," Malingunde Health Center HW 1*

4.3.1.3 Experienced Facilitators

Participants believed that the trainings were successful because the facilitators who were involved in facilitation had sound experience on HMIS. They had been working in the field of HMIS for several years and they had hands on experience.

> *"It was effective because the facilitator were those people who are on the ground, the ones who move around the facilities and know how things work. Another thing was the bringing of us together, we were able to share experiences" Kawale Health Center HW 2*

4.3.2 Negative Factors

Negative factors refer to the factors that were deemed as issues that had made the HMIS training to be ineffectiveness on HMIS. The study found selection of participants, duration of the training, refresher trainings, lack of monitoring and supervision and staff turnover.

4.3.2.1 Selection of Participants

Participants said that selection of participants to attend trainings in most health facilities is a jurisdiction of one person, as a result there is biasness in the selection. Same people are always selected to attend trainings. This demotivate the rest of staff who do not pay attention to the briefing organized by those attended the training. Finally, the quality of work to be implemented is compromised. Participants believed that HMIS trainings had experienced similar scenarios, in some facilities same people were selected to attend these trainings.

"… The people that are taken for the trainings are the same let's say at nursing department you will see that it is always the same person so when it comes to completing the registers you will find that the one who attended the training is not there so the one who is there will just complete anyhow so when it comes to reporting you will see that there is under reporting or over reporting, the numbers do not add up." Mitundu Hospital HW 1

While other participants felt that number of people selected to attend the trainings was not adequate. Therefore, their impact could not be easily seen despite orienting what they learnt from the training to the rest of staff.

"… For a facility which has large staff like ours we are 81 but only four we trained. And one staff who was trained is out, that means very few people are conversant with data management, so I feel like if there were enough funds some more people could have been trained." Dzenza Health Center HW 1

4.3.2.2 Duration of the Training

Participants participated in the study including those who were involved in designing the training manual agreed that the duration of the training was not enough. The training manual was too big to be implemented for a period of one week. This had made facilitators not to go into details on key topics.

"… They had a lot of questions and the one teaching were also rushing to complete the course in the given time as such those that were slow learners did not get much

that is why in other facilities they have failed to implement the system." Area 25 Health Center HW 1

4.3.2.3 Refresher Trainings

There are no clear schedules for HMIS trainings. As such HMIS trainings had been taking a long period of time to be conducted. People who had been trained need to be often reminded on data management techniques. New developments in HMIS need to be communicated. Some participants felt that there was need for refresher trainings to cover the gap.

"Another factor is refresher trainings, at least if they could be doing refresher once a year. You know we were trained longer period back and there are some changes eg some registers are changed, each time there is change they are supposed to orient us." Lumbadzi health center HW 3

4.3.2.4 Lack of Monitoring and Supervision

Some participants believed that after the HMIS trainings there was need for deliberate monitoring and supervision visits to all facilities. These supervisions could assess if the trainings had some impact and mentor further staff in areas that are not performing well.

"It also seems that those with higher positions (managers) are not monitoring their staff, as a result everybody does things the way they want" HMIS Coordinator KI 3

4.3.2.5 Staff Retention

Participants stressed that staff turnover had contributed to the failure of trainings to improve HMIS system. Health facility staff had been trained with the aim of improving the HMIS system in their respective facilities. However, to maintain them has been a challenge. Staff kept on moving in and out of the health sector, some resigns to look for better jobs while some change positions. The transferring of staff from one facility to another has also contributed to the challenge.

> *"It helps but the problem is the changing of staff, as I said before we went as a team for training but some have move out and new staff who did not attend the training have joined as such it becomes a challenge so there is need for these training to be happening yearly to accommodate these changes." Malingunde Health Center HW 1*

4.4 HMIS Training Needs

The study further assessed the structure of HMIS training manual and how it is being delivered. The study sought views and opinion from the participants if they are satisfied with the way the training manual had been structured and the mode of its delivery.

4.4.1 The Effective HMIS Training Structure

Figure 6 indicates the results from the study, 100% (n=50) of the participants who participated in the study agreed and satisfied to the fact that the content of the national HMIS training curriculum has been divided into different modules. It has been divided into modules such as

health data management, digital literacy, data quality, data analysis, interpretation and use. HIS security and systems support. 90% (n=45) of the participants agreed that each module has specific days. However, results from this study indicated that number of days allocated to cover all the modules were not enough. Only 4% (n=2) of the participants agreed to the fact that not all modules should be attended by participants, rather participants should attend the module according to their level of competency. Some participants should not attend other modules if they illustrate competency in that module. 84% (n=42) of the participants agreed that all modules should be delivered concurrently, there should be no breaking but rather all should be delivered in one specific period. 68% (n=34) of participants agreed to fact that HMIS training include all cadres from all departments. Overall the participants who participated in the study were satisfied to the way national HMIS training curriculum has been structured.

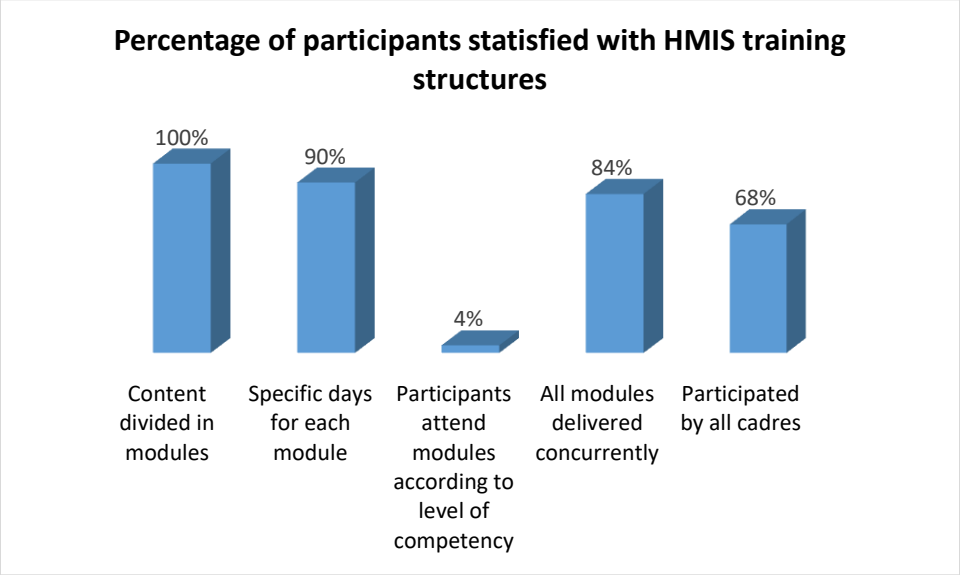

Figure 6: Percentage of participants satisfied with how HMIS training is structured

