UiO : Department of Informatics
University of Oslo

Computer supported evidence-based decision-making at health facilities in Zambia

Master Thesis

Anastasia Parramore

November 2017

© Anastasia Parramore

2017

Computer supported evidence-based decision-making at health facilities in Zambia

Anastasia Parramore

http://www.duo.uio.no

Print: Reprosentralen, Universitetet i Oslo

Abstract

This thesis builds on an exploratory, interpretive case study conducted in a developing country context. It was undertaken to discover how computers and data analysis software at facility level of the health system could support various types of decision-making. Health Management Information Systems produce data about population health status and health service provision that should be used for decision-making and planning at all levels of the health system, especially at the local level where it has been collected. Nevertheless, in practice, information is often neglected and not used efficiently or at all for decision-making at health institutions. To solve this problem the Ministry of Health in Zambia initiated facility trainings on 8th of May 2017 to implement electronic data entry and analysis at the facility level. This study shows that facility level workers, in fact, make decisions and data-driven actions and discusses in details their everyday work routine in terms of informed decision-making and the decisions themselves.

The empirical evidence for this study was collected during training workshops using qualitative and quantitative methods concurrently. Data collection techniques involved observations, interviews/conversations, questionnaires, and tests. The gathered data was structured and analyzed through the application of a theoretical framework that segregates health information processes into managerial, administrative and clinical functions.

Existing literature discusses challenges related to evidence-based decision-making in low-recourse setting and solutions to overcome these. This thesis reveals similar issues in Zambia and therefore suggests recommendations for improvements. In addition, the study provides rich insights on how facility staff perceive changes to their information-oriented work and the introduction of computers and the DHIS2 software.

Acknowledgment

The journey that I had to undergo in completing this thesis was long and hard. Without the support of many, it would have been just a dream. Herein, I take the opportunity to acknowledge these contributions with gratitude.

I would like to start by thanking my supervisor, Terje Aksel Sanner for guidance, encouragement, and patience throughout this experience. I also want to thank the team in Akros for their help and assistance in my fieldwork, and for making me feel like home in Lusaka.

A special thank you to Natasha, Yuna, James, Phillip, Matilda, Malumbo and Chilo for making my stay in Zambia a part of my life that I will never forget. Next, I want to thank my family and friends, particularly Thomas for his understanding and support during my stay in Africa, a significant aspect to the course of my thesis. I also want to thank my friend and colleague Peter for sharing this journey with me; and Dimitra for proofreading and assisting with the final touches.

Table of Contents

List of Figures

List of Tables

Abbreviations

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral Therapy
CBV	Community-Based Volunteers
CHA	Community Health Assistants
CHMT	Council Health Management Team
CSO	Central Statistic Office
DHIO	District Health Information Officer
CHMT	Council Health Management Team
CSO	Central Statistic Office
DHIO	District Health Information Officer
DHIS	District Health Information System
DIPH	Data-Informed Platform for Health
EHT	Environmental Health Technician
HIA	Health Information Aggregation Forms
HIS	Health Information System
HIV	Human Immunodeficiency Virus
HMIS	Health Management Information system
IS	Information System
ITN	Insecticide-Treated Net
MCDMCH	Ministry for Community Development and Mother and Child Health
MOH	Ministry of Health
NGO	Non-Governmental Organization
OPD	Outpatient Department
PA	Performance Assessment
RHC	Rural Health Center Representative
UNICEF	United Nations Children's Fund

1 Introduction

The main goal of any health information system (HIS) used for public health administration is to collect quantitative data such as mortality of population, health condition, analysis of causation of diseases and evaluation of the effectiveness of public health services (AbouZahr & Boerma, 2005). The aim is to ensure the effective and appropriate use of resources to facilitate improved health service performance and the health of the community (Garrib et al, 2008). Therefore, it is clearly different from health-care data for medical specialists or more common health knowledge. Both the statistical system and the health system include the HIS as a part. Health-related statistics are often dispensed across different agencies or line ministries such as ministries of employment, education, and furthermore (AbouZahr & Boerma, 2005). The health information system must take steps to measure the effectiveness of the healthcare it provides and must assemble information on the accessibility of its services, their relatedness to needs, levels of uptake, their acceptability, and the quality of care provided (Sandiford et at, 1992).

HIS does not exist by itself, but *"is a functional entity within the framework of a comprehensive health system to improve the health of individuals and the population",* such as a management information system (Lippeveld, 2001, p. 3). Hurtubise (1984) defines management information system as a system that provides concrete information necessary for making decisions at all levels in an organization.

Elucidating the above-mentioned terms helps to better understand the meaning of one of the main terms relevant to my study – health management information system (HMIS). As Mutemwa (2006) states HMIS is a system that is designed to carry administrative information such as resource inputs and service utilization as well as epidemiological information such as mortality, morbidity statistics, incidence, and health prevalence. Thus HMIS produces data about population health status and health service provision that should be used for decision-making and planning at all levels of the health system, particularly in the local area where it has been produced (Wickremasinghe et al, 2016). However it is not always the case, in practice, information is not always used efficiently or at all for decision-making at health institutions (Walshe & Rundall, 2001).

In this thesis I will focus on efforts to strengthen decision making by leveraging a software called the District Health Information System (DHIS), which is a kind of HIS that used to be a standalone software system and nowadays has evolved into a software architecture (Braa & Sahay, 2012), with many components and modules. Hence, DHIS is a software platform that was successfully adapted in Zambia and is used as part of the national HMIS (Mutemwa, 2006).

1.1 Research context

This thesis is written with the Information Systems (IS) research group at the Department of Informatics, University of Oslo. The IS-group is part of the Health Information Systems Program Network, and the main developer behind the DHIS2-platform. The platform is broadly used software within HMIS, at the present time implemented in over 42 countries ("DHIS 2 In Action", 2017). Akros is an NGO founded by an American couple and based in Lusaka, Zambia, is also a member of the HISP-network, a partner of UiO and a partner of MoH Zambia, they use DHIS2 in several areas such as malaria prevention, water and sanitation and etc. My access to the field was through the affiliation with them. The main empirical study was thus conducted over a three-week period in May 2017 in Lusaka and Kabwe. It involved district health information officers and facility level health workers.

1.2 Motivation

1.2.1 Personal motivation

The motivation towards undertaking this research did not manifest overnight. Being myself from a country with high poverty level and relatively low level of industrial development, I realized that disorganized informational systems lead to harder life, including worse health. I never had to really struggle but I wanted to contribute to making the world a better place for people with lesser resources and possibilities than I have. When it came to choosing a topic for my master thesis, I wanted to work on something I would be passionate about, something that would not be written just for the sake of literature but would have actual practical benefits for someone who really needs it.

I saw projects in Zambia dealing with the strengthening of DHIS2 and I got interested as it suited what I wanted. I did not know exactly what my topic would be and it changed over time as Akros had to change their plans due to situational circumstances. In the end, it was exactly

what I wished for. I always had a passion for both humanitarian and technical sciences, so something in between was intriguing for me, like project management within information systems. A topic of evidence-based decision-making suited my interest perfectly and I could use my mixed (economics/informational systems) background for better contribution.

I was first introduced to DHIS2 through a course at the University of Oslo and learned that if utilized well, DHIS2 can increase the quality of the reported data, make data collection and reporting easier for the health workers, improve evidence-based decision-making and therefore improve health and perhaps even save lives.

1.2.2 Practical motivation

In order to strengthen its HIS, Zambia aims to improve its data use in general and especially at the level where it is collected. Facilitated data use will increase data quality and health management as well. Akros in cooperation with UNICEF arranged DHIS2 data entry and analysis trainings for facility level staff, starting the 8th of May 2017. The main purpose of the trainings was to encourage facilities to use the data, that is transfer data use all the way down to the facility level. The data should inform health workers' actions and contribute to improved evidence-based decision-making. Therefore my role was to understand better the facility staff, what they do everyday at different facilities, which data they use, which decisions they make, how they perceive new changes and so on, for a successful DHIS2 implementation.

1.2.3 Knowledge motivation

There is a lot of existing literature on the strengthening of HMIS in low recourse settings; improving data quality and even evidence-based decision-making (AbouZahr & Boerma, 2005; Avan et al, 2016; Bhattacharyya et al, 2016; Braa et al, 2012; Sandiford et al, 1992; Stansfield et al, 2006; Weeks et al, 2000; Wickremasinghe et al, 2006). However little has been written about the process of decision-making, which data is being used and how it is being used. There is almost no evidence in the existing literature that data is indeed being used at lowest levels.

My knowledge motivation therefore originates from giving a better picture of which decisions can be made at the facility level, which data elements are essential for planning and actions and which system based tools can support decision-making at the lowest level.

1.3 Research questions

The research in this thesis aims to discover what the everyday work routine for facility workers in Zambia looks like in terms of informed decision-making. Which information do they already use for planning or other activities? What types of decisions do they make, based on which data? Specifically, how can software such as the DHIS2, assist them in making decisions? The study, therefore, explores how data collection and analysis software can support different types of facility-level decision-making. This is interesting because at lower levels of the health system decision making is often associated with having to balance multiple priorities in terms of both patient wellbeing, identification of public health risks and dealing with resource limitations. Hence, the overarching research question is as follows: *How can computers and data analysis software at facility level of the health system support different types of decision-making, such as clinical, administrative and managerial?* Beyond answering this particular research question the thesis also provides rich insights on how facility staff perceive changes to their information-oriented work and the introduction of computers and the DHIS2 software, as personal experiences and motivation of the stakeholders play an important role in the success of promoting decentralized decision-making.

