

**INFORMATION FLOW AND FEEDBACK IN HEALTH INFORMATION SYSTEMS
AT DISTRICT LEVEL IN MALAWI: CHALLENGES AND OPPORTUNITIES**

MASTER OF SCIENCE IN INFORMATICS THESIS

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UNIVERSITY OF MALAWI

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AT DISTRICT LEVEL IN MALAWI: CHALLENGES AND OPPORTUNITIES**

Master of Science in Informatics Thesis

By

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Submitted to the Department of Mathematical Sciences, Faculty of Science in partial fulfillment
of the requirements for the Degree of Master of Science in Informatics

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November, 2013

DECLARATION

I the undersigned hereby declare that this thesis “**Information flow and Feedback in Health Information Systems at District Level in Malawi: Challenges and Opportunities**” is my own original work which has not been submitted to any other institution for similar purposes. Where other people’s work has been used acknowledgements have been made by means of complete references.

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November, 2013

CERTIFICATE OF APPROVAL

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DEDICATIONS

To my beloved late mother Matress Nyauhango, my wife Justina and my children.

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Firstly, I thank God for this opportunity that He has given me for remaining alive and the guidance He has given me through out this Research.

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ABSTRACT

The main objective of this study was to explore challenges and opportunities affecting information flow and feedback in health information systems (HIS) at district level in Malawi. The study employed qualitative research methods that included semi-structured interviews, observations in the health facilities settings, review of patient registers focusing on data collection tools and their contents and focus group discussions. The study was carried out at Health Facilities and District Health Offices in Blantyre, Zomba and Lilongwe.

The results show that there is existing Health Management Information System (HMIS) data being used in health facilities and District Health Offices (DHOs) in Malawi. However, system of data collection and vertical data flow is rather complex; and there are a number of data collection tools in use: patient cards, registers, tally sheets and forms.

Several challenges were identified, namely: lack of clear understanding of the purpose of data collection, information flows reflecting the requirements of higher levels without addressing the health facility and district level's information needs, lack of appropriate transport to take data from community to health facilities and DHOs; inadequate HMIS materials and supplies (stationery, computers with internet connection, phones, etc), lack of adequate storage space and existence of parallel reporting systems in the health information systems.

The research findings also indicated that the health data being reported is not sufficient to support informed decision-making and health planning. Furthermore, the study revealed that some of data collected is of low quality, incomplete, inaccurate; and there was untimely reporting.

The following measures are recommended to mitigate the challenges in information flow and feedback at district level in Malawi: Promote local learning and discussion of essential HIS needs, and the role of routine data collection in meeting those needs; Establishing an information culture in HIS and health care organizations; Investing in health data collection, use and management of health information at local levels within the HIS; and provide enough resources (transport, computers with internet connection, cell phones).

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LIST OF ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
CHAM	Christian Health Association of Malawi
CHIP	Committee on Health Information Policy
CHW	Community Health Worker
DEHO	District Environmental Health Officer
DHIS	District Health Information System (Software)
DHIS2	District Health Information Software 2
DHMT	District Health Management Team
DHO	District Health Office
DNO	District Nursing Officer
EPI	Expanded Program on Immunization
ESCOM	Electricity Supply Corporation of Malawi
FMIS	Financial Management Information System
FOSS	Free and Open Source Software
GIS	Geographic Information System
GPRS	General Packet Radio Service
GSMA	Global System for Mobile communications' Access
HIMTC	Health Information Management Technical Committee
HIPC	Heavily Indebted Poor Countries
HIS	Health Information System
HISP	Health Information System Program
HIV	Human Immune deficiency Virus
HMIS	Health Management Information System
HMIU	Health Management Information Unit

HRMIS	Human Resources Management Information System
HSA	Health Surveillance Assistant
HSMIS	Health Services Management Information System
ICT	Information and Communication Technology
IDSR	Integrated Disease Surveillance and Response
II	Information Infrastructure
IS	Information System
IT	Information Technology
LMIS	Logistic and Supply Management Information System
MOH	Ministry of Health
MOHP	Ministry of Health and Population
MPTC	Malawi Posts and Telecommunication Corporation
MSH	Management Sciences for Health
NHSRC	National Health System Resource Centre
NSO	National Statistical Office
NGO	Non Governmental Organization
NORAD	Norwegian Agency for Development cooperation
PAMIS	Physical Assets Management Information System
RHINO	Routine Health Information Network
USAID	United States Agency for International Development
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

1.1. Background

Having a healthy population is one of the targets for attaining socio-economic development in any country. The health care system is one of the major determinants of the health status of the population and therefore the importance of quality health care services cannot be overemphasized (Galimoto, 2007).

However, the health status and quality of the health care services in many developing countries fall short with reference to international standards mainly due to dominating shortage of financial and human resource in the public sector. It is in such situations that good management is crucial and a prerequisite for increasing efficiency and effectiveness of the health services (Sauerborn & Lippeveld, 2000). It is widely believed that the Health Information System (HIS) has a major role in supporting good management which will eventually assist in the improvement in the quality of health service provided to the population as Mahler states *“The WHO has long identified health information systems as critical for achieving health for all by year 2000”* (Mahler, 1986 cited by Sauerborn & Lippeveld, 2000:1). A Health Information System is therefore defined as *“a set of components and procedures organized with the objective of generating information which will improve health care management decisions at all levels of the health system”* (Sauerborn & Lippeveld, 2000:3).

Health information systems in developing countries have been considered as obstacles that hinder the provision of quality health services rather than supporting tools. The reasons for this view include: the data gathered and information produced is irrelevant and of poor quality; the HIS is fragmented; there is lack of timely reporting and feedback; and poor use of the information (Sauerborn & Lippeveld, 2000; Lungo, 2003; Galimoto, 2007).

If it is believed that information is indispensable for effective management and development of health services and that, furthermore, it has to be meaningful, reliable, accurate, and timely, then health system managers should be ‘keeping an eye’ on the information system and its performance (Sapirie, 2000; Lungo, 2003).

Health is a major concern of people everywhere in the world especially in developing countries such as Malawi where most people are poor. Information flows and feedback is essential commodity for delivery of health services and lack of proper information flows and feedback has been shown to discourage utilization of public health facilities (Ministry of Health and Population, 2003). There is need to assess continually and objectively the effectiveness of information flows and feedback among health practitioners in order to achieve a reliable health management information system.

The way information is created, stored, and shared within the healthcare industry limits the ability of doctors, nurses, clinicians, and administrators to share information and work together. Healthcare professionals are overwhelmed with paper-based processes, manual data entry, and isolated information systems that do not communicate (ibid).

Good information systems are desirable, but unfortunately as the World Health Organization (WHO) (2004) emphasize, they do not in fact exist. HIS, especially in developing countries, have typically been found inadequate in providing effective management support because of these systems being primarily “data”, rather than “action” driven. This implies systems that are typically aimed at filling endless registers, sending reports without obtaining adequate feedback, collecting data that is not very helpful for management decision making because they tend to be incomplete, inaccurate, untimely, obsolete and often unrelated to health priorities (Macueve, 2003).

Data (facts and statistics collected together for reference or analysis) on the primary health care systems is collected at the community level and then is transmitted up to the levels of the administrative hierarchy where various decisions have to be made, including resources allocation. However, what is often found is that the transmitted data typically end up on the shelves of an office at the upper level of administrative hierarchy and unused for decision-making. The gathered data typically has little relevance, is of poor quality, and is inadequately used. The lack of timely reporting and feedback, duplication and waste due to parallel existing HIS are some of the reasons why current systems in developing countries are not providing expected benefits (WHO, 2004; Macueve, 2003).

1.2. Purpose of Health Information Systems

Health information systems generate information (data that is accurate and timely, specific and organized for a purpose) in order to inform health planners and decision-makers on what is happening at health delivery facilities. Health information systems improve health management, and health management is a pre-requisite for good health service delivery. Thus, health information systems are there to bridge the gap between disease occurrence and the response of health workers to fight against diseases. Wilson *et al.* defined a Health Information System (HIS) similarly to a Health Management Information System (HMIS), as “a set of tools and procedures that a health programme uses to collect, process, transmit, and use data for monitoring, evaluation and control in a health system”. A health information system includes, “patterns of belief about the causes of illness, norms governing choice and evaluation of treatment, socially legitimated status, roles, power relationships, interaction settings, and institutions”. Hardon, states that, “a health system is not a static phenomena. It is a continuous process of changes due to pressure from both outside the system and from within the system” (Hardon *et al.* 2001:27).

1.2.1. The Malawian Health Care System

The Ministry of Health (MoH) in Malawi provides 62 percent of the health care services while the Christian Health Association of Malawi (CHAM) provides 38 percent (Deliver, 2007). CHAM facilities complement public health sector facilities in the provision of reproductive health services and have full access to public-sector reproductive health commodities. Apart from the public sector, Non Governmental Organizations (NGOs) are also involved in health care services delivery, of which Banja La Mtsogolo, a Marie Stopes International affiliate, is the most significant (ibid) as seen in Figure 1.

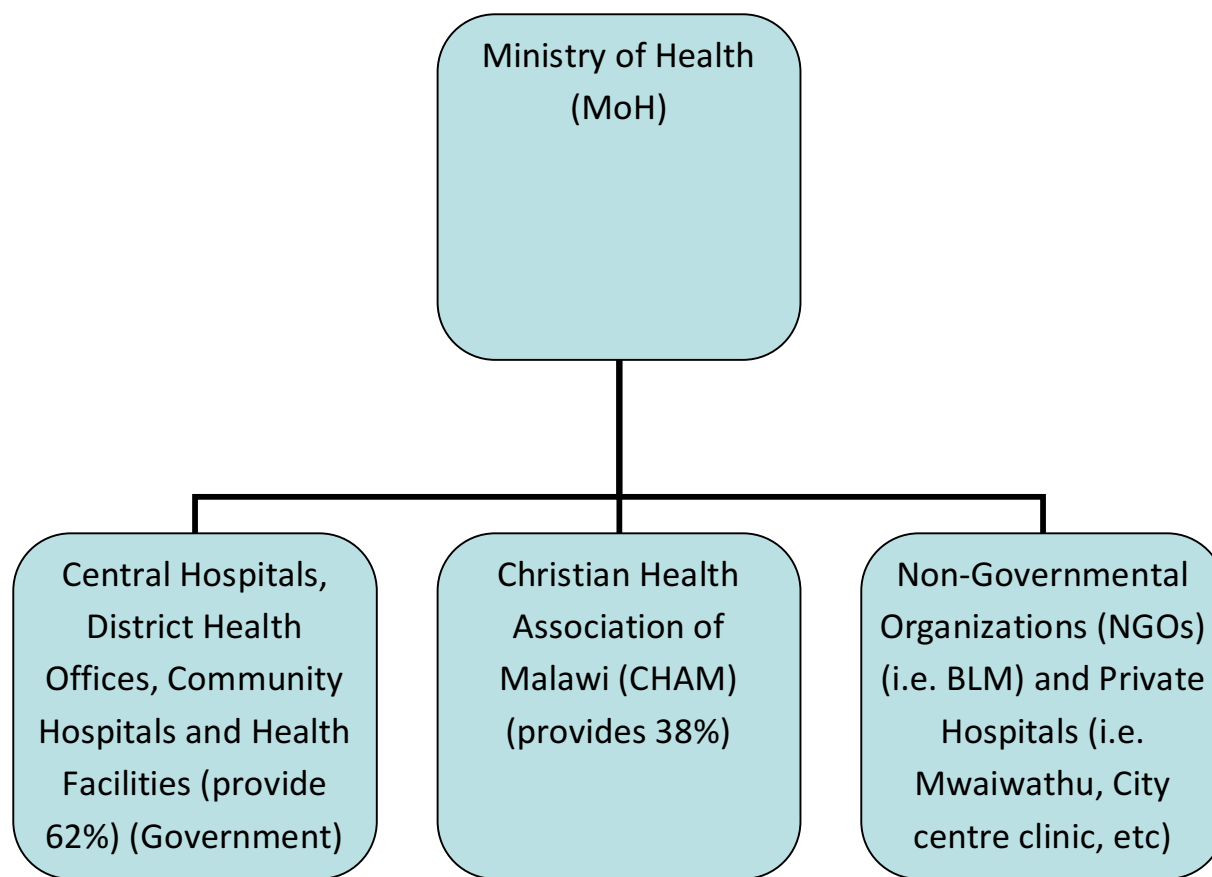


Figure 1: Malawian Health Care System Structure.

The public health sector system comprises three levels: the primary level, comprising health centers, health posts, dispensaries, and rural or community hospitals; the secondary level comprising district and CHAM hospitals; and the tertiary level which comprise central hospitals and private hospitals (Sandvand, 2007). This research study focused at the district level, being the secondary level of the health sector and the hub of all the information from the periphery levels.

In January 2002, the Ministry of Health and Population started the implementation of a comprehensive and integrated routine Health Management Information System (HMIS) throughout the country. The introduced system was guided by the principles of; integration of all routine information systems; decentralization in information generation and use; information for action; and being simple to establish and maintain. For the first time Malawi would have access to continuous monthly data on all agreed indicators for each health facility, district and the

nation. It was also the first time that each public health facility and district health office would know the catchment areas and the population size to be served (Galimoto, 2007).

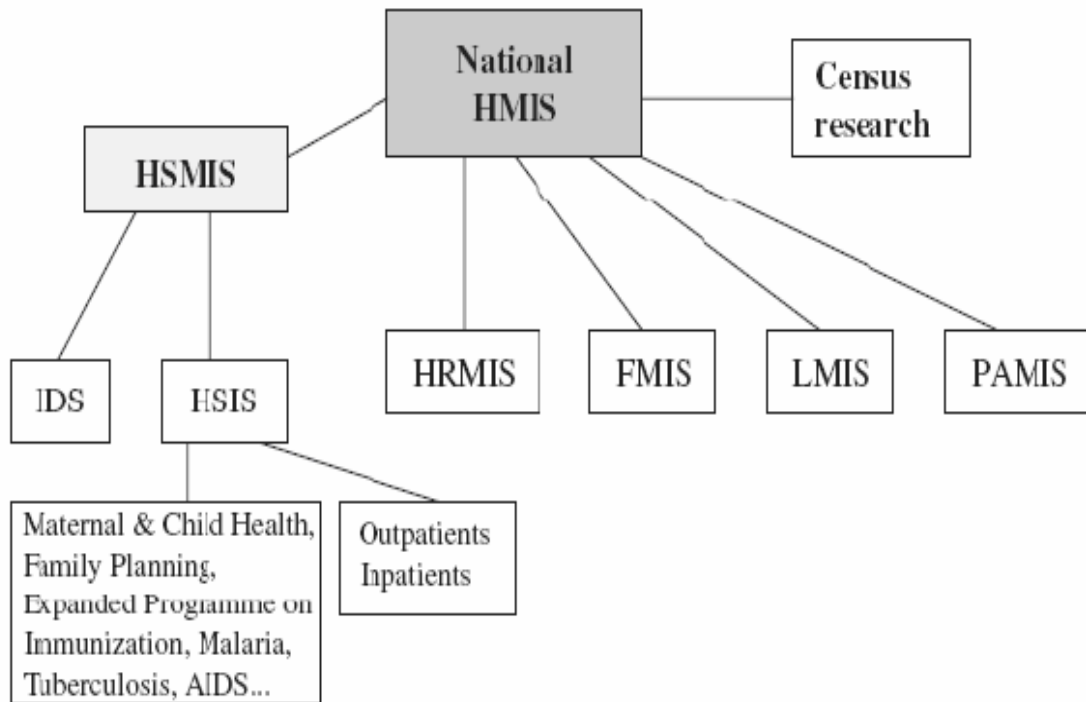
The integrated HMIS is designed to provide programme managers and staff with reports on how well each programme is functioning and to alert the service providers and programme managers to take timely necessary corrective actions (Ministry of Health and Population, 2003). MoH officially endorsed a limited set of core health sector indicators (measurable characteristics of an individual, population or environment) as a standard for ensuring that all data collected has purpose (*ibid.*). These indicators were developed through consensus building process whereby various stakeholders were involved in determining the required indicators. Once the consensus was reached, tools for data collection, processing and reporting were revised (Chaulagai et al., 2005).

➤ **Overall Structure of the HIS**

The Ministry of Health recognizes that the HMIS can never be fully integrated into a single entity in any setting. Therefore, for proper flow of information and feedback, HMIS has been logically grouped into a number of sub-systems which have been identified as interdependent components of the national HMIS as seen in Figure 2. These sub systems are: (a) the Financial Management Information System (FMIS), (b) Human Resource Management Information System (HRMIS), (c) Logistic and Supply Management Information System (LMIS), (d) Physical Assets Management Information System (PAMIS), and (e) Integrated Health Services Management Information System (IHSMIS).

The Integrated Health Services Management Information System is at the core of this structure and derives information from all other sub-systems to serve as a comprehensive health and management information system. Malawi has fully integrated all service-related information systems and the Disease Surveillance System into a single entity of a Health Services Management Information System. The program-specific logistics and supply components have been integrated into a broader Logistics Management Information System (Chaulagai et al, 2005).

HMIS design and implementation



Abbreviations:

HMIS = Health management information system

HSMIS = Health services management information system

HRMIS = Human resource management information system

FMIS = Financial management information system

LMIS = Logistics management information system

PAMIS = Physical assets management information system

IDS = Integrated disease surveillance

HSIS = Health services information system

Figure 2: Model of the National Health Management Information System (HMIS)

(Source: Chaulagai et al, 2005:5).

➤ **Objectives of the information system**

The main mission of the National Health Management Information is to improve the health status of the people by providing reliable, relevant, up-to-date, adequate, timely and reasonably complete information for health managers at community, facility, district and national levels through increased effectiveness and efficiency of health services (Ministry of Health and Population, 2003).

More precisely, there are three main objectives intended to be achieved through the HIS and these are:

- To ensure that the required health and management information is available to all users in the health sector to meet each of their predefined needs.
- To ensure that the required information is accessible to all concerned users.
- To ensure that the intended primary users of the information are informed about the information. (The individual and organizations involved in delivering and managing health services and providing support to this effect are the primary users of information).

The design of the health information system has been guided by the principles of:

- Data for decision-making.
- Integration of management of health service specific routine information systems into a single system.
- Data collection for local analysis and use.
- Data collection, analysis and use by the same health and support personnel who are responsible for the management/delivery of health services.
- Complete information available at a single repository.
- Strong links between all data collection systems in order to avoid duplication and produce synergy in data analysis and dissemination.

➤ Institutional set-up

The philosophy behind the HMIS was that the people who provide the service collect and compile information; and that the storage, interpretation and dissemination to different users should be done from a single point at each level (Galimoto, 2007).

Therefore, to achieve this, a new post for a statistician was created for each district health office and central hospital to assist with computerised data processing. The Health Management Information Unit (HMIU) was also established in the Ministry headquarters with the responsibility of coordinating information collection functions; compiling health information from internal, external, primary and secondary sources; analysing, interpreting and storing information in appropriate format; generating reports in different ready-to-use format; and disseminating information to all relevant stakeholders (Chaulagai et al, 2005).

Furthermore, a Health Information Management Technical Committee (HIMTC) was established at national level consisting of members from various departments of the MoH and other stakeholders. The responsibilities assigned to this committee include: defining minimum datasets and their definitions; conducting periodic review of health data collection procedures and tools; identifying integrated sentinel sites for all purposes; setting operational research priority and approving operational research proposals (Ministry of Health and Population, 2003)

A Committee on Health Information Policy (CHIP) was also established at national level consisting of members to be chaired by the top officials in the health sector (public and private) and with members from other external organisation such as Local Government ministry, National statistical Office. The overall responsibility assigned to this committee is of devising and approving policy on data collection, data management, and data distribution (*ibid*).

1.3. Research problem domain area

At the beginning, health information systems were oriented to collect information on diseases and on health service outputs. The practice of collecting and maintaining information on health is as old as the history of medicine itself. Since the earliest times, those who were engaged in the art of healing found it necessary to record various outcomes in relation to the number of patients attended. As a result, the health data collected proved to be valuable in all aspects of health care

provisions. In contemporary times, health information systems were transcended to the domain of modern health practices, and they hold great significance in the planning and decision-making of health services delivery (Lungo, 2003).

Macueve (2003) claims that if data and information are properly collected and sent on a timely basis to decision-makers, it could potentially be helpful on deciding what drugs and medical supplies to deliver, how much, where and when. Since people and the health facilities are spatially dispersed it is necessary to know their locations with relation to the geographical factors such as distance between medical stores/warehouses and those health facilities; the road networks; and other physical constraints to the transportation. In order to understand patient's needs, it is necessary to integrate the drug logistics data with the health data for proper information flow and feedback to be achieved (Macueve, 2003).

The World Health Organization has developed HIS assessment approach. The approach of health information systems assessment developed by WHO encourages the selection of subsystems and domains of health information systems for assessment because normally it is not possible to assess all health information subsystems in one study (Sapirie, 2000; Lungo, 2003).

Sapirie (2000:74) presents the assessment that, “the assessment does not have to be nationwide, but could, for example, focus on one region”. Common subsystems of health information systems are:

- *Epidemiological surveillance* for notifiable infectious diseases, certain environmental conditions, and risk factors;
- *Routine service reporting (Information flow and feedback)* from the basic health services at community level, health centers, dispensaries, district hospitals, referral hospitals, and special and tertiary hospitals;
- *Special programme reporting systems* such as Tuberculosis Control, Leprosy Control, Malaria Control, Maternal and Child Health and Family Planning, Expanded Programme on Immunization, and HIV/AIDS prevention;
- *Administrative systems* including health programme budget management, health financial systems, health personnel systems, health supply and logistic systems, health training

programmes, health research management, health documentation management, and managing external health resources for health; and

- *Vital registration* of births, deaths, and migration.

This study focused on the “routine service reporting” subsystem of the health information systems. However, the other subsystems are also highlighted, especially in the case where the other subsystems intersect with the main area of study. In this study, Health Information System component (routine service reporting) is divided into categories as categorized by WHO (Sapirie, 2000:75) as follows:

- *Data input*: validity and completeness of data recording and collection, including surveillance, routine case and activity data, surveys, data emerging from administrative processes, and registration data;
- *Data analysis, transmission, and reporting*: efficiency, completeness, and quality of data analysis, processing, and presentation, at all levels of the health system, in order to produce actionable information;
- *Use of information*: decisions and actions taken for patient/client, community, health unit, programme, and executive management;
- *Information system resources*: availability, sufficiency, and use of critical resource to support: the health information system budget; facilities such as space for record storage, records, and formats; and necessary equipment for data communication, storage, analysis, and document preparation (fax, computers, printers, photocopy machines, cell phones etc.); and
- *Information system management*: organization and coordination mechanisms for assuring that data and information are properly defined, standardized, produced, maintained, shared, and reported.

These categories are among the themes in the analysis of the empirical findings (see Chapter 4).

1.3.1. Information sources

The health system obtains required information from several direct sources as well as other systems within and outside the health sector. The most important sources are; (1) the census; (2)

the registration of vital events; (3) Health facility based records; (4) community monitoring reports; (5) population surveys and research; (6) records from ministries and institutions.

The health data is collected/compiled from both the primary and secondary sources. The primary source is from data collected by health and support personnel while delivering service and undertaking other management functions. The secondary data (i.e. from secondary sources) includes data obtained from sources such as census, surveys and research that are required for planning and management of health services (Ministry of Health and Population, 2003).

The information produced from the data is anticipated to be used to: (1) measure the health status of the people; (2) quantify the health problems; (3) quantify the medical and health care needs; (4) formulate health policies, plans and strategies; (5) set priorities to allocate resources; (6) design health interventions; (7) monitor trends and changes; (8) assess progress; (9) evaluate effectiveness and efficiency of health services (*ibid*).

1.3.2. Information flow

The main responsibility of recognizing disease outbreaks, low coverage of health services and adverse environmental conditions weigh upon local health staff. The main response and actions is expected to take place at health facility level followed by district level. The transmission of information is designed to elicit help from higher levels, and not merely to find a place in an archive, as shown from the information flow depicted in Figure 3 (Ministry of Health and Population, 2003).

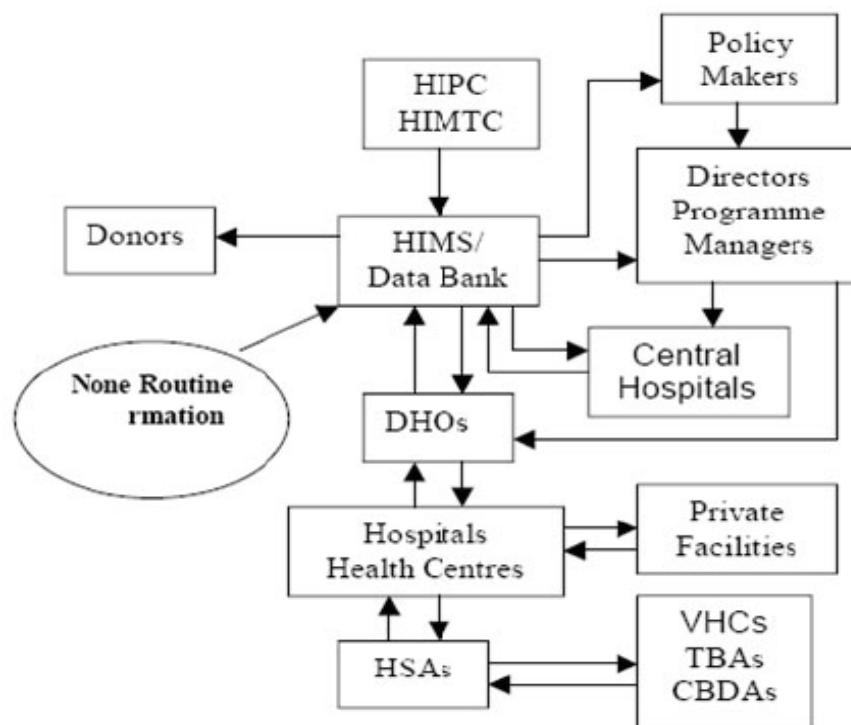


Figure 3: Expected Information flow for National HMIS

(Source: Ministry of Health and Population, 2003:21).