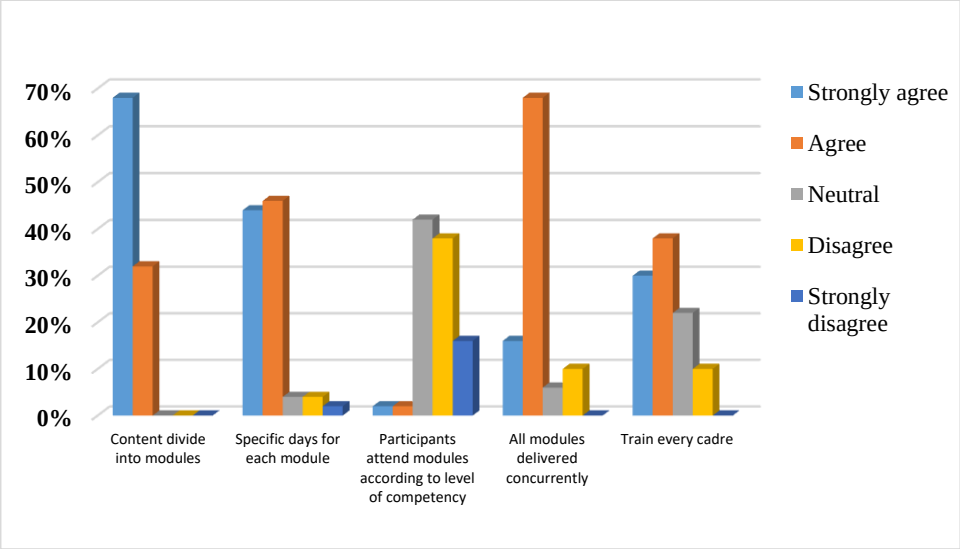

Figure 7: Graph showing HMIS training structure

4.4.2 The Effective Mode of Delivering HMIS Training

Staff who participated in the study were asked what type of mode of delivering HMIS training they felt could be effective. Level of agreement on different training delivering style such as workshop, lecturing, mentoring, practical and e-learning were assessed. The study found that 100% (n=50) of the participants agreed that bringing participant to one place in a form of workshop was the best way to delivery HMIS training. They believed workshops provided a platform where participants can share experience and learn from each other. 86% (n=43) further agreed that facilitation through lecturing is effective way of delivering HMIS training. 60% (n=30) of the participants agreed to mentoring where facilitators could go to facilities and provide one on one teaching or to a small group of people. Again 100% (n=50) of the participants agreed that practical sessions are essential and effective in HMIS training. Only 28% (n=14) of the participants agreed that e-learning could be effective in delivering HMIS training. However, the national HMIS training curriculum had been implemented through workshop,

lecturing and practical. Figure 8 demonstrates how level of agreement to the mode of delivering HMIS training was distributed.

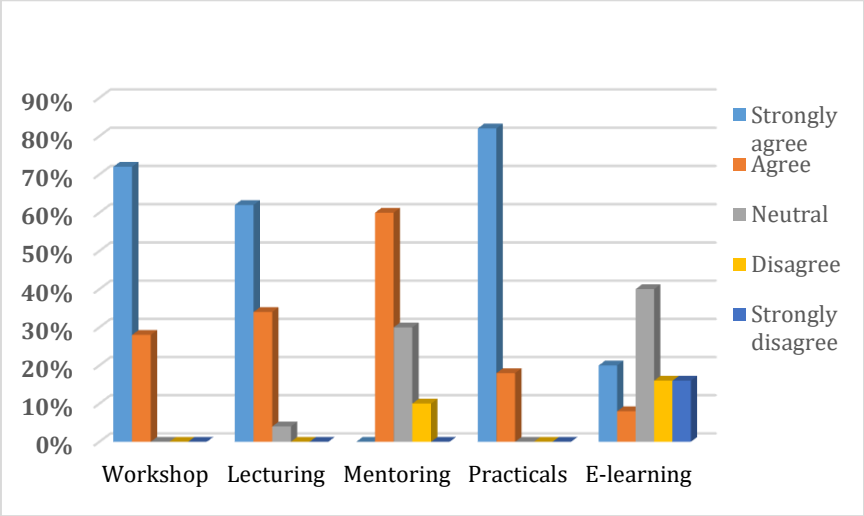

Figure 8 Graph showing effective HMIS training mode

4.5 The Effectiveness of HMIS Trainings

Almost all health facilities across Lilongwe district had their representatives trained on HMIS. At least every facility had sent representatives. The representatives were comprised of staff from facility management, HMIS office and other departments. The study expected to see change or improvement on the performance of HMIS in these health facilities as a result of the HMIS trainings. The study conducted data quality assessment in some of these facilities to evaluate the effectiveness of HMIS trainings on the performance of HMIS.

The data quality assessment was done in four health facilities. These were Mitundu community hospital, Kang'oma health center, Area 25 urban health center and Kawale health center. The assessment was done by looking at four data quality dimensions, completeness, correctness, timeliness and consistency. Data from three clinical programs maternal health, immunization and

malaria was used to evaluate the quality of HMIS data. One indicator for each program was selected to assess the data quality. The indicators were: pregnant women who attended antenatal clinic first visit (ANC1), newborn received BCG3 vaccine and confirmed cases of malaria. The assessment was done in registers and reports for a period of six months January 2020 to June 2020.

4.5.1 Completeness

The study had assessed completeness of data in these four health facilities by examining the number of data elements on monthly reports and registers that were zeros or left blank, excluding absolute zero values and those had non monthly reportable data elements. Completeness of data was then assessed by subtracting percentage of zero/missing data on reports and registers from 100%. The study found that completeness of data was higher on reports compared to completeness in registers in all health facilities participated in the study. An average of 95% completeness of filling data on reports was observed while completeness in registers was at 90%.