The study shows that facility staff already use various data elements for decision-making, However, the process is not particularly effective as paper-based reports often don't provide timely and good analysis tools. Hence, the analysis currently carried out is rather ad hoc and not standardized. To support evidence-based decision-making, different analysis software dashboards, for instance by using DHIS2, can be created for different types and domains of decisions. This will be further discussed and problematized in the thesis. Overall, the study finds that the facility staff have a positive attitude towards the DHIS2 and coming changes in their work routines and this should facilitate the process of implementation of the DHIS2 at the facility level. There are issues and challenges that are already being faced in regard of transitioning to facility-level electronic data entry and analysis such as lack of guidelines for data-driven decision-making, financial constraints and so on. The study also addresses these previously identified problems and suggests improvements.

1.4 Thesis structure

Chapter 2 presents literature and theory relevant to this thesis. First, I introduce a term *"decision-making",* and then I review literature in data quality, use, and analysis as well as challenges in evidence-based decision-making and ways to overcome them.

Chapter 3 describes the context and background of the research, emphasizing the main factors that affect decision-making at the medical facilities, such as political and cultural aspects and main infrastructural challenges.

Chapter 4 presents the methodology used for this study. I discuss the research approach, the research methods, data collection methods and data sources as well as data analysis and ethical considerations.

Chapter 5 presents my empirical findings on facility staff work routines, decisions that they make, which data elements they use and which challenges they face.

Chapter 6 discusses further the empirical data with elements of analysis and emphasizes some key findings.

Chapter 7 discusses the empirical findings through a framework for decentralized evidence-based on decision-making at the facility level. I present results from the study and bring forward the relationship between the research questions.

Chapter 8 concludes, provides a summary of the thesis and suggests areas and questions for further research.

2 Literature review

This chapter describes a literature and a theory relevant to this thesis. First, I introduce a term *"decision-making"* and talk about human nature and behavior associated with this term. Furthermore, I focus on decision-making in low-resource setting and will give examples from several countries as well as Zambia. Then, I continue by reviewing literature in data quality, use and analysis. Finally, I look at the literature on action-led information systems and improving evidence-based decision-making.

2.1 Decisions in a complex world

Decision-making is a process that leads one to structure a problem, elicit judgments that reflect ideas, feelings, and emotions; represent those judgments with meaningful numbers, synthesize results and analyze sensitivity in changes in judgment (Saaty, 1990).

According to scientists when people make decisions, personal preferences and persuasion generally prevail over rationality and logic. Needs and personal motives are the driving forces in human behavior, however, people contend that they use reasons to attain their goals efficiently without enduring any harm or injury. Critics of this theory argue that this so-called reason is an abyss of unconscious or barely conscious urges and habits that overwhelm the intellect (ibid).

Often for a decision to be successful the various interests of different stakeholders, who are in conflict with one another, should be taken into consideration. Good decisions must survive the difficulties and dangers of the environment. The most important test of a theory is its success in predicting outcomes correctly. Decisions must be desirable and durable, rather than preferable with disregard to how lasting they can be. Predictable results play an important role in making such choices. In order to do this well, decisions must be decomposed into separate structures involving benefits, costs, opportunities and risks and combining their separate outcomes for best decisions. In order to make rational and effective decisions, one has to participate intensely in the act of understanding the context around them, to persevere in thinking matters through carefully and to debate with others who have different views. To solve problems one also needs a framework that will enable them to think of complex problems in a simple way. There are two approaches to solving problems: the deductive approach, that

focuses on the parts and the systems approach which concentrates on the workings of the whole (ibid).

A decision-making approach should have the following characteristics:

- be adaptive to both individuals and groups;
- be natural to our intuition and common thinking;
- be simple in construct;
- encourage consensus building and compromise;
- not require inordinate specialization to master and communicate (ibid).

Described above are general suggestions for successful decision-making and are formulated for leaders of enterprises, however I find them interesting and applicable in the context of this thesis as facility staff often need to act as managers and determine how to best utilize limited resources to provide clinical care, public health outreach services and information campaigns, drug ordering and supply management as well as order upgrades or maintenance work to their facility structures. Therefore, facility-level decision-making is a complicated process and when talking about it, a lot has to be taken into consideration such as personal motives, logical reasons, the context and available resources.

2.2 Decision-making in low-recourse settings

According to Avan et al, low-recourse settings commonly make only limited use of local data for health-system planning, monitoring, evaluation and decision-making (Simba & Mwangu 2004 cited in Avan et al, 2016; Bhattacharyya et al, 2016). Wickremasinghe et al (2006) also state in his systematic literature review that in practice HMIS data is not being sufficiently used at community or district level. This is due to: lack of accurate, complete and timely data, parallel and duplicate reporting channels, and inadequate capacity to analyze and use data for decision-making, as well as lack of standardized process for its usage (Bhattacharyya et al, 2016; Wickremasinghe et al, 2006). Core challenges also include professional expertise, information-system infrastructure, robustness of technology and a culture of evidence-based decision-making (Avan et al, 2016). Issues and challenges related to decision-making will be discussed in greater detail later in this chapter.

The Health Management Information System represents health-facility usage and performance: local program staff have a possibility to report on human and physical resources; private

service providers have information on service provision; non-government organizations (NGOs) can have data on community-based activities. Nevertheless Avan et al (2016) states that there is little published evidence of information being brought together at a district level. Avan et al (2016) proposes a data-sharing platform through the district health managers – a data-informed platform for health (DIPH) – to help coordination, gathering together key data from the public and private health sectors on inputs and processes, including service delivery, that could influence certain health indicators. The basic purposes of the DIPH are to promote the use of local health program data for decision-making, priority setting and planning at the district health administration level (ibid). Data-informed platform for health framework depicted on figure 2.1.

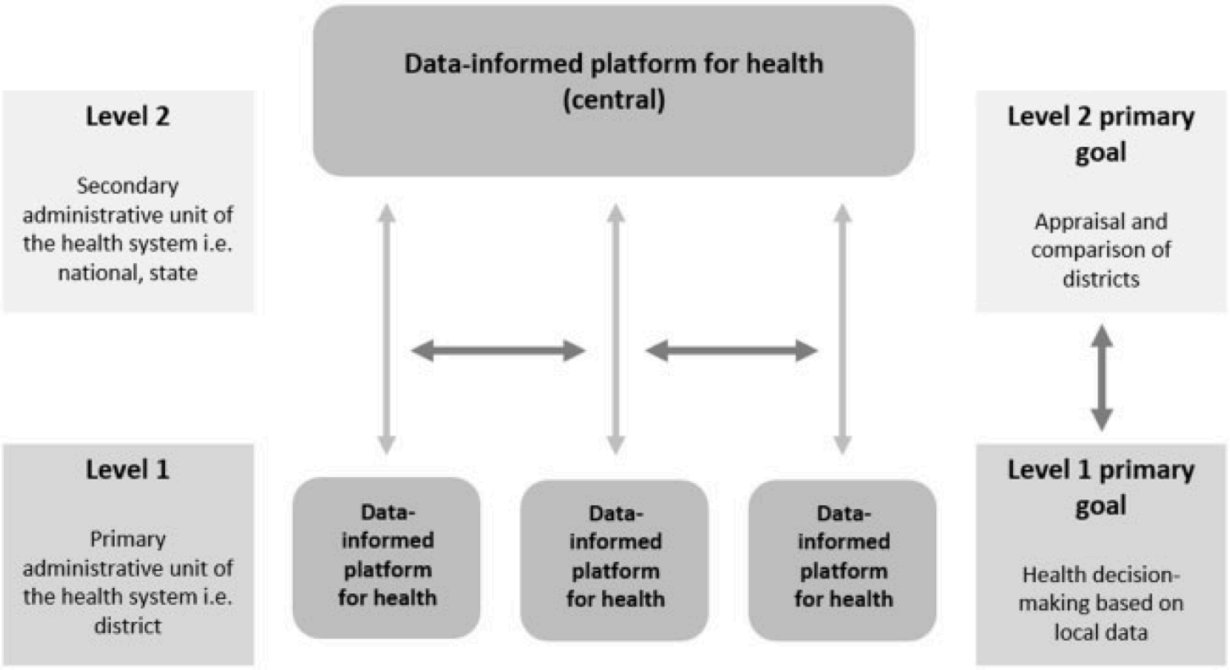

Figure 2.1 Data-informed platform for health framework (Avan et al, 2016)

The viability of DIPH in a low-resource context is based not merely on the availability and sharing of data at the district level but also on a number of other factors, such as the culture of democratic governance, a public-private partnership, and decentralization. The DHIP would retrieve data – a primary prerequisite for objective decision-making – from different public and private health institutions. Governmental and non-governmental service providers would gather in a common forum to exchange data on a regular basis, and to use the resulting data as a tool in priority-setting for recourse distribution and needs-evaluation for the acquisition of funds (ibid). Thus, the main point of DIPH is similar to data warehouse – collect data from

different sources and provide access to all the available information to all the stakeholders and in this manner improve evidence-based decision-making.

There are also other studies that examine the use of local health data at the community level, for example, a field experiment in Uganda, in which community members used health data to hold their local health workers accountable for performance, leading to enhanced utilization of health services and better health outcomes. Another study had a participatory approach to community evaluation and planning for maternal and child health programs in Ethiopia, and resulted in health information and community priorities being used to choose health care activities (Wickremasinghe et al, 2016). Garrib et al (2008) state that according to their study in South Africa there have been reported delays in submission of data due to non-delivery of forms, unreliable data quality, poor understanding of indicators, facility managers not maintaining data summaries and poor feedback. There was a little evidence that managers were using the information for facility level decision-making (ibid).

2.2.1 Decision-making in Zambia HMIS

Only one publication is found about decision-making in Zambia HMIS, which stresses that not just the quality of data is essential for better decisions, but also the motivation of people who make decisions based on this data, as well as the entire health system. Mutemwa (2006) states in his article "HMIS and decision-making in Zambia: re-thinking information solutions for district health management in decentralized health systems" that literature review suggests public and private organizations still understand very little about the nature of information within the organizational environment. Therefore decision-makers are guided by the traditional logic and for decades now it has been acknowledged that they ignore information, they make a decision and only after looking for relevant information, they manipulate information for their own goals. Notwithstanding, the study revealed that it is not entirely true in Zambia; different forms of information from a variety of sources are used in district decision-making (ibid).