More specifically, the information flow depicts a scenario where a facility generates quarterly reports on each predefined indicator for use by the concerned health programmes and other stakeholders. Each facility compiles data from its entire catchment area and reports to the district level. The District Health Office compiles data from all facilities, performs comparative analysis, reports to Ministry Headquarters and also sends feedback to each health facility. The Ministry headquarters compiles data from all districts and central hospitals, performs necessary analysis and provides feedback to all reporters.

The Health Management Information Unit at headquarters sends reports to national program managers and provides general feedback to the District Health Offices and central hospitals. The Program managers at the national level also respond to the district and the Central hospital based on the report received. In this way, technical feedback by higher levels becomes as important as the bottom-up reporting.

Besides the bottom-up reporting and top down feedback mechanism as described above, the Health Management Information Unit (HMIU) at the headquarters compiles data on core indicators from all reliable secondary sources and sends to districts and central hospitals for their use in planning and management of health services (Ministry of Health and Population, 2003).

The expected flow of information in the system is then as shown in Figure 4 where there are programme-specific reporting systems running parallel to the HMIS. This is in opposition to what was intended by the Ministry of Health to have the information flow where there is one point of transmission of data from one level to the next.

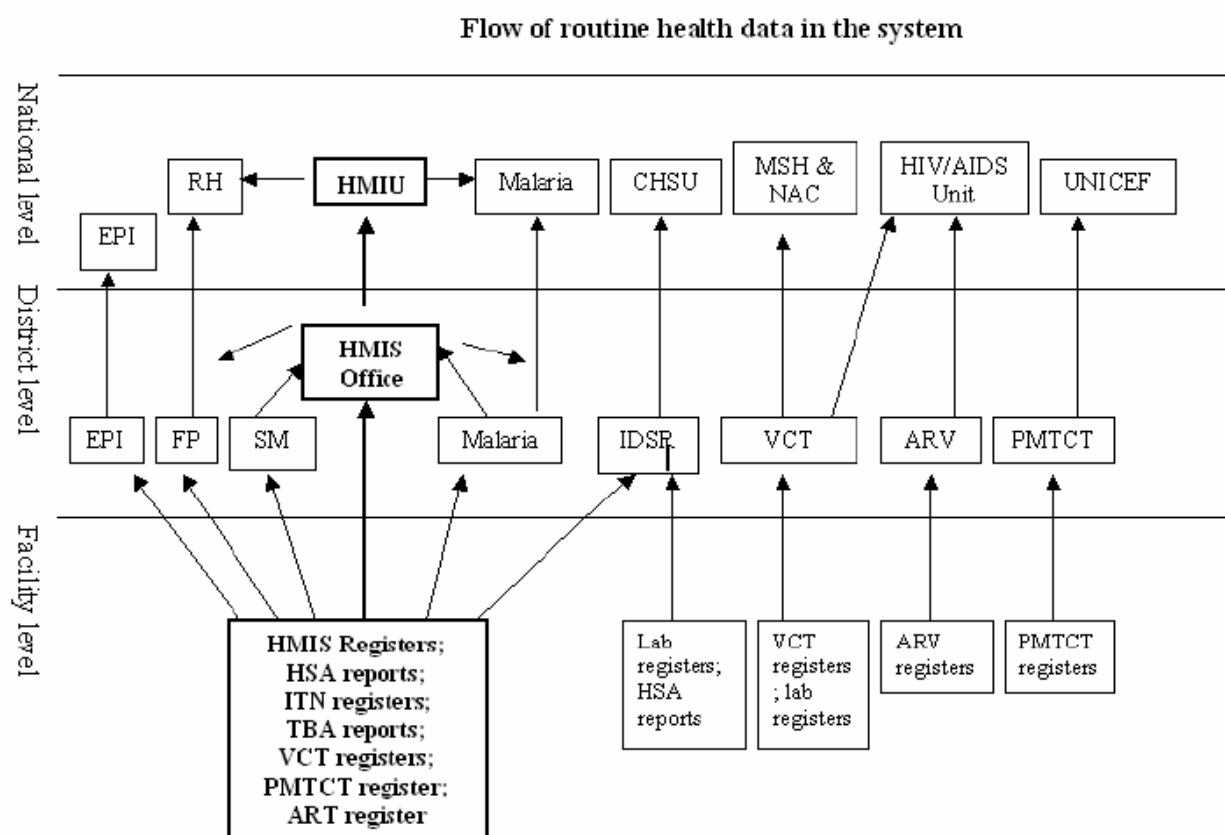


Figure 4: Flow of routine Health data (Source: Galimoto, 2007:98)

1.3.3. Data processing and dissemination

All health personnel involved in managing and delivery of health services are expected to collect, aggregate and analyze information using paper, pencil and a simple calculator and make immediate use in their daily work. At the end of every quarter each health facility aggregates data from all the registers into a quarterly report and submit it to the district health office, i.e., to the statistician as indicated in the institutional set up.

The statistician compiles a report each quarter based on the quarterly reports received from the facilities in the district and a computerized system, the District Health Information Software (DHIS) has been established to assist in the processing of the data of each facility including the district hospital. The district report produced is then submitted to the MoH, i.e. the HMIU. This district report is also required to be fed back to the health facilities and other stakeholders who are partners in health service management in the district.

Each district is required to conduct an annual review meeting with its facility in-charges and other stakeholders and produces an annual performance report with the content of: district at a glance: Maps, facts and figures; current health status in the district, i.e., analysis of routine indicators; organization of health services: types of services, delivery points and frequencies; quality assurance, monitoring and supervision, etc; as shown in Figure 5.

The central hospitals are also required to produce quarterly monitoring reports on tertiary care indicators. Annually, performances are analyzed and comprehensive report is produced covering the area of service delivery, human resources, financial management, physical assets, drugs and supplies, etc.

At national level, each quarter the HMIU compiles data from all districts and central hospitals and produces quarterly monitoring aggregated and comparative reports for use of different

Diagram showing information process at facilities

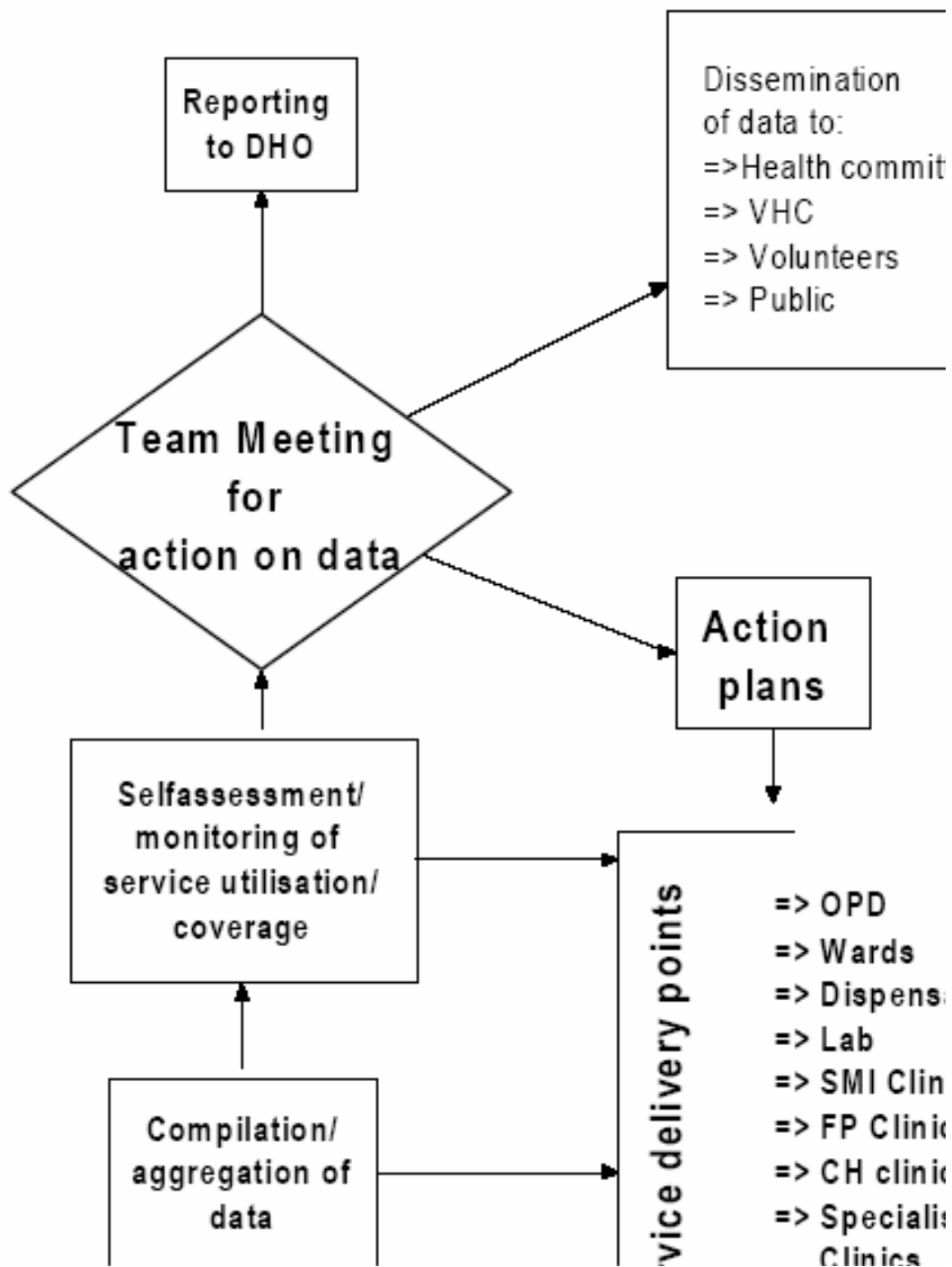


Figure 5: Information process at health facility level

(Source: Chaulagai et al. 2001:4)

National programs and other stakeholders. A copy of this report is sent back to district health offices and central hospitals for their self-assessment, comparative analysis and actions.

These details about routine monitoring functions at different levels are depicted in Figure 6.

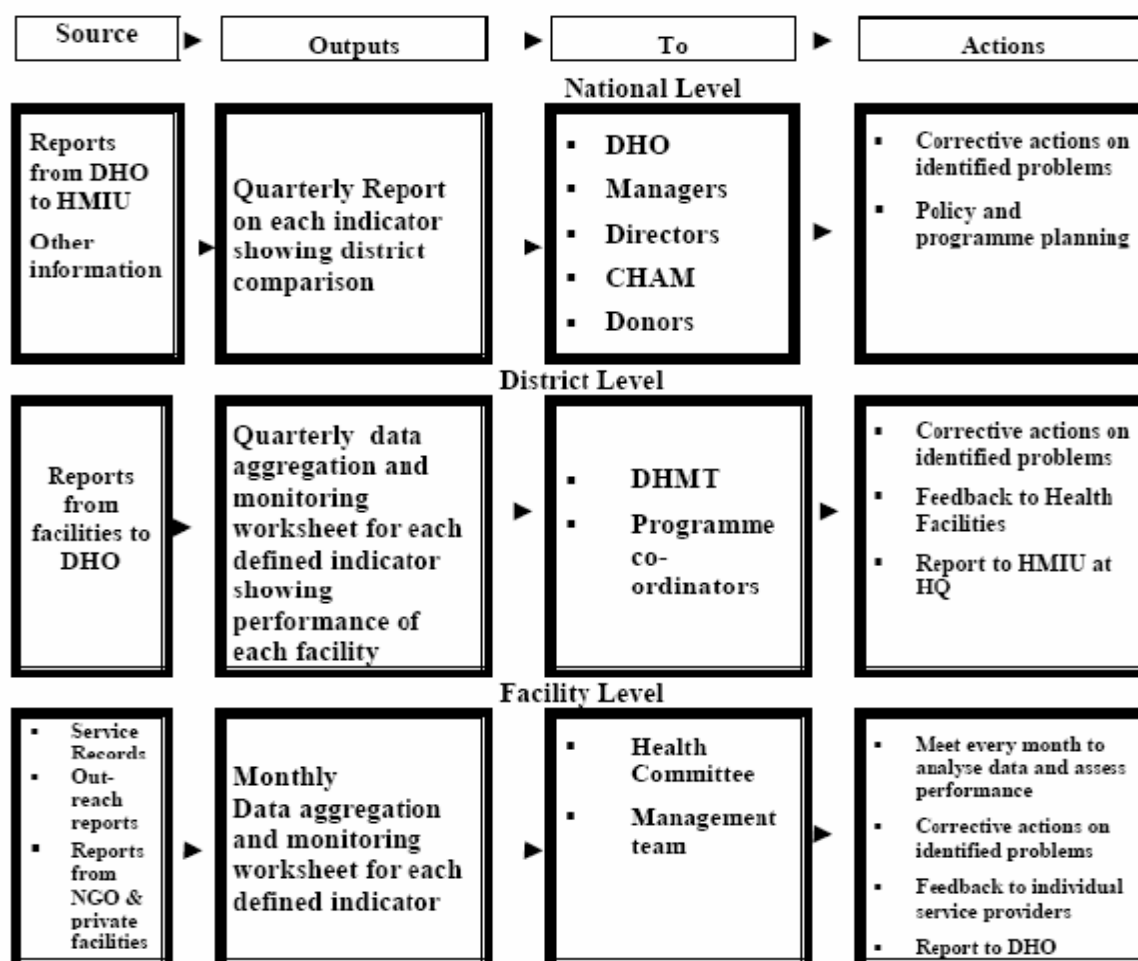


Figure 6: Routine actions within each level

(Source: Chaulagai et al. 2001:3)

1.3.4. District Health Information System (DHIS)

At the district level, health data is kept in District Health Information System (DHIS), a health management information system which is targeted at the distributed collection and analysis of routine data, specifically for primary health care mainly at aggregate level. This application is Free and Open Source Software (FOSS) HMIS designed and developed under a global research

and development initiative, Health Information Systems Project (HISP). The development of DHIS application software originated from the Department of Informatics, University of Oslo, Norway under a team of public health specialists in system design from different developing countries.

The first version (DHIS1.3/1.4) was developed on Microsoft Office platform, and distributed free. This was subsequently upgraded on an ongoing base continuously in South Africa since 1997. DHIS 1.3/1.4 is the current national standard in South Africa and is being used in all the health facilities in the country as well as in many African countries such as Ethiopia, Nigeria, Botswana, Tanzania, Zambia and Malawi, among other countries. This application is used for collection, validation, analysis, and presentation of aggregate statistical data customized to integrated health information management activities at the district level (National Health System Resource Centre, 2010). DHIS2 is the upgraded version to be implemented at the district level in Malawi (Chikumba, 2009).

1.4. Problem statement

This study responded to the question of how to transform the existing information flow systems and feedback into management support systems, focusing on the routine services reporting component of the Health Information Systems in developing countries. The rationale behind the approach of examining routine services reporting is based on several existing conditions: First, the problems of inefficient and chaotic data collection and use of information in health facilities and at the district levels typically apply to the routine services reporting component of the health information systems. Second, routine services reporting are the only way to generate data for patient and clients management decisions (Sauerborn and Lippeveld, 2000) such as ordering supplies, including medicines and supervision of health personnel (Lungu, 2003).

This research was aimed at making qualitative and quantitative analysis of the bottlenecks in challenges and opportunities in information flows and feedback in Health Information Systems in developing countries using Malawi as a case study, and discussed suggestions on how these bottlenecks can be addressed. Findings and recommendations of this study are meant to be useful in assisting policy makers and health planners in the country.

The following **research questions** were addressed:

- What are the challenges and opportunities of information flow and feedback in Health Information Systems at District level in Malawi?
- How are HIS data/information generated, managed and transmitted in both circumstances (lower levels to higher levels and vice versa)?
- Why is data /information quality and timeliness of reported data/information currently compromised at various organizational levels and how can these issues be addressed?
- Information is reported upwards in primary health care organizations, but how does information flow downwards from a higher organizational level to a lower level? In particular, what artifacts are central to organizational feedback and information transparency?

1.5. Research Objectives

The main goal of this research was an attempt to explore challenges and opportunities of the current information flow systems and feedback (routine service reporting) among health practitioners in Health Information Systems at District level in Malawi, identify potential remedies and therefore suggest ways for possible solutions in order to improve health care delivery in the country.

The following were the **specific objectives** for this research study:

- Analyze the performance of the current information flow systems in Health Management Information Systems' data in Malawi.
- Identify the kind of media currently used to transfer data/information from source to destination.
- Establish the quality of information being sent and received and assess the security of the information being sent and received since some medical information is confidential.
- Determine extent of the information which is sent from source to destination and extent of feedback that takes place i.e. kind of feedback, media used, duration and reasons for delayed or no feedback.

- Determine the challenges and opportunities of information flow and feedback in Health Information Systems/Health Management Information System's data.

1.6. Structure of the Thesis

Following this introductory chapter which also presents more on the research problem domain area, research objectives, the health care system and the supporting health information system in Malawi. Chapter 2 of this thesis discusses on literature reviewed related to the issues of health management information systems. Additionally, literature is reviewed on health information systems in developing countries such as Malawi, etc.

More details on the research approach adopted in this study are presented in Chapter 3 together with the ethical considerations taken on board. Chapter 4 presents the core findings/results and discussions of the research with reference and guidance from the literature reviewed in chapter 2.

Concluding remarks drawn from the study are presented in Chapter 5 which also includes the recommendations stemming from this study. The limitations of this study and the possible area for further research are also presented in this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1. Health Information Systems (HIS)

A Health Information System is a functional entity of the health system of any country and its objective is to provide information that supports the decision making process in the health system (Lippeveld & Sauerborn, 2000).

2.1.1. Components of HIS

From the definition of HIS; Thus, the HIS should fit into the overall management structure of the health services system and a possible fit is depicted in Figure 7.

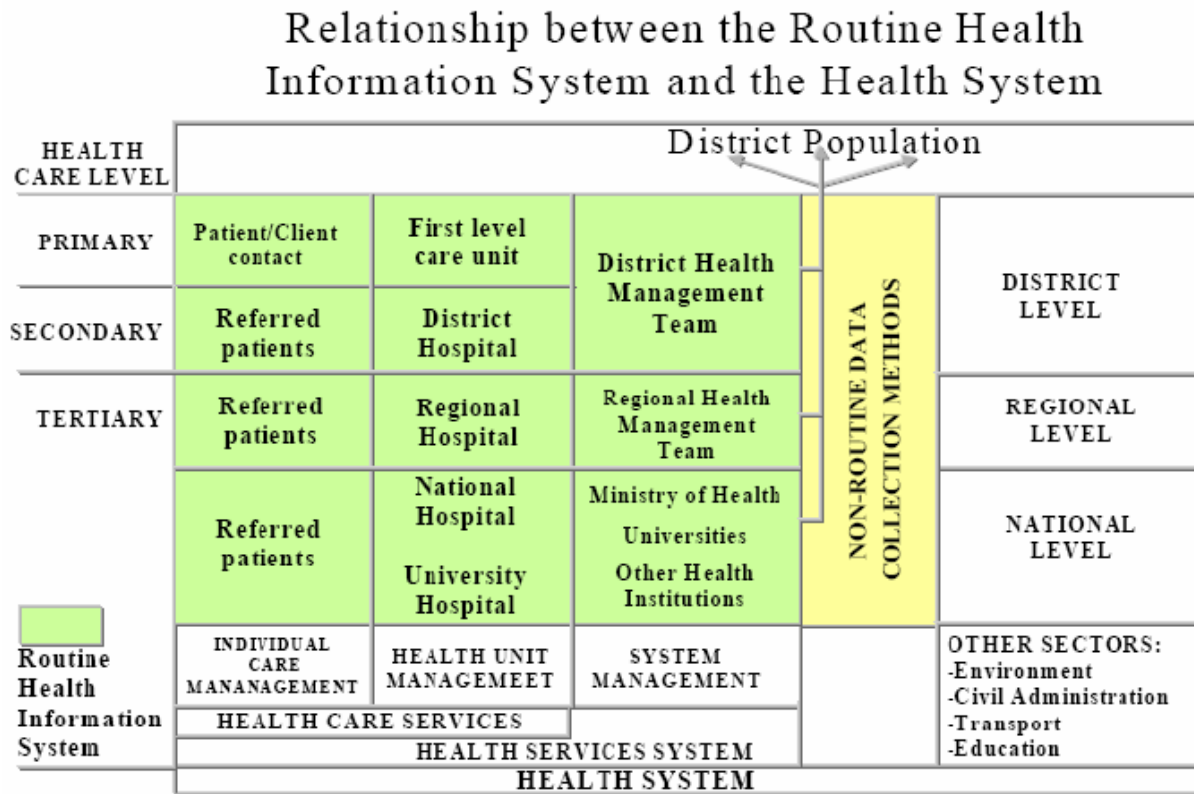


Figure 7: Relationship between the HIS and the health system

(Source: Lippeveld, 2001:16)

Lippeveld & Sauerborn (2000) grouped the components of an HIS into two entities:

- The information process through which raw data is transformed into information. For clarification, data refers to the recorded descriptions of things, events, activities or transactions; and information is a sub-set of data that means something to the person receiving it (Boddy *et al.*, 2005).
- The management structure, which consists of resources and a set of organizational rules. The management structure ensures that resources such as hardware, software, financial and human resources are used efficiently following organizational rules in a way that the information process produces quality information (Lippeveld & Sauerborn, 2000).

Heywood & Rohde (2001) indicated that the information process can be represented as a cycle consisting of different phases known as data collection, processing, analysis, presentation, interpretation and use of information for decision-making. As shown in Figure 8, each of the phases has a number of aspects important at that particular stage (Heywood & Rohde, 2001).

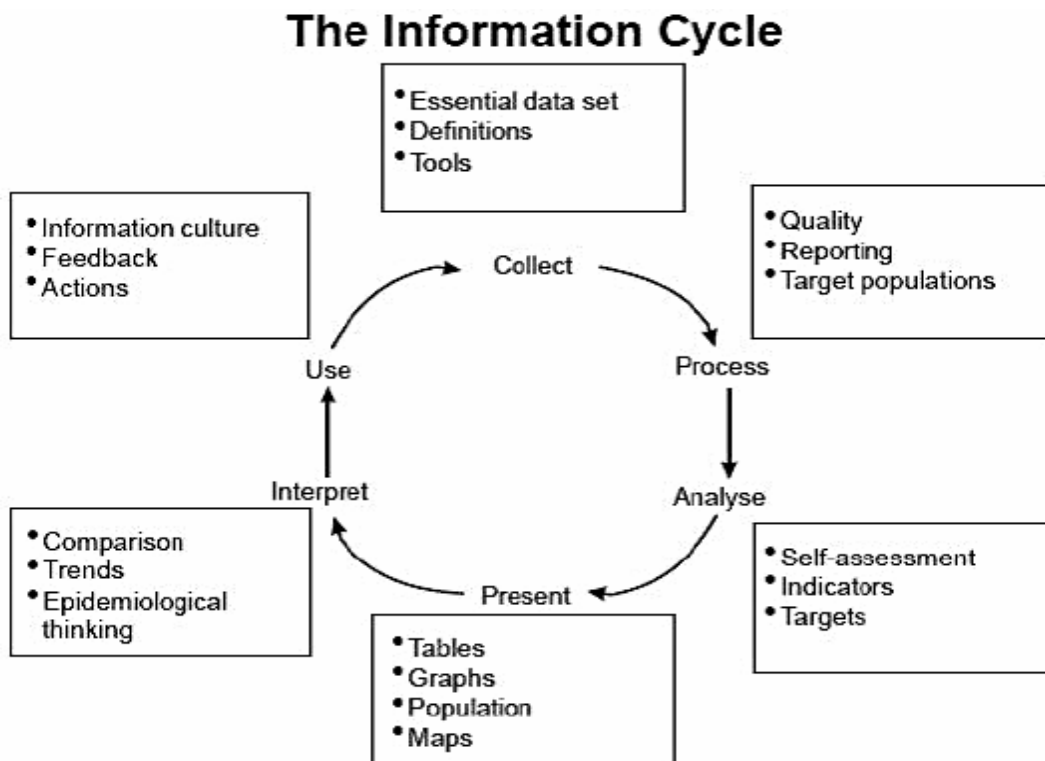


Figure 8: The Information Cycle

(Source: Heywood & Rohde, 2001:21)

➤ **Data Collection**

The data required for the health system is collected using a combination of routine methods and non-routine methods as shown in Figure 7. The routine methods collect activity data about special programmes, routine services, and epidemiological events as well as semi-permanent data about the administration and the population served while the non-routine methods include surveys, population censuses, and qualitative and quantitative rapid assessment methods (Heywood & Rohde, 2001; Lippeveld, 2000). For this thesis, the data collected and the information produced from the routine methods is what is of interest. Routine health information is defined as “*information that is derived at regular intervals of a year or less through mechanisms designed to meet predictable information needs.*” (RHINO cited by LaFond & Fields, 2003:20).