Table 1: Percentage of zero/missing data in registers and reports for four health facilities

Zero/missing data	**Kawale**	**Area 25**	**Mitundu**	**Kang'oma**	**Average in four facilities**
In ANC registers	6%	12%	13%	14%	11%
In EPI registers	5%	no data	3%	12%	6%
In MRDT registers	35%	8%	4%	4%	13%
Average at a facility	16%	5%	4%	6%	8%
Zero/missing data	**Kawale**	**Area 25**	**Mitundu**	**Kang'oma**	**Average in four facilities**
On ANC reports	82%	1%	0%	0%	21%
On EPI reports	30%	2%	1%	1%	8%
On MRDT reports	1%	4%	5%	4%	4%
Average at a facility	16%	5%	4%	6%	8%

Table 2 Percentage of completeness of filling data in registers and reports for four health facilities

Completeness of filling data	Kawale	Area 25	Mitundu	Kang'oma	Average in four facilities
In ANC registers	94%	88%	87%	86%	89%
In EPI registers	95%	no data	97%	88%	94%
In MRDT registers	65%	92%	96%	96%	88%
Average completeness in registers	85%	90%	94%	90%	90%
On ANC reports	83%	99%	100%	100%	96%
On EPI reports	70%	98%	99%	99%	92%
On MRDT reports	99%	96%	95%	96%	96%
Average completeness on reports	84%	98%	98%	98%	95%
Overall average at a facility	84%	94%	96%	94%	92%

Table 1 were the percentages of zero/missing data observed in registers and reports. A sample of 10% pages in registers for a particular month was used while on reports the study used all monthly reports for the period. Table 2 were the results of subtracting percentage of zero/missing data from 100% to find percentage of completeness.

Assessment for individual health facility found that completeness of data in both registers and reports were 84%, 94%, 96%, 94% at Kawale, Area 25, Mitundu and Kang'oma respectively. There were no immunization registers available which is used to capture data for EPI at Area 25 urban health center. Hence the study could not collect data for EPI. The senior health surveillance assistant who was responsible for immunization program reported that the facility did not receive any immunization register since December 2019. Overall average of completeness of data in the four health facilities was assessed at 92%.

4.5.2 Correctness

The study assessed the correctness of data by weighing the similarities of what was recorded on reports against what was documented in registers. This was done by verification process whereby

data recorded on reports was recounted in the registers. Thereafter a verification ratio was calculated by dividing recounted data by reported data. The correctness was also measured by evaluating the presence of outliers.

(a) Verification ratio

In this study verification ratio referred to the product of recounted data over reported data. The verification process was aimed to assess correctness of what was recorded on reports tally with what was documented in the registers. The study recounted data in ANC, EPI and malaria registers for the following indicators: pregnant women attending first antenatal clinic (ANC1), newborn receiving BCG3 vaccine and cases of malaria respectively. The verification ratio was calculated between total recounted data against data recorded on program reports that is register over report data. ANC, EPI and malaria reports were used. The process was done on data compiled for a period of six months.

Table 3: Verification ratio comparing data in registers and data on reports

Indicator	Kawale	Area 25	Mitundu	Kang'oma	Average in four facilities
ANC1	0.99	0.98	0.98	1.00	0.99
BCG3	1.08	no data	1.07	1.08	1.08
Confirmed cases of malaria	0.94	0.96	1.01	0.87	0.95
Overall at a facility	1.01	0.97	1.02	0.99	0.98

Table 3 illustrates ratios between data in registers and data on reports. The study found that from the three programs that were assessed, maternal health particularly in ANC data showed the highest levels of correctness between registers and reports. In all the health facilities ANC1 had verification ratio of very close to 1.00, indicating that the register and report totals were identical. Immunization BCG3 showed verification ratio of 1.08, meaning 8% of data was under reported.

Malaria (malaria cases) indicated a verification ratio of 0.95, meaning 5% of the data was over reported. On average the correctness of data across all the four facilities was rated at 98%. Remarkable under reporting was observed in immunization EPI reports.

(b) Presence of outliers

The study further assessed the correctness by calculating the outliers in the data reported for six months. Despite that values would likely to vary from months to months, large fluctuations are questionable obviously regarded as indication for poor data quality. The outliers were defined by values falling outside 2 standard deviations (2SD) from the mean. The 2SD was adopted from a recommendation of World Health Organization (WHO) in its data quality assessment tool kit [45]. The study found no outliers reported in the period under assessment as Table 4 is showing.

Table 4 Number of outliers outside 2SD from the mean

Indicator	Kawale		Area 25		Mitundu		Kang'oma		Total outliers
	+- 2SD	Outliers	+- 2SD	Outliers	+- 2SD	Outliers	+- 2SD	Outliers	
ANC 1	476 – 288	0	757 - 440	0	506 - 315	0	135 - 82	0	0
BCG 3	256 - 120	0	670 - 280	0	500 - 292	0	132 - 30	0	0
Confirmed cases of malaria	1142 - 279	0	3242 - 1287	0	5669 - 1414	0	3414 - 1049	0	0

4.5.3 Timeliness

Timeliness in this study was referred to reports that were compiled and submitted to the District Health Office (DHO) within a recommended schedule of reporting. Three reports ANC, EPI and malaria were assessed from maternal health, immunization and malaria programs respectively. ANC and malaria reports were recommended for submission by 5^{th} of the subsequent month while EPI report was recommended by 7^{th} of the subsequent month. Timeliness was measured by percentage of monthly reports completed and submitted on time. At each facility 18 reports for a

period of six months were assessed. The assessment was on date of completion and submission to the DHO. Timeliness was measured by the reporting rate, number of reports submitted on time against the expected number of reports.

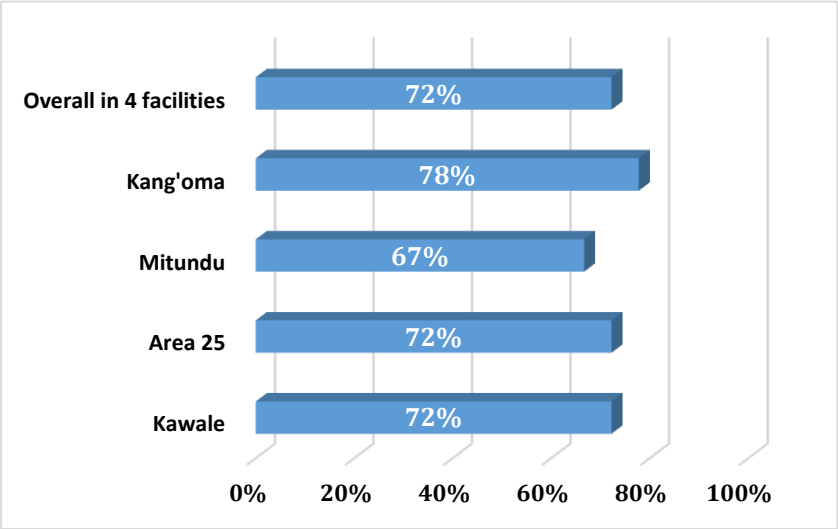

Figure 9: The reporting rate for four health facilities

Figure 9 is showing a graph indicating the percentage of reports submitted to the DHO on time. The finding indicates that timeliness in reporting data was high at Kang'oma health center 78%, while Mitundu, Area 25 and Kawale were at 67%, 72% and 72% respectively. Overall timeliness in the four facilities indicates 72%, this is lower that the recommended 90% for Malawi.