HMIS is not the only source of information but also human resources, management/organizational processes and the organizational structure. The study suggests that each of these three organizational elements is involved in the actual health management information system and must be appreciated as a conveyor of data. Therefore, it is important to strengthen and align these other components for their informational contribution; otherwise, HMIS will not likely succeed in supporting district performance (ibid).

2.3 Challenges in decision-making processes

2.3.1 Data quality, use and analysis

One of the major challenges in decision-making processes is lack of data available at sub-national level and difficulties in accessing data as well as quality and use of health facility data. Some data is unreliable, not produced on a timely manner to facilitate the decision-making process. In Tanzania, HMIS data, being centrally determined and accommodated towards upward reporting, did not have possibilities for the adaptation required for local planning, in addition, data for vertically funded programs was not always replicated to the District Medical Officer (Mubyazi et al, 2004 cited in Wickremasinghe et al, 2016).

Good quality data from different relevant sources plays an important role in the effectiveness of health systems (Bhattacharyya et al, 2016). According to Shaw (2005) the larger the number of data elements to be reported upon, the poorer the quality of the data. Shaw (2005) discusses methods and principles for creating an essential data set such as limiting the routine reporting requirements for primary health care and hospital services to a set of 100-150 data elements; an integrating the reporting requirements of various program managers, so that their needs are included in the set of essential data elements and indicators. From Shaw's experience creation of substantial data set at district level has a significant impact on neighboring districts and results in the development of a regional essential data set (ibid).

Braa et al (2012) argue that increased use of quality checks (for timeliness, correctness, consistency – mention in empirical data) improves data quality significantly at the facility level. Simplified forms based on revised indicators and data sets dramatically reduce the number of data elements collected and thus the workload of facility staff. Emphasizing of links between plans, targets and indicators help to increase the use of indicators at the local level and the analysis of coverage and quality of service delivery. Figure 2.2 shows a screenshot of the DHIS dashboard displaying analytical graphs (ibid).

Figure 2.2 District Health Information Software screenshot and example of data presentation (Braa et al, 2012)

2.3.2 Centralization versus decentralization

In the Soviet Union, health care model had a great emphasis on providing services, but the system directed less attention to routinely monitoring those services. Health workers followed directives from the top and reported upward. Epidemiologists compiled reports, but for the next higher bureaucratic level. The tables created from excessive data collections were too complicated for any practical analysis or timely detection and action on problems. Outdated policies and procedures further contributed to the needless data collection. Separating the management of curative and preventive services was also a disadvantage in the Soviet Union in early 1990's. Physicians treated patients while epidemiologists investigated outbreaks and implemented control measures. Pediatricians prescribed unnecessary contraindications against immunization, which left a significant number of children unprotected, either by not immunizing the child or by delaying it. Because report of immunized children excluded those

with contraindications, immunization coverage rates overrated the factual level of protection in the population (Weeks et al, 2000).

In Malawi, when defining the minimum data set for inclusion in HMIS, achieving consensus was viewed as a challenge as stakeholders wanted to include all possible indicators for routine collection, including human, financial resources, logistical information and physical assets (Chaulagai et al, 2005 cited in Wickremasinghe et al, 2016).

2.3.3 Political issues

Another challenge is social and political dynamics in the decision-making. There were concerns that decisions are not always based on data. In one of the studies, the decision-making process was *"corrupted"* due to political conflict, no decisions were made and the initial problems remained unresolved (Mutemwa, 2006). People who have influence in the community can dominate decisions and therefore the needs of some groups are not heard. In Tanzania decision-making processes were seen as swayed by district health professionals on the Council Health Management Team (CHMT), because nevertheless the planning guidelines included provision for different stakeholders, through members of health committees that worked in collaboration with the CHMT to ensure input from the community Comprehensive Council Health Plan, in reality, the health committees nearly never met. Moreover, there was no system in place to ensure that the community received the plan and only little opportunities for them to appeal against a decision. It was also noted in Nigeria that neither community nor private sector representatives were adequately involved in the decision-making process (Wickremasinghe et al, 2016).

2.3.4 Financial constrains

In low-recourse settings, decisions are often compromised by financial constraints. Local decisions have to be made correspondingly to available funding, but this was not always the case. According to Wickremasinghe et al, (2016) four studies noted financial restrictions: in Ghana, a lack of flexible funds resulted in a disconnection between plans and expenditure. National Planning Guidelines and budget ceilings constrained local level planning and financial allocation, efforts to engage different stakeholders in the decision-making process were limited by delays in the payouts from central government (Maluka et al cited in Wickremasinghe et al, 2016). Limited overall financial funding hindered motivation of the stakeholders over time (Wickremasinghe et al, 2016). AbouZahr and Boerma (2005) also mention insufficient financial funding as a reason for failing health information systems in

many countries. However, they argue that there is evidence, that significant financial resources are directed towards the generation of health information in developing countries. The problem is that the money is spent in a fragment, uncoordinated and duplicated manner.

2.4 Action-led information systems

The common *"data-led"* approach to reforming health information systems takes for granted the items, which should be involved in a deliberately comprehensive information system. This approach applies that all the data is substantially useful and that it is worthwhile to define even problems that nothing can be done about. It is based on assumptions of what an ideal information system comprises and sets about reconfiguring the existing system accordingly. The tendency with this approach is to reform an information system by extending the data set, revising data collection procedures, redesigning the forms, hoping that this would improve accuracy and timeliness (Sandiford et al, 1992).

In contrast, the action-led approach aims to relate information needs to intervention or potential intervention with a concentration on how the information generated influence decisions and on the importance of these decisions for the health of the target population. The lack of routinely collected data is not the core problem with most health information systems. The data needed to produce indicators of effectiveness and efficiency that can facilitate decision-making or identify problem areas meriting attention often already exists in one form or another. There is an unwillingness to use this data, which could be associated with lack of confidence in its quality or with the ambiguity of how it should be processed (ibid).

The action-led view on information systems implies that poor data quality is a consequence, not a cause of its underutilization. Once data is being used, anomalies and errors are rapidly discovered and corrected (Henderson, 1978 cited in Sandiford et al, 1992). If an effort is made to analyze and use the data, there is a feedback to the staff responsible and then this occurs naturally and it is not always vital in order to create formal feedback mechanism. Action-led systems can be designed only after careful consideration of the areas where decisions can be taken which potentially affect the equity, efficiency or effectiveness of the health system. This makes it necessary to have a good understanding of how material and human recourses are translated into health generating activities, and of the ways that decisions are made which affect this process. When this is understood, it becomes feasible to define the information

needed for evaluating and monitoring the progress being made towards meeting the system's goals such as for example to control unexpected outbreaks of disease (Sandiford et al, 1992).

2.5 Improving evidence-based decision-making

An effective HIS requires an overarching architecture that determines the data elements, procedures, and processes for collection, presentation, collation and use of information for decision making throughout the health sector. This information architecture promotes comparison and integration of data elements from different subsystems. A comprehensive design empowers phased system development, diminishes redundancy, improves interoperability and increases efficiency. Interoperability is essential to ensure, for instance, vital statistics, that census data and health facility data can be integrated to generate rates, cost-effectiveness estimates, and other information needed to examine options for health investment (Stansfield et al, 2006).

Information is a means to the end of improving health, but the availability of sound information does not ensure its use or enhanced decision-making. Decisions are often driven as much by politics as by evidence, it is important to design information systems to meet the needs of decision-makers and to build a culture of evidence that guarantees incentives and accountability for evidence-based decision-making (ibid).

Systems and dissemination patterns for information should be designed to ensure that clients, providers, and managers seek and use data to inform decisions. Standard procedures should be created to ensure analysis and use of data at the level at which it is collected. Trainings of health staff should be developed to include both basic and refresher training in the analysis and interpretation of data that is relevant to every job. Expectations of data use can be designed into routine job requirements, including the use of evidence for planning, information requirements for periodic reporting to supervisors, and use of information during performance reviews. Managers should be summoned across districts or regions for benchmarking, where each manager presents and compares performance data and is recompensed for learning and transparency (ibid). According to Stansfield et al (2006) these arrangements will result only from intense training in analysis and use. Sandiford et al (1992) also state that deficit of staff trained in data analyses and interpretation is one of the factors limiting the effectiveness of HIS in developing countries. Transformation of data into information requires good analyses and interpretation skills. These skills are not in abundance even in developed countries.

2.6 Informatics in health planning

Information is an important element in the drive for efficiency and effectiveness and the major challenge and opportunity for policymakers and healthcare professionals are to use the information to balance demands and costs. Health information systems are a powerful tool in the process of planning and delivery of high-quality and cost-effective healthcare. Health informatics is an emerging discipline with no solid boundaries but the information processes and types intrinsic to health care define its scope (Norris, 2002). These processes and types embody a wide spectrum of clinical, administrative and managerial functions (figure 2.3). These three types of functions/decisions are essential to this thesis, as it will help to organize the empirical data later on. However evidence-based health care requires major reform of the whole process of knowledge management in health care systems, which affects individual clinicians, healthcare organizations, researchers and their institutions, the users of health services and the health system as a whole (Walshe & Rundall, 2001).