Routine data, being activity data, is collected during delivery of service be it in the community or at the health facility. Thus, the tools for data collection include patient record cards, tally sheets and registers and the task is a responsibility of anyone providing services to patients/clients ranging from community health workers to doctors in the hospital (Sauerborn and Lippeveld, 2000). According to previous research, in many developing countries including Malawi, there is generally a negative attitude associated with collecting data as it is seen as a burden whose main purpose is to provide statistics to higher levels of the health hierarchy (Chaulagai et al., 2005; Damitew and Gebreyesus, 2005; Mukama, 2003; Østmo, 2007; Sauerborn and Lippeveld, 2000). This attitude has been attributed to, among other reasons, severe staff shortages that lead to high workload, the irrelevance of the data collected for their tasks and the existence of duplication and unclear design of the tools. Therefore, in order to ensure that all routine data collected has purpose, it has been recommended that data collection should revolve around an essential dataset, which is a set of the most important data elements that should be reported routinely based on pre-identified minimum indicators for the health system (Heywood and Rohde, 2001; Shaw, 2005).

➤ **Data Processing**

The data collected needs to be processed as the next stage of transforming the raw data to information. This stage involves data aggregation; data cleaning through, for instance, visual

scanning (eyeballing); and data reporting (Heywood and Rohde, 2001). Data reporting/transmission can be in two forms: vertical data transmission, which focuses on transfer of data between the levels of the health system; and horizontal transmission, which looks at the transfer of data among users at the same level of the system (Bodart and Shrestha, 2000). The tools used for data processing range from being completely manual (paper-based) to electronic using computer software systems. In many developing countries such as Malawi, Mozambique and Tanzania, the case is usually that data is processed manually at the lower level of the health system and then electronically as it is transmitted to higher levels. Just like data collection, (manual) data processing is seen as yet a more cumbersome and time-consuming task and tends to be avoided by health workers (Mukama, 2003). The person responsible for data processing depends on how the management structure of the information system is organised i.e. whether there are vertical information systems for each programme, or an integrated general information system.

➤ **Data Analysis**

Analysis of the processed data is expected to involve at least the calculation of indicators which measure changes over time in the health system (Heywood and Rohde, 2001). The indicators are usually made up of a numerator and a denominator where the numerator is the count of the events that are being measured and the denominator is the group with which the numerators are compared. However, there are some indicators with just the number of events without a denominator and these are classified as count indicators. Other types of indicators are: Proportion Indicator where the numerator is contained in the denominator; Rate Indicators that show the frequency of the event in a specified time in a given population; and Ratio Indicators that have the numerator not included in the denominator (Heywood and Rohde, 2001). In developing countries such as Mozambique, calculation of indicators at the lower levels has been problematic and has been left to be done at district, provincial or national level (Lungo, 2003; Mukama, 2003). This has been attributed to the lack of denominator values at the facility level as the catchment population for a health facility is usually unknown, however in the case of Malawi, facility catchment areas have been demarcated and so the facility catchment populations are known. Nevertheless, in general, i.e. in most developing countries, the data analysis

responsibility is automatically associated with the person who processes the data (Galimoto, 2007).

There are various ways of classifying indicators depending on how they are used. The input-outcome spectrum classification distinguishes five classes of indicators (Bodart and Shrestha, 2000).

- Input indicators, which measure the resources needed to carry out the activities.
- Process indicators that monitor activities that are carried out.
- Output indicators measure the results of activities such as coverage and knowledge.
- Outcome indicators determine developmental long-term effects including changes in the health status.
- Determinant indicators refer to conditions that contribute to or are precursors of disease such as environmental conditions.

It is also possible to classify indicators according to programmes or activities i.e. with the indicators within the programmes categorized according to input-outcome spectrum. Indicators can also be classified as monitoring and evaluation indicators where monitoring indicators usually measure input and process while evaluation indicators measure output and impact. Overall, the need for different classes of indicators varies with the type of management at that level of the health system (Bodart and Shrestha, 2000).

➤ **Data Presentation**

After data analysis has been done, it is important that the information is presented to the relevant users and how it is presented is very important as it influences the use of information. The data can be presented mainly using tables or graphs that can easily be understood. It is the responsibility of the designated data processor to make sure he/she understands the information needs of different users and should therefore present relevant information to the potential users accordingly (Sauerborn, 2000).

➤ **Data Interpretation**

According to Heywood and Rohde (2001), interpretation of the information presented involves comparison to targets, to other geographical areas, to norms (program targets), comparison over time (i.e. identification of trends over a period of time), and epidemiological analysis of the indicators (i.e. proportions, rates, ratios, incidence and prevalence) and therefore appropriate interpretation of the information is the responsibility of the users. The authors perceive use of information to be there if decisions are made and actions are taken based on the information produced. However, the concept of information use in HIS has been discussed widely with different perspectives and these perspectives are explored in the next section (Heywood and Rohde, 2001).

It is important to note that it is indicated that even though the processes of analysis, presentation, interpretation and use have been separated in the cycle, they are closely related in practice and can be viewed more or less as a continuum (*ibid*).

It is also important to recognize that others have referred to the information process, particularly the sub-processes of processing, analysis and presentation as data management (Lungu, 2003; RHINO, 2006).

2.1.2. Use of Health Information

One of the implicit assumptions underlying information systems is that good data, once available, will be transformed into useful information, which in turn will influence decisions; and that such information-based decisions will lead to a more effective and appropriate use of resources (Sauerborn, 2000). Unfortunately the availability of high quality (relevant, reliable, timely) information does not guarantee its appropriate use in the decision making process and various authors claim that there is non-use or under-use of information in the health system of most developing countries (Chaulagai et al, 2005; Sauerborn, 2000; Muquingue et al., 2002). Østmo (2007) explains that this perspective that there is no use of information for decision-making is dominant in research on HIS, project reports and evaluation reports by stakeholders. However, what exactly is meant by “use of information “or better yet” appropriate use of information? One of the discussions from the RHINO (2003) workshop concluded that the term

“information use” is not easily defined which makes the assessment of information use also difficult. This explains why there are various perspectives and recommendations of what information use should encompass (RHINO, 2003).

In discussing the issue of use of routine information in health, emphasis has been placed on using the information to support system and health unit managerial functions such as planning and resource management (Galimoto, 2007). In a guide for assessing the HIS in South Africa, Gouws (s.a.) states that use of information should be demonstrable and there should be a written account of information use. It is proposed that there should be action plans developed for selected indicators in order to improve the indicator. In the same light, Campbell (2003) talks about using health information to make informed decisions and these decisions should be put into “actionable recommendations”, which include clear specification of the action to be taken, by whom, by when, and with what resources. To understand how informed decisions come about, it is important to understand the decision making process and this is discussed in the subsection that follows. But continuing looking at other possible ‘demonstrable actions’ of information use, Heywood and Rohde (2001) mention feedback as one mechanism to promote and ensure that actions are taken based on the information and so provision of feedback is considered evidence of use of information. This feedback can be in written form ranging from simple tables of the data that was reported to reports containing graphs showing and comparing indicator performance by facility, district or even region/zone. It can also be verbal feedback given during meetings or supervision (Heywood and Rohde, 2001).

There are also other researchers who have discussed use of information in a different view. For instance, Østmo (2007) and Jacucci et al. (2006) give evidence of the existence of use of routine information for patient management (e.g. in the wards) and for administration at health facilities in South Africa (Østmo, 2007; Jacucci et al., 2006).

Furthermore, researchers have also mentioned the importance of using information in relation to the concept of an information culture and sometimes with no clear definition of what they mean by information culture. Heywood and Rohde (2001:84) advocate that “information use is made easier if its use is ritualized and routines are set up as part of the information culture” and Chaulagai et al. (2005:9) highlights the need for support for strengthening the HMIS in Malawi

“until a culture of information is created in the entire health sector”. However, other researchers have explained their understanding of the information culture: for instance, Zheng (2005:3) defines information culture as “the general capability, views, norms and rules of behavior with regard to accessing, understanding and using information in a social collectivity”. Campbell (2003) explains that a “culture of information use” begins to evolve when the elements of an integrated HIS become normative practice, where the elements include data collection, self-assessment and peer review, HIS informed decision making, feedback and reporting (Campbell, 2003).

➤ **Decision Making**

A health information system measures its ultimate success by informed decisions that lead to action and positive change in the health system or health status rather than by the quality of data produced. These informed decisions are described as “those where there is evidence of HIS information being used to support the decision making process” (Campbell, 2003:10). However, little is known about how decisions are made at the various levels in the public health sector and most of what is known is borrowed from analysis of policy-making process derived from other sectors with the underlying assumption that the process of decision making is similar to that for policy making (Sauerborn, 2000).

Several models have been used to describe decision-making. The knowledge-driven model of decision-making by Van Lohuizen (Figure 9) and the classical model of decision-making by Lasswell (Figure 10) represent decision making as a process consisting of linear distinct steps (Sauerborn, 2000). However, it has been argued that in the real world decisions are not made in a linear logical fashion but rather in an iterative way because the phases overlap (*ibid.*). In addition, there are social and political dimensions that influence decision makers as shown in Figure 11.

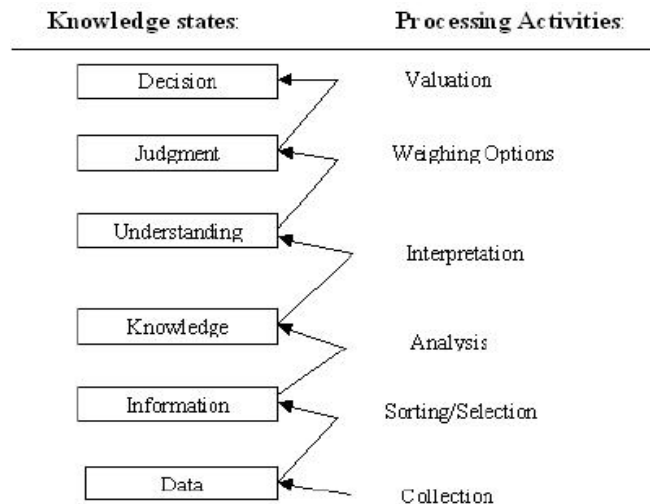


Figure 9: Knowledge-driven model of decision making

(Source: Sauerborn, 2000:35)



Figure 10: Lasswell's Classical Model of decision-making

(Source: Sauerborn, 2000:36)

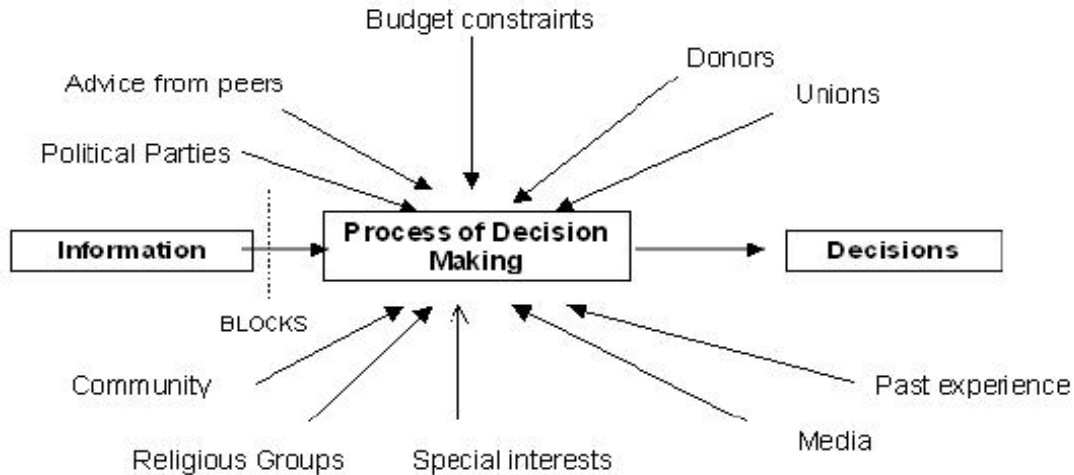


Figure 11: Factors influencing decision-makers

(Source: Sauerborn, 2000:37)

From Figure 11, it shows that information is just one of the many inputs of the decision making process and thus it is not surprising that decisions are made, even in the absence of reliable information because in practice, decision-making in health is mostly based on political opportunism, expediency or donor demand (AbouZahr & Boerma, 2005).

2.1.3 Factors influencing use of Information

According to Sauerborn (2000), several factors influence use of information and these are:

- Characteristics of the data in terms of relevance, reliability, level of detail (aggregation of data) and timeliness;
- Characteristics of the required decision;
- Organization or structural characteristics;
- Cultural differences between data people and decision-makers; and therefore
- Communication between these two groups.

Galimoto (2007) indicates that the characteristics of the data are a product of the design and implementation of some of the phases of the information cycle already discussed i.e. data collection and data management. For instance, the relevance and reliability is determined by the

design of data collection tools and by how the data has been processed (Galimoto, 2007:59). The WHO states that information will not be valuable unless it is accurate, relevant, timely, structured and presented in an easily useable form (World Health Organization, 2003).

The organizational characteristics in terms of whether it is privately owned or public also affect the use of information. Research indicates that private organizations tend to use information more than public ones because of the profit incentives involved (Sauerborn, 2000). In the public health sector, other issues related to organizational aspects of the public health system also affect use of information (Galimoto, 2007).

One of the implicit assumptions underlying information systems is that good data, once available, will be transformed into useful information, which in turn will influence decisions; and that such information-based decisions will lead to a more effective and appropriate use of resources (Sauerborn, 2000).

2.1.4 Health Information systems: social aspects

A health information system can be considered to be a combination of people, equipment and procedures organized to provide health information to health workers and the population it serves. It should have at least the following technical elements: *input* (data), *processing*, in which input data are transformed into output, and an *output* (information). It also includes a *storage* element, where data can be stored before and after processing (Ties, 1991; Mukama, 2003). Mukama (2003) however argues that, information systems cannot be understood independently of the people around them; their social relationships, their culture and the work practices that they are engaged in within everyday life. In order to gain a better understanding of information systems development, implementation and use, all work within a particular information system must involve a better understanding of how people work and what kind of organizational practices they are engaged in (Mukama, 2003:24).

An information system includes the social system, which in turn, has its own subsystems of people, business processes, social structure, and culture. The problems of development, implementation and use of information systems are well known and invariably they concern an interaction of human, organizational and technical factors, which cannot be separated. Therefore,

information systems should not be regarded as technical systems with behavioral implications but are better conceptualized as social systems in which technology is only one of the elements (Walsham *et al.*, 1988).

Working with data and information within the health information system involves filling in forms, tally sheets and registers, collating data into aggregated reports and statistics and the reporting of health data from low levels to higher levels of the health information system. These activities make up important aspects of most health workers' jobs. "The health information systems therefore tend to be deeply embedded in social work practices and are barely separable from social context of which they are part" (Braa *et al.*, 1999:2).

The key perspective on such health information reporting and information flows are that they provide opportunities to information system change. At the same time they reinforce existing social relationships between health workers at low levels and their managers at higher levels. Health workers at low levels view the data they are collecting as a tool for showing their managers what they do (Mukama, 2003).

The problems of information systems development, implementation and use are considered to be more severe in developing countries in terms of factors such as the current state of knowledge, availability of suitable tools and infrastructure, lack of financial resources, shortage of technically competent personnel and constraints imposed by the social and political context (Walsham *et al.*, 1988; Mukama, 2003). Health information systems are therefore complex systems and social systems as they tend to be deeply embedded in social working practices. Lippeveld and Sapirie advise a successful way of designing and implementing health information systems, by arguing that "the success of a health information systems reform depends not only on technical improvements but also on in depth understanding of political, socio-cultural, and administrative factors" (Lippeveld and Sapirie, 2000:249).

2.2 Decentralization of information management toward the district level

Lippeveld (2001) indicates that routine health information systems in most countries are centrally planned and managed. Indicators, data collection instruments, and reporting forms

usually have been designed by centrally located epidemiologists, statisticians, and administrators (called data people), with minimal involvement of lower-level line managers and providers of the health services (called action people) (Lippeveld, 2001:19).

Hutchinson (2002) further adds that recent experiences have shown that decentralization of information management toward the district level is an effective strategy to improve local use of health information in developing countries. Hutchinson (2002) further argues that however, there are some questions about the actual extent of decentralization in Tanzania. “By some indications, the extent of decentralization is quite modest, restricted to only a few administrative functions” (Hutchinson, 2002:5).

In a survey of District Health Management Teams (DHMTs) in Tanzania on the progress of the decentralization process in that country, it was reported that, ...while decentralization has been ongoing for over a decade, at least rhetorically, less than half of DHMTs report that decentralization is underway in their districts and the actual transfer of administrative and fiscal responsibilities is still limited for the majority of districts (Hutchinson, 2002:1).

It is expected that, in decentralized health information system most public health functions can be carried out by the DHMT, in collaboration with and with active involvement of the community. Thus, delegation of information systems management responsibilities to the district level becomes a major step towards integrating individual and community health information systems (Lippeveld, 2001; Mukama, 2003).

The importance and needs for appropriate decentralized district-based health information systems addressing the needs of local management and health workers has been widely acknowledged and emphasized by the World Health Organization (WHO). According to the WHO definition, *a district health system based on primary health care is a more or less self-contained segment of the national health system. It comprises first and foremost a well-defined population living within a clearly delineated administrative and geographical area. It includes all the relevant health care activities in the area, whether governmental or otherwise. It therefore consists of a large variety of interrelated elements that contribute to health in homes,*

schools, workplaces, communities, the health sector and related social and economic sectors. It includes self-care and all health care personnel and facilities, up to and including the hospital at the first referral level... (Mukama, 2003:34).

Lippeveld (2000) argues that however, substantially less agreement has been reached on exactly how to develop such systems. “The scientific literature on how to develop appropriate health information systems in support of basic health services is relative scanty, despite the general consensus that these systems should be restructured” (Lippeveld *et al.*, 2000:7).

In the discussion below, Braa *et al.* (2003) describes the experiential basis from a large and global project on the design and implementation of health information systems (HIS) in a number of developing countries. This project, which is known by the acronym HISP (Health Information Systems Project), was initiated in 1994 by researchers from Norway, the University of Western Cape and University of Cape Town as an action research HIS project in post-apartheid South Africa (Braa *et al.*, 2003; Mukama, 2003). With its inspiration drawn from the “Scandinavian action research” tradition coupled with the fervor of the South African freedom struggle, the aim of HISP was primarily to empower the new and emerging local health management structures and health workers through improved and locally based information systems (Braa *et al.* 2003:6).

Braa *et al.* (2003) further argues that the status and inefficiency of most existing HIS in developing countries are linked to the structural weakness of the health system and lack of integration of the overall health system: Braa *et al.* (2003) further gives an example of a complex settings of primary health care in developing countries, changes are not possible to be conceptualized or implemented through simple cause and effect models, but need to take into account the various “networks of interdependencies,” some of which can be mutually self-negating. For example, donor funded vertical health programs on e.g. HIV/AIDS, family planning, tuberculosis, build their own top-down structures (‘empires’) and standards for collecting data from the local health unit level, making integration of IS and action at local (district) level, which they all have as a major target, more difficult to come by (Braa *et al.*, 2003:17-18).

According to Braa *et al.* (2003), HISP addresses the problems of fragmentation and multiple data standards, information systems, and organizational structures existing side by side, by focusing systems development activities on the local level, while simultaneously attempting to gain support from the higher levels (Braa *et al.*, 2003).

2.3 Information Technology (IT) and Information Systems (IS)

The terms IT and IS have been used by various researchers over the years. Heeks (1998) defines IT and IS as follows: “*Information technology (IT)* is computing and telecommunications technologies that provide automatic means of handling information. IT is therefore taken here to represent equipment: both the tangible hardware and the intangible software. *Information systems (IS)* are systems of human and technical components that accept, store, process, output, and transmit information. Information systems may be based on any combination of human endeavors, paper-based methods and IT” (Heeks, 1998:5). This emphasizes that IS are not just technical systems, but represent also a larger network of people, practices, and organizations (Lungu, 2003:11).

In health information systems, when discussing information technologies (IT), usually the discussion is about the use of computers in health information systems. Wilson and Smith (1991 cited Wilson 2000) suggest that, “the creative use of microcomputer technology is one of the most promising means of improving the quality, timeliness, clarity, presentation, and use of relevant information for primary health care” (Wilson, 2000:199). Recent experience (Braa and C. Hedberg 2002; Wilson 2000; Wilson *et al.* 2001) attests to the potential for using computers in health information systems. However, Wilson (2000) gives a warning that, “it is important to ensure that; computerization of health information systems does not dominate the health information system reform improvement process” (Wilson, 2000:199). This is because the majority of health information users in developing countries have no access to computer technology, thus the development and improvement of manual systems for collection, analysis, and use of data should be the primary focus (Lungu, 2003:12).

2.4 Information and Communication Technology (ICT)

Saugene (2005) defines Information and Communication Technology (ICT) as the convergence of electronics, computing, and telecommunications. Saugene (2005) further argues that this convergence has helped to unleash a tidal wave of technological innovation in the collection, storage, processing, transmission, and presentation of information. This convergence helps to provide more rapid and efficient mechanisms for responding to shifts in demand patterns and changes in international settings through more efficient production processes and new and improved products and services (Saugene, 2005:35).

2.4.1. ICT in Organizations

The survival and growth of organizations in increasingly turbulent contemporary environments depends upon effective utilization of ICT for aligning the organizational structure with environmental changes. How ICTs can help organizations in responding to the challenges of effectively harnessing ICTs, to achieve flexible organizational structures are key ongoing challenges for developing countries like Malawi (Sahay & Avgerou, 2002; Saugene, 2005).

ICT can play a substantial role in the following major areas:

- improving access to services;
- strengthening the basis for decision-making;
- promoting information exchange among users; and,
- Enhancing the effectiveness of institutions.

For example, quality in health care delivery is largely dependent on the availability of and access to information, which directly contributes to the capacity building of the service providers and increases the awareness and thereby the health seeking behavior of the community. Thus, the use of ICT can help reduce disparities between the services available in urban and rural areas and reduce the costs involved in transporting patients to urban facilities (Saugene, 2005:36).

Saugene (2005) also suggested that because an effective information dissemination system enhances the participation among the stakeholders more than an application, ICT is fundamental to enhancing knowledge, and communicating for better health. ICT itself does not do anything useful; in order to realize any gains, it must become part of an information system. As Heecks

has argued, it is important to emphasize that these technologies only provide new mechanisms for handling an already existing resource: information. Therefore, to understand ICTs, one must first understand information practices and needs (Heeks, 1999; Saugene, 2005:36).

Information management skills rely on the ability to make choices about the optimal arrangements for particular situations. Unlike earlier generations of technology, ICT offers not a single “best” way of organizing, but rather represents a set of more or less appropriate alternative organizing, staffing, and managing options that may be adopted in different organizational contexts (Saugene, 2005).

Thus, following Heeks arguments, ICTs cannot be understood without analyzing information. Developing an enterprise system requires information about several different things. For example, this means information relating to *supply*, such as the availability and sources of finance, labor, technology, raw materials, and other enterprise inputs. Information is also required about *demand*, including market opportunities and its characteristics such as issues related to location, price, size, and quality. Information is also needed about *other environmental factors*, like competitors, laws, etc (Heeks, 1999; Saugene, 2005).

2.4.2. ICT in Developing Countries

Saugene (2005) argues that, many researchers see ICT as a powerful new opportunity for at least some developing countries to improve their competitive position in certain fields and to foster their development precisely because of their relative lack of established infrastructure. However, often, the focus is placed entirely on the technology, and not enough on the information and practices surrounding it that are required to make their ICTs deliver effective outputs (Saugene, 2005:38).

Saugene (2005) further argues that for instance, in Mozambique, banks, public and private institutions and the government are currently engaged in introducing ICT in order to improve their services. Saugene (2005) further cites examples shown by Mosse and Sahay (2003), related to ICT in health where they argue that “Mozambique has been attempting to introduce ICTs in various sectors to promote socio-economic development” (Mosse & Sahay, 2003). This is also supported by Macome, when she talks about ICT projects in rural communities, the “Telecentre Project”, which is the first experience of its kind in Mozambique (Macome, 2003).

Although the socio-economic structure of many developing countries are not flexible on handling organizational or institutional changes, the complex interrelations between these changes and information technology have significant implications for the way ICT does and will affect the societies and economies of these countries (Saugene, 2005).

The main issue facing developing countries is thus not so much the access to a particular technology, but dealing with the challenges relating to the processes of technological change and the human and social factors that need to be adapted to these processes. Also, the introduction of ICTs requires certain new skills of design, maintenance, and management, as well as complementary infrastructural facilities such as reliable telephone systems, power supplies, and physical infrastructure like roads and transport. Deficiencies in these factors prevent the widespread adoption of information technology in developing countries. Quality of data too, requires an adequate level of skill, infrastructure, and managerial know-how that is generally lacking in developing countries (Saugene, 2005:38).

These constraints on ICT development in developing countries have been well documented by researchers. For example, Mosse and Sahay, in relation to the introduction of ICT in the health sector, argue that these ICT initiatives take place in a context that is historically and culturally shaped; the socio-cultural structures are reflected in patterns of how work is currently done (Mosse & Sahay, 2003). NORAD recognizes the challenges posed by ICT in development contexts and acknowledges the increasing digital gap between the rich and the poor parts of the world. In May 2000 a working group submitted a report entitled "Bridging the digital divide – challenges and opportunities for NORAD and its development partners". In the light of the report NORAD decided to integrate ICT into development cooperation in order to combat poverty more effectively (NORAD, 2002; Saugene, 2005).

2.4.3. ICT's support for Health Information System in developing countries.

Wilson *et al.*, define Health Information System as a set of tools and procedures that a health programme uses to collect, process, transmit, and use data for monitoring, evaluating and controlling the health system (Wilson, Rohde, Puchert, & Hedberg, 2001).