4.5.4 Consistency

The study looked at the consistency of data in the four health facilities participated in the study. The consistency of data was analyzed by the ratio between two coherent indicators and the degree of correlation between them. The ratio between HIV tested at first ANC visit to pregnant women attending first antenatal clinic (ANC1), live births to newborn receiving BCG3 vaccine

and number treated for malaria to cases of malaria. The indicators were assumed to be related in some aspect.

(a) Ratio between two indicators

The study analyzed the ratio between two related indicators. ANC1, BCG3 and confirmed cases of malaria were considered related to number of HIV status known at first ANC visit, Total live births and number treated for malaria respectively. These indicators were related in the sense that number of one indicator depends on the other indicator example pregnant women to know their HIV status will depend on number of ANC1. The level of consistency of data was measured by subtracting the ratio from 1.

Table 5 Consistency of data across four health facilities

	Kawale	Area 25	Mitundu	Kang'oma	Average in four facilities
ANC 1	100%	100%	100%	100%	100%
BCG 3	65%	no data	82%	35%	61%
Confirmed cases of malaria	90%	88%	85%	86%	87%
Per facility	85%	94%	89%	74%	83%

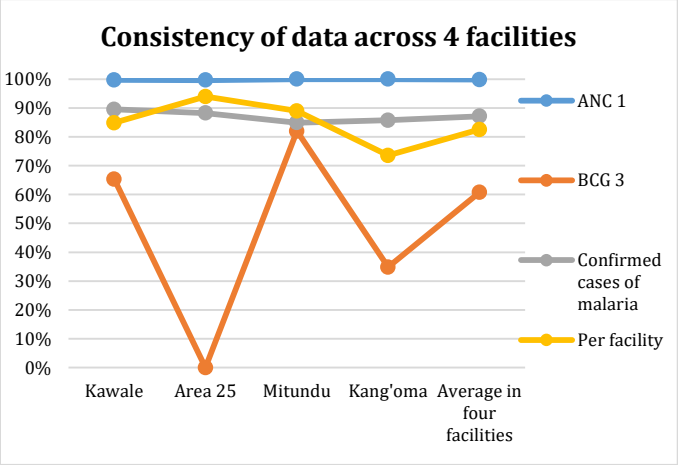

Figure 10: Consistency of data

Table 5 and Figure 10 illustrate that Maternal health data (ANC1) had high level of consistency at approximately 100%, EPI data (BCG3) was observed at 61% and malaria data (malaria cases) at 87%. Across the four facilities the consistency level was measured at 83%. The result showed that the quality of data had some challenge since it did not meet the WHO recommendation of +-10%.

(b) Correlation between coherent indicators

Consistency as one of data quality dimension in this study was also measured by correlation between coherent indicators. It was assumed that changes in indicators: ANC1, BCG3 and malaria cases could affect indicators; number of HIV status known at first ANC visit, total live births and number treated for malaria respectively. Therefore, it was expected that good quality data would show high degree of correlation. Both should be high and stable across all the facilities. A large discrepancy between these indicators was assumed indicative of errors in reporting and problems with data quality.

Table 6 illustrates the correlation between two related indicators for each facility participated in the study. The correlation coefficient for ANC1 and HIV status known was 1.000 (p-value0.0000) at Kang'oma, Kawale and Mitundu, 0.9990 (p-value = 0.0000) at Area 25. All three coefficients indicate strong correlation indicative of data consistency. BCG3 and live births was 0.2826 (p-value = 0.5874), 0.4063 (p-value = 0.4241), 0.5193 (p-value = 0.291) and -0.5541 (p-value = 0.2539) at Kang'ma. Kawale, Area 25 and Mitundu respectively. All the three coefficients show weak correlation a signal of inconsistency in data. Finally, malaria cases and treated for malaria was 0.7948 (p-value = 0.0588), 0.9886* (p-value0.0002), 0.7881 (p-value =

0.0626) and 0.9619* (p-values = 0.0022) at Kang'oma, Kawale, Area 25 and Mitundu respectively. Here the coefficients of Kawale and Mitundu show strong correction while Kang'oma and Area 25 the correlation was moderate. Overall maternal health data ANC in particular indicate consistency while immunization and malaria there were no enough evidence.

Table 6: Correlation between indicators for four health facilities

	Kang'oma Health Center	Kawale Health Center	Area 25 Urban Health Center	Mitundu Community Hospital
	P values	P values	P values	P values
Live births against BCG	0.2826	0.4063	0.5193	-0.5541
Treated malaria against malaria cases	0.7948	0.9886*	0.7881	0.9619*
HIV status known against ANC1	1.0000*	1.0000*	0.9990*	1.0000*

CHAPTER 5: DISCUSSION

5.1 Introduction

The purpose of this research was to investigate the effectiveness of HMIS training in improving data quality in the Malawian health system particularly in Lilongwe district. The objectives of the study as outlined in chapter three were: to analyse the perception of staff towards HMIS training, to assess whether the structure and mode of delivery of HMIS training respond to the training needs, to evaluate the effectiveness of the trainings on performance of HMIS using data quality metrics and to determine the factors that affect effectiveness of training on HMIS in Malawi. The discussion in this study is presented in this order: staff perception towards HMIS training, HMIS training needs, effectiveness of HMIS training and factors affecting the effectiveness of training on HMIS.

5.2 Staff Perception towards HMIS Training

The findings from the study clearly indicates that health facility staff have positive perceptions towards HMIS training. HMIS training is being regarded as very important just like any other trainings which are provided to health workers. This is in tandem with another study conducted in Napal by Khanal et al. in 2020 that mentioned that majority of health workers in developing countries highly appreciate training opportunities [47].

Particularly in this study the staff attitude towards HMIS training was found to be very good. Participants felt that HMIS training is very important because they were formally taught what HMIS as a system is all about and how other subsystems like EMR and DHIS2 works. These

findings are similar to that of Nyamtema in her 2010 study where she found that the attitude of health workers towards HMIS both clinicians and nurses was good, and agreed that HMIS was worthy for the time and the resources spent on it [13].

The study further highlighted effects and benefits health facilities experienced as a result of HMIS trainings. Team work among staff was perceived to be the major benefit or effect. These trainings included staff from other departments rather than staff from HMIS department only. This contributed to a change in perception of staff on HMIS activities being for data personnel only. Health facility staff embraced HMIS activities into their own activities. This resulted in good coordination in data management as staff are now supporting in data collection and report writing. Staff developed a tendency of using and owning their data. Good documentation as staff are able to review each other's work and improvement in report rate since staff from other departments support data clerks in report writing. This is similar to a study by Yourkavitch et al. who suggested that staff at all levels should be provided with more trainings in data management [12].