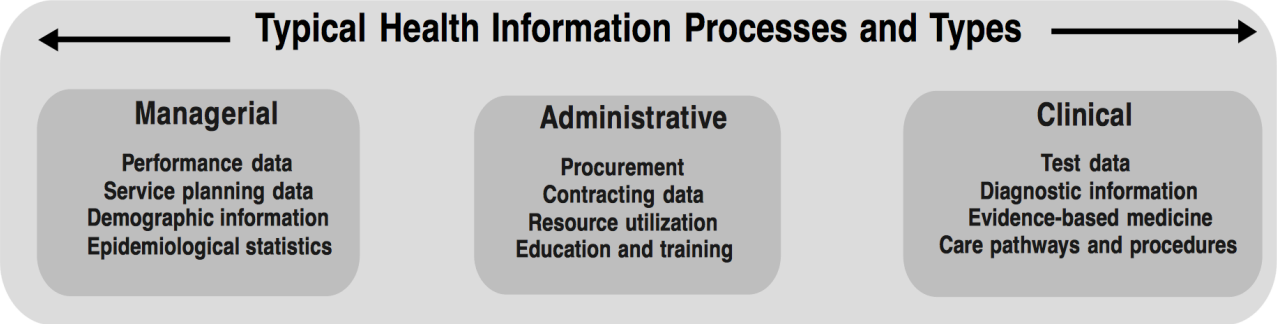

Figure 2.3 The health information spectrum (Norris, 2002)

The health information system is part of both the wider statistical system and the health system. Demand for and supply of data vary in complex ways at several levels of the health system. Populists discuss that there should be no data collection other than at the level of which it will be used, however in practice, things are more complicated. For instance, the census is nationally planned, but data is gathered from individuals and the data is analyzed and used at both the national and subnational levels (AbouZahr & Boerma, 2005).

National household surveys aggregate information collected from individuals at the national level, but this information cannot be disaggregated to the community or even the district level. At the level of communities and individuals, information is needed for effective clinical management and for obtaining the extent to which services are meeting the needs and demands of communities. At the level of the district, health information empowers health planners and

managers to take decisions in connection with the effective functioning of health facilities and of the health system as a whole. At higher levels, health information is needed for strategic policy-making and resource distribution. Nevertheless, the data requirements for patient care, policy-making and system management are in some measure different they are also related along a continuum (figure 2.4) (ibid).

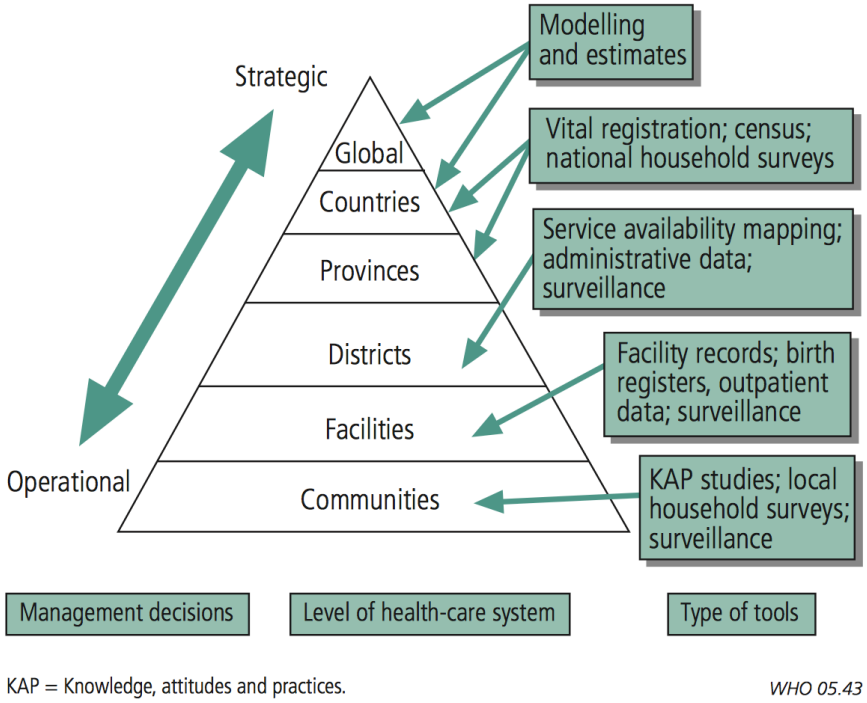

Figure 2.4 Data needs and sources at different levels of the health-care system (AbouZahr & Boerma, 2005)

This continuum from patient care to strategic management means that not everything needs to be identified at every level of the system. The quantity and detail of data needed are generally greater at lower levels of the system, where decisions on the care of individuals are made, rather than higher levels where wider policy-making takes place. Commonly, the lower level staff is required to report enormous quantities of data to higher levels but rarely receive any feedback. Simultaneously, the information overload at higher levels is such that the data is in practice rarely used effectively (ibid). According to AbouZahr & Boerma (2005), currently, less sensible information is available than is needed for effective decision-making. Poor data quality is one problem, which constitutes a bottleneck for good information systems as well as good decision-making (Mavimbe et al, 2005).

Health policy makers need data for decision-making. However, a feature of health care systems in many parts of the world if those decisions are taken not withstanding the absence of sound information. Decision-making in health is often based on political opportunism, donor demand

or expediency. There is an increasing understanding that this leads to the ineffective and inefficient use of resources (AbouZahr & Boerma, 2005).

Data for decision-makers is substantial, but the circle of stakeholders for health-related information is much larger. Communities have the right to know why people die before their time, why they get ill, what care is available and how they can protect themselves. Health information is too important to be left to statisticians and politicians; it should be accessible to all levels (ibid).

A table 2.1, presented below depicts a summary of the literature review. After analyzing articles relevant to this thesis, I developed a framework for decentralized evidence-based decision-making at the facility level. Most of the articles discussed different cases of intervention for improving data quality and decision-making, thus I summarize all the challenges that were faced and all the solutions that can help overcome the challenges and improve decision-making in general. I start the table with human behavior in decision-making, as in my opinion, it is a core factor that should be noticed, and then I continue with decision-making in low-resource settings.

Human behavior in decision-making	
Challenges	Adverse personal preferences/goals/motives/habits
Recommendations	• Think simple (e.g. decompose complex problems) • Involve different stakeholders with different views • Decisions must survive the difficulties of the environment • Predict outcomes correctly (analyze benefits, costs, opportunities and risks in analysis) • Understand the context
Decision-making in low-recourse settings	
Challenges	• Data quality, use, analysis • Inadequate capacity to analyze data • Lack of standardized procedures • Infrastructure • Culture of evidence-based decision-making • Politics, traditional logic, power relationships • Centralization versus decentralization • Financial constrains
Recommendations	• Careful consideration of the areas where decisions can be taken • Intense training in data analysis and interpretation • Data-sharing platform – promote use of local data • Incentives to hold health staff to account for performance (improved data use) • Overarching architecture, comprehensive design • Building a culture of evidence-based decision-making • Standard procedures for data use and analyses

Table 2.1 Framework for decentralized evidence-based decision-making at the facility level (based on literature review)

3 Background and context

In this chapter, I present an overview of the Zambian context, emphasizing the main factors that effect decision-making at the medical facilities. First, I give a brief overview of the county, history, political and cultural aspects and main infrastructural challenges. Next, I present health management informational system and health care situation in Zambia. Finally, I zoom in on current decision-making at the facilities and facility trainings in context of which the study was conducted.

3.1 Zambia overview

Zambia is a Southern African country, located east of Angola and south of the Democratic Republic of the Congo (figure 3.1) with a tropical climate and mostly high plateau with some hills and mountains ("The world factbook", 2017). Zambia takes its name from the Zambezi River, which drains all the territory except for a small northern part. The landlocked county has many natural resources ("Zambia", 2017) and has experienced rapid economic growth over the last years as Africa's second-largest copper manufacturer after the Democratic Republic of the Congo. However, its excessive dependence on copper has made it vulnerable to falling commodity prices ("Zambia country profile", 2017).

Figure 3.1 Zambia location map ("The world factbook", 2017)

Major parts of the country are thinly populated. Most of the population is settled in the county's best-developed area – known as the "Line of Rail" – which is served by the railway connecting the Copperbelt with the capital Lusaka, and with the border town Livingstone ("Zambia", 2017). Zambia has one of the world's fastest increasing populations with the UN forecasting that its population of 13 million will triple by 2050. Nevertheless, economic growth and enormous Chinese investment have not improved the lives of most Zambian people, with two-thirds still struggling with poverty ("Zambia country profile", 2017).

Most Zambians speak Bantu languages of the Niger-Congo language family. There are seven official languages: Bemba, Tonga, Nyanja, Lozi, Luvale, Lunda, and Kaonde, the last three being languages of North-Western Province. English is the official language of government and is used for commerce, law, and education ("Zambia", 2017). English is also widely spoken in the country and in most schools pupils are introduced to the language from the first grade. As a matter of fact, English has become so dominant, that parents often choose to speak English with their children rather than their local language (Taylor, 2006). Regarding the religion, Zambia is mainly a Christian country, however, a few have completely abandoned all forms of traditional belief systems. Approximately three-fourths of Zambians are Protestant, while one-fifth of the population identify as Roman Catholics ("Zambia", 2017).

Zambia is a presidential republic with mixed legal systems of English common law and customary law ("The world factbook", 2017). The provincial government system represents central government throughout Zambia, each of the resident ministers is the president's direct representative and is assigned by the president to each of the provinces. The provinces are divided into districts (figure 3.2), each of which has a council chairperson, who is occupied with political and economic developments ("Zambia", 2017). At the moment Zambia is separated into 10 provinces and these provinces are further subdivided into a total of 105 districts (Zambia Central Statistical Office, 2016).