Saugene (2005) argues that health management is a pre-requisite for effective health services, and can potentially be improved by better HIS. However, HIS in developing countries face diverse problems such as resource (human and infrastructure) constraints, poor information,

multiplicity of programs, and donor dependence (Saugene, 2005). Lippeveld and Sapirie (2000) also argue that, most developing countries have routine (paper-based) HISs in place to collect and report data; these are seen largely inadequate and ineffective to support health care (Lippeveld & Sapirie, 2000).

Braa *et al.*, argues that, HIS in developing countries tend to be data-led where data is seen an end in itself, rather than being action-led, with a focus on how collected information will inform decision and action (Braa, Monteiro, & Sahay, 2004).

Saugene (2005) further argues that ICT has the potential to change the delivery of health care services and patient care, and the management of the health care system around the world. Technologies and applications are changing at ever increasing speeds and so are the dynamics of the process surrounding the implementation of e-health technologies and applications. Some important areas of applications concern accelerating patient access to new and promising technology. As a result, most developing countries are attempting to strengthen and computerize their HISs but most of them have to date yielded unsatisfactory results. This is because the implementation of HIS in developing countries is a complex and very challenging task, as the process demands not only a technology transfer, but also the introduction of a different kind of culture that accompanies the system. In addition, public health setting in developing countries is a complex environment, characterized by the existence of different donors, different levels of organization, and use of top-down approaches for decision-making (Saugene, 2005:42).

Basically, there are two things to help make HIS work effectively in challenging developing countries contexts. The first one concerns sustainability, which refers to how the HIS can work in practice, over time and in a local setting. This involves shaping and adapting the systems to a given context, cultivating local learning processes and institutionalizing routines of use that persist over time. The other challenge refers to scalability which concerns the problem of how to make one working solution spread to other sites, and be successfully adapted there (Braa *et al.*, 2004; Saugene, 2005). To support the sustainability and scalability of health information systems; it is of vital importance to generate local, self-sufficient learning processes together with working mechanisms for the distribution of appropriately formatted experiences across sites. It is also emphasized that interventions must be aligned with the surrounding configurations of existing institutions, competing projects and efforts, as well as with every day

practices. In relation to the introduction of ICT in health sector in Mozambique, Mosse and Sahay (2003) advocate that historical and cultural practices and socio-cultural structures are reflected in patterns of how work is currently done.

However, the adoption of ICT in the health sector in developing countries will continue to face challenges from weak infrastructure and resources and resistance unless issues such as lack of awareness are successfully addressed. The barriers with regard to technology, regulatory frameworks, financial requirements and socio-cultural issues need to be addressed. These challenges require a concerted national framework that pools knowledge together, community, district and/or province networks of centres of excellence and a national coordination mechanism. As a way to bring these opportunities to the health environment, there are complexities that must be taken into account. This includes dealing with socio-economic, cultural and political issues (Saugene, 2005).

2.5. Health Management Information Systems (HMIS)

The implementation of routine health information systems in developing countries is widely seen as critical for improving the quality of health services. By providing the management of the health sector with timely and accurate data, for instance, resources can be allocated more effectively and epidemics can be monitored and appropriately addressed (Lippeveld et al., 2000; AbouZahr and Boerma, 2005). Further more Stansfield et al. (2006) stresses that among other things, health information is required for strategic planning and the setting of priorities; clinical diagnosis and management of illness or injury; quality assurance and quality improvement for health services; and human resource management (Stansfield et al., 2006).

Health management information systems can enable proper management of health information and efficient allocation of scarce resource required to improve healthcare, in several ways. By using health management information systems with a geographical information component, for example, district health offices in Malawi know their catchment areas and the spatial distribution of the population to be served (Chaulagai et al., 2005; Manda, 2009). Manda (2009) further says that such type of knowledge of using geographical information system is vital in the visual monitoring of health services coverage, organizing outreach clinics and planning community health development activities (Manda, 2009). Health management information systems are also important for the evaluation of programs from both the perspectives of effectiveness and

coverage (Azubuike and Ehiri, 1999). Furthermore, at district and national levels, the aggregation of data from various health facilities makes the comparison of key health indicators between different geographic areas, possible (Manda, 2009).

2.5.1. Problems with currently existing HMIS

Developing countries, generally, have a poor track record as concerns the planning and management of ICT projects (Gichoya, 2005). The implication of this is that even though health management information systems hold so much promise with respect to healthcare development, most of the health management information systems in Africa are not working effectively (Gething et al., 2006; Manda, 2009). A multitude of political, cultural, social and technological factors have negatively impacted on the effective use of health management information systems in Africa. There are a multitude of bottlenecks related to ICT implementation that include the top-down, centralized, and fragmented character of design and services (Kimaro and Nhampossa, 2005). Other additional factors include users' perception of information as a burden; inadequate access to information; poor preparation of data for use; weak analysis of data; some information bypassing decision makers; poor capacity for decision making; low initiative for using data; inability of central health management information system units to contribute effectively (Smith et al., 2008); and aiming the presentation of epidemiological data at specialists and other experts without regard to other stakeholders (Health-Metrics-Network, 2007).

Furthermore, Manda (2009) argues that heavy reliance on external donors to fund health initiatives, in general, and health information systems implementation, in particular, weakens health information systems in developing countries. Usually, external donors focus their efforts on specific program areas and impose their own information reporting needs (Manda, 2009). This, then, creates vertical program-specific information systems that exist parallel to government reporting structures, thereby giving rise to health information systems fragmentation (Galimoto, 2007; Aanestad et al., 2007; Manda, 2009). Historically, health information systems that hugely depend on donor funding have not been sustainable due to the short-term nature of funding, inability to mobilize national support, and the lack of focus on building local competencies to handle these systems. Without the availability of appropriate local capacity it is rather difficult to translate an organization's ever changing needs into an effective health

information system, which in turn contributing to unsustainable systems (Kimaro and Nhampossa, 2005; Manda, 2009).

Besides these problems, another huge stabling block to successful ICT projects implementation is usually the poor state of ICT infrastructure in developing countries (Dada, 2006). This coupled with unreliable physical (e.g., roads, power supply, and transportation) and communication infrastructure contributes to the underperformance of health management information systems in developing countries (Kimaro and Nhampossa, 2005).

2.5.2. Poor infrastructure and its implications on HMIS

Poor infrastructure negatively influences coordination and information sharing (Kimaro and Nhampossa, 2005; Manda, 2009). In Malawi, most health programs run paper based systems and have to manually aggregate data when formulating reports. Poor network infrastructure at district level also makes it hard to widen access to the country's central health management information system (Galimoto, 2007). These problems, therefore, usually make face-to-face meetings necessary for people to report and access centrally located data. However, during the rainy season travelling to various places to report or access data is bound to be problematic, as most of Malawi's roads are in poor condition and roads in rural areas are often impassable for up to four months in a year (Banda, 2008). This, then, makes data sharing difficult (Manda, 2009).

Considering that adequate and timely availability of health information is crucial towards managing and improving healthcare (Stansfield et al., 2006; Lippeveld et al., 2000; Manda, 2009), lack of adequate access to health information at the point of care, and poor communication are more likely bound to lead to errors and negatively impact patient care (Mendonça et al., 2004). Manda (2009) suggested that these difficulties can, however, be mitigated through the use of mobile solutions to enable hospital or clinical workers, or community healthcare practitioners stay in constant communication and remotely report or access information (Manda, 2009). Furthermore, mobile solutions also allow employment hours to be more flexible and extend beyond designated office hours (Archer, 2005; Manda, 2009).

2.6. Mobile technologies for health

The exploration of novel information-based approaches can help improve communication and ensure access to information at the point of decision-making (Mendonça et al., 2004). Currently, in developing countries, mobile phones are being used by a broader segment of the population than computers and mobile telephony is the dominant means of communication (Rashid and Elder, 2009). Mobile phones and their corresponding infrastructure and services, like voice communication, SMS and mobile Internet, are increasingly being used to permit data transfer and coordination. In addition, mobile phones are a more accessible and affordable means to close the digital divide between developed and developing countries (Rashid and Elder, 2009; Manda, 2009).

Mobile phones, for example, can help in addressing the critical gap that exists in the reporting speed and quality of data between healthcare providers and centrally located managers, in developing countries (Ibrahim et al., 2007). In addition to this, although the cost of mobile phones is still an issue and income remains the major barrier for adoption, mobile phones are, over time, becoming increasingly less costly, thereby allowing a wider group of people to own the technology (Rashid and Elder, 2009).

To underscore the ubiquity and relevance of mobile phones, half the world's more than 6.5 billion people now use mobile phones and there are more than twice as many mobile phone owners in developing countries as in industrialized countries (Heeks and Jagun, 2007). To their users, the use of mobile phones enables people to do better what they already do and also grants them new ways to access services and support livelihoods (Heeks and Jagun, 2007; Manda, 2009). Heeks and Jagun put forward the following important benefits of using mobile phones:

Mobility

- By providing communications on the move, mobile phones enable people to engage in development activities that previously would not have been possible.

Multi-functionality

- Mobile phones open up other windows of opportunity to users. Now many of the world's poor communities have access not just to a phone but to a camera, calculator, audio player, video player, etc.
- By using General Packet Radio Service (GPRS) technology, mobile networks are now a potentially viable way to deliver Internet services, and avoid costly and protracted fixed line models.

Cross-functionality

- Mobile phones bring together services that cross existing boundaries. For instance, by allowing airtime to be used as currency, they provide an overlap between telecommunications and finance.

The above listed benefits show that mobile phones can be used in a wide set of application areas (Manda, 2009).

2.6.1. Current use of mobile phones in the health sector

The growth of mobile phone GSM communication is resulting in the emergence of new telecommunication backbone networks in Sub-Saharan Africa (Engvall and Hesselmark, 2007). Through mobile phones, the first digital information and communication technologies (ICTs) have reached poor households and communities (Heeks and Jagun, 2007; Manda, 2009).

Some previous studies on the application of mobile phones in healthcare have focused on mobile phone-based wearable vital signs monitoring systems (Chen et al., 2005; Holopainen et al., 2007; Manda, 2009). Here, mobile phones have been used as a bridge between portable health status measuring tools and larger information systems, to promote personalized healthcare (Holopainen et al., 2007). Halopainen et al. (2007), for example, present Health Gateway, a modularized system using a mobile phone client to capture patient health status data. The system captures data on blood pressure, blood coagulation and body weight, from measuring instruments and then relaying it to a remote information system for intervention by a care giver (Holopainen et al., 2007).

Further to this, other studies have included the use of mobile phones in a wide number of application areas, which include: reminding patients to take their TB medication at pre-

determined times (Hüsler, 2005), tracking the daily exercise activities of people (Anderson et al., 2007), and improvement of maternal and child health in Egypt (Mechael, 2005).

In addition to all this, some studies have also covered the use of mobile phones in data gathering and reporting to aid decision making and resources allocation in health programs. In Rwanda, for example, mobile phones are being used by health workers to collect and report health data during field visits (GSMA Development- Fund, 2007; Manda, 2009).

2.7. Health Information System's fragmentation

According to AbouZahr & Boerma (2005) the local level health facility need information for effective clinical management and assessment of health care delivery services to meet the needs and demands of individuals and communities. At the district level, health information enables health planners and managers to make informed decisions on effective functioning of health facilities and the health system as a whole. Health information requirement at higher levels is for strategic policy-making and resource allocation. The focus of this research study is at the district level where health information requirement is for management planning and decision-making.

According to National Health System Resource Centre (NHSRC) (2010), HMIS aims to bring about architectural corrections, among others, in health systems as a whole. In the HMIS context, architectural corrections are seen as implying the following dimensions:

- Integration of various existing HIS;
- Decentralization at the district level, by allowing local health service providers to use the information, not only to send reports to the levels above, but to support their own local everyday action;
- Flexibility by supporting a hierarchy of information needs, where different stakeholders have the capacity and ability to customize the system to their own needs;

Following the recommendation by NHSRC above, HIS integration is central to effective data management at the district level which is the hub of health services delivery (Nyella, 2007). Without data integration the above dimensions' achievement will be with challenges. A unified view of the HIS will enable effective centralization where all reports are derived from a central

database with accurate and timely information that will be seamlessly accessed by all health program managers (Bowersox, et al., 2007). Flexibility in system customization can be effective when the customized system is linked to the central database to enable accurate data capture and timely linking of all related data in the system. Otherwise if there is no integration, the various systems will produce individualized reports, unrelated to the other systems which are prone to error, and therefore can not be used to make independent informed decisions without the other individual reports. Cost-effectiveness can only be achieved when resources are shared in the system and that there is no redundancy data entry at any point in the organization (Ibid).

CHAPTER 3

RESEARCH DESIGN AND METHODOLOGY

3.1. Research Strategy

Myers (1997) defines a research method as a strategy of inquiry which moves from the underlying philosophical assumptions to research design and data collection. Several qualitative research methods such as action research, case study, ethnography and grounded theory are used in conducting IS research. Myers (1997) states that the choice of a specific qualitative research method is independent of the underlying philosophical position adopted e.g., a case study could be positivist, interpretive or critical. However, Oates (2006) argues that ethnographies and case studies are strongly associated with the interpretive paradigm but action research can be in any of the three paradigms.

On the other hand, ethnographies set out to understand how a particular group of people perceives its world, concentrating on social constructs such as language, symbols and organization structures (Oates, 2006). Furthermore, the ethnographers recognize that their own background, beliefs and actions inevitably shape the research process and affect the situation and thus their report includes a discussion of their self and how they may have shaped what was observed and how they interpreted it (Galimoto, 2007).

3.1.1. Study Sample/Sites

Case studies are similar to ethnographies as they provide an account of what occurs in a social setting. Yin (2003) defines a case study as *“an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”*. Myers (1997) argues that the case study research method is particularly well suited to IS research, since the object of the discipline is the study of information systems in organizations, and interest has shifted to organizational rather than technical issues. The main difference between case studies and ethnographies is the extent to which the researcher immerses himself/herself in the life of the social group under study (Myers, 1999). In a case study, the primary source of data is interviews, supplemented by documentary evidence such as annual reports, meeting minutes

while in ethnography, data is also collected through participant observation and it usually requires the researcher to spend a long period of time in the “field” (*ibid*).

In this research, both case study and ethnography methods were adopted to assess the information flow and feedback in health information systems/health management information systems in Malawi. The case study method was particularly considered more appropriate than ethnographies considering the time factor; the ethnographies require a reasonably long period in the field while a maximum time allocated for the study was six months.

This research adopted two types of case study approaches at various stages of the study. Partly, the case study adopted a holistic approach in order to obtain a broad overall understanding of the HIS/HMIS to know how the system operates (and/or how it is supposed to operate). Therefore, this approach particularly involved collecting data at the district and facility levels of the health system.

However, bearing in mind that within this holistic view, the health system is further divided into multiple units in form of districts, the study therefore adopted an embedded case study design where three districts were chosen within the holistic single case. Thus a comparative case study approach was used to investigate on the HIS/HMIS at the district level and this approach was chosen because as Yin (2003) states, the results are more compelling and provide room for generalisation as compared to a single case study.

The three districts chosen were Blantyre, Zomba and Lilongwe and the selection of these districts was done with assistance and guidance from Research Supervisors and the Ministry of Health, and was also based on the performance of the districts, physical accessibility, and financial constraints. All districts chosen are typical rural/urban areas and this was done to avoid the complexity in urban settings resulting from existence of central hospitals and numerous private health centres. Furthermore, the majority of the Malawian population is in the rural areas and that is where Primary Health Care efforts are central and crucial.

Blantyre was selected because according to the Ministry, this was one of the best performing districts nationwide in relation to HMIS activities and this was particularly attributed to the fact that this was one of eight districts being supported by MSH, which has one of its main areas of focus to be strengthening of the HMIS. Additionally, the MSH was also working towards eliminating parallel program reporting by piloting (in this district) on a monthly reporting system of HMIS from the facilities to the district and this was particularly interesting to my topic of study of information flow and feedback in HIS. However, the pilot reporting system project did not have any impact on my study or research findings because it was discovered in the course of the study that this piloting was not operational on the ground as facilities were mainly only reporting on quarterly basis. This District was also chosen because the researcher was staying in the same district and it was easier for the researcher to cut down transport expenses.

Zomba was selected as the other district for the study because it was one of the districts that have a lot of health activities taking place e.g. at Mwandama millennium village. Thondwe health facility was particularly chosen because of its easily accessibility since it is located near the road to Zomba. This district also supports HMIS reporting from its health facilities. Furthermore, considering financial factors, the district was convenient as it is about 60 km from Blantyre through a good road and is accessible by public transport and therefore would provide the researcher with an opportunity to cut down on accommodation expenses as the researcher could live with the family in Blantyre and yet still have easy access to the field study site.

Lilongwe was selected as the other district for the study through the assistance of three G8 University of Oslo PhD Students who were also carrying out a research on “how the use of Mobile Phones with District Health Information Software 2 (DHIS 2) can enhance routine services reporting (information flow and feedback) in HIS/HMIS in Malawi” in the same district. The researcher took advantage of this group since the researcher was chosen to be among them and this group was fully sponsored. In this district, the research took place at Area 25 and Kabudula health areas with Lilongwe DHO. These areas were chosen as pilot

case study areas for this research project with guidance from Ministry of Health and DHO officials.

3.1.2. Sampling Techniques

As regards to fieldwork, selection of interviewees was determined by other responsible people in the fieldwork settings (for example, hospital directors and facility in-charges); the researcher tried to retain the possibility to choose candidates for interviews.

However, gaining access to interviewees was quite complex, as difficult as gaining access to the setting, requiring negotiation with the health directors in each particular health facility before contact with the health workers for interview. Each interview took about 40 to 50 minutes.

Investigation was done at facility level and at district hospital office, to understand how the information system worked on the ground and this involved interviews of the health workers at the DHO especially the Statisticians, District Environmental Health Officers, Integrated Disease Surveillance and Response (IDSR) Officers, District Nursing Officers (DNO) who were involved in data collection, aggregation, reporting, analysis, sending data to higher levels and use of information. Additionally interviews were also conducted at several facilities as indicated in Table 1. At the facility level interview targeted HMIS Officers/Clerks, Senior Environmental Health Surveillance Assistants (SEHSAs), Assistant Environmental Health Officers (AEHOs), Facility Officer In-charges, Facility Community Health Nurses (purposive random sampling) and on average about three interviewees were selected per study site. These individuals were targeted because they are the ones who collect, store, aggregate, analyze, use and also send data to higher levels (reporting) and also receive feedback for the information they sent. These individuals can easily identify challenges and opportunities of information flows and feedback in health information systems (HMIS) in Malawi.

Table 1: Time frame for empirical data collection

Period	Activity and Location
3 rd July 2011 – 1 st August 2011	Processing research approval at the MoH in Lilongwe
6 th September 2011 – 9 th September 2011	Data collection at Blantyre DHO and Ndirande Health Facility.
14 th October 2011 – 18 th October 2011	Data collection at Zomba DHO and Thondwe Health Facility.
25 th October 2011 – 15 th December 2011	Data collection at Lilongwe DHO and Kawale, Area 18, Area 25, Ngoni, Mbang’ombe, Lumbadzi, Kabudula and Khongoni Health Facilities.
7 th December 2011	Conducted training on Mobile Phone – based Routine Health Facility Data Reporting at Kabudula Health Area in Lilongwe DHO.

3.2. Data Collection

There are many methods of data collection in research strategy, some of which include interviews, and self-completion questionnaires (Thomas, 2004). This study adopted semi-structured interviews, observations, questionnaire administration, system and documentation reviews and analysis as methods of data collection. A comprehensive record of every procedure was undertaken in the field and every detail was kept. A field log was kept where actual time spent was recorded and notes transcribed and analyzed accordingly.

The information presented in this thesis was collected through a combination of the fieldwork and document review. Document review was conducted prior to, during and after fieldwork. The fieldwork information is considered as a primary source of information, while the document review is considered as a secondary source of information in this research. The document review and the findings from the fieldwork together make up the foundation for the analysis and

discussion in this thesis. At all the study sites; questionnaires were administered, carried out semi-structured interviews and observations and system document review.

Before the empirical data collection could start, appropriate approval was obtained from the Ministry of Health through the Health Management Information Unit (HMIU) to gain ethical approval to conduct the research. The empirical field study lasted for a period of 4 months from September to December 2011. Table 1 show more details on where and how the time was spent during data collection period. Sections 3.2.1 to 3.2.5 provide more details on how the empirical data collection exercise was carried out.

3.2.1. Semi – structured Interviews

Interviews were conducted with different health workers in health facilities and district health offices aiming at understanding an individual health worker's or a group of health workers' perspectives on primary health care data collection, storage, use, information flow and feedback as well as their suggestions to improve on the current procedures.

Semi-structured interviewing was used; whereby each respondent was asked a series of pre-established questions (*see the interview questions guide in Appendix A*). Elaboration was provided if a question was not clearly understood and further explanation was also done. This provided information in the words of health workers in health facilities and district health offices about their experiences, opinions, feelings, and the procedures used in primary health care data collection, storage, use, information flows and feedback.

Table 2 shows number of interview respondents and their respective workplaces and Data Collection Information Sheet was filled to keep track of the respondents. The interviews conducted were mainly in English but some other respondents preferred to use Chichewa, which therefore required the researcher's immediate translation. The interviews were conducted at the interviewees' respective workplaces such as their offices, the wards, the consultation rooms, or even at an open place.

Table 2: Number of Interview Respondents

Interviews conducted	Place of Interview and positions of Officers	Number of Respondents
Alone	Blantyre DHO (DEHO, DNO, Statistician & IDSR Officer)	4
	Ndirande Health Facility (CO, Nurse, HMIS clerk, ART Clerk & SHSA)	5
	Zomba DHO (DEHO, Statistician and DNO)	3
	Thondwe Health Facility (CO, Nurse & SHSA)	3
With Colleagues	Lilongwe DHO (DEHO, Statistician and DNO)	3
	Ngoni Health Facility (MA, HMIS Clerk & AEHO)	3
	Mbang'ombe Health Facility (MA, Nurse & SHSA)	3
	Kawale Health Facility (CO and AEHO)	2
	Area 25 Health Facility (CO and SHSA)	2
	Lumbadzi Health Facility (CO, Nurse and HMIS Clerk)	3
	Kabudula Health Facility (AEHO and HMIS Clerk)	2
	Khongoni Health Facility (MA and HMIS Clerk/SHSA)	2
Total Number of Respondents		35

Note: DEHO (District Environmental Health Officer), DNO (District Nursing Officer), IDSR (Integrated Disease Surveillance and Response), CO (Clinical Officer), MA (Medical Assistant), SHSA (Senior Health Surveillance Assistant), HMIS (Health Management Information System), AEHO (Assistant Environmental Health Officer), ART (Anti-Retroviral Therapy).

3.2.2. Documentation Analysis

Document analysis was the first method to be applied in order to acquire an understanding of the methods that are applied in the applicable health information systems e.g. DHIS 2, including a coherence of the methods with health sector principles, and the likely gaps in information availability relative to the established information needs of the operational environment, that is the district level. Document analysis also assisted with the formulation of discussion questions for different key respondents, and with the identification of key respondents which were interviewed.

The documents analyzed were health articles on the use of information systems, feedback, health policies, registers, ethical issues, meeting presentations, minutes and report forms for e.g. HMIS review meetings, HMIS guidelines and manuals, Policy documents such as National HIS policy and strategy, etc. Documentation on HMIS usability was also reviewed. An integrated compilation of all the documents at the DHO and Health Facilities together with the literature review from the Internet and other sources assisted in collecting the right data.

The national guidelines and manuals, policy documents and other official documents also informed the research on how the system was supposed to work in general.

Registers, Forms and HMIS reports (monthly, quarterly and yearly) (See Appendix B) assisted to know what type of data is collected, analyzed, used and sent to the required authorities, how this data is sent and if feedback for the sent data is being received.

3.2.3. Participant Observation

Observations are important in qualitative research as they allow the researcher to see what the people are doing as well as what they say they are doing (Myers, 1999).

In an effort to obtain a better picture of what was discovered from other sources, participant observation was used whenever possible. One such observation was an HSA for one catchment area under Khongoni Health Facility in Kabudula Health Area under Lilongwe DHO while he was administering Vitamin A and Abendazole vaccines to under five children and at the same time he was recording in his data collection form. After data collection from his catchment area, the HSA travels on foot or cycles for about 10km to deliver his report to Khongoni Health Facility and at Khongoni, the HMIS officer compiles the monthly/quarterly report which is delivered to the Statistician at Lilongwe DHO about 60km away by private transport which becomes expensive during the rainy season because the roads become impassable.

Also participated and observed training on Mobile Phone-based Routine Health Facility data reporting together with colleagues from University of Oslo. This training was conducted at Kabudula Health Area under Lilongwe DHO. The main aim of the training was to teach HMIS officers and IDSR officers for all Health Facilities under Kabudula Health Area to report HMIS and IDSR data through the software (DHIS2) which is installed in the cell phone and the cell phone has all HMIS and IDSR reporting forms already designed and will just be filled and saved. Once saved, then these reports are automatically available on a DHIS2 server which is centrally positioned to be accessed by Statisticians or IDSR officers or any other responsible person given access rights to this server. This training and initiative was very important for this research because information would easily flow from Health Facilities to DHO as a result feedback would also be given in time.

3.2.4. Fieldwork Documentation

During the interviews and observations, data was collected mainly through note taking and questionnaire filling by respondents. Most of the interviews carried out in Lilongwe DHO used Tape recordings because all the participants were comfortable with it. Pictures were also taken of various types of documents and interview sessions.