A study in South Africa indicated that health care workers and managers were not putting the collected data to the best use, they had a culture of reporting rather than a culture of using the information [10]. Similar findings were reported in Nyamtema study where 63% of care providers indicated that the primary purpose of data collection was to report to higher level [13]. However, the study done by Paschal in Uganda highlighted lack of sensitization on HMIS and lack of formal training in completing reports and data analysis as the reasons why HMIS data was not used for decision making at the point of collection [14]. Therefore, this concur with the findings of this study that after HMIS trainings health facility staff have developed data

ownership tendency and are able to use data at facility level. As it was reported by one respondent:

> *"Previously we thought we write reports for the sake of reporting to the DHO, but now we were told in the training that we need to use that data, that data is ours." Lumbadzi Health Center HW 1*

The respondents also perceived to have acquired some certain skills through participation in the HMIS trainings. A study by Hamre and Kaasboll on motivation and demotivation a case study on Malawian HMIS found that there was a general need for training in the Malawian health sector due to unskilled health workers with no formal qualification, especially HMIS knowledge and skills [31]. This study found that majority 61% (n=36) of health workers participated in the study had no formal qualification, they only reached up to secondary level. Therefore, providing some skills in HMIS was necessary. The study found that through HMIS trainings participants have acquired data verification skills, data analysis skills and skill in using EMR and DHIS2. As one respondent reported:

> "Y*ah we are able to do data analysis, that is why we are able to order commodities depending the analysis of our data. We are able to know where we are doing well or not, we are able to know which services require more commodities, all through the analysis of our data" Kang'oma Health Center HW 2*

5.3 Factors Affecting the Effectiveness of Training on HMIS

The study found several factors that affect the effectiveness of trainings on HMIS. Some of these factors affect the trainings positively while some negatively. Participants who participated in the study labelled inclusion of staff from other departments, workshop mode of delivery and experienced facilitators as factors that have made trainings to be successful on HMIS.

Every health facility staff is supposed to be oriented or trained in HMIS. A study in Uganda indicated that training and support supervision on HMIS to staff is required to strengthen quality of HMIS [48]. A study by O'Hagan et al recommended that the Malawi Ministry of Health should focus on training staff at all levels of the health system in HMIS not just those responsible for HMIS [5]. Meaning that providing HMIS knowledge to all cadres at a facility improve HMIS performance. This corresponds to the findings of this study where by responded stated that inclusion of other cadres during HMIS trainings affect positively HMIS trainings.

An article by Belay et al. stated that workshops are great for brainstorming and building relationships by providing participants with invaluable structured face to face contact. And they engage participants to interact among themselves and with the facilitator [49]. This is similar to what this study found that bringing participants to a workshop encourage knowledge sharing among participants. People bring different expertise and experiences which are shared among participants. Therefore, this is regarded as another factor affecting positively the effectiveness of trainings on HMIS.

The study also assessed issues that are considered factors to have made trainings not effective on HMIS. These factors affect negatively the effectiveness of HMIS trainings. Firstly, the participants bemoan the selection of participants to attend these trainings. Participants reported that there is biasness in choosing who to attend the trainings in some facilities. The very same people are selected to attend every training emerged especially those who are in good terms with the management. This eventually demotivates the rest of the staff and the implementation of what the training entails is affected. This is in contrast with a study by Khanal et al. which regards career development opportunities such as trainings are motivating factor and job satisfaction for health workers [47].

Secondly, the study found the duration of training affecting the effectiveness of trainings on HMIS. According to CMED one HMIS training covering the whole curriculum is scheduled to be delivered in a period of one week. However, the content of the curriculum is so many to be delivered in the stipulated period. Almost 94% of respondents participated in this study were not satisfied with the duration given to the HMIS training. As one respondent mention:

> *"Time, we had a lot of materials to cover in just a week of which it was just like briefing not detailed. This is the reference manual; you can see it is very big but it was covered just in a week." Malingunde Health Center HW 1*

This affect the outcome of the training because facilitators do not have adequate time to explain topics in details and some participants are slow learners who need enough time for clarification.

Thirdly the refresher trainings, a study which was conducted in Malawi on effects of refresher training on the use of manual vacuum aspiration concluded that by conducting a refresher training to health workers who treat women with incomplete abortions improved the use of manual vacuum aspiration [50]. Another study in Nepal showed that there was a significant increase in knowledge and skills of volunteers on maternal and child health following the refresher trainings [51]. Therefore, in every training such as HMIS training, it is important to provide refresher trainings following the initial training for it to be more effective. This corresponds with the opinion of the respondents in of this study that refresher trainings affect the effectiveness of HMIS training. In HMIS refresher trainings act as a reminder to some skills and data management techniques which might have been forgotten between time. It also provides platform for introducing new developments in HMIS.

Fourthly lack of monitoring and supervision, every training has to assessed for its impact on the intended goal. This assessment could be in a form of monitoring or supervision to participants who were trained. Hence after completion of every HMIS training session there should be a deliberate monitoring and supervision visits to the participated facilities to assess if the training objectives are being implemented. And also to mentor further if facilities are not performing accordingly. However, this is not the trend in the current situation according to the findings of this study. 76% of the respondents stated that they did not receive any form of supervision or mentorship post HMIS training. This also corresponds to what a key informant from Kuunika mentioned that after the HMIS trainings they did not conduct any supervision.

"Yah, plans were there but due to other circumstances we failed to perform supporting supervision visits to these participants…" Respondent at Kuunika KI 2.

Therefore, the study found that lack of monitoring and supervision is one of the factor affecting the effectiveness of training on HMIS.

Lastly retention of staff, staff retention in health sector has been a challenge especially in developing countries. There are factors which countries fail to uphold in order to maintain the retention of health workers. A study done in Kenya revealed that leadership style, remuneration of health workers and promotion influence the retention of health workers [52]. Another study done in Malawi found that inadequate career progression strategies, unavailability of job descriptions, inadequate supervision and feedback on performance demotivating staff that later have impact on retention [53]. As a result of this staff keep on moving in and out of the health sector, some resigns to look for better jobs while some change positions. Therefore, poor retention of staff affect health systems at a facility including HMIS system. Like the moving out of people who were trained in HMIS affect the performance of HMIS system at a facility. This concur with results from this study which indicate that staff turnover contributes to the failure of trainings to improve HMIS system.

5.4 HMIS Training Needs

The revised national HMIS training curriculum has been structured in way that the content has been divided into modules. The modules include: data management, digital literacy, data quality, data analysis, interpretation and use. HIS security and systems support. this is almost similar to

the HMIS training manual designed by MEASURE Evaluation in collaboration with USAID [54]. All the modules are delivered concurrently, each module has specific days or time and the training is for every cadre in health system. The findings indicate that participants who participated in the study were satisfied with these structures. Again only 4% of the participants did not agree to the fact that every participant should attend to all modules. Rather participants should attend modules according to their level of competency and knowledge.