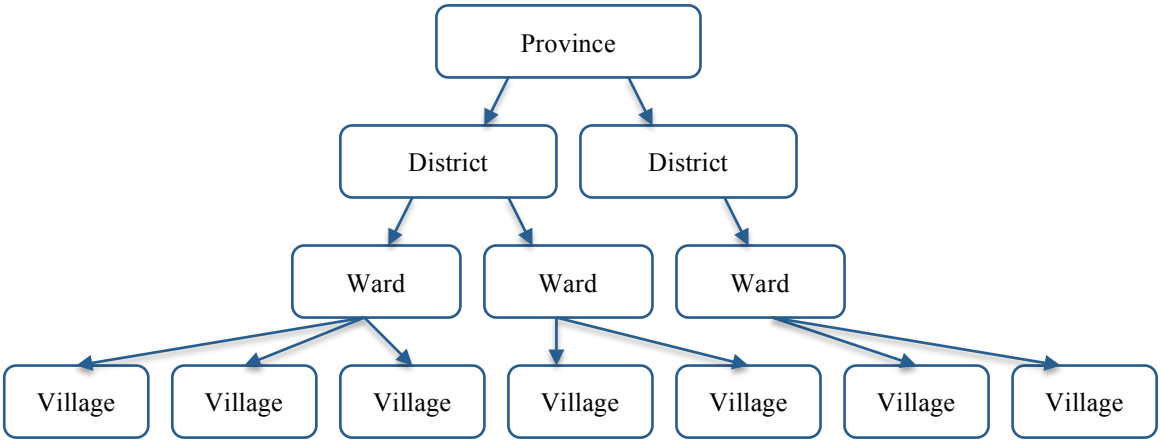

Figure 3.2 Organizational units hierarchy

Apart from their public government, Zambia also has a traditional system of Chiefs, a system that is very operational and well respected in local communities. At the moment Zambia has 288 Chiefs, administered by the Ministry of Chiefs and Traditional Affairs. House of Chiefs is a department under Traditional Affairs and Ministry of Chiefs. Functions of the House of Chiefs include reviewing policy and legislation relating to Chief Affairs; creating an enabling environment for Chiefs to participate in Governance and National issues; initiating, discussing and deciding on matters referred to it by the president and many other functions ("House of Chiefs", 2016). Chiefdoms have a great influence on local communities, social development, and business operations and are passed down through male inheritance. Chiefs in Zambia are viewed as royalties, it is common to down for them, refer to them as *"your royal highness"* and bring gifts for them. In order for any intervention in local communities to be successful, the chief must be engaged (Ommundsen, 2017).

3.2 Cultural life

With its tropical climate, softened in most of its territory by high altitude, Zambia is also a land of geographic diversity. This diversity expands to its people as well. It's a county of rich cultural and social traditions and an interesting and long history. Zambia got its independence from the United Kingdom in 1964 after almost a century of colonial domination. Independence brought new opportunities as well as challenges to Zambia (Taylor, 2006). The Zambian cultural context has been changed since the 1950s by wide urbanization and exposure to influence from Europe, other parts of Africa and the Americas. However, government initiated attempts to preserve cultural diversity and initiated the revival of many traditional ceremonies. Zambians still appreciate communal ideas such as interchange within a household, the clan, the

neighborhood, and an official political system of chieftainship. Changes in the modern Zambia haven't diminished Zambian's dependence on one another and they frequently practice *umucinshi,* a Bemba term for mutual respect, when agreeing on favors ("Zambia", 2017).

I learned a lot about people and some interesting cultural aspects while I was on my first field trip in Zambia. Most of the information I received from colleagues from Akros (a development partner assisting the Ministry of Health, introduced in chapter 1) and from Zambian people we met along our way. As Zambia is fairly rural and many people live in villages, I wanted to know more about village life. As a dismal fact, most people in villages are not literate and do not know how to read or write. They rarely finish school as girls get married very early and boys start working to help their families. Many people tend to be superstitious due to lack of education. I heard many disturbing stories how people can be brutal towards each other due to superstition. Some people, for example, wouldn't move from a not well fit for life place to another better spot because they believe that they belong there as the remains of their ancestors are buried there and they believe they would be cursed in another place if they abandon their original home. Facts like this hinder attempts of local government to improve living conditions for people.

Figure 3.3 Kitchen in the village

3.3 Infrastructure

On almost every aspect of infrastructure, rural Zambia is significantly behind their African peers. In a county where agriculture is the only means of subsistence for more than 70% of the population, this represents a massive burden on the economy. As it was mentioned before, Zambia's economic activity and most of the population are concentrated along the railway connecting the Copperbelt with the capital Lusaka. Zambia's ICT network and power mirror this economic geography. The road network gives a larger coverage of the country, however, the distant segments in the east and west of the country are in the worst condition. Zambia is one of the most urbanized countries in Sub-Saharan Africa and has an urbanization rate of more than 50% (Foster & Dominguez, 2011).

3.3.1 Roads

Over past years Zambia has made great improvements with its road networks. Primary and secondary networks ensure basic regional and national coverage, connecting the provincial capitals to Lusaka, and Lusaka to the main foreigner border crossings (Foster & Dominguez, 2011). However, the road sector assessment disclosed that only 40% of the core road network is in fair condition and 60% is in need of serious rehabilitation. Increasing traffic volumes combined with delayed maintenance due to lack of financial funding leads to the deterioration of the main road network condition (Muya et al, 2017). Another issue is rural road networks, which seem to be particularly neglected; only 17% of the population lives within 2 km of an all-season road. The condition of rural roads is extremely poor, with only small part of them in good or fair condition (Foster & Dominguez, 2011).

3.3.2 Water supply and sanitation

Zambia has fair access to high-end water and sanitation solutions. About a third of the population has access to utility water from stand posts or private taps. Zambia has been taking actions in expanding access to boreholes, wells and traditional latrines. However, coverage of high-end solutions such as flush toilets and piped water has dropped slightly, while the increase in improved latrines and stand posts had been moderate. The proportion of the population without access to reliable solutions is growing over time and there's still a problem with big part of the population relying on surface water and practicing open defecation. In addition to that, tendency in household access to water supply and sanitation services from successive household surveys show that many people living in unsanitary conditions continue

to grow. The great health risks associated with this situation make this a very acute issue (Foster & Dominguez, 2011).

3.3.3 Power and ICT

Zambia has a relatively large amount of cost-effective hydropower and abundant generation capacity and power consumption per capita. Massive hydro resources allow Zambia to generate electricity at approximately $0.08 per kilowatt-hour (kWh), about half the average cost of electricity generation in Africa (Foster & Dominguez, 2011). However, only around 27% of the population has access to electricity ("Access to electricity", 2017) and the gap for rural electrification is notably big. Only 0.5 % of Zambians are newly electrified every year, while power is relatively abundant in Zambia, a large amount of that power is used in the mining sector, leaving little for domestic consumption (Foster & Dominguez, 2011). Some parts of the Zambian electrical power system are obsolete and requires urgent upgrading or replacement (Muya et al, 2017).

Zambia's GSM coverage is quite low compared to the regional standards and firmly below what the market can produce. Only around 50% of the population lives within range of a GSM signal (Foster & Dominguez, 2011). The fixed telephone network suffers from a slow adaption of newer technologies, which might be caused by reducing capital injection due to competing technologies on the market. The mobile network is growing exponentially; nevertheless, its expansion in rural areas is being constrained by poor infrastructure. Service providers face multiple quality of service issues, which include long average call set up time, billing issues on both data bundles and voice calls and high call drop rate (Muya et al, 2017). Only 21% of the population use the Internet. Mobile subscriptions are though fairly high, estimating about 77 subscriptions per 100 inhabitants ("The world factbook", 2017).

All medical facilities have fairly good cellphone coverage, even those that do not have Internet set up at their facility. Facilities commonly experience power outages with high frequency and duration. Only one rural clinic running on solar power, all the other facilities experience at least eight hours a week of outages, with the 17 peri-urban facilities averaging five hours (Heywood et al., unpublished assessment).

3.4 Health and welfare

Zambia is among the world's countries most heavily affected by HIV/AIDS, approximately one-sixth of the adult population lives with the disease. Early deaths from HIV/AIDS-related illnesses deprive the county of skilled professionals and facilitate an increasing number of orphaned children. Second widespread problem and a major cause of death among children is malnutrition, the problem is caused by poverty and most acute in the rural areas. Most common tropical diseases in Zambia are malaria, schistosomiasis (bilharziasis), and parasitic infections such as hookworm and leprosy ("Zambia", 2017). Malaria is another leading cause of death for adults and children (Hjortsberg, 2003). Leprosy has been constrained and leprosariums have given way to ambulatory treatment. There were attempts to control the *Anopheles* mosquito that spreads malaria but these programs have failed to a great extent and the disease is growing even in the urban areas. Another decease – Schistosomiasis, it is a debilitating sickness disseminated by waterborne snails that are extensively found in riverine areas. Typhoid fever and smallpox have been successfully managed through immunization programs. In the contrary, there have been large outbreaks of dysentery and cholera in Lusaka and the Copperbelt, doubtlessly connected with growing poverty and lack of sanitation and community health programs ("Zambia", 2017). Tuberculosis and meningitis, associated with HIV/AIDS, are main causes of infant and adult mortality. Other spread causes of death are accidents and injuries (the number of car accidents is high), gastrointestinal disorders and respiratory infections. Measles is a major cause of death in children ("Zambia", 2017). Many of the health problems come from infected water and constant food shortages (Hjortsberg, 2003).

After Zambia became independent, a large investment was made in the healthcare system, which comprises a number of general hospitals in main towns, smaller hospitals, and rural health centers. First doctors in Zambia graduated in 1972 from the University Teaching Hospital in Lusaka, which is used by the medical school of the University of Zambia. Notwithstanding local training, Zambia suffers from a deficiency of doctors and other specialist staff, especially in the rural areas, despite the presence of a number of well-run mission hospitals. In 1978 Zambia adopted Primary Health Care, a curative and preventive health program with the aim of obtaining health care for everyone. The poor economy in the 1980s severely affected the quality of existing health care at the time that HIV/AIDS was beginning to have a massive impact. In the 1990s the development of Healthnet was initiated, a system designed to solve communication issues between health centers and hospitals. Generally, the number of public health facilities, mines and missions have been increasing

constantly, however, the number remains far short of demand. There is also a prevalent belief in alternative medicine such traditional healers ("Zambia", 2017).

Traditionally, in Zambia, families look after the well being of their members. Elders are responsible for advising in village affairs. However, in the urban areas, kinship ties have weakened, enforcing the developments of government welfare services. Nongovernmental agencies and voluntaries are increasing their numbers; many rely on funds outside Zambia, thus drawing skepticism from government circles about their investment to sustainable development and their ability to follow national priorities. Notwithstanding, these organizations contribute the most to the care of those who need help ("Zambia", 2017).