At the end of each interview day, the field notes were transcribed to come up with an interview transcript and if there was need for interpretation from Chichewa to English then it were done immediately. All documents (or pictures of documents) obtained were analyzed and this enabled a comprehensive reflection on all the data obtained and identification of areas for clarification and further investigation. An analytic memo (log report) was also written containing the researcher's views/opinions on the findings, the interviews as well as the activities observed.

3.2.5. Questionnaire Administration

A questionnaire (*see Appendix A*) was divided into six sections:

- *Section A was for data acquisition/collection*; in this section, the goal was to find out the type/category of data being collected, who collects it, the type of tools/instruments used to collect data.
- *Section B was for data storage and analysis*; in this section, the goal was to find out where the data is stored, how it is stored, how secure it is, if data is analyzed and who analyses it, if the analyzed data is being used.
- *Section C was for HMIS (ICT competence)*; in this section, the goal was to find out if Health Departments have computers and internet connection, importance of computers, types of Information Systems currently used, how computers assist them in information flow and feedback.
- *Section D was for Information flow in HMIS*; in this section, the goal was to know how the information is sent to responsible areas, type of media used to send data, if there are any problems in sending data.
- *Section E was for Feedback in HMIS*; in this section, the goal was to find out if the feedback for the sent information is given, type of media used, after how long and if they have any problems in receiving feedback.
- *Section F was for General*; this section contained open-ended questions where the goal was to find out in-depth thoughts of the respondents in terms of challenges and opportunities in Information flow and Feedback in Malawi's Health Information Systems and HMIS in particular.

All questionnaires which were distributed in Blantyre and Zomba DHOs were answered and filled by the interviewees within the interview time because they were administered by the researcher and any clarification was done immediately. However, in Lilongwe DHO the questionnaire acted as a question guide because the interview was administered as a group session with colleagues (research assistants) and note taking plus tape recording were the main data collection tools.

However, within the generic section the interviewees in the health sector were prompted to identify their roles in terms of information flows. In some instances the interviewer assisted the interviewees with the completion and clarification of questions. Respondents were also asked to give some narrative comments regarding the major flows of data to and from their departments/sections, how effective were these data flows, what additional data was required and the role that played in facilitating these data flows.

3.3. Data Analysis Techniques

The purpose of data analysis is to develop an understanding or interpretation of answers to the basic question of “what is going on here?” The process of data analysis as described by Agar (1980) has a cyclical character:

You learn something (“collect some data”), then you try to make sense out of it (“analysis”), then you go back and see if the interpretation makes sense in light of new experience (“collect more data”), then you refine your interpretation (“more analysis”), and so on. Thus, the process is dialectic, not linear (Agar, 1980).

Merriam (1988) and Marshall and Rosman (1989) contend that data collection and data analysis must be a simultaneous process in qualitative research. Schatzman and Strauss (1973) claim that qualitative data analysis primarily entails classifying things, persons, and events and the properties which characterize them. Typically throughout the data analysis process ethnographers index or code their data using as many categories as possible (Jacob, 1987). They seek to identify and describe patterns and themes from the perspective of the participant(s), then attempt to understand and explain these patterns and themes (Agar, 1980).

During data analysis the data was organized categorically, reviewed repeatedly, and continually coded. A list of major ideas that surfaced was chronicled (as suggested by Merriam, 1988). Field notes, tape recordings, filled questionnaires and diary entries were regularly reviewed.

The way of reviewing data collected was through triangulation, which aimed to obtain confirmation of findings through convergence of different perspective (Saugene, 2005). This involved testing one source of information against another to improve the quality and accuracy of findings before drawing any conclusions. This included comparing the explanations drawn from formal documents, member descriptions (interviewees), observation, etc. The use of this technique helped the researcher in analyzing the data as the research went on. So, the isolated findings that were not supported by other sources of data were either disregarded or served as the basis for further investigation.

3.4. Validity and reliability of Data

As described by Hammersley (1990), the researcher refer to the validity of this research as the extent to which the research accurately represents the social phenomena to which it refers and the degree to which the research methods measure or record what they aim to measure. On the other hand the reliability of this research refers to the degree of consistency with which the researcher assigns instances to the same category as the observer in different occasions (Hammersley, 1990).

In qualitative case study research, validity and reliability of the evidence obtained is one of the criteria for evaluating the research. Therefore, several measures were taken to ensure the validity and reliability of the data/information obtained for the research. These measures include:

- Use of several techniques to obtain and verify the data i.e. interviews, observations, document analysis and questionnaire administration.
- Clarifications from knowledgeable respondents were also sought whenever things did not appear to make sense.
- A preliminary report (Analytic Memo) on the research findings was produced and distributed to some participants to verify the contents to ensure the content was correct without errors.

3.5. Ethical Considerations

The following safeguards were employed to protect the informant's rights: (John, 2003:202)

- Written permission to conduct the research was sought from the Ministry of Health and Population in Malawi and also from The District Health Officer of each and every DHO where the research work was carried out.
- The research objectives were articulated verbally and in writing so that they were clearly understood by the respondents (including a description of how data will be used).
- During data collection, consent was also sought from respondents, before involving them in this research work e.g. use of Tape Recorders and Taking of Pictures.
- The respondents were informed about all data collection tools, devices and activities.
- Verbatim transcriptions and written interpretations and reports were made available to the respondent.
- The respondent's rights, interests and wishes were considered first when choices were made regarding reporting the data.
- The final decision regarding respondent's anonymity was with the respondent.

CHAPTER 4

RESULTS (FINDINGS) AND DISCUSSIONS OF THE STUDY

4.1. Combined analysis of the research findings

4.1.1. Data generation

- **Categories of data**

What categories of data are collected at a health department?

Categories of data collected at both Health Facilities and DHO are: reported cases, maternal data, Community Health data, Family planning, Child health, Human Resource, Finance, HIV/AIDS, antenatal, disease surveillance, water and environmental, village clinics data, program on immunization, IDSR data, quarterly reports and monthly reports (at DHO). Categories of data collected depend on the responsibility of the data collector.

At one of the Health Facilities which were visited, the HMIS clerk explained the type of data required to enter into a register through one to one interview and questionnaire administration, as follows:

“I ask the patients for their name, address, age, sex and from their health passport book; I extract diagnosis, treatment and diagnosis code. This is entered into an out-patient department (OPD) register” (see Appendix B.11) (HMIS clerk, one of the visited Health Facilities).

At one of the visited DHOs, the Environmental Health Officer (EHO) explained the type of data required from health facilities to compile reports, as follows:

“From Health Facilities, data on disease surveillance, water and environmental sanitation (WES), village clinic data, IDSR, program on immunization, maternal, family planning, child health, community health, TB, ART, etc is required. This data assists to write reports (quarterly or annual)” (Environmental Health Officer, one of the visited DHOs).

- **Data collecting personnel**

Who collects data at the health department?

The research results indicate that at some health facilities there are no specific personnel employed for collecting health data (e.g. at Khongoni, Ngoni and Thondwe health facilities just to mention a few); instead, they involve all health service providers (clinicians, nurses, HSAs, AEHOs, EHOs, HMIS or Statistical clerks/officers, ART clerks, Human Resources personnel, Accounts personnel and emergence workers or volunteers) but at some health facilities (e.g. Kabudula Community Hospital, Ndirande and Lumbadzi health facilities, etc) there are HMIS or Statistical clerks employed for collecting health data and compiling reports. At the health facilities where there is an HMIS clerk, the whole data collected by other personnel like clinicians, HSAs, nurses, etc is given to him at the end of every month in order to compile the final report to be sent to DHO.

At District Health Offices (DHOs), data is collected by Environmental Health Officer for environmental data, IDSR officer for surveillance diseases data. At Health Facilities, environment data is collected by HSAs, IDSR data is collected by clinicians (CO, MA or Nurse), ART data is collected by ART clerks, etc and final Health Facility's report is compiled by an HMIS clerk. The monthly and quarterly reports from EHOs, IDSR officers (from DHO) and HMIS clerks (from Health Facilities) are submitted to Statistical officers who collate the data to form monthly and quarterly reports.

- **Primary tools for data collection**

What instruments/tools of data collection are used? e.g. forms, registers, memos, etc.

Data collection tools at the health facilities and DHO are forms, registers, memos, letters and sometimes questionnaires and interviews. These tools are designed according to health programs e.g. community health, child health, antenatal, OPD, ART, IDSR, etc and supplied by the Ministry of Health. However, some health facilities do design their own data collection tools because they want to collect their own data or the official data collection tools are not available due to lack of stationary, and would like to simplify their work (see Appendix C.1 for several data collection forms and their use).

In this study, a locally designed form for recording *monthly report stock sheet for likuni phala* at Chiwe Health Facility in Lilongwe DHO was observed (see Appendix B.16). The researcher asked the health workers (Medical Assistant, Nurse, HMIS clerk and Senior HSA) at one of the

visited Health Facilities in Lilongwe DHO why they designed their own forms while the official forms are available in the health centre. One respondent (Senior HSA) explained as follows;

“At this time such type of forms for recording monthly stock sheet for likuni phala were not available at this facility due to lack of stationary, that is why we used locally made form to simplify our work. Most of the times we go into the field without properly printed forms and we use notebooks or A4 plain papers and demarcate lines on the pages to fill in the data which we collect at the field. Most of the times we buy these notebooks using our own cash due to lack of stationary at health facilities, lack of well designed forms and financial problems” (SHSA, one of the visited Health Facilities in Lilongwe DHO).

- **Time spent during data collection and writing reports**

How much time is spent in data collection and writing reports?

As shown in Appendix C.2, some of the respondents said that number of hours for data collection and report writing differ due to the nature of the job of that particular officer.

Time spent in data collection was categorized to be viewed as daily, at the end of the week and at the end of the month. On average time spent for collecting data/filling registers/writing reports are: 7.7 hours/day, 33.2 hrs/week and 175.5 hours/month as shown in Figure 12 (Questionnaire results, field work, Sept to Dec 2011).

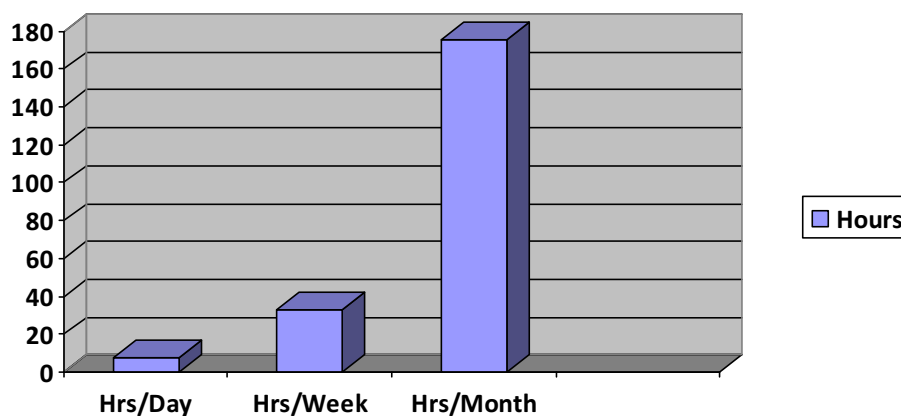


Figure 12: Average time spent on data collection

- **Type of information required by Health Program Managers, Nurses, Pharmacists, Statisticians, Regional Office and Ministry.**

Respondents indicated that all health program managers require information on OPD, under five, TB, community, ART, maternal, antenatal, family planning, total population, sanitation, age, sex, marital status, diagnosis, immunization, etc depending on the responsibility of that particular individual or officer.

- **Availability, Accuracy and Completeness of information**

Do you consider the information to be easily available (Y/N/D), Accurate (Y/N/D), Complete (Y/N/D)? Y=Yes, N=No and D=Don't know

As shown in Appendix C.3; some of the respondents indicated that indeed the required information is easily available but sometimes it is not accurate and complete. One of the respondents indicated that the information is not accurate and complete and explained the position as follows:

Due to pressure of work due to shortage of staff, sometimes the people who collect data tend to miss some of the required information. Also if data is collected by the person who is not conversant with the reporting system, the information tends to be incomplete. For example, if the information is collected by not trained personnel like volunteers (Nurse, one of the visited Health Facilities).

Almost 95% (see Figure 13) of the respondents indicated that: the information required is easily available; it is also accurate and complete *depending on who* collected the information. Respondents also indicated that if the information is collected by trained staff like HSAs, HMIS clerks, ART clerks, Clinicians and Nurses, it is very complete and accurate but if collected by volunteers (not trained personnel); *sometimes* it becomes inaccurate and incomplete.

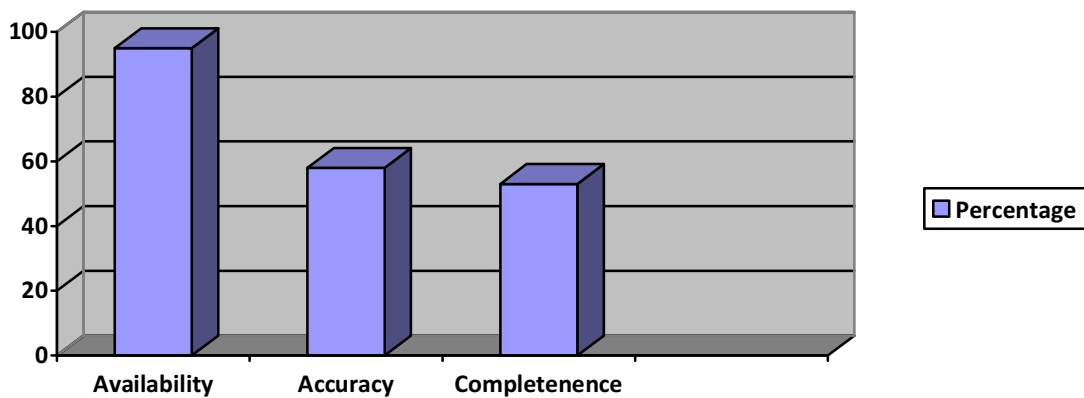


Figure 13: Average availability, accuracy and completeness of collected data

4.1.2. Data Management

This theme presents the storage, processing and analysis of health data at the health facility and district levels.

- **Data Storage**

Where is data stored?

At District Health Office data is stored in a computer, files and filing cabinets. At Health Facilities data is stored in piled forms, files and filing cabinets and sometimes files are put on the floor due to lack of filing cabinets and storage space (Questionnaire results, field work, September to December 2011).

- **Problems with data storage**

Are there any problems with data storage?

Almost 100% of the respondents from health facilities which were visited indicated that there are a number of problems with data storage which are: Lack of computers which can be used to store data, lack of storage spaces such that some of the files are stored on the floor or on top of tables as shown in Appendix B.17 and in other Health Facilities there is a great shortage of filing cabinets for storage of files. At one of the visited Health Facilities in Blantyre DHO, an HMIS Clerk said that:

At this Health Facility we have one desk top computer which is kept in Officer In-charge's office and it is not used for data collection and storage by us and we can not access it. We even don't know how to use a computer. That is why we keep our forms and registers in files and filing cabinets. When filing cabinets are filled up, we sometimes keep the files on the floor or in piles on top of tables which sometimes violets the privacy of health information (HMIS Clerk, one of the visited Health Facilities).

At District Health Offices, though there are computers for data collection and storage but there is still a problem with hard copy data storage due to lack of storage space and lack of filing cabinets. These computers are most of the times attacked with viruses; as a result stored information is sometimes lost. There are no specialized people at the DHO to clean the computers.

- **Capacity of data stored in the system (daily, weekly, monthly and quarterly)**

How much data/information is stored in the system (daily, weekly, monthly and quarterly)?

As shown in Appendix C.4, capacity of data stored in health information system depends on the responsibilities of a particular health department. On average; 31 forms/day, 137 forms/week, 525 forms/month and 1,465 forms/quarter of a year are stored in HMIS (see Figure 14).

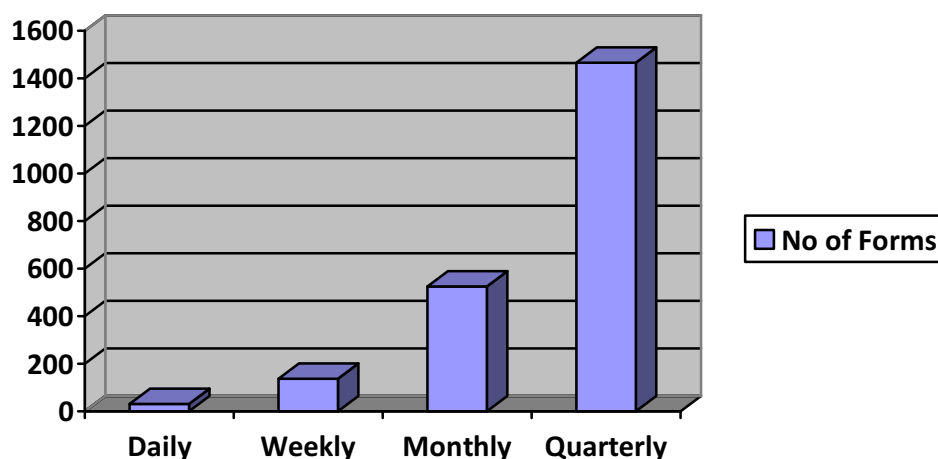


Figure 14: Average capacity of data stored in HMIS

- **Forms/Registers after completion**

What do you do with the forms/registers (data) when you have completed them?

Respondents indicated that: after the forms have been completed; they are checked for errors, if there is a computer e.g. at DHO the data is entered into a computer, analyze the data, copies of the forms are put in files for storage, the analyzed data is used for compiling reports and finally compiled reports (monthly/quarterly/yearly) are sent to the Statistician (at the DHO) who compiles a report for the whole district, then final report for the district is sent to the District Health Officer for checking/approval and send the report further to Region or Zone, then to the Ministry of Health Headquarters (Source: Questionnaire results, field work, Sept to Dec 2011).

- **Instruments used to calculate statistics from the data**

What instruments do you use to calculate statistics from the data?

The respondents from Health Facilities indicated that they use manual (tallies) and calculators for calculating statistics from the data collected while respondents from the DHO indicated that they use manual (tallies), calculators and also Microsoft excel to calculate statistics from the data collected (Questionnaire results, field work, Sept to Dec 2011).

- **Time spent in analyzing data**

How much time is spent in analyzing data?

On average; 2 hours/day, 8 hours/week, 30 hours/month and 90 hours/quarter are spent in data analysis (see Figure 15) (Questionnaire results, field work, Sept to Dec 2011).

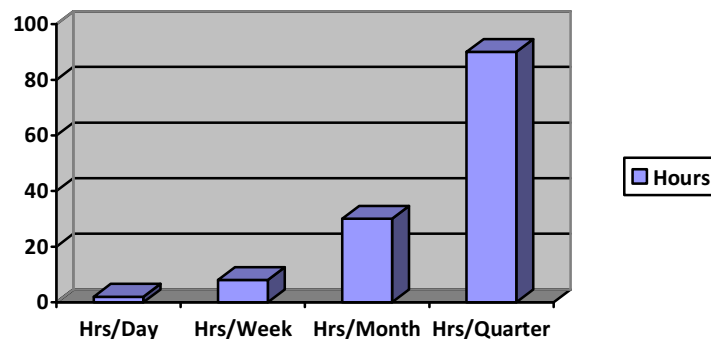


Figure 15: Average time spent on data analysis

- **Instruments used for data analysis**

Do you analyze data at your level using the following: (Tables (Y/N/D), Graphs or Pictures (Y/N/D), used in reports (Y/N/D) and other (specify))?

At the District level; data is analyzed by using Tables, Graphs, Microsoft excel, SPSS and used in reports where as at the Health Facility level; data is analyzed by using Tables and Graphs only as shown in Appendix C.5 (Questionnaire results, field work, Sept to Dec 2011).

Almost 100% of the respondents indicated that they analyze data using manual (tallies, calculators, etc), tables and graphs while only 36.8% of the respondents indicated that they use Microsoft excel and SPSS for analyzing data as shown in Figure 16.

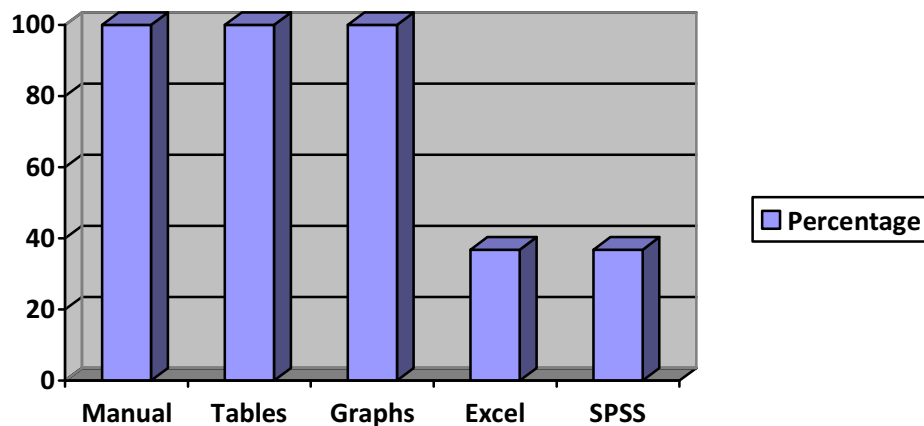


Figure 16: Percentage of data analyzing instruments

- **Data analysis**

How is data/information analyzed and by whom?

At the District level; data is analyzed (aggregating the data according to different indicators) by using tables, graphs, Microsoft excel & SPSS and by responsible person e.g. HMIS Officer/Statistician, ART Officer, IDSR Officer and DEHO where as at the Health Facility level; data is analyzed by using tables, manual (tallying), & graphs and by responsible person e.g. HMIS Clerk, ART Clerk, SHSA/AEHO, etc (Questionnaire results, field work, Sept to Dec 2011).

- **Capacity of stored data and analyzed to derive reports**

How much of the stored data/information is analyzed to derive reports and how often are these reports produced?

Almost all respondents indicated that every data that is collected is analyzed by aggregating the data according to different indicators and used to derive weekly, monthly, quarterly and yearly reports (Questionnaire results, field work, Sept to Dec 2011).

4.1.3. ICT competence/Health Management Information System (HMIS)

In this sub-section, the objective was to find out if the Health Facilities and District Health Offices (DHOs) have computers, if the collected data is entered into a computer, if the use of a computer is helpful to workers and how, how many information systems do the workers use, is there any data security in the current information systems and what ICT skills are available (e.g. Use of mobile phones, use of computers and length with these competencies).

- **Computer availability**

Does your institution/department have a computer? Is the data you collect being entered into a computer? If yes do you benefit from this? Can a computer support you/your institution or department better? Does your institution need a computer? Are there any computer training opportunities at your department? (Y/N/D)

The results obtained through questionnaire administration, interviews, audio tape recordings and field note taking were as shown in Appendix C.6.

At District Health Office (DHO) level

At Zomba, Blantyre and Lilongwe DHO level; all the respondents indicated that there are computers which are used for data entry, analysis and storage.

Respondents confirmed that availability of a computer at their institutions really assists them for easy data entry, storage, retrieval and analysis and also with the availability of internet; data is easily sent to District Health Officer, Zone/Region and Headquarters.

During period of this research responsible officers provide some computer training at DHO levels but the respondents emphasized that some responsible people are not yet trained and there

is need to train them. The training would provide knowledge to assist them in data entry, storage, retrieval, analysis and sending information and feedback through internet in order to improve in data flow/reporting.

At the DHO level the staff has access to HMIS, DHIS, Drugs Logistics Information System (DLMIS) and Manual Documentation systems and these are the most frequently used systems. Respondents also emphasized that these systems are not reliable at Health Facility level because they don't have any security for the information being sent to and from destination. Information can easily be altered or miss in-transit. Some respondents at DHO indicated that these systems are reliable when data is reported through internet.

At Health Facility (H/F) level

The findings show that almost all the Health Facilities which were visited indicated that there is no computer used for data entry and storage. However the HMIS clerk at Ndirande Health Facility in Blantyre DHO indicated that there is one computer in the Facility Manager's office (CO) but it is not used for data entry. This is the same as at Thondwe Health Facility in Zomba DHO.

Respondents at the Health Facilities also indicated that availability of a computer at their institutions can really assist them for easy data entry, storage, retrieval and analysis and also with the availability of internet data can easily be sent to DHO.

During period of this research there was no computer training at the facility level but the respondents emphasized that there is need for it so that they should acquire computer knowledge to assist them in data entry, storage, retrieval, analysis and information transfer through internet.

At the facility level the staff has access to HMIS and Manual Documentation systems and these are the most frequently used systems. Respondents emphasized that these systems are not reliable because they don't have any security for the information being sent to and from destination. Information can easily be altered or miss in-transit.

The respondents at all health facilities which were visited confirmed that they have the following ICT skills: use of mobile phones and use of computers, and also the local capacity to support these systems is available.

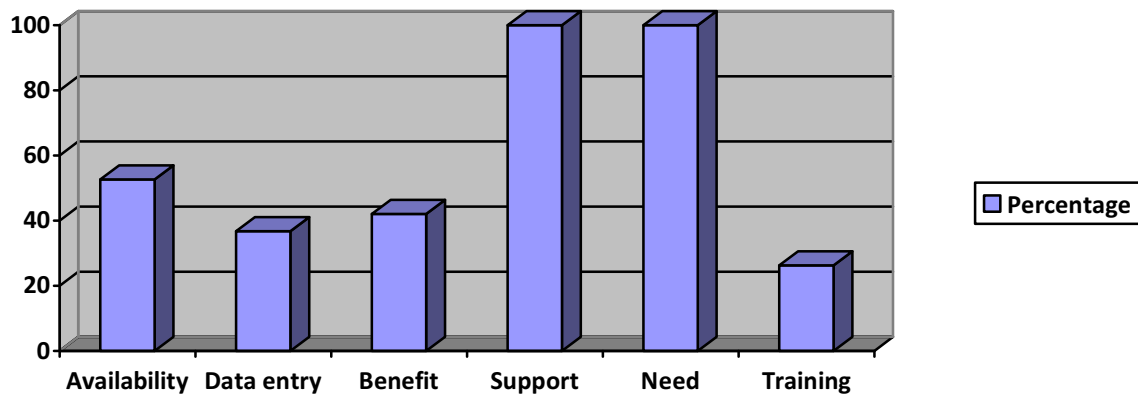


Figure 17: Percentage on availability, data entry, benefit, support, need and training opportunity for a computer.