There are several teaching strategies and methods of delivering trainings in health sector. Such as lecturing, workshop, e-learning, practical and mentoring. A study by Friedman et al. [55] found that lectures were more effective teaching strategies than discussions. While Bluestone et al. [56] in her study effective in-service training design and delivery found that clinical simulations, practice and feedback were identified as effective education techniques [56]. These findings are similar with the findings of this study. In this study above 85% of the participants agreed that lecturing and provision of practical sessions are the effective mode of delivering HMIS training. The study also found workshops as the effective platforms to deliver such trainings because participants can share experiences and learn from each other.

Therefore, HMIS trainings is required to be provided through workshops where sufficient time should be given to lecturing and practical sessions. Overall participants were satisfied with the structure of the training and its mode of delivery.

5.6 The Effectiveness of HMIS Training

Strong HMIS has been manifested as critical for effective decision making and planning in health system. Therefore, it is a paramount mandatory for every health system to have HMIS

which is efficient and reliable. Studies have suggested that if health facility staff are provided with HMIS training the performance of HMIS system will automatically improve. And the data generated will have good quality. Nyamtema [13] reported that gaps in HMIS such as poor data quality and lack of informed decision making at facility level are linked to lack of training. While Teklegiorgis [29] stated that continuous training on health information system (HIS) activity is important to create awareness and to have skilled human resources that are confident and motivated to perform HIS tasks.

The assumption in this study was that HMIS trainings would improve the performance of HMIS especially in data quality. Therefore, the study conducted data quality assessment in health facilities whose staff were provided with HMIS training to measure the effectiveness of training on HMIS data quality using completeness, correctness, timeliness and consistency as quality dimensions.

The study found that completeness of data was 95% on reports and 90% in registers. While overall completeness of data in all the facilities assessed was at 92% for all the three programes assessed in this study, maternal health ANC, immunization BCG and malaria. Almost similar findings were reported on Nicol [57] study in South Africa and Belay [58] in Ethiopia in both studies completeness of data elements on reports were 91% and 90% respectively. All these findings are above the acceptable completeness standard rate by WHO DQR guide of 80% [59].

Correctness of data in this study was measured by presence of outliers and level of verification ratio. Using the 2SD recommended by WHO DQR guide no outliers were found in all

participated health facilities for a period of six months. Denoting that correctness of data was good, despite some variations when using verification ratios. Only maternal ANC1 data showed highest level of correctness at 100% with a verification ratio of 1.0. Immunization BCG3 data showed 92% correctness with a verification ratio of 1.08 meaning 8% of under reported data. While malaria data showed 95% correctness with a verification ratio of 0.95 meaning 5% of over reported data. Different with findings from study in Ethiopia [58] where ANC data was shown over reported by 24%. Another study by Nshimyiryo et al also observed over reporting in ANC related data, in their study they recommended HMIS training to address the gap [7]. Therefore, good correctness of data observed in this study is attributed to HMIS trainings.

Timeliness in compiling and submitting reports from health facility to the district health office was found at 72% in all the health facilities. this is lower than the recommended 90% by Malawi and also lower than the acceptable standard rate by WHO DQR guide. Similar challenge in timeliness of HMIS reporting have been observed in another study in Ethiopia reported timeliness of below 90% [60]. There are several factors which could contribute to this such as poor mechanism of sending data to the district since majority of facilities still depend of paper based reporting and delays in supplying HMIS tools such as reporting forms and registers. This revealed potential gaps that warrant further investigations

Consistency of data was evaluated by measuring the ratio between coherent indicators and correlation between these indicators. Both measurements indicated that only maternal ANC1 data had evidence of consistency above WHO recommended 90%, while immunization BCG3 and malaria data had no evidence of consistency all below 90%. Some factors attributing to these

inconsistencies could be competency of the people/cadre collecting the data, example immunization BCG3 data is collected by HSAs, this cadre is most of the time overwhelmed with a lot of tasks hence their competency in data collection is questionable. This is similar to what another study in Malawi found that the HMIS data originating from statistical clerks and nurses-midwives was perceived as being more reliable than data from HSAs [36]. Yourkavitch et al. also identified gaps in data consistency particularly in HAS's record keeping [12]. While the inconsistency in malaria data could be due to the tendency of health workers of getting prescribed malaria drugs such as LA without being diagnosed or tested for malaria.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

The probing and evaluation study conducted in Lilongwe district demonstrates that the effectiveness of HMIS training observed and interrelated on several levels. The findings suggest that the effect of HMIS trainings was observed on perceived benefits of HMIS training, perceived skills acquired through HMIS training and the data quality. The perceived benefits identified in this study include good coordination in data management, data ownership, good documentation and team work. Perceived skills acquired include data verification, data analysis and skills in using electronic systems such as EMR and DHIS2. Key data quality dimensions influenced by HMIS trainings were completeness, correctness while timeliness and consistency had some gaps which warrant for further investigations.

The study observed further that the structure and mode of delivery of the HMIS training is satisfactory. However, the study identified some factors that were deemed to have negatively affected the effectiveness of trainings on HMIS. Such factors include selection of participants, training duration, absence of refresher trainings, staff retention, lack of monitoring and supervision. These factors can be overcome with the involvement of key stakeholders such MoH leadership, cooperate partners, donor community and health facility workers.

6.2 Recommendations

Appropriate implementation of HMIS trainings remain a challenge in Malawi. To enhance the implementation of HMIS trainings health facility staff, health facility and district management,

donor community and government (Ministry of Health) are important stakeholders to make the following considerations:

1. District and health facility management should promote fair selection of participants to attend trainings;
2. Since training opportunity cannot be given to all health facility staff at once, staff should develop a tendency of learning from those who attended the training;
3. Training duration for delivering the new national HMIS curriculum should be revised to accommodate enough time;
4. Government should consider introducing HMIS training in pre-service schools for all medical and paramedical training programs in the country;
5. Government and partners should mobilize funds for refresher trainings;
6. Enhance monitoring and supervision visits to health facilities on HMIS.

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Appendix 2: Informed Consent Form

Informed Consent Form for Participants

Study Title: Assessment of the Effectiveness of Health Management Information System Training in Malawi, a case of Lilongwe district.

Principal Investigator: Jime Tambala Masters Student of Public Health at College of Medicine

PI Version Date: Version 2.0 21 December 2019

What you should know about the study

You are being asked to join a research study. This consent form explains the research study and your part in the study. Please read it carefully and take as much time as you need. Please note that your participation in this study is entirely voluntary and you may decide not to take part or to withdraw from this study at any time.