3.4.1 The health care system in Zambia

The overarching goal of the Zambian health sector is *"equity of access to cost-effective and affordable health services as close to the family as possible"* (Picazo & Zhao, 2009, p. 5). Since 1992 Zambia has implemented many health sector reforms with a purpose to achieve that goal. In order to move resources from central level health facilities to more operational levels of the health care system with an aim to be more constructive where the majority of the people are, a decentralization process has been carried out within the Zambian health sector (MoH, 2006 cited in Magnussen, 2011). In 2006 user fees for primary health care services were terminated with the goal of increasing availability of health care services for those who have incapable of paying (GRZ, 2011).

Zambia has several providers of healthcare services. The core providers are public health facilities served but the Ministry of Health, mission hospitals and clinics, hospitals within the mining industry, Non-Government Organizations and traditional healers (MoH, 2006). The private for-profit sector is growing, but concentrated mostly in urban locations. Health posts intend to cater for a population of 500 households (approximately 3,500 people) in the rural areas and 1,000 households (7000 people) in urban areas. The goal is to have 3000 health posts, but only 20 exist. The rural health centers under the MoH intend to support a population of 10,000 within a radius of 29 km. There are also first/second/third level hospitals – first level hospitals are found in most of the 72 districts and are required to support a catchment area of between 80,000 and 200,000 with medical, surgical, obstetric and diagnostic services, including clinical services to cater referrals from health centers. The second level also called general hospitals at the provincial level are intended to cater to a population of 200,000 to 800,000 people. Third level hospitals are central hospitals and support population of 800,000

and above and have sub-specialization in internal medicine, surgery, pediatrics, obstetrics and gynecology, intensive care and etc. There are only 5 such facilities in the country (Picazo & Zhao, 2009). There are 17,178 health workers employed in the public health sector and this number is well beneath recommendations from the WHO (GRZ, 2011). A diagram of health care facilities hierarchy for better visualization is depicted in figure 3.4.

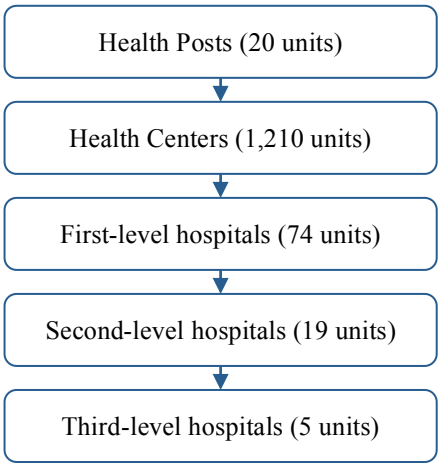

Figure 3.4 Health care facilities hierarchy (Picazo & Zhao, 2009)

The delivery of healthcare in Zambia is limited by a number of factors such as a deprived state of existing health facilities and accessible equipment, the essential shortage of human resources within the workforce of the health sector, insufficient funding and others. The human resource crisis that is occurring nowadays within the Zambian health sector is greatly influencing the ability to support the population with basic health care services (MoH, 2006). Many rural health centers are managed by untrained personnel, as there is no professional staff employed. Some of the openings of new facilities have been initiated without the required staff to run the centers (Magnussen, 2011). Studies also suggest that the current stock of health workers cannot support the effort required to provide universal treatment of such illness as HIV/AIDS (Vledder & Campbell, 2011), therefore it is evident that existing health staff at the facilities is also overworked and that affects decision-making at facility level as well.

3.5 HMIS in Zambia

The Government of the Republic of Zambia has a long history of fairly successful Health Management Information System implementations, starting from 1990s. The following is a brief overview of the HMIS implementations (Heywood et al., unpublished assessment).

- In 1996 HMIS was adopted using the Decentralized, Action-oriented Responsive and Transparent (DART) principles.
- The DHIS 1.4 was implemented in 2006. It was a large improvement, however persistent organizational and technical problems were occurring at national and sub-national levels, with slow reporting times and poor data quality.
- The DHIS2 web-based platform was adopted in 2013 by the Ministry of Health to all districts with support from Global Fund and PATH (an international health organization driving transformative innovation to save lives). During this move to DHIS2, much of the credentials for HMIS-related data collection transferred from the MoH to the Ministry for Community Development and Mother and Child Health (MCDMCH). An additional 33 districts were established in Zambia within that time, increasing the number of districts from 72 to 103.
- The MCDMCH was dismissed and responsibilities from HMIS returned to MoH (ibid).

There are several problems facing the HMIS in Zambia, which is not changing through last years. The issues faced, however, are not unique to Zambia, they are experienced in many other African countries. Nevertheless, Zambia's HMIS is in a better state and use, compared to other countries (ibid).

The information cycle in the Zambian HMIS includes five major components (figure 3.5):

1. decision and action,
2. collection and processing,
3. data mining and extraction,
4. feedback and communication,
5. analysis and interpretation (ibid).

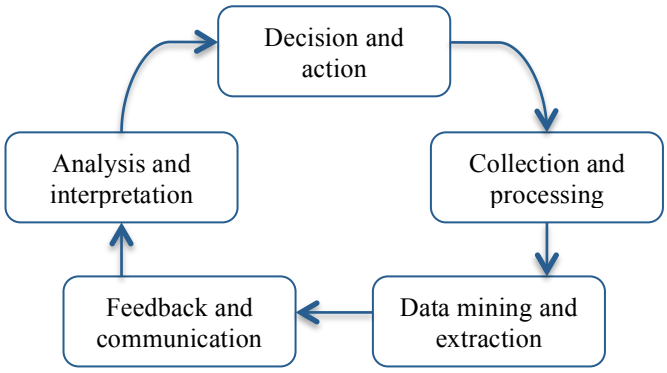

Figure 3.5 The information cycle (Braa & Sahay, 2012)

The current HMIS focuses mostly on data collection in order to send data to the next level (from facility level → district → province → national level). Other elements of the cycle require considerable strengthening (Heywood et al., unpublished assessment).

The Zambian government, in cooperation with a number of NGOs and faith-based organizations, has invested in health information technologies to improve service delivery and follow-up in the country. For instance, the Smart Care system is an electronic medical record system that utilizes Smart Cards comprising patient's individual medical history. However, many of Zambia's rural facilities have not yet adopted this technology. By February 2014 141 facilities had been equipped with staff trained to use these cards, with an uncompleted plan to expand use in 469 facilities (Velez & Foster, 2006).

3.5.1 District health information system (DHIS2)

The first version of the DHIS was deployed in South Africa in 1996 and became a national standard in 2001 (Garrib et al, 2008). The system is decentralized and has functions of flexibility and local control integrated into the software with an aim to empower local users (Braa & Sahay, 2012). DHIS is a software tool for collection, validation, analysis, and presentation of statistical data managed in multiple data sets. Version 2 of DHIS is an open-source web-based software package available free of charge (www.DHIS2.org). It is being used by national health management information systems in more than 40 countries in Africa and Asia (Braa et al, 2012).

DHIS2, besides being a fully functional HIS, aims to operate as a data warehouse where data from several recourses can be aggregated and stored and to work as a platform upon which additional applications and services can be built, as illustrated in figure 1.1. It is not possible to record individual health records with DHIS2 as its main purpose is to collect and aggregate different health data and indicators for the population altogether and to provide tools to analyze and display these (Braa & Sahay, 2012). In other words, the system is intended to support decentralized decision-making and health service management (Garrib et al, 2008).

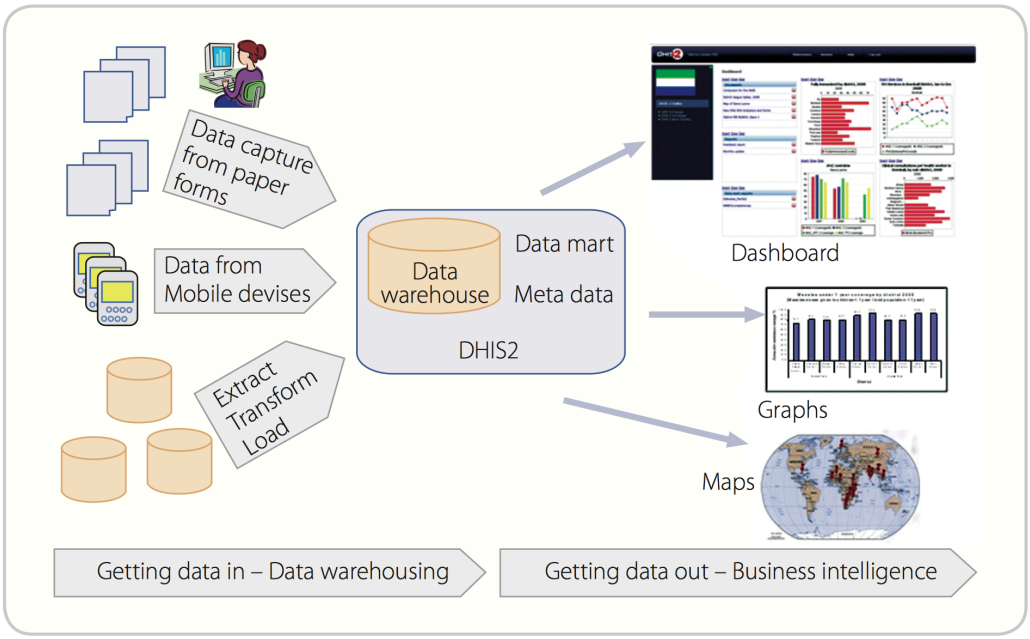

Figure 3.6 DHIS2 as data warehousing and business intelligence application (Braa & Sahay, 2012)

3.6 Current situation with the decision-making in Zambia

Decision-making was commonly restricted at facility and district levels due to lack of decentralization of decision-making to empower action by facility management. There are no guidelines to lead health workers to the idea of what decisions can be made, or how to use data. Furthermore, facilities receive insufficient funds from the government to make improvements and upgrade their facility. Facility grants are extremely small (for instance, some facilities receive only 600ZMK per month); therefore they don't have flexibility about how to spend their money. In 2016 there was an assessment of decision-making at three levels: client care, facility management and systems management (Heywood et al., unpublished assessment). These three levels can be further specified under managerial, administrative and clinical functions, as it was discussed in chapter 2.