As shown in Figure 17, 52.6% of the respondents indicated that there is availability of computers at their work places, 36.8% indicated that computers assist them during data entry, 42.1% indicated that there is a great benefit in using a computer, 100% indicated that availability of computers at their work places can really support them, 100% indicated that there is really a great need for computers at their work places and lastly 26.3% of the respondents indicated that there is no computer training opportunity at their work places.

4.1.4. Information flow in HMIS / Data Reporting and Transmission

- **Uses of health data**

The idealized relationship between data, information and decision-making (Sauerborn, 2000) is that:

“The collected data are transformed into information. Processing and analyzing information with problem solving in mind leads to knowledge. The interpretation of this knowledge, then, is guided by subjective judgement, rather than by objective, scientific rigour” (Sauerborn, 2000:34).

The focus in this subsection is to illuminate the under-use and non-use of information in health information systems; because this is a major problem found in health information systems both in my own experience and in the published literatures (Wilson *et al.*, 2000; Lungo, 2003).

The study results show that health information is used in the following ways:

What do you do with the forms when you have completed them? What do you think happens to the information sent to the top level?

At DHO level, when data collection forms have been completed and reports are received from Health Facilities; the responsible officer (Statistician, IDSR officer, DEHO) analyze them locally, after analysis he/she also aggregates them and send them to the top level inform of reports, give feedback and lastly the forms are kept or stored in files and filing cabinets for future reference.

When the information reaches the top level (Zone/Region and Ministry of Health headquarters) from DHO; it is also analyzed/aggregated, used for planning, used for decision making, used for preparing reports and it is further sent to higher levels (donors, stake holders, etc) as well.

At Facility level, when data collection forms have been completed; the responsible officer (HMIS clerk) analyze them locally, after analysis he/she also aggregates them and send them to the top level inform of reports and lastly the forms are kept or stored in files and filing cabinets for future reference.

When the information reaches the top level (District Health Office) from Facilities; it is also analyzed, used for planning, used for decision making, used for preparing reports and it is further sent to higher levels (Zone/Region and Ministry of Health headquarters) as well.

According to respondents, in brief, health information is used:

- to control epidemics;
- to plan and manage the health delivery services in the health facilities, including allocating the budget, allocating drugs, and consumables;
- to monitor and evaluate health facility performance; and
- to monitor and evaluate the health information system performance.

A respondent from one of the visited District Health Offices said:

“I am not sure if the Regional Health Office uses all the data we are sending to them, but with outbreak disease reports, they are really acting on it very fast. If you send them a report indicating that cholera is disturbing somewhere within the DHO’s catchment area, you will see more cholera drugs coming in and some extra vehicles are also brought in to assist” (District Environmental Health Officer, one of the visited DHOs).

- **Data Reporting**

Are you getting the monthly/quarterly statistics in time? Are you sending the monthly/quarterly statistics in time?

At DHO level; respondents at most of visited DHO units indicated that these monthly statistics are at times received in time and sometimes not in time from Health Facilities due to shortage of transportation, pressure of work, shortage of staff and these statistics are also sometimes sent in time and sometimes not in time to the responsible person at the Region/Zone and Ministry Headquarters due to the same problems.

At Facility level; monthly statistics are most of the times got in time from Community Health Workers or HSAs and Private Clinics and these statistics are also sometimes sent in time and sometimes not sent in time to the responsible person at the DHO due to transportation problems.

In almost all the three DHOs (Blantyre, Zomba and Lilongwe) which were visited, health facilities are required to send periodic reports to district health offices, which further report to the regional/zonal offices, and regional offices further report to the national health headquarters’ offices (see copies of HMIS-15 quarterly reports in Appendices B.12, B.13, B.14 and B.15).

At Lilongwe district health office, the researcher requested the Statistician to show the health facilities’ reports in the district processing file and the record of health facilities’ reporting and was done as requested. Through observations at Lilongwe DHO, the researcher gathered enough information to determine the level of total reporting of health data from the health facilities to the district offices.

Untimely data reporting

For one to get a picture of the real situation at the district, one should get the data from all health facilities. In the Ministry of Health's "health information system implementation plan", it is a requirement that all health facilities, whether public, private, or religious owned are required to report health data to the district health office, using HMIS-15 quarterly report forms. Lilongwe district health office has almost 53 Health Facilities. From the study sample, Kabudula health area quarterly report data for the year 2011 (see Appendix B.18), although the set date for report submission is 5th of the following month but some of the health facilities did not submit in time for October 2011 reports e.g. Nambuma, Chikowa, Kabudula community hospital, etc.

- **Data Transmission/Information flow**

Data transmission/information flow refers to the transfer of raw data from the health facilities to higher levels of a health management information system for the purpose of data processing. In this study, data transmission/information flow means the transfer of paper documents from health facilities to the District Health Office level and from DHO to Regional and Ministry headquarters. Health Facility reports are generated, and then sent to the district, regional or zonal level where data are entered in the computer database system. From the region or zone, data is sent to the national level in both paper documents and in computer files such as compact disks (CDs), flash disks and through internet.

The type of data transformation in the three DHOs (Blantyre, Zomba and Lilongwe) studied, is determined as a vertical data transmission. There are four levels of vertical transformation of data namely: health facility level (lowest level), district level, regional or zonal level and national level (highest level). With vertical transmission, data are flowing from lower levels to the higher levels and vice versa. During the course of the study, it was observed that a high traffic of data flows from the lower levels (Health Facilities) (paper documents reporting routine health delivery services) to higher levels (District Health Offices). The observed data flowing from the higher levels to health facilities are the data registers/forms and their guidelines for completing the data registers, description of the drugs or vaccination kits and supervision visits schedules.

At district level, the Statistician aggregates the data from the HMIS facility reports using the DHIS to produce a district report. This is done on a quarterly basis. The content of the district report is the same as that of the individual facility reports and is submitted electronically to the Health Management Information Unit (HMIU) at the ministry headquarters. The Statistician is also required to transmit the district data horizontally by providing it to the program coordinators and this is done in form of Pivot tables, mainly so that the coordinators can prepare presentations for their programs for DIP/HMIS review meetings (Statistician, Lilongwe DHO, field work, September to December 2011).

How are the monthly/quarterly statistics being sent? By what means are the monthly/quarterly statistics being sent? Are there any problems in reporting/sending information/data to the next level?

At health facility level

Most of the times monthly statistics from the Health Facility to DHO are sent through by carrying them on their own (responsible person) using public transport and also using their own cash (money). Sometimes they send them through other people who are on their way to DHO and if by chance the ambulance passes by then they send them through the driver. At times a motorcycle or bicycle is used to deliver the reports to DHO if the Facility is near to DHO. One of the respondents from one of the visited Health Facilities in Lilongwe DHO said:

When I finish compiling an HMIS quarterly report for the whole Kabudula Health Area, I put the report in an envelope; look for the money to use for public transport (Matora in Chichewa), when I find the money then I go to a public transport depot where we wait until the vehicle is filled up in order to start off. During the wet (rainy) season, these public transport operators charge more money because the roads are usually in poor condition. When I don't find money for transport fare then I still wait even if the report delivery date passes by up to until I find the money as a result the report is delivered late to DHO and also, am not refunded. At Kabudula, we have one ambulance for the whole health area and if by chance this ambulance goes to DHO while the report is ready then I sometimes send it through the ambulance driver. The disadvantage of sending the report with ambulance driver is that; sometimes he forgets to deliver it and returns back with it

or sometimes he leaves the report at the reception where again it takes some time to reach the responsible person (Statistician). To me therefore sending reports to DHO is a great challenge which needs to be addressed quickly (HMIS clerk, one of the visited Health Facilities in Lilongwe DHO).

At Facility level the respondents indicated that there is a great problem in reporting/sending information to the top level (DHO); this is because when you send the forms/reports through other people they may get lost or not delivered or alter information and sometimes if the responsible person does not have money for public transport then the report will be delivered late.

At Facility level the information from the monthly statistics is used for compiling quarterly reports which are then sent to DHO.

At district level, most of the times monthly/quarterly statistics/reports from the DHO to Region/Zone and Headquarters are sent through internet, fax, flash disks and sometimes monthly/quarterly reports are carried by the responsible person through by ambulance, motorcycle or sometimes by public transport to Zonal/regional office and Ministry of health headquarters. One of the respondents from one of the visited DHOs said:

After I finish compiling a quarterly report, I first hand it to the District Health Officer who checks it. When the DHO says that it is okay, then I save it in a flash disk and carry the flash disk to the zonal/regional office and another copy is delivered to the ministry headquarters through by ambulance or public transport. When there is someone going towards the same direction, I sometimes send the report with him or driver. At my office I don't have internet connection so that is why I don't use internet for sending my reports to zonal office. Also, sometimes I face problems with my computer since it has a lot of viruses which usually attack my reports. To my side the greatest challenge which I have in sending information is lack of internet connection and transport (Statistician, one of the visited DHOs).

At DHO level, the information from the monthly/quarterly statistics/reports is used for planning, decision making and compiling quarterly/yearly reports which are then sent to Region/Zone and Ministry Headquarters. Copies of these reports are also sent to all health facilities in the district.

4.1.5. Feedback and Supervision in HMIS

Regular supervision is an important part of an effective health information system (Lungo, 2003). Respondents from a number of health facilities which were visited expressed an interest to receive a supervisory visit from district or regional level staff at least once in every three months, which currently is not happening. The incentives (e.g. allowances) of supervision trips to health facilities make the health officers from the district health office visit the health facilities regularly. While visiting the health facilities, they chat with health workers and that is what many informants referred to as feedback.

Results on feedback responses collected from respondents are shown in Appendix C.7.

At DHO level

At the DHO level the respondents indicated that sometimes they get feedback on the results they send to the top level either quarterly through quarterly reports (written feedback and graphs) or once in a while through supervision in case there is an outbreak which needs immediate attention. When there is no quarterly meeting and no outbreaks, no any feedback is received.

The respondents also indicated that feedback is most of the times received both ways (from both top and bottom) but stressed that most of the times it is from bottom and once in a while from the top and usually inform of quarterly reports during quarterly meetings and supervision.

The feedback of the sent information is most of the times given through the internet/fax and if it is urgent then it is given through the phone call, ambulance and sometimes even by a motorcycle.

Length of feedback depends on the activity or urgency of the case e.g. when there is an outbreak the feedback is given right away but on normal HMIS data the feedback is given quarterly through quarterly reports given at quarterly meetings.

At Health Facility level

At the Facility level the respondents indicated that sometimes they get feedback on the results they send to the top level. Such reports are received either quarterly through quarterly reports or once in a while through supervision in case there is an outbreak which needs immediate attention. When there is no quarterly meeting and no outbreaks, no any feedback is received.

The respondents also indicated that feedback is most of the times received both ways (from both top and bottom) but stressed that most of the times it is from bottom and once in a while from the top and usually inform of quarterly reports during quarterly meetings and supervision in case there is an outbreak.

The feedback of the sent information is carried by the people who attend to quarterly meetings and they usually use public transport/ambulance & motorcycle sometimes to and from quarterly meetings and if the case is an urgent one, the feedback sometimes comes through the phone call or radio message.

Length of feedback depends on the activity or urgency of the case e.g. when there is an outbreak the feedback is given right away but on normal HMIS data the feedback is given quarterly through quarterly reports given at quarterly meetings.

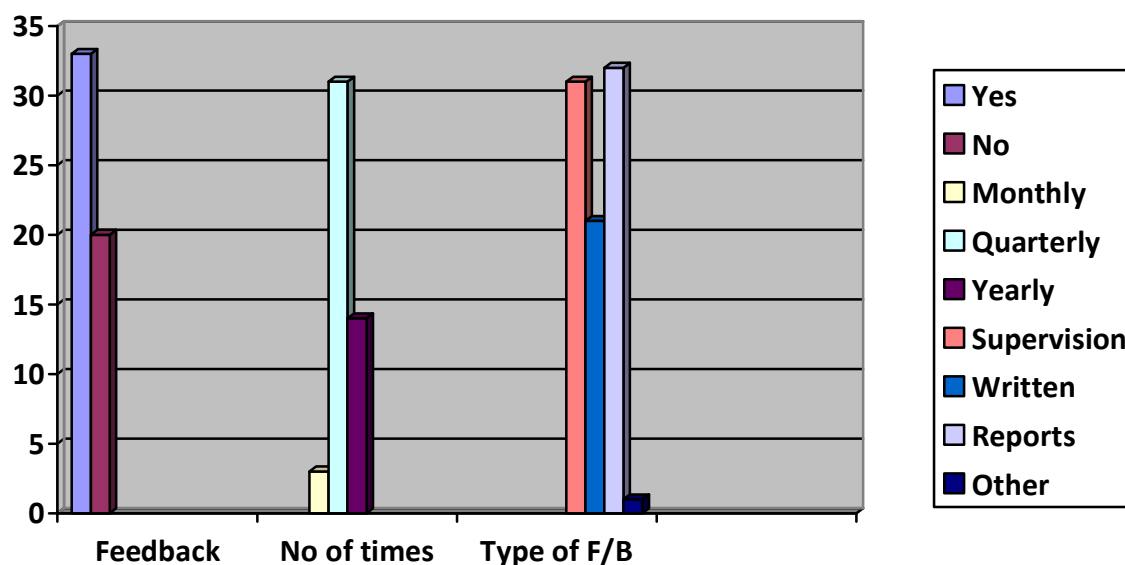


Figure 18: Showing feedback responses, number of times and type of feedback.

As shown in Figure 18, 33 respondents indicated that they do receive feedback for the information they send while 20 indicated that they don't receive any feedback for the information they send; 3, 31 and 14 respondents indicated that they do receive feedback for the information they send monthly, quarterly and yearly respectively; 31, 21, 32 and 1 respondents

indicated that they receive feedback for the information they send through supervision, written documents, reports and other means (phone, wireless message) respectively.

4.1.6. General (Challenges and Opportunities)

This sub-section, considers the thinking of the respondents on the Challenges and Opportunities in the Information flow and feedback in HMIS; which are: if the respondents feel that, there is any gap in the information at hand and the one which is required, how can the information system and use of information be improved, what are the challenges and opportunities in sending and receiving information and finally, what should be done in order to address the mentioned challenges.

At DHO level

At the DHO level respondents indicated that the gap between the information they have and the information that they need depends on the type of data required. Some type of data has gaps but other type of data does not have any gaps because when they need information it is readily available at there catchment area/health facilities.

The respondents indicated that the information system and the use of information can be improved at the DHO level by recruiting qualified people specifically for managing data, availability of transport, availability of training opportunities in various disciplines, availability of solar power at the Health Facilities without ESCOM's electricity, availability of computers with internet connection at all Health Facilities, availability of cell phones with units with DHIS2 reporting data facility just to mention a few and finally introduce DHIS2 up to Health Facility level.

The following are the challenges and opportunities in the information flow and feedback of HMIS data as indicated by respondents at the DHO level:

- **Challenges:** Lack of transportation, lack of personnel for data management, shortage of tools for data collection e.g. Registers and Forms, lack of space for completed forms' storage, poor or no feedback on the sent information, lack of proper training, lack of drugs, lack of computers with internet connection, lack of cell phones with units with

DHIS2 data reporting facility which can be used to send data, analyzing data manually is not easy in case the computer crashes and as a result report production takes a long time.

- **Opportunities:** Apart from the challenges addressed above by the respondents, they also indicated that the current HMIS has a few opportunities which are: HMIS data collection forms are well designed and easy to fill, data can still be entered/collected into forms even without electricity, data is collected in time, with a few computer terminals; data is easily analyzed and planning by management is made simple etc.

According to respondents, the above mentioned challenges can be addressed by making availability of transport, availability of drugs, availability of computers with internet connection and a lot of hard drive space for data storage at all Health Facilities, availability of training opportunities in relevant fields, availability of cell phones with units with DHIS2 data reporting facilities for data reporting, recruiting more personnel for data management, etc.

At Health Facility level

At the Facility level, respondents indicated that the gap between the information they have and the one that they need is not there because when they need information it is readily available at their catchment area.

The respondents also indicated that the information system and the use of information can be improved at the Facility level by having ready printed data collection forms, availability of transport, availability of training in various disciplines, availability of computers with internet connection, availability of cell phones with units just to mention a few.

The following are the challenges and opportunities in the information flow and feedback of HMIS data as indicated by respondents at the facility level:

- **Challenges:** Lack of transportation, no security of data sent to DHO, lack of space for completed forms' storage, poor or no feedback on the sent information, lack of proper training, lack of drugs, lack of computers with internet connection, lack of cell phones with units which can be used to send data, analyzing data manually is not easy and as a result report production takes a long time.

- **Opportunities:** Apart from the challenges addressed above by the respondents, they also indicated that the current HMIS has a few opportunities which are: HMIS data collection forms are easy to fill, data can still be entered/collected into forms even without electricity, data is collected in time, etc.

According to respondents, the above mentioned challenges can be addressed by making availability of transport, availability of drugs, availability of computers with internet connection and a lot of hard drive space for data storage, availability of training opportunities in relevant fields, availability of cell phones with units for data reporting, etc.

4.2. Key Findings, Analysis and Discussions

This sub-section provides the analysis and discussion of the research findings presented in the previous section 4.1. It is in this section where the researcher provides the answers toward the research questions and toward the main problem area as presented in the introduction chapter, that is, “How best can information flow from one point to another and how can we ensure that there is a proper feedback on the sent information/data in health information systems in Malawi?” The general discussion reviews the key findings from the case studies to understand their significance in relation to the literature reviewed where applicable. In the case of this discussion, the researcher provides recommendations on how to improve on the use and management of information, information flow and feedback in HMIS at local levels (health facility and district levels) within the HIS.

This research revealed that local levels (facility and district levels) of the HIS require greater attention in order to become effective in using and managing health information for the improvement of health care activities. This is because the functioning of HIS comprises human and nonhuman factors, which are deeply embedded in socio-cultural and political contexts (Mukama, 2003). These socio-cultural and political contexts are reflected in work practices that surround data collection, data storage, data processing and analysis, data presentation and use, and information flows and feedback, particularly at local levels within the HIS.

4.2.1. Data generation, management, information flow and feedback at health facility and district levels within the HIS (focus on HMIS data)

Data collection is the first step of the information generating process within the HIS (Lippeveld, 2000). Data collection can be quite simple, requiring only a pen and a piece of paper. It can also become quite sophisticated, employing several people, a set of preprinted forms, calculators, and computers (Ties, 1991). In this research, routine data collection consists of a set of forms, registers, and tally sheets filled in by health workers at health facility and district levels within the HIS. While performing their daily activities, health workers at local levels collect health data by filling in the data collection tools, aggregating data into reports and reporting to higher levels of the HIS/HMIS.

The quality, use and management of data collected through routine data collection depend on the *layout*, *simplicity* and *relevance* of data collection tools (Lippeveld, 2000).

By the *layout* of data collection tools, the researcher refers to the arrangement of data elements in a logical manner and the printing quality of data collection tools, for example, the space provided to fill in data, that is, is there a space for filling in data on every service being provided and is the space enough to fill in data?

By *simplicity* of data collection tools, the researcher refers to the clarity and helpfulness of the instructions for filling in the data collection tool and the time and effort required by health workers to fill in the data collection tools, that is, how much time and effort is required by health workers to fill in the data collection tool?

By *relevance* of data collection tool, the researcher refers to the usefulness of data collected in a particular data collection tool for management of health care activities at the data collection level.

From the field studies in this research, it was revealed that the data collection tools neither meet the requirements of the health units' health care service delivery nor the reporting requirements due to unavailability of spaces to fill in data for either some of the services being delivered by

particular health units or some of the services that the health units are required to report. This is evidenced in sub-section 4.1.1 (data collection; primary tools for data collection).

Data processing and analysis should generate high-quality of information for decision-making at all levels of the HIS/HMIS. By data processing and analysis, the researcher refers to the manipulation of raw data in order to transform them into useful information that can be used for decision-making (Shrestha and Bodart, 2000). Data processing involves checking for inaccuracies or inconsistencies that must be corrected, for example, missing or duplicated records, improbable values for a variable, and inconsistency with other known information (Shrestha and Bodart, 2000). After processing, data can be rearranged to form a summary set of variables conducive to analysis. This results in a set of tabulations and/or statistical analyses, which present information in the form that is clearer and most useful for health workers. Rearranging data would point to certain types of errors when improbable information is generated through preliminary data processing.

From the field studies in this research, it was revealed that the data processing and analyzing tools are very poor especially in the visited health facilities such that it takes a long time for the workers to process and analyze data. This is due to lack of computers which can easily process and analyze data. This is evidenced in sub-section 4.1.2 (data management; Time spent and instruments used for processing and analyzing data).

Data sharing, reporting, information flows and feedback

A health information system should ensure that data reporting, information flows and feedback do not only support decisions that have to be made at higher levels but also day-to day management of health care services at the health facility level. Streamlining data transmission should address the two main flows of information within the health services system: within the individual health care system and from health unit to system management levels (Lippeveld, 2001).

This study identified the two main information flows within the health care service delivery systems in the study sites, whereby within the individual health care system special attention is

on data-sharing from one health facility to another, that is, the referral system. For example, when a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, data sharing is done through a letter and a card that indicates the risks of her illness/sickness and the diagnosis made.

Regarding data reporting from health unit to system management levels, Sapirie (2001) pointed out that, extensive emphasis is placed on the importance of correct and complete recording and reporting, considerable in-service training is provided in the proper completion and submission of the reports, and service units are monitored for timely and complete reports. Data reporting and information flows should include feedback from higher levels to local levels. This in turn will motivate local levels in reporting high quality data (Sapirie, 2001). However, this research showed that, data is being reported from local levels to higher levels with minimal supervision and support from higher levels resulting in poor quality of data, incompleteness of reports and late reporting. Information is of use when it is complete and current, so correctness and timely submission of reports is crucial for effective decision-making.

Data presentation and use of information

Basing on appropriately designed support, supervision and feedback mechanisms and innovative approaches in data presentation, the information generated can be used to improve health care services: preventive and curative services to patients, clients, and the community; in managing the health facilities; in managing the health services from the district to the national level; and in ensuring essential community health functions such as environmental protection and diseases surveillance (Lippeveld, 2001; Mukama, 2003).

Most health workers at health facility and DHO levels considered the use of collected data as mainly a way of showing the higher levels the work done for more provision of resources such as medicines and injections. It is important to measure the workload and efforts done by a particular health unit for provision of resources. However, collecting and using data for the purpose of showing work done fall short of the kind of information needed to achieve the broader public health goals.

4.2.2. Problems faced with data generation, management, information flow and feedback at health facility and district levels within the HIS (focus on HMIS data)

There are several problems faced with data generation, management, information flow and feedback within the HIS such as, poor quality of data, weak analysis of data, lack of an information culture and lack of trained personnel (Mukama, 2003). This research identified similar problems, which are grouped into the following categories:

- Health workers at district and health facility levels are lacking a clear understanding of the purpose of data collection.
- Information flows reflect the requirements of higher levels, without addressing the local level's information needs.
- The health system at local levels has poor and inadequate resources and infrastructure for health care activities.

Lack of clear understanding of the purpose of data collection

There is a lack of training in information awareness and handling among health workers. There is also a lack of expertise in health information management and use particularly at local levels. These have great effects on the HIS in terms of analysis, use and management of information at local levels. The findings from this research (sub-section 4.1.1 (data generation) and 4.1.6 (challenges)) revealed that health workers especially in all visited health facilities are not properly trained on how to use the data collection and reporting tools even when the changes are made to the health information system. For example, when the structure of data collection and reporting forms is changed to include more reporting requirements (sub-section 4.1.1 (primary tools for data collection)), but this does not happen most of the times. Health workers collect data for disease reporting and use of resources and partially address the management objectives at the health facility.

Quality of care is crucially involved with continuity, far more than just the number of services provided. For example, the collected data can be used for monitoring conditions that need follow-up over long periods such as antenatal care, immunization and tuberculosis, that is, to see which patients have been provided with the services as expected and which need follow-up or tracing in the community.

Information flows reflecting the requirements of higher levels, without addressing the facility and district (local) level's information needs.

The findings described in sub-section 5.1.4 (data transmission/information flow and with reference to Figure 3 in sub-section 1.3.2) above illustrate a number of problems related to information flows within the HIS, particularly the vertical data flows, from local levels to higher levels that result in poor integration of information at the district level. There is a continuous aggregation of data that takes place as the data move up the hierarchy, which masks the health facility data, making it difficult to analyze and use the data for local management activities, for example, detecting health care problems from a particular health facility. The reporting is one-way with limited supervision and feedback from the top authorities (sub-section 5.1.5; feedback and supervision).

Centralization of routine health information systems management is among the factors that influence low use and poor quality of information at local levels within the HIS. Indicators, data collection instruments, and reporting forms usually are designed by centrally located epidemiologists, statisticians, and administrators with minimal involvement of local level managers and health service providers. Lippeveld and Mukama pointed out that, the main result of this centralization is that information use is weakest at the district level, where the main public health interventions are planned, implemented, and monitored, and at the health facility level, where individual health decisions are made (Lippeveld, 2001; Mukama, 2003).