The study is being done by **Jime Tambala** the principal investigator who is currently undergoing Master of Public Health course at the University of Malawi, College of Medicine. As part of the course requirement the principal investigator is conducting a study titled, Assessment of the Effectiveness of Health Management Information System Training in Malawi. This study is being done under the supervision of **Dr. Benjamin Kumwenda** senior lecturer at College of Medicine. Please feel free to ask any question or doubt related to this study. We want you to understand the study before you decide to participate in the study.

Rationale & Objective of the Study

Health information is the foundation of public health and a well performing routine health management information system is needed to improve evidence based decision making and health system performance. Malawi introduced HMIS through the Ministry of Health and Population in the year 2002, Since then several HMIS trainings have been provided to health facility staff. However, little is known about effectiveness of these trainings. Therefore this research will investigate the effectiveness of such trainings and the impact they have on the quality, usability of data generated by HMIS. The study will help the Lilongwe district health office and other partners to better plan the implementation of HMIS training that will eventually improve the HMIS performance and the data quality.

The main objective is to investigate the effectiveness of Health Management Information System training in improving data quality in the Malawian health system particularly in Lilongwe district.

Study Settings and Methods

The study is being done in Lilongwe district. Health facility staff trained in HMIS using CMED HMIS curriculum developed by the Kuunika project will be included in the study. A total of 73 participants will be asked to participate in the study. A particular set of tools will be used to undertake this evaluation and it consists a semi-structured questionnaire and interview guide. All participants will be asked to self-administer the semi-structured questionnaire while 13 from the total participants will be scheduled for in-depth interviews. Time taken will range from 30 to 40 minutes. The collected data will be used for research only.

Risks

The study do not anticipate any major risks. Participating in this study will in no way affect your status, reputation or career prospects in the department or elsewhere.

Benefits:

There may not be any direct benefit for you from this study but from a public health view point. The information you provide may prove to be of great importance with respect to understanding the functioning of health information system so that it can be improved for benefit of the nation.

Confidentiality:

Utmost priority will be given to protect the privacy and confidentiality of the information provided by you. The collected information will not be shared with anyone not involved in the study and reporting will be done in aggregate form only. At no stage your identity will be revealed. All hard copies of filled questionnaires, interview notes, consent forms and recordings will be kept under the custody of principal investigator and will be destroyed properly when they are deemed no longer needed or after one year of dissertation report submission, whichever comes first.

Voluntary participation:

Your participation in this study is voluntary and you have the right to withdraw your participation at any time during the interview without any explanation. Refusal to participate will not involve any penalty or loss of benefits to which you are otherwise entitled.

Problems or Questions

If you have additional questions about this research you may contact:

- Jime Tambala, 0999794858, m201870074865@stud.medcol.mw
- The Secretariat, College of Medicine Research Ethics Committee, phone 01-874-377

Signature Section

If you have read the informed consent, or have had it read and explained to you, and understand the information, and you voluntarily agree to join the study, please write your name and signature below.

_____	_____
Participant's Name	**Participant's Signature and Date**
_____	_____

Study Staff Conducting Consent Discussion **Study Staff Signature and Date**

Appendix 1: Data collection tools

Section A: Interview Guide for Health Facility Staff.

Name of HF: ……..	**Name of Interviewer:** ……
Date of Interview:	**Title of Interviewee:** ……..
……../……/……**Age**:..……..	**Gender:** …….
Level of education: Primary☐ Secondary☐	**Department:** ……..
Tertiary☐ Specify:……	**Cadre:** …….
Start time: …...…/…….. **End time:** ……../……	

1- Have you received any formal HMIS training or any staff at facility?
   - Explore: Where was the training took place and when? Who funded the training?

2- What (if anything) is your facility doing differently as a result of HMIS training?
   - Explore: use of information, data management, quality checks, reporting

3- Do you feel you have acquired necessary skills to influence the improve of HMIS at your facility/district?
   - Explore: Individual (knowledge, skills)

4- Do you feel the HMIS training you attended was important?
   - If yes or no explore: how?

5- Please describe current quality of HMIS data at your facility/district?

6- Do you think HMIS training has improved the quality of HMIS at your facility/district?
   - If yes, how so? Probe: how it has attributed to the following: data collection and documentation, data flow, Data usage. Explore changes in dimensions of quality:

- If No, how so? How could it be changed to ensure HMIS training influence data quality at your facility/district?

7- At your facility some staff have been trained in HMIS, what do you thing are the direct benefit of the HMIS training at your facility and the district?
   - Explore in terms of data management, analysis, usage, and data quality

8- How do you think HMIS training have helped (or failed to help) improve data quality at your facility? Could you briefly explain?

9- What and how did HMIS training helped you achieve (personally)?

10- Do you think HMIS training has effect on HMIS in Malawi? Explain how?

11- What are the factors affecting HMIS training for it to be more effective?
   - Explore: (i) those affecting positively, (ii)those affecting negatively

Interview Closing Script:

Thank you for spending time with me today, for sharing your opinions and experiences with me. Your participation in this discussion is helping us to better understand the HMIS.

Since I have asked you so many questions today, do you have any questions?

I learned a lot from our discussion today and enjoyed spending time with you

Thank you very much!

Section B: Questionnaire for Health Facility Staff.

Name of HF: …….…….	**Title of respondent:** MO ☐ Nurse ☐
Date: ……../……/……**AGE:**…….	Pharmacist/Pharmacy tech ☐ Registry Clerk ☐
Department of respondent: ……..…	Data/Statistician clerk ☐ Lab tech ☐ CO ☐
Level of education: Primary ☐ Secondary ☐	MA ☐ Other specify: _____
Tertiary ☐ Specify:……..	**HMIS knowledge:**
Gender: Male ☐ Female ☐	Trained ☐ Oriented ☐ None ☐

1- How long have you been working in your current position? _____*years*

2- When were you trained or oriented on HMIS? _____ *mm/yyyy*

3- How many times were you trained or oriented in HMIS? _____

4- Since the time you were trained in HMIS did your work changed?

Yes ☐ No ☐

If yes how? _____

_____

5- What are your key responsibilities in regards to HMIS?

_____

_____

Answer the following questions in reference to your recent HMIS training you attended.

6- What was your expectation from HMIS training?