3.6.1 Patient care (clinical)

Facilities use the system of individual records, tally sheets and registers to collect detailed data for all patients, collected information appears as the basis for the most decision made on individual patients. With help of these paper forms the impressive amount of data is captured and nevertheless, it is not leveraged for decision-making at the facility level, this data is aggregated and sent to the district on monthly forms but doesn't benefit the facility itself (ibid).

3.6.2 Facility management (administrative)

All facilities prepare annual plans, following MoH guidelines for planning at each level of the system, the plans, however, have no references to DHIS and facility level workers have to return to their HIA forms to retrieve data. Performance Assessments are conducted quarterly or semi-annually using MoH templates. However, most of 200 aspects of facility performance are outside of the control of the managers at the facility level. The PA also has minimal reference to the HMIS and no reference at all to DHIS. Furthermore, performance assessments do not follow up on past assessment, what gives little incentive to make improvements before the next assessment (ibid).

3.6.3 System management (managerial)

System management looks at the six World Health Organization blocks – Information, Service Delivery, Human Resources, Finance, Drugs, Governance and the data assembled to measure these (ibid).

The HIS is relatively well designed, with a standard set of national indicators and data elements, the data is regularly collected and passed upwards. The software DHIS is an adequate, customizable and open source, but IT infrastructure (computers and Internet) requires improvements at the facility level. At the time when this assessment was done, implementation of the DHIS at the district level was not well followed through – there has been an uncontrolled increase in the number of data elements and quality was not well controlled either. There was not sufficient effort to monitor the performance of the HMIS itself (ibid).

3.7 Facility trainings

In 2016 Akros (a development partner assisting the Ministry of Health, introduced in chapter 1) started preparation to train facilities to use DHIS2 and to enter health data into the system. Currently, it is the responsibility of District Health Information Officers (DHIO). Workers at the medical facilities fill out Health Information Aggregation Forms (HIA) based on the information from different registers they have and deliver these forms to the district. DHIOs use these reports to enter the data into the system; each DHIO is accountable for all the facilities in the district. However due to poor infrastructure discussed above, lack of vehicles or money for fuel, these reports often come to the district late or don't come at all. Reports can also get destroyed due to such circumstances as rain – the rains can be unpredictable in Zambia

(Taylor, 2006). Therefore a necessity to train the facilities to enter the data themselves is obvious.

To achieve improvements at the facility, one needs to compare what was done to what was planned to do. The goals have to be defined and indicators that are used to measure the progress towards those goals should be defined too (Heywood & Rohde, 2002). With using DHIS2 facility staff *"own"* their data and will be able to use it in a more effective way. Usually, in developing countries, Zambian health facilities and community health workers have limited access to appropriate computer-based tools and the Internet (Braa & Sahay, 2012). Local and primary level data management is paper-based. Now with UNICEF providing the computers for all the facilities that do not have one and Akros arranging the trainings, facility staff will have a better use of data to influence decision-making, planning, and evaluation of the performance (Braa & Sahay, 2012). Figure 3.6 depicts information flow before and after the adoption of DHIS2 at the facilities.

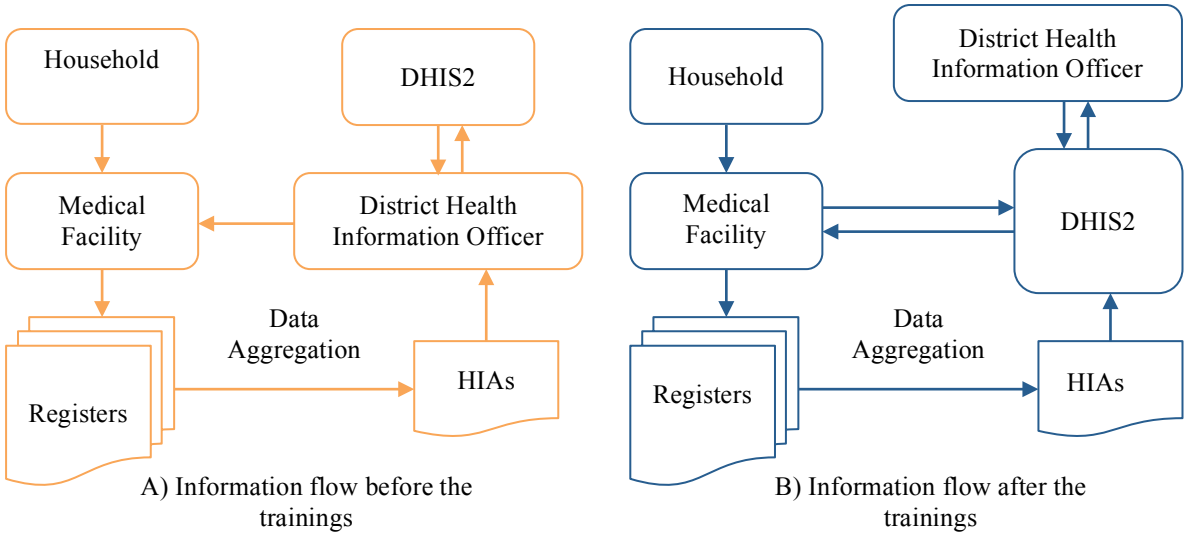

Figure 3.7 Information flow before and after the trainings (envisioned)

The trainings started on 8th of May 2017 and are still continuing through summer 2017. One training session lasts 4 days and includes a lot of different material, such as basic computer use, introduction to health management information systems, DHIS2 and everything related to how the facility staff should use it and also a lot of information is given on decision-making, and how the system can facilitate decision-making.

4 Methodology

This chapter outlines the quantitative and qualitative research methods applied in this research, as well as the research approach, including several challenges and difficulties. To proceed with these two study-trips to Zambia were carried out. The first trip was conducted in an exploratory manner, I did not aim to search only for the certain form of information, but rather I wished to have an *"open mind"*. Theory can provide an essential initial guide, but there is a risk of the researcher only seeing what the theory proposes, and therefore, using it in an uncompromising way that suppresses possible new issues and means for exploration. Thus, I choose to preserve a substantial degree of openness to the field data and I was willing to modify initial hypotheses and theories (Walsham, 2002). My second field trip was more focused on retrieving particular data and getting answers to several specific questions. In terms of methodology, this study is an interpretive case study, which will be discussed further.

4.1 Research methods

Commonly, research is divided between quantitative and qualitative research methods. Qualitative research aims to understand and explain social phenomena, by using qualitative data, such as interviews, documents, and observations (Myers, 1997). Quantitative research focuses on empirical investigation via mathematical techniques (Vogt, 2011). In my research, I wished to combine these two methods in the same research inquiry in order to develop a profound understanding of a phenomenon. Silverman (1998) argues that it is inappropriate to assume that quantitative and qualitative researchers are polar opposites, he undermines the assumption that these two paradigms are incommensurable and suggests that a researcher would often benefit from applying both approaches. It has been also advocated by Venkatesh et al (2013) that notwithstanding possible challenges associated with methodological pluralism, it is as a matter of fact, feasible to carry out research that crosses multiple methodologies and paradigms.

My goal was to use qualitative and quantitative research methods concurrently to collect data about decision-making at the facility level and learn about different cases of decision-making and people's understanding of it but also to see how well the facility staff comprehended trainings by employing not just interviews and observations, but also tests and surveys as it would subsequently relate to future decision-making after the system implementation. This way, I gain the ability to address confirmatory and exploratory questions simultaneously

(Teddlie & Tashakkori cited in Venkatesh et al, 2013). I used quantitative measures to infer from one case to a larger population, even though a qualitative research method was chosen as the basic method, as according to Silversman, such comparisons with a larger sample may allow a researcher to establish some sense of the representativeness of a single case (Hammersley cited in Silverman, 2013).

4.1.1 Case study

A case study is an empirical inquiry that aims to understand a contemporary phenomenon in its natural settings, especially when the line between phenomenon and settings is not explicitly evident (Yin, 2002). According to Myers case study is the most prevalent way of conducting qualitative research in the field of information systems (1997).

In my study I was following 2 training courses over a period of 2 weeks to find information for my research questions, however, it is important to mention that I spent longer time within settings of my study which is in Zambia, just developing tools for the research and gaining a deeper understanding of the context. The case study research was chosen, as I wanted to understand a complex issue of decision-making at the medical facility level in-depth (Flyvbjerg, 2006).

Flyvbjerg (2006), as well as Walsham (2006), argue that general phenomenon can be determined even by studying only one case or small set of case studies, however, it surely depends on the case itself and how it is chosen. In connection with the limitation of time, that I spent in Africa due to personal circumstances case study research was most convenient, and the survey data was collected to assess the plausibility of my interpretations of empirical data collected through observation and interviews.

4.2 Research approach

4.2.1 Carrying out field work in foreigner countries

Doing a fieldwork in a foreign country can be challenging: different language, different culture, different rules, and laws. Therefore, certain preparation had to be done before my first field trip – I tried to learn about the history, religion, politics, and ways of living in Zambia by reading various sources. The myth that travel widens the mind is a steady one, but international tourism shows the exact opposite, where people *"travel in body but not in spirit"*. Thereby I

made every effort to be *"there"* in both *"body and spirit",* trying to understand the culture (Walsham, 2006, p. 323).