Health workers at local levels do not take part in defining appropriate solutions to common health problems in the community that they face in their daily work activities and lives. This in turn does not promote ownership and control of essential health system functions. Therefore, health workers at local levels are not motivated to produce high quality data, because most of the data they collect is irrelevant to their own information needs but it is useful at higher levels.

Decentralization of health information systems management towards the district level is an effective strategy to improve local use and quality of health information. However, to achieve positive results in decentralized health information systems management, most administrative functions should be carried out by the District Health Management Teams (DHMTs) in

collaboration with and with active involvement of the community. These administrative functions often include control over personnel, supplies and equipment: hiring of staff, purchasing and ordering of resources, planning and defining the data collection tools, delivery of health care services, and control over allocation of resources for different health programmes.

Lack of feedback and untimely reporting

The process of collating, analyzing, transmitting, and presenting the health data is so tedious that by the time a report is prepared, the information is obsolete and decisions are often made without relying on any information input (sub-section 4.1.5, feedback and supervision and sub-section 4.1.4, information flow). Health planners and decision makers face deadlines and time constraints especially with many tasks on their hands due to shortage of staff. This study found health facilities reports reaching the district health office one to three months later after they are due and reporting to the region/zone delayed further (sub-section 4.1.4, untimely data reporting and Appendix B.18).

Delays in data transmission and lack of feedback is attributed to the presence of strong vertical programmes, few resources of data analysis, lack of reporting tools including the forms, poor transport and communication infrastructure, and few health workers. Since health services supervisors and facilities health workers rarely receive feedback on the data reported to higher levels, they have little incentive to ensure the quality of the collected data and to comply with reporting requirements and deadlines.

The lack of complete reporting is also a serious problem found. The study results indicate many health facilities (sub-section 4.1.4 and Appendix B.18 as an example) that do not send report to the district health offices. In general, being located very far from the district health office and lack of transportation is an excuse for many health facilities not to submit a health report. Since not all facilities do report health data, users of health data cannot get the picture of the real situation for health delivery services.

Poor and inadequate resources and infrastructure for health care activities

There is a shortage of both human and financial resources, while the demand for healthcare services is increasing at the health facilities. The field research showed that the health facilities are understaffed resulting in high workloads, poorly qualified and trained health workers at health facilities, and the health facilities are lacking the most essential HMIS supplies such as forms and registers (sub-section 4.1.1, data generation).

Opportunities for applying the ICTs in supplying health, educational and agricultural information in developing countries are limited by a number of features, which include inadequate basic physical infrastructure such as telephone lines, and lack of required skills among health workers for using ICT tools (Mukama, 2003). The field research revealed that; lack of infrastructure, for example, telephone lines, internet, etc to be a problem for communication between the district offices and the health facilities within the district. Poor roads and lack of funds, for example, for cars and fuel, restrain the transport possibilities of the community and health workers, for instance, in cases of reports submission and to transport referred patients from one hospital to another.

While computer technology (computing) generally serves as a resource or tool to support other work such as performing complex analysis, preparing documents and sending electronic messages using office automation equipment (Gasser, 1986; Mukama, 2003), this research identified several problems related to computerized parts of the health information systems in Malawi. For example, some health facilities (Ngoni and Mbang'ombe 1) under Lilongwe DHO have touch screen computers for data collection and entry but they don't have enough trained personnel to perform these duties. As a result, the responsible health workers prefer to use manual data processing.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1. Concluding remarks

In conclusion; according to the research results discussed in this thesis, it has been revealed that the performance of the Health Management Information Systems (HMIS) in some selected sites in Malawi is not optimal enough to generate data that could support decision-making. The health data generated are of low quality (if collected by not trained personnel like volunteers) because they are subjected to being aggregated late, untimely reported and not all health facilities submit their reports to the district health offices.

Based on the analysis and discussion of the empirical findings in the previous chapters, the following statements describe crucial factors that lead to efficiency problems (challenges) of the Health Management Information Systems (HMIS):

- The health data generated are poor because health workers perceive information effort as a burden to them.
- The health data generated are poor because data collection tools (registers) are not available all the time in the health facilities (sub-section 4.1.1, data generation).
- There is incomplete and untimely reporting of health data because of poor transport and communication infrastructures.
- The inaccurate of the health data is caused by existence of few health workers and lack of data analysis tools like computers.

All efforts must be made to improve the quality of data collected at the data collection level. To ensure that the HIS/HMIS is well understood by health workers, training should be conducted. To enable accurate data collection and reporting; registers, forms and tally sheets should be relevant and easy to understand; to accomplish this, and data collectors must be involved in designing data collection tools. Supervision, support and feedback must be provided to local level health workers. Feedback may take many forms but it is best done in writing combined with discussion about what is written. Computers with internet connection must be provided to all health facilities and district health offices in order to improve in information flow. Transport

should also be made available all the time and lastly; cell phones with DHIS2 facility should be provided to all health facilities and DHOs in order to improve in information flow and feedback.

5.2. Limitations of the research

5.2.1. Unaccomplished tasks

Time is the limit. In this study, there are some activities which were supposed to be part of the study but have not been accomplished. The initial plans for this research were to look at challenges and opportunities of information flows and feedback in HIS (emphasis on HMIS) in Malawi; that is from community level (villages) to Health facilities to District Health Offices to Zonal /Regional offices to Ministry of Health Headquarters and also look at the feedback in all circumstances. But due to lack of time, the researcher only concentrated at District level which is from community level to health facility to District Health offices and did not proceed to look at information flows and feedback further to Zonal/Regional offices and Ministry of Health Headquarters. The researcher also wanted to analyze the information flows and feedback for other health information systems like Drugs Logistics Management Information System (DLMIS), Integrated Disease Surveillance and Response (IDSR), etc but due to lack of time this was not accomplished.

5.2.2 Constraints

Lack of resources, distances to the health facilities, time constraints and means of transport hampered the mode of research, since there are other health facilities that are in very remote areas, which the researcher did not manage to visit.

In some health facilities, most health workers were busy with health care delivery services. As a result, interview sessions were to undergo postponement, or were conducted during odd hours, which might have resulted in the interviewee being tired by the time the interview was conducted and thus not providing detailed answers.

Resources are always scarce, so one has to live within the available resources in terms of finances since this research was not sponsored or any other tools that might be of essence and

this therefore limited effective data collection. In this case instead of visiting as many DHOs and Health Facilities as possible only a few were visited.

5.3. Recommendations and further research needs

5.3.1. Recommendations

In the light of key findings, analysis and discussion from the research, the following ideas and recommendations are crucial to enable the use and management of health information and information flow and feedback at health facility and district levels within the health information system. The country needs to establish appropriate mechanisms for overcoming the problems facing work practices, information flows and feedback at local levels.

To overcome the problems/challenges facing work practices, information flow and feedback at district and health facility levels the following must be done.

- Local learning and discussion of essential HMIS needs, and the role of routine data collection in meeting those needs.
- Establishing an information culture in HMIS and health care organizations.
- Investing in health data collection, use and management of health information at local levels within the HMIS.
- Addressing challenges facing information flow and feedback in HMIS at health facility and district levels.
- Addressing challenges in Information efforts which are seen as a burden to workers.

Below are the details for the above mentioned overcoming the problems (challenges).

- ***Local learning and discussion of essential HMIS needs, and the role of routine data collection in meeting those needs:***

Health workers at DHO and health facility levels should be able to learn and practice their profession with due regard to the socio-cultural, organizational and political context of their work. Local learning and discussion of essential HMIS needs involve training health workers in data collection, analysis, use and management of information by discussing with health workers how to keep data collection tools as simple as possible and performing simple processing and

analysis of data. For example, one way of ensuring data quality at the health facility level is to look at the data by running one's eyes across each line looking for missing data values and inconsistencies. At the district level health workers may ensure data quality by checking for completeness of the reports from the health facilities before reporting to higher levels, that is, by checking if all health facilities have submitted all the reports with all the data they should report on.

- ***Establishing an information culture in HMIS and health care organizations:***

It is important to establish an information culture at district and health facility levels, where the health workers are able to collect data that are relevant, and direct its use to address the everyday problems that they are engaged in. By information culture, the researcher refers to a situation whereby information is valued as a resource that if meaningfully used and managed, can support the process of local decision-making and improve the effectiveness of healthcare service delivery. For example, when the district level discovers errors in the reports the following steps can be taken as a way of establishing an information culture:

- Finding the source and cause of errors by going back to the person who has collected the data, pointing out the problem and getting the data collector to appreciate the need for accuracy. Maybe the data collector does not understand the definition of the data element, or has double counted or collected the data incorrectly.
- Correcting the report by going back to the source data collection tool, that is, the register book or tally sheet or a form, to find the correct number to put in the report.
- Preventing future errors to the data collector by being sure that the data collector understands the importance of the particular data element and checking this particular data element in the next report to be sure that the error is not repeated.

This in the long run will establish an information culture among health workers and thus within the HIS.

- ***Investing in health data collection, use and management of health information at district and health facility levels within the HMIS:***

The improvement in the use and management of health information at district and health facility levels within the HIS needs to be made by considering the constraints of infrastructure and

scarce resources (physical and human), which cannot be ignored. The Ministry of Health (MoH) and donor assistance need to invest in health data collection, use and management of health information to support local decision-makers. Investing in HIS/HMIS involves supervision and support for the acquisition and development of basic resources and infrastructure. This in turn will involve providing sufficient and appropriate physical and human resources for HIS management and ensuring that the available resources are used in such a way that high-quality information is produced in a timely manner.

- ***Addressing challenges facing information flow and feedback in HMIS at health facility and district levels:***

In order for the information to flow properly and in good time from community to health facility to district health office to regional/zonal offices to headquarters and back to community, there is need for the government through the Ministry of Health to address the following challenges:

- Availability of data collecting tools (registers, forms, tally sheets, etc)
- Recruiting qualified people or train more people specifically for managing data.
- Availability of transport (ambulances, motorcycles, bicycles, etc).
- Availability of training opportunities in various disciplines.
- Availability of solar power energy in health facilities without hydro power electricity from ESCOM.
- Availability of computers with internet connection at all health facilities and district health offices.
- Availability of cell phones or fixed line telephones with units.

- ***Addressing challenges in Information efforts which are seen as a burden to workers:***

Whenever possible, the health information systems should minimize the constraints to health workers by employing more staff and by integrating their fragmented systems so that health workers collect data for only one system. In addition, adequate technological support should be made available at the district level in order to assist data storage and analysis. Data collection tools should be available at the health facilities all the time, and the design of the data registers should be clear and should support local contexts.

5.3.2. Further research areas

A further research area could be to study the challenges and opportunities of information flows and feedback in health information systems and emphasis should be on Drugs Logistics Management Information System (DLMIS) and Integrated Disease Surveillance and Response (IDSR). Another further research study area could be to proceed looking at challenges and opportunities of information flows and feedback in HIS (HMIS data) in Malawi from DHO to Zonal/Regional offices to Ministry of Health Headquarters which were not accomplished due to time constraint.

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APPENDICES

APPENDIX A: SAMPLE QUESTIONNAIRE

UNIVERSITY OF MALAWI



CHANCELLOR COLLEGE

FACULTY OF SCIENCES

MATHEMATICAL SCIENCES DEPARTMENT

RESEARCH PROJECT QUESTIONNAIRE

*Information Flow and Feedback in Health Information Systems at district level in Malawi:
Challenges and Opportunities*

(Case Study: Lilongwe DHO & Area25 and Kabudula Health Areas, Zomba DHO & Thondwe Health Facility and Blantyre DHO & Ndirande Health Facility)

Research conducted by **Enock Chibankhuni Nyirenda MSC/INF/13/10**

(Master of Science Degree in Informatics, Year 2)

This research will be concerned with the difficulties, barriers and opportunities that the Malawian health information system is facing in Information flow and Feedback. This research will dwell much on Health Management Information Systems (HMIS) especially relating to how the information flows from bottom-up/top-down and how the feedback is given in both circumstances.

How to answer:

- Mark corresponding letters by ticking beside them or circling them.
- Where there is no response, please leave blank unless instructed to write.

Questionnaire used for HMIS (DHIS) in Malawi

This research is for academic purposes whereby the findings will be presented at the Faculty of Science, Chancellor College, University of Malawi. There are no right and wrong answers. **All information will be strictly confidential**, please feel free to respond on these questions.

Topic: *Data Collection, Storage, Retrieval, and Analysis for Health Information System in Malawi.* **Key:** *Y: Yes, N: Not, D: Don't know, CHW: Community Health Workers*

Interviewer:.....

Meeting:

Place:.....Date:.....Start:.....End:.....

Interview:

Type:.....Language:.....

Interviewee:

Name:.....Occupation:.....

Age:.....Marital Status:.....Department:.....

Section A: Data Acquisition/Collection

1. What categories of data do you have? (a)..... (b).....
(c)..... (d)..... (e).....
2. Who collects data at the department? (a)..... (b).....
(c).....
3. What instruments/tools of data collection are used? e.g. Forms, letters, memos etc
(a)..... (b)..... (c).....
(d)..... (e).....
4. How much time do you spend collecting data/filling registers/writing reports?
(a). every day..... (b). at the end of the week.....(c). at the end of
the month.....
5. What types of data are collected at this level? (a).....
(b)..... (c).....
6. What type of information is required by the health program managers?
(a)..... (b)..... (c).....
7. What type of information is required by the Nurses?
.....
8. What type of information is required by the Pharmacists?
.....
9. What type of information is required by the Statisticians?
.....

10. What type of information is required by the Regional Office?
.....
11. What type information is required by the Ministry?
.....
12. Do you consider the information to be easily available **Y/N/D** (a). Accurate **Y/N/D**
(b). Complete **Y/N/D** If not accurate,
why?.....
.....

If not complete,
why?.....
.....

Section B: Data/Information storage and analysis

1. Where is data stored (Piled forms, in computer, files, filing cabinets etc)?
(a). Piled forms (b). In a Computer (c). Files (d). Filing cabinets (e). other
(specify).....
2. Are there any problems with data storage? **Y/N/D**. If YES what are
they?.....
3. How is data/information stored?
.....
4. How much data/information is stored in the system (daily, weekly, monthly and
quarterly)? (a). Daily..... (b). Weekly..... (c).
Monthly..... (d). Quarterly of a year.....
5. What do you do with the forms (data) when you have completed them?
(a)..... (b)..... (c).....
6. What instruments do you use to calculate statistics from the data? (a). Manual (b).
Calculator (c). Microsoft Excel (d). other
(specify).....
7. How much time is spent analyzing data? (a). every day..... (b). at the end
of the week..... (b). at the end of the
month.....
8. Do you analyze data at your level using the following? (a). Tables **Y/N/D** (b). Graphs
or pictures **Y/N/D** (c). Used in reports **Y/N/D** (e). other (specify)
Y/N/D.....
9. How are you calculating the monthly statistics? (a). Not calculating **Y/N/D** (b). By hand
Y/N/D (c). By calculator **Y/N/D** (d). other
(specify).....

10. How is the data/information analyzed and by whom?
.....
11. How much of the stored data/information is analyzed to derive reports?
.....
12. What types of reports are produced out of the stored data/information?
.....
13. How often are these reports produced? (a). Weekly (b). Monthly (c). Quarterly
(d). Yearly

Section C: Health Management Information Systems

1. Does your institution have a computer? **Y/N/D**
2. Is the data you collect being entered into a computer? **Y/N/D**
If yes, at what level is the data being entered?.....
.....
If yes, do you benefit from this? **Y/N/D**
How do you benefit from this?
.....
3. Can a computer support you/your institution better? **Y/N/D**
If yes, how?
.....
4. Does your institution need a computer? **Y/N/D**
If yes for what purpose?.....
.....
5. Are there any computer training opportunities at your dept? **Y/N/D**
If not, do you need one? **Y/N/D**
If yes, why do you need one?.....
.....
6. Do you have access to any of the following Information Systems?
(a). HMIS (DHIS) (b). DLMIS (c). Manual documentation (d). other
(specify).....
8. Which type of Information System is used most?
.....
9. How reliable is this mostly used Information System?
.....
10. Does this mostly used Information System have security for the information which flows
from source to and from destination?
.....

Section D: Information Flow in Health Management Information System (HMIS)

1. What do you do with the forms when you have completed them?
(a). Analyze locally (b). Aggregate and send to top level (c). Store them in files
(d). other (specify).....
2. What do you think they do with the information you send to the top level? (a). Analyze
(b). Use it for planning (c). Use it for decision making (d). for annual report (e). Send it
to higher level (f). Nothing (g). other
(specify).....
3. Are you getting the monthly statistics on time? **Y/N/D** (a). From Health Centers?
(b). From CHWs? (c). From DHO (d). other (specify).....
4. Are you sending the monthly statistics on time? **Y/N/D** (a). To Health Centers? (b). To
DHO? (c). To Region (d). other (specify).....
5. How do you send the monthly statistics? (a). Carrying it myself. (b). Sending it with
other people. (c). By Post (d). others
(specify).....
6. By what means do you send the monthly statistics? (a). By Ambulance (b). By Post
(c). By bicycle (d). By Motorcycle (e). Through Internet (f). Other
(specify).....
7. Do you have problems in reporting/sending information to the next level? **Y/N/D** If yes,
specify.....
8. Are you using the information from the monthly statistics? **Y/N/D** If yes,
specify.....

Section E: Feed back in Health Management Information Systems

1. Do you ever get feedback on results you send to the top level? **Y/N/D**
If yes, how often? (a). every week (b). Every month (c). Once a year (d). Twice a
year (e). Quarterly a year (f). Once in a while (g). Other
(specify).....

If yes, in what form do you get the feedback? (a). Supervision (b). Written feedback
(c). Reports (d). Graphs (e). any others (specify)
.....

If no, what do you think are the reasons for not getting feedback on the sent information?
.....
2. Is the feedback received only from top, bottom or both ways? (a). Top (b). Bottom
(c). Both ways (d). other (specify).....
3. By what means do you get the feedback of the sent information? (a). By Ambulance
(b). By Post (c). By bicycle (d). By Motorcycle (e). Through Internet (f). Other
(specify).....

4. How long does it take for the feedback to be received?
.....

Section F: General

1. What gaps do you feel exist between the information you have and the information you need?.....
.....
2. How can the information system and the use of information be improved?
.....
.....
3. What do you think are the Challenges and Opportunities in Malawi's Health Management Information Systems?
Challenges:.....
.....
.....
Opportunities:.....
.....
.....
4. How can we address the mentioned Challenges?
.....
.....
.....

Thank you for spending your precious time to answer the questions!!

B.1. Tally Sheet for Child Health Days.

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B.2. Form 1A: IMCI Village Clinics Monthly Report Form for Under Fives.

FORM 1A

IMCI VILLAGE CLINICS MONTHLY REPORT FORM FOR UNDER FIVES

Village clinic _____ Month _____
 GVH _____ Year _____
 TA _____ HSA name _____
 District _____ Date of reporting _____
 Nearest Health facility _____

Condition/Age	New cases			referrals			Deaths (within 7 days of receiving treatment at a village clinic)		
	2 to 11 months	12 to 59 months	TOTAL	2 to 11 months	12 to 59 months	TOTAL	2 to 11 months	12 to 59 months	TOTAL
Malaria/Fever									
Diarrhoea									
Pneumonia/Fast breathing									
Red eye									
Malnutrition									
Anaemia/pallor									
Other conditions									
TOTAL									

New cases by gender	
males	
females	

Supplies management Table

Name of Drug/Supply	Unit of Issue	(A)	(B)	(C)		(D)	(E)	(F)
		Opening balance	Qty Dispensed	Losses	Adjustment	Ending balance	Qty received	New SOH
					(+) (-)			
1. CHILD HEALTH								
LA 6X1	Treatment							
LA 6X2	Treatment							
ORS	Sachet							
Paracetamol	Tablet							
Cotrimoxazole	Tablet							
Zinc	Tablet							
Eye ointment	Tube							

Name of Verifying officer _____ Signature _____
 Name of Approving officer _____ Signature _____

* Report should be sent to the nearest Znd of each month
 * To be completed in duplicate, copy for the village clinic file, copy to be sent to the health centre

B.3. IDSR monthly report form.

Monthly surveillance summary report form in Malawi 37513

Health Facility _____ District _____ Region _____ Month _____ Year _____

Number of sites that are supposed to report _____ Number of sites that reported on time _____

Number of sites the reported late _____

		Out-Patient	In-Patient	
		Cases	Cases	Deaths
Malaria <5 years	Uncomplicated			
	Severe			
Malaria ≥5 years	Uncomplicated			
	Severe			
Malaria in Pregnant Women	Uncomplicated			
	Severe			
In-Patient Malaria with severe anaemia (<5 years)				
Uncomplicated Malaria < 5 years, lab-confirmed				
Uncomplicated Malaria 5+ years lab-confirmed				
Pneumonia (<5 years)				
Severe Pneumonia (< 5 years)				
Very severe Pneumonia (< 5 years)				
Diarrhoea with dehydration				
New AIDS cases				
Male Urethral Discharge				
Male Non-vesicular Genital Ulcer				
Female Non-vesicular Genital Ulcer				
Diarrhoea with blood				
Schistosomiasis urinary				
Schistosomiasis intestinal				

Zero reporting for immediately-reportable, case-based disease/conditions:
Total cases and deaths previously reported this month on case forms or line lists

	OUT PATIENT CASES	IN-PATIENT CASES	DEATHS
AFP			
Cholera			
Measles			
Meningitis			
Neonatal Tetanus			
Plague			
Viral Hemorrhagic Fever			
Diarrhoea with blood			

NOTE: Official counts of immediately notified cases come only from case forms or line lists. The counts from the zero-reporting boxes are not official counts.

Analysis, interpretations, comments, and recommendations on both out-patient and in-patient data

Other information:
Look at the trends in the District Analysis Book. Comments on observed trends? Abnormal increase in cases, deaths, or case fatality ratios? Lack of decrease of previous increasing trends? Improving trends?

Conclusions:
Actions taken:
Recommendations:

Sent _____ Date: _____ Received _____ Date: _____
Report _____ Person: _____ Report _____ Person: _____

• Record above the total number of cases and total number of deaths for each disease/condition except for TB and leprosy which is reported quarterly on separate form
 • Pneumonia, and severe pneumonia are defined according to WHO Integrated Management of Childhood Illnesses (IMCI) definitions. Update District Analysis Book if receive late reports from health facilities. If late reports are received from health facilities from previous months, send a separate sheet to the national updating numbers

B.4. IDSR weekly report form.

179801

DISTRICT REPORT ON DISEASES UNDER WEEKLY SURVEILLANCE IN MALAWI

Report ID Number (CCC-DDD-YYYY-WW) ____-____-____-____ (County code-District code- Year-Week number)

Year: ____

Week: ____ Week beginning Date ____/____/____ Week ending Date ____/____/____

Health Facility Name: _____

District Name _____ Total population: _____

Number of sites expected to report: ____

Number of sites that reported on time: ____

Number of sites that reported late: ____

Region: _____ Country: **Malawi**

Diseases	Cases	Deaths	Lab confirmed cases	Laboratory specific findings			
					Number		Number
Bloody diarrhoea				SD1		Other Dysentery pathogens	
Cholera				V. cholerae 01		V.cholerae 0139	
Measles							
Meningitis				N.mA		N.mC	
				N.m W135		Hib	
				Pneumo		Other CSM pathogens	
Plague							
Viral haemorrhagic fever				Crenea-Congo		Dengue	
				Ebola		Lassa	
				Marburg		Rift valley	
				Other VHF pathogens			
Acute Flaccid Paralysis							
Neonatal tetanus							

Source(s): _____

Date of report ____/____/____

Reporting officer: _____

Comments

B.5. Family planning reporting form (page 1).

REPUBLIC OF MALAWI MINISTRY OF HEALTH		CODE..... Office use only				
MONTHLY SUMMARY FORM FOR FAMILY PLANNING CLINIC						
A: METHOD OF CONTRACEPTION						
District.....	Name of Clinic.....	Month.....	Year.....			
(Please complete all above spaces)						
Method of Contraception	Clients	Subsequent 1st Visit	This Year Revisit	Restarting	Discontinuing	Cycles/Units
1. Lofemenol						
2. Ovrette						
3. Other Oral						
4. Lippes						
5. Copper T						
6. Other IUCD						
7. Depoprovera						
8. Norplant						
9. Tubal Ligation	XX XX XX					
10. Vasectomy						
11. Condom Reg Client						
12. Spermicides Tabs						
13. Other Methods						

Clients Counsellled : New..... Old..... Dropouts.....

Clients Changing Methods.....

Total Non-Registered Clients Issued Condoms.....

Postnatal Check-ups: 1 Week..... 6 Weeks..... Absentees:.....

Comments :

.....

.....

.....

B.6. Family planning reporting form (page 2).

B. AGE OF NEW CLIENTS

Method	>20	20-24	25-29	30-34	35-39	40-44	45-49	49+
Oral								
IUCD								
Depoprovera								
Norplant								
Vasectomy								
Tubal Ligation								
Others								

C. PARITY OF NEW CLIENTS

Method	0	1	2	3	4	5	6	7	8	9	9+
Oral											
IUCD											
Depo											
Norpla.											
Vasec											
Tubal L.											
Others											

D. REASON FOR DISCONTINUATION (DISCONTINUING CLIENTS ONLY)

Method	Want Another Child	Abnormal Bleeding	Pelvic Infection	Severe Headache	Pregnancy	High Blood Pressure	Other Side Effects
Oral							
IUCD							
Depo							
Norpla.							
Vasec							
Tubal L.							
Others							

Prepared by: Signature: Date:
 MED.