_____

_____

_____

Using the scale of 1 – 5 provide answers to the following:

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
	1	2	3	4	5
HMIS training is important					
HMIS is meant for health managers at DHO and ministerial level not the health facility					
HMIS training has helped improve data quality					
The effective mode of delivering HMIS training is by:					
7- Bringing participants to a workshop					
8- Lecturing					
9- Mentoring					
10- Practicals					
11- E-learning					
For effective HMIS training structure should have:					
12- Contents divided in modules					
13- Each module having specific number of days					
14- According to level of competency, Not all participants should attend all modules					
15- All the modules should be delivered concurrently					
16- Train everyone not only the HMIS designated personnel					
Other questions					
17- The content of HMIS training is too much to be trained at once					
18- There is no formal supporting coaching/mentoring post training					
19- Trained staff do little to implement what they have learn					
20- Trained staff do not teach/orient the rest of staff					
21- The inclusion of other cadres in the training rather than those directly designated for HMIS has some challenges					
Through HMIS training I have acquired the following skills					
22- In data collection					

23- Data analysis					
24- Data presentation					
25- Data usage					
I was satisfied with the HMIS training in the following:					
26- Content of the training					
27- Mode of delivery					
28- Training duration					

29- Did the HMIS training meet your expectations?

Yes ☐ No ☐

30- Did you find the HMIS training useful/effective?

Yes ☐ No ☐

If yes how? If no why? _____

_____

31- What are the barriers or challenges that you experience during HMIS training?

_____

_____

32- How do you rate your level of competence in HMIS after the training?

Excellent ☐ Very good.☐ Good ☐ Average ☐ Poor ☐

Explain your answer?

_____

33- If you were asked to design a training or orientation package in the current HMIS, what considerations would you take into account?

_____

34- What gaps/challenges do you think exist in the current HMIS training?

_____

Section C: Data Quality Assessment Tool.

Name of HF: …….	**Level of education:** Primary ☐ Secondary ☐
Date: ……../……/……	Tertiary ☐
Department of respondent: ……	**Title of respondent:** MO ☐ Nurse ☐
	Other:……

1- Number of health facility staff trained in HMIS? _____

2- Number of health facility staff designated for HMIS? _____

3- Does the facility compile any reports on maternal health, immunization and malaria?

Yes ☐ No ☐

4- If yes, list all the reports on maternal health, immunization and malaria

Title of the report	Frequency of the report		
	Monthly	Quarterly	Biannually

5- Does the facility have registers where maternal health, immunization and malaria programs use?

Yes ☐ No ☐

If yes list all the registers

Program	Title of the register

Completeness of data

1- Completeness of data in registers, zero/missing values in a period of six months January to June 2020.

Registers		Months						No. pages summary done	No. of months summary done
		J	F	M	A	M	J		
ANC register	Number records reviewed								
	Records with zero/missing values								
	Records with errors								
EPI	Number records reviewed								

register	Records with zero/missing values								
	Records with errors								
Malaria register	Number records reviewed								
	Records with zero/missing values								
	Records with errors								

2- Completeness of data on reports, zero/missing values in a period of six months January to June 2020.

Reports		Months							
		J	F	M	A	M	J		
ANC report	Number of data elements on a report								
	Number data elements with zero/missing values								
	Number of errors								
EPI report	Number of data elements on a report								
	Number data elements with zero/missing values								
	Number of errors								
Malaria report	Number of data elements on a report								
	Number data elements with zero/missing values								
	Number of errors								

Correctness of data

3- Data verification for specific indicators for a period of six month January to June 2020.

Indicator	Month						
	J	F	M	A	M	J	
Pregnant women who attended antenatal clinic (ANC) first visit							Report
							Register
Newborn babies receiving BCG 3							Report
							Register
Confirmed cases of malaria							Report
							Register

4- Accuracy of event reporting the outliers in the reporting period (outliers is a value of an indicator between ±3 SD from the facility mean).

Indicator	Month						Number of outliers
	J	F	M	A	M	J	

Pregnant women who attended antenatal clinic (ANC) first visit							
Newborn babies receiving BCG 3							
Confirmed cases of malaria							

Timeliness of reporting

5- Facility monthly reports for the selected review period submitted on time to the district. Tick against the month if submitted on time (Reports completed before 5th of the subsequent month).

Report	Month						Total reports on time	Total expected reports
	J	F	M	A	M	J		
ANC Monthly Report								
EPI Report								
Malaria Facility Report								

Consistency of data

6- Consistency of same data items at different points in time, between related data items,

Program	Indicator	Number of events						
Maternal health		J	F	M	A	M	J	Total
	ANC first visit							
	Total HIV status known at first ANC visit							
Immunization	Newborn babies receiving BCG 3							
	Live births (facility+BBA)							
Malaria	Confirmed cases of malaria							
	Number treated for malaria							

Section D: Interview Guide for Key Informants.

Name of Organization: ……...…	**Name of Interviewer:** ……
Date of Interview: ……../……/……	**Title of Interviewee:** ……..
Level of education: Primary☐ Secondary☐ Tertiary ☐	**Gender:** …….
	Department: ……..
Start time: …...…/…….. **End time:** ……../……	**Cadre:** …….

1- Have you participated in any formal HMIS training? And what was your role?
   - Explore: Where was the training took place and when? Who funded the training?

2- Have you made any deliberate follow ups (supervision) to health facility staff trained in HMIS?

3- What (if anything) are facilities doing differently as a result of HMIS training?
   - Explore: use of information, data management, quality checks, supervision, reporting

4- Do you feel the staff trained have acquired necessary skills to influence the improve of HMIS at their facility/district?
   - Explore: Individual (knowledge, skills)

5- Do you really feel the HMIS training is worth the time and effort given (important)?
   - If yes or no explore: how?

6- Please describe current quality of HMIS data?
   - Explore: at facility level, at district level, national level

7- Do you think HMIS training has improved the quality of HMIS in Lilongwe/Malawi?
   - If yes, how so? Probe: how it has attributed to the following: data collection and documentation, data flow, Data usage. Explore changes in dimensions of quality:
   - If No, how so? How could it be changed to ensure HMIS training influence data quality in Lilongwe/Malawi?

8- Health facility staff have been trained in HMIS, what do you thing are the direct benefit of the HMIS training in the district?
   - Explore in terms of data management, analysis, usage, and data quality

9- How do you think HMIS training have helped (or failed to help) improve data quality in the district? Could you briefly explain?

10- Do you think HMIS training has effect on HMIS in Malawi? Explain how?

11- What are the factors affecting HMIS training for it to be more effective?

- Explore: (i) those affecting positively, (ii)those affecting negatively

12- What challenges/ problems are you currently facing in line with the health management information system functioning properly (effectively and efficiently)?

13- What is the way forward and how do you think the current challenges facing the health management information system in Malawi can be better addressed?

Interview Closing Script:

Thank you for spending time with me today, for sharing your opinions and experiences with me. Your participation in this discussion is helping us to better understand the HMIS.

Since I have asked you so many questions today, do you have any questions?

I learned a lot from our discussion today and enjoyed spending time with you

Thank you very much!