B.7. Register for TB patients contacts.

[illegible]

B.8. ARV Clinic Quarterly Supervision Form.

4th Quarter 2010
Version 5

ARV Clinic Quarterly Supervision Form - Part 1 2010 Q3

Ndirande Health Centre

First patient registered: 01/07/05 Visit date: Public sector South West Blantyre

Contactable Clinic Staff

Name	Position	Phone
Ireen Magombo	Clerk	0 999 400 852
Chikondi Maluwa	CO	0 999 316 336
Jean Maloya	Nurse	0 888 188 753

Number of outreach / mobile ART clinics served by this clinic during the quarter evaluated (write 0 if none)

Cohort survival analysis

Cohort	Interval months	Age group	Total reg. (database)	Total reg. (confirmed)	Alive	Outcomes as of end of quarter evaluated			
						Died	Defaulted	Stopped	Transfer out
2005 Q3	60	All	132						
2006 Q3	48	All	101						
2007 Q3	36	All	128						
2008 Q3	24	All	173						
2009 Q3	12	All	192						
		Children	26						

Action points to be tackled by CLINIC STAFF before next visit

-
-
-

Action points for SUPERVISION TEAM

-
-
-

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B.9. Environmental Health Quarterly Report Form by HSA.

ENVIRONMENTAL HEALTH QUARTERLY REPORT BY HSA

	JULY	AUG	SEPT	OCT	NOV	DEC
Total pop	1332	1332	1332	1189		
Total HH	332	332	332	291		
No. of villages	2	2	2	1		
No. of planned VHCs	2	2	2	1		
No. of VHCs formed	2	2	2	1		
No. of active VHCs	20	20	20	18		
coverage of latrines	239	248	259	218		
coverage of improved latrines	17	18	19	18		
HHs with covered latrines	230	231	235	200		
HH casted san plats	0	0	0	0		
HH installed san plats	0	0	0	0		
HH casted dome slabs	0	0	0	0		
HH casted dome slabs	0	0	0	0		
HH with HWF at latrine	192	203	211	174		
HH with bath shelters	242	250	257	211		
HH with refuse pits	153	159	166	146		
No of stand pipes	2	2	2	2		
No of boreholes	3	3	3	3		
Boreholes functioning	3	3	3	3		
Boreholes not functioning	0	0	0	0		
B/Holes with washing slabs	2	2	2	2		
B/ Holes with satis. drainage	3	3	3	3		
No of shallow wells	2	2	2	2		
No. of protected wells	2	2	2	2		
Wells functioning	2	2	2	2		
Wells with washing slabs	0	0	0	0		
Wells with satisfactory drainage	2	2	2	2		
No. of springs	0	0	0	0		
No. of springs protected	0	0	0	0		
HHs with water container indoors	330	330	330	289		
HHs with water containers covered	298	299	306	287		
HHs with wet HWF	192	203	211	174		

REPORTED By : HSA KASTHAMA

B.10. Maternity Clinic – Facility Monthly Report Form.

MATERNITY CLINIC – FACILITY MONTHLY REPORT			
Facility Name		Version 2	
Reporting Year	Reporting Month		September
Was any client served at this site during this month? If no, still submit this report			2009
			Y N
HIV test result			
1 Previous negative		24 A	
2 Previous positive		25 B	
3 New negative		26 C	
4 New positive		Mother alive	
5 Not done		27 Alive	
Total women		28 Died	
Total HIV pos. (2+4)		Twins	
ARV during pregnancy			
6 None		29 Single babies	
7 AZT 0-3w		30 Twin babies	
8 AZT 4+w		Total babies (29+30)	
9 ART 0-3w		Delivery place	
10 ART 4+w		31 This facility	
ARV during labour			
11 None		32 In transit	
12 sdNVP		33 Other facility	
13 NVP+AZT+3TC		34 Home/ TBA	
14 ART		Delivery mode	
Obst. complications			
15 None		35 Spontaneous vaginal	
16 Haemorrhage		36 Vacuum extraction	
17 Obstr / prol labour		37 Breech	
18 (pre-) Eclampsia		38 Caesarean section	
19 Sepsis		Infant complications	
20 Ruptured uterus		39 None	
21 Other		40 Prematurity	
Referred out			
22 No		41 Weight less 2500g	
23 Yes		42 Asphyxia	
Infant survival / PMTCT			
		43 Sepsis	
		44 Other	
		45 Alive not HIV exp.	
		46 Alive exp. no ARV	
		47 Alive exp. NVP	
		48 Alive exp. NVP+AZT	
		49 Alive exposed AZT	
		50 Alive unknown exp.	
		51 Stillbirth, fresh	
		52 Stillbirth, macerated	
		53 Neonatal death	
Breastfeeding initiated			
		54 No	
		55 Yes	
Report filled			
		Date	
		Name	
		Phone	
Notes			
Report received			
		Date	
		Name	

[illegible]

B.12. HMIS – 15 Quarterly Report Form (Page 1).

Fiscal Year: _____

Nelwanele Hospital / Health Centre
Health Management Information
Quarterly Report

HMIS-15

Indic No	Data Elements (DE)	Facility Code			Quarterly Total
		Month	Month	Month	
39	Number of pregnant women starting antenatal care during their first trimester	Jan	Feb	March	
40	Total number of new antenatal attendees	17	26	32	
40	Total antenatal visits	552	609	749	1910
41	Number of deliveries attended by skilled health personnel	983	933	1154	3070
42	Number of women with obstetric complications treated in care facility	226	156	170	
43	Number of caesarean sections	11	23	13	
44	Total number of live births	0	0	0	
44	Number of babies born with weight less than 2500g	136	173	188	
45	Number of abortions complications treated	4	3	1	8
46	Number of eclampsia cases treated	3	5	4	12
47	Number of Postpartum haemorrhage (PPH)	4	2	2	8
48	Number of sepsis cases treated	0	1	3	4
49	Number of pregnant women treated for severe anaemia	0	0	0	0
51	Number of newborn treated for complications	3	2	1	6
52	Number of postpartum care within 2 weeks of delivery	0	0	0	0
Family Planning					
53a	Number of persons receiving 3 months supply of condoms	47	20	3850	3917
b	Number of persons receiving 3 months supply of oral pills	25	0	0	25
c	Number of persons receiving Depo-Provera	124	1736	0	57
d	Number of persons receiving Norplant	0	34	23	0
e	Number of persons receiving IUCD	0	0	0	0
f	Number of persons receiving sterilization method FP	0	0	0	0
Child Health					
55	Number of fully immunized under 1 children	505	501	512	1518
56	Number of under 1 children given BCG	581	560	550	1691
56	Number of under 1 children given Pentavalent III	545	540	512	1627
56	Number of under 1 children given Polio-III	545	540	524	1609
56	Number of under 1 children given 1st doses at 9 months	496	501	512	1509

1

B.13. HMIS – 15 Quarterly Report Form (Page 2).

ic	Data Elements (DE)	Month Jan	Month Feb	Month March	Quarterly Total
57	Number of Vitamin A doses given to 6-59 months population	93	104	155	
62	Number of under-weight in under-fives attending clinic	12	7	9	30
30	Number of 15-49 years receiving volunteer and confidential testing and serostatus result	207	202	147	556
31	Number of 15-49 age group tested HIV positive	42	48	27	111
32	Number of HIV positive persons receiving ARV treatment	65	57	86	208
34	Number of pregnant women receiving VCT and serostatus result	201	235	308	744
35	Number of pregnant women tested HIV positive	30	41	53	124
36	Number of HIV positive women treated for PMCT	30	41	53	124
62	Total number of children attending under-five clinic	8009	7333	6980	22322
103	Number of OPD attendance	10743	11330	12885	34958
	Tuberculosis				
65	Number of confirmed TB new cases	18	12	12	43
66	Number of smear negative and extra-pulmonary cases completed treatment	0	0	0	0
67	Number of new sputum positive cases proved smear negative at the end of treatment	0	0	0	0
	Supplies				
23	Was there any stock outs of SP for more than a week at a time (Y/N)	N	N	N	
23	Was there any stock outs of ORS for more than a week at a time? (Y/N)	N	Y	N	
23	Was there any stock outs of cotrimoxazole for more than a week at a time? (Y/N)	N	Y	N	
23	Was there any stock outs of SP, ORS and cotrimoxazole for more than a week at a time? (Y/N)	Y	Y	Y	
24	Number of functioning ambulances	7	7	7	600
76	Number of insecticide treated nets distributed	600	0	0	
	Community Health Activities				
25	Number of households with access to safe drinking water	32000	22000	22000	
26	Number of households with at least a sanplat latrine	17627	17627	17627	
38	Number of HBC patients followed-up and provided treatment	84	83	88	255
	Human Resource Currently at Work				
7	Clinical Officer				

B.14. HMIS – 15 Quarterly Report Form (Page 3).

ic No.	Data Elements (DE)	Month	Month	Month	Quarterly Total
	Doctors				
	Dental Surgeon				
	Dermatologist				
	Medical Officer				
	Obs/Gynaecologist				
	Ophthalmologist				
	Paediatrician				
	Pathologist				
	Physician				
	Surgeon				
	Environment Health Officer				
	Health Surveillance Assistant				
	Medical Assistant				
	Nurses				
	Registered				
	Enrolled/Midwife				
	Community				
	Pharmacist				
	Physiotherapist				
	Radiologist				
	Technicians				
	Laboratory				
	Pharmacy				
	Radiography				
	All other positions				
	Total personnel currently at work				
	Finance				
56	Total income from cost sharing				
	Physical Facilities				
17	Do you have functioning water supply system? (Y/N)	Y	Y	Y	
17	Do you have functioning electricity? (Y/N)				
17	Do you have functioning communication system? (Y/N)	Y	Y	Y	
17	Do you have functioning water supply, electricity and communication system? (Y/N)	Y	Y	Y	
	Management and Supervision				
13	Is the health Centre committee functional (Y/N)	N	Y	Y	
15	Did DHMT members using the integrated supervision checklist supervise you? (Y/N)	N	N	N	
	New Cases (OPD plus Inpatient)	10743	11330	12885	34958
		73	154	173	400
27	Sexually transmitted infections-new cases	9	8	9	26
29	Syphilis in pregnancy				
		42	48	27	114
31	HIV confirmed positive (15-49 years) new				

B.15. HMIS Quarterly Reporting Form (Page 4).

ad No.	cases	Month Jun	Month Feb	Month Mar	Quarterly Total
37	Opportunistic infections-new cases				
58	Acute Respiratory Infections -new cases (Under 5)	109	93	73	273
60	Diarrhea non -bloody-new cases (under 5)	363	127	405	895
64	Malnutrition-new cases (under 5)	141	199	496	819
69	Malaria -new cases (under 5)	30	29	44	100
70	Malaria new cases (5 and over)	1198	1305	2111	4614
78	Neonatal tetanus -confirmed new cases	2535	2864	3727	9123
79	Cholera - confirmed new cases	0	0	0	0
81	Measles - confirmed new cases	0	0	0	0
82	Acute Flaccid Paralysis-confirmed new cases	3	1	0	4
83	Ebola-confirmed new cases	0	0	0	0
84	Meningococcal meningitis - confirmed new cases	0	0	0	0
85	Plague-confirmed new cases	0	0	0	0
86	Rabies-confirmed new cases	16	13	14	
87	Yellow fever-confirmed new cases	0	0	0	0
88	Dysentery-new cases	83	29	42	154
90	Eye infections-new cases	173	109	98	388
91	Ear infections-new cases	43	32	29	104
92	Skin infections -new cases	209	211	415	
93	Oral conditions (including dental decay)-new cases	478	409	433	1314
94	Schistosomiasis-new cases	19	6	11	36
95	Leprosy -new cases	0	0	0	0
96	Common injuries and wounds (except RTA)	0	0	0	0
98	Number of road traffic accidents	0	0	0	0
	Admissions				
	Psychiatric patients referred to Zomba Mental Hospital	0	0	0	0
	New under 5 Psychiatric cases	0	0	0	0
	New over 5 Psychiatric cases	0	0	0	0
	Epilepsy new cases under 5 years of age	9	17	13	39
	Epilepsy new cases over 5 years of age	9	7	13	29
	TBA				
	Number of deliveries attended by Traditional Birth Attendants	0	1	0	1
20a	Epilepsy new cases over 5 years of age		Change the bed capacity if it is different from the previous month		
.b	Total number of admissions (including maternity)	226	156	170	
.c	Total number of discharges				
.d	Total inpatient days				
	Inpatient Deaths (including Maternity Deaths)	0	0	0	0

B.16. Locally designed monthly report stock sheet for Likuni Phala at Chiwe Health Facility in Lilongwe DHO by an HSA.

MONTHLY REPORT STOCK SHEET

MONTH OF REPORT: July, Year: 2011

NAME OF FACILITY: Chiwe
 District: Lilongwe
 TA: Kalselo
 NO OF OUTREACH CLINICS: 4

Commodity	Measuring And Unit	Stock on first day of month	Deliveries received in month	Quantity distributed to beneficiaries	Quantity for giving demonstration	Quantity lost	Stock on last day of this month	Request for the following month
Likuni Phala	Lg	0	2275	1335	0	0	940	
ON	Lt	0	160	135	0	0	27	

Beneficiaries Numbers

Beneficiary Category	Male	Female	Total
Number of Children U15	30	36	66
No of Pregnant and Lactating Mothers		70	70
Others		0	0

B.17. Registers and forms stored in files, filing cabinets and on tables due to lack of storage space at Nambuma Health Facility in Lilongwe DHO.



B.18. Dead line for report submission for Kabudula Health Area in Lilongwe DHO for the month of October 2011.

HEALTH

20. Malembo
21. Muanda
22.

REPORTS TO BE SUBMITTED BEFORE THE 5TH OF EVERY MONTH

MONTH: OCTOBER YEAR: 2011

HEALTH FACILITY	REPORTS TO BE SUBMITTED AT THE END OF THE MONTH						DESCRIPTIVE REPORT
	OTP	NRU	IDSR	HIMS	SFP	XCH	
KABUDULA COMM.HOSP	✓				✓	✓	✓
NAMBUMA							
NSARU	✓		✓	✓		✓	✓
UKWE	✓		✓		✓	✓	
CHIWE	✓		✓	✓		✓	
CHIKOWA	✓						
MALEMBO	✓		✓			✓	✓
KHONGONI	✓						
CHILOBWE	✓	—	✓	✓	—	✓	✓

NB: TICK UPON SUBMISSION OF THE REPORT

VILLAGE HEALTH REGISTER
CODES FOR TRADITIONAL AUTHORITIES

APPENDIX C: TABLES SHOWING RESULTS

C.1. Register books and tally forms for data collection and reporting at the health facilities in Malawi (Source: Field visits at Blantyre, Zomba and Lilongwe DHOs).

Register book/Tally form title and functionality
IMCI Village Clinics monthly report form for under fives (App. B.3) -Used to collect data for water and sanitation, under 5, deaths, births, maternal, etc in villages by either HSAs or volunteers.
Register for TB patients contacts (Appendix B.8) -Used to collect data and contacts for TB patients.
ARV Clinic Quarterly Supervision form (Appendix B.9) -Used to collect data for patients who are on ARV treatment.
Outpatient Department (OPD) register book (Appendix B.12) - Used to collect information on outpatients
Maternity Clinic – Facility Report Form (Appendix B.11) - Used for monitoring pregnant women.
Tally sheet for Child Health Days (Appendix B.2) - Used for recording information about the children attending the health facility.
Family planning reporting form (Appendix B.6) - Used for recording all the family planning clients as well as the quantity of contraceptives supplied to clients.
IDSR monthly and weekly report forms (Appendices: B.4 and B.5) - Used for recording monthly and weekly disease surveillances.
HMIS – 15 Quarterly Report Forms (Appendices: B.13, 14, 15 & 16) - Used for recording all HMIS data.
Environmental Health Report Form (Appendix B.10) -Used for recording age, boreholes, house holds, vaccinations, immunization of under fives, pneumonia vaccines, births, deaths, etc

C.2. Time spent during data collection and report writing (Source: Questionnaire results, field work, September to December 2011).

Note: CO: Clinical Officer, AEHO: Assistant Environmental Health Officer, LL: Lilongwe, BT: Blantyre, MA: Medical Assistant, SHSA: Senior Health Surveillance Assistant, H/F: Health Facility, SRNM: State Registered Nurse Midwife.

Respondent/work area	Time spent during data collection and report writing		
	Every day (hrs)	At the end of the week (hrs)	At the end of the month (hrs)
CO / Thondwe Health Facility	1	5	110
Comm. Health Nurse/Thondwe H/F	8	40	176
HSA/Thondwe H/F	4	20	88
SRNM/Zomba DHO	8.5	42	170
EHO/Zomba DHO	8.5	42.5	170
EHO/Blantyre DHO	8.5	42.5	170
ART Clerk / Ndirande Health Facility	8	40	160
Nurse/Ndirande H/F	8	5	8
HSA/Ndirande H/F	8.5	42.5	170
MA, SHSA, HMIS Clerk/Ngoni H/F	8.5	42.5	170
HMIS Officer / Blantyre DHO	8	40	160
IDSr Officer/Blantyre DHO	8	40	880
Statistician/Zomba DHO	8	12	12
HMIS Clerk / Ndirande H/C	8	5	40
SHSA, MA, Nurse, HMIS Clerk / Lumbadzi H/F	8.5	42.5	170
SHSA, MA / Khongoni H/F	8.5	42.5	170
HMIS Clerk, Nurse, SHSA, MA / Mbang'ombe Health Facility	8.5	42.5	170
Statistician/LL DHO	8.5	42.5	170
AEHO, CO, HMIS Clerk/Kabudula H/F	8.5	42.5	170

C.3. Availability, Accuracy and Completeness of information (Source: Questionnaire results, field work, September to December 2011).

Respondent/work area	Availability, Accuracy and Completeness of information		
	Availability (Y/N/D)	Accuracy (Y/N/D)	Completeness (Y/N/D)
Clinical Officer /Thondwe H/F	Y	Y	Y
Comm. Health Nurse/Thondwe H/F	Y/N	Y/N	Y/N
HSA/Thondwe Health Facility	Y	Y	Y
SRNM/Zomba DHO	Y	Y	Y
EHO/Zomba DHO	Y	Y	Y
Statistician/Zomba DHO	Y	Y	Y
ART Clerk / Ndirande Health Facility	Y	Y	Y
Nurse/Ndirande H/F	Y	N	N
HSA/TB Officer/Ndirande H/F	Y	Y	Y
MA, SHSA, HMIS Clerk/Ngoni H/F	Y	Y/N	Y/N
HMIS Officer / Blantyre DHO	Y	Y	Y
IDSR Officer/Blantyre DHO	Y	N	N
EHO/Blantyre DHO	Y	Y/N	Y/N
HMIS Clerk / Ndirande H/C	Y	Y	Y
SHSA, MA, Nurse, HMIS Clerk / Lumbadzi Health Facility	Y	Y	Y
SHSA, Medical Assistant / Khongoni H/F	Y	Y/N	Y/N
HMIS Clerk, Nurse, SHSA, MA / Mbang'ombe H/F	Y	Y/N	Y/N
Statistician/Lilongwe DHO	Y	Y	Y
AEHO, CO, HMIS Clerk/Kabudula H/F	Y	Y/N	Y/N

C.4. Capacity of data stored in the health information system (Source: Questionnaire Results, interviews, field work, September to December 2011).

Respondent/Work area	Capacity of data stored in the system			
	Daily (forms)	Weekly (forms)	Monthly (forms)	Quarterly (forms)
Clinical Officer/Thondwe Health Facility	10	50	220	360
HMIS Officer/Blantyre DHO	15	50	150	400
Statistician/Zomba DHO	10	50	200	350
EHO/Zomba DHO	25	100	200	600
HMIS Clerk/Ndirande H/F	5-8	25-40	100-160	300-480
Statistician/Lilongwe DHO	10	50	200	400
HMIS Clerk, Nurse, SHSA, MA / Mbang'ombe H/F	10	50	200	350
MA, SHSA, HMIS Clerk/Ngoni H/F	8	40	160	400
SHSA, MA / Khongoni H/F	10	50	200	400
SHSA, MA, Nurse, HMIS Clerk / Lumbadzi H/F	8	40	160	350
AEHO, CO, HMIS Clerk/Kabudula H/F	10	50	200	350
HSA/Ndirande Health Facility	250	1000	4000	12000
Nurse/Ndirande Health Facility	10	50	200	400
ART Clerk/Ndirande Health Facility	150	750	3000	9000
EHO/Blantyre DHO	25	100	200	600
IDSR Officer/Blantyre DHO	10	50	200	400
SRNM/Zomba DHO	7	30	120	360
HSA/Thondwe Health Facility	5	25	110	330
Nurse/Thondwe Health Facility	6	30	132	396

C.5. Data analyzing instruments.

Respondent / work area	Data analyzing instrument				
	Manual	Tables	Graphs	Excel	SPSS
Clinical Officer/Thondwe Health Facility	Yes	Yes	Yes	No	No
HMIS Officer/Blantyre DHO	Yes	Yes	Yes	Yes	Yes
Statistician/Zomba DHO	Yes	Yes	Yes	Yes	Yes
EHO/Zomba DHO	Yes	Yes	Yes	Yes	Yes
HMIS Clerk/Ndirande H/F	Yes	Yes	Yes	No	No
Statistician/Lilongwe DHO	Yes	Yes	Yes	Yes	Yes
HMIS Clerk, Nurse, SHSA, MA / Mbang'ombe H/F	Yes	Yes	Yes	No	No
MA, SHSA, HMIS Clerk/Ngoni H/F	Yes	Yes	Yes	No	No
SHSA, MA / Khongoni H/F	Yes	Yes	Yes	No	No
SHSA, MA, Nurse, HMIS Clerk / Lumbadzi H/F	Yes	Yes	Yes	No	No
AEHO, CO, HMIS Clerk/Kabudula H/F	Yes	Yes	Yes	No	No
HSA/Ndirande Health Facility	Yes	Yes	Yes	No	No
Nurse/Ndirande Health Facility	Yes	Yes	Yes	No	No
ART Clerk/Ndirande Health Facility	Yes	Yes	Yes	No	No
EHO/Blantyre DHO	Yes	Yes	Yes	Yes	Yes
IDSR Officer/Blantyre DHO	Yes	Yes	Yes	Yes	Yes
SRNM/Zomba DHO	Yes	Yes	Yes	Yes	Yes
HSA/Thondwe Health Facility	Yes	Yes	Yes	No	No
Nurse/Thondwe Health Facility	Yes	Yes	Yes	No	No

C.6. Results from respondents on computer availability (Questionnaire results, field work, Sept to Dec 2011).

Respondent/work area	Availability of, data entry into, benefit of, support from, need of and training opportunities for a computer. (Y/N/D); Y=Yes, N=No, D=Don't know					
	Availability	Data entry	Benefit	Support	Need	Training opportunities
Clinical Officer /Thondwe H/F	Y	Y/N	Y	Y	Y	N
Comm. Health Nurse/Thondwe H/F	N	N	N	Y	Y	N
HSA/Thondwe Health Facility	N	N	N	Y	Y	N
SRNM/Zomba DHO	Y	Y	Y	Y	Y	Y
EHO/Zomba DHO	Y	Y	Y	Y	Y	Y
Statistician/Zomba DHO	Y	Y	Y	Y	Y	Y
ART Clerk / Ndirande Health Facility	N	N	N	Y	Y	D
Nurse/Ndirande H/F	N	N	N	Y	Y	D
HSA/TB Officer/Ndirande H/F	N	N	N	Y	Y	D
MA, SHSA, HMIS Clerk/Ngoni H/F	N	N	N	Y	Y	D
HMIS Officer / Blantyre DHO	Y	Y	Y	Y	Y	Y
IDSr Officer/Blantyre DHO	Y	Y	Y	Y	Y	N
EHO/Blantyre DHO	Y	Y	Y	Y	Y	D
HMIS Clerk / Ndirande H/C	Y	N	N	Y	Y	D
SHSA, MA, Nurse, HMIS Clerk / Lumbadzi Health Facility	N	N	N	Y	Y	D
SHSA, Medical Assistant / Khongoni H/F	N	N	N	Y	Y	D
HMIS Clerk, Nurse, SHSA, MA / Mbang'ombe H/F	N	N	N	Y	Y	D
Statistician/Lilongwe DHO	Y	Y	Y	Y	Y	Y
AEHO, CO, HMIS Clerk/Kabudula H/F	Y	Y/N	Y/N	Y	Y	D

C.7. Feedback results (Questionnaire results, field work, September to December 2011).

Type of Organization	Feedback		Number of times for feedback			Form/type of feedback			
	Yes	No	Monthly	Quarterly	Yearly	Supervision	Written	Reports	Other
	Count								
Blantyre DHO	3	1	0	2	0	2	1	2	0
Ndirande H/F	4	2	1	3	0	3	1	4	1
Zomba DHO	3	1	1	3	1	3	2	3	0
Thondwe H/F	3	2	1	3	0	3	1	3	0
Lilongwe DHO	2	0	0	2	2	2	2	2	0
Kabudula Community Hosp.	3	3	0	3	3	3	3	3	0
Khongoni H/F	2	2	0	2	2	2	2	2	0
Ngoni H/F	3	3	0	3	0	3	3	3	0
Mbang'ombe H/F	4	0	0	4	0	4	0	4	0
Lumbadzi H/F	3	3	0	3	3	3	3	3	0
Area 25 H/F	3	3	0	3	3	3	3	3	0

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