Fortunately most people in Zambia speak English as it was mention in the previous chapter, however, they often incorporate words and sentences from their local dialects into conversations between each other and it was not always easy to understand them. Nevertheless, everyone who I met tried to use only English when they spoke with me, yet it required some time for me to be able to understand them well and get used to a new accent.

One of the biggest challenges that I faced was getting an access within a specific time frame. The main field trip was first scheduled in the middle of January, although it got delayed over and over again due to different circumstances. Originally e-training was planned, and therefore some of the relevant literature was researched, although later in the end of February after Akros' meeting with MoH, it was revealed that a combo of e-training and face to face training would be a more convenient solution, finally in the beginning of March Akros together with the Ministry of Health decided not to go ahead with e-training ideas due to lack of time to successfully put the necessary documents and systems in place.

4.3 Data collection methods

During my research, I have applied several different methods of data collection, primarily qualitative, but also quantitate such as questionnaires and tests. Some of the research tools were developed during my study in cooperation with the colleagues from Arkos while I was in Lusaka. Considering that my study is based more on empirical findings rather than on the theoretical bases, by having an aggregative view on data drawn from different contexts, I wished, as in trigonometry, to be able to *"triangulate the 'true' state of affairs"* by investigating where the different data intersect. In this way triangulation may enhance the trustworthiness of a single method (Silverman, 2013, p.).

As the first step in any research, it is important to develop an early contact in the organization/community in which one is interested (Crang & Cook, 2007). My research was conducted in cooperation with Arkos, one of the HISP-network partners affiliated with the University of Oslo, thus, all the details about the research were discussed beforehand via e-mail and skype calls. The setting up and carrying out fieldwork is the essential foundation of the interpretive study, which comprises choosing a style of involvement and gaining and

maintaining access (Walsham, 2006). Concerning the access, it was not an issue once I arrived in Zambia – colleagues from Akros arranged the trainings where I could interview facility staff and observe the trainings sessions, they also assisted me with an accommodation and transportation. Regarding the style of involvement, I wished to be as involved as possible; thereby I participated in the training session like all the facility staff, I will describe in more further in this section.

4.3.1 Observations

I could define my role as a participant observer as I was working together with a new team, who was responsible for implementing the trainings. I was helping them with organizing the trainings as much as I could; however, during the training session itself, I participated together with the facility staff almost on equal terms, like if I also was learning the system. I was sitting together with them at the same table and participating in all the games, quizzes, and other activities. In the beginning of training sessions I presented myself and explained the purpose of my research, I also talked about my future actions as an observer and interviewer. My goal was to become friends with these people in order for them to be comfortable around me and to behave naturally. I tried to chitchat with people on the first day, asked them how they were doing. Already on the second day facility staff started to treat me, as I was one of them, they even laughed and joked about my ways of dressing, as I tended to wear lighter clothes while everyone else was wearing jackets – it was winter for them. From second day many of them started to approach me first, also asked questions about Norway and my home country Russia, made kind jokes about Russian politics, therefore, I believe they perceived me as part of the team and were not confused by my presence, but rather entertained. They always encouraged me when I participated in the games and they showed curiosity. I suppose they also wanted to make me feel comfortable, as I was the only foreigner person there. They got acquainted with each other very fast and they tried to make me feel included. We went to lunch together and talked about different personal topics over the food, from time to time I would ask something related to the research but in an informal way.

During the lessons, when facilitators just explained the material, I wrote down my notes on my computer about everything that I observed. Sometimes language was a barrier, people spoke fast and even though I listened very carefully, I could not always understand every word, but I always understood the idea, so if I found something particularly interesting, I would ask the facilitators to explain it to me again later. I also had a small notebook with me through the whole field trip where I tried to recapitulate everything I heard and saw (figure 4.1).

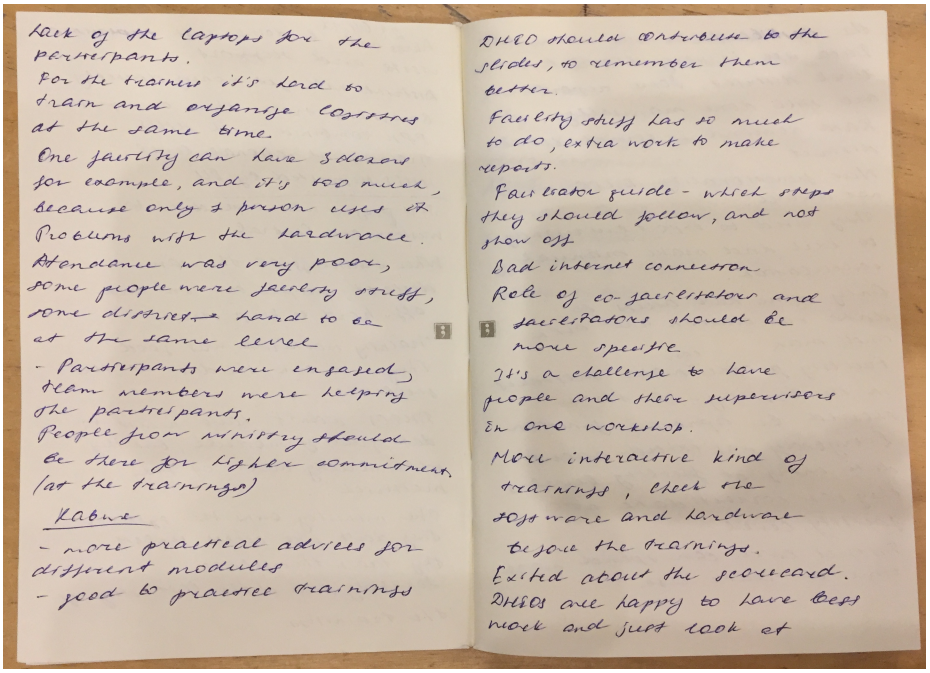

Figure 4.1 Field trip notes

4.3.2 Interviews/Conversations

As with most qualitative research (Johnson & Turner, 2003), face-to-face interviews played a fundamental role in this study. Semi-structured individual interviews were conducted with 8 different medical facility staff and 2 group interviews were conducted with the facility staff. Earlier, before the facility trainings one DHIO was also interviewed. Through the whole study trainers were interviewed as well.

Crang and Cook (2007) suggest that before conducting an interview a researcher should consider the selection of an appropriate time and a place. The place and time should be most convenient for the interviewee. In my study, I did not have an opportunity to choose neither place nor time, but I believe that a place chosen by Akros for the training session was most convenient and likable for the facility staff. The trainings occurred in a pleasant hotel, just outside of Lusaka, in conference rooms with air conditioner and water provided in the morning and after lunch.

Regarding the time – I tried to talk to some of the facility staff and ask a few questions anytime when there was a break during training sessions, sometimes it was challenging as breaks were short and there was lack of proper space for an interview, some people still stayed inside the room where the training took place, a lot of people were outside and it was quite noisy outside. Therefore, I tried to have a walk with each interviewee slightly further away to get some

privacy and to be able to understand responses better. Some people had stronger accents and talked very quietly or fast, so I decided to record all the interviews to be able to grasp their every word afterward. There are also some advantages related to tape-recording such as a truer record of what was said; this record is even possible to use later for more detailed or different form of analyses. It also gave me the possibility to engage with the interviewees more freely and to pick up direct quotes when writing up (Walsham, 2006). However, I did not actually have a choice, if I did not record the interviews, I would miss a lot of valuable information due to the language barrier. Walsham (2006) states that tape-recording can make the interviewee less truthful or less open, I do not think that it happened in my study, people seemed comfortable with me tape-recording their answers. It is also not advisable to judge people's views or attitudes exclusively on what they say; therefore I tried to pay attention to my interviewee's body language as well and wrote down notes right after each interview (ibid).

I started each interview reassuring the respondent about my purpose and about the confidentiality. If I saw that my interviewee was nervous I did most of the talking in the beginning myself, this way I might have lost some of the interview time but I managed to make the interviewee more comfortable and relaxed, and it resulted as an improvement of the quality of the interview being that the responses were more honest (ibid).

As this thesis is my first qualitative research and I did not conduct such interviews before, especially in settings like a foreigner country, I was nervous myself to some extent in the beginning. The similarity of the research interview to an everyday conversation can imply certain simplicity, but this simplicity is deceptive (Kvale & Brinkmann, 2009). A greatest challenge concerning the interviews for me was a question, how I can avoid influencing the subject with leading questions. As decision-making is not always an easy term and not everyone understands it in the same way, I had to give some examples of decisions to my interviewees to lead them in the right direction. Another issue with the interviews was calibrating social distances without making the interviewee feel like *"an insect under the microscope"* (Sennett, 2004, pp. 37-38 cited in Kvale & Brinkmann, 2009). I wanted to probe the responses people gave me and in order to achieve that I could not be stonily impersonal; I had to give something of myself to gain an open response (Kvale & Brinkmann, 2009). My own personal background and my good social skills certainly assisted me in making the interviews easier and receiving, in my opinion, open answers.

4.3.3 Questionnaires and tests

When I arrived for the first training session with DHIO, Akros already had prepared some questionnaires for the feedback and test to evaluate knowledge after the trainings. The test was modified at the end of DHIO training in cooperation with DHIOs. Training team suggested that I add my questions to the feedback form. I decided not to change anything for the DHIO training, as it was not my main target. Next week after the DHIO training I was at the office preparing for the facility training together with the facilitators team. After a group meeting we decided that we wanted to prepare on-line version of the test and the feedback form – this way we did not have to spend a lot of time on transcribing handwriting and it was especially beneficial for me as I would get new data through all the trainings online and it would allow me to get enough data to make justified assumptions. I was anxious not to be able to collect enough data, as due to trainings being postponed I could only stay in Zambia for one week of the facility trainings; online questionaries' helped to solve this issue. Using questionnaires as a semi-quantitative method also increased the possibility of obtaining perhaps different information since it was done anonymously.

I was responsible for developing on-line forms. I used Google Forms, as it is an easy tool for producing questionaries' that doesn't require any payment. Example of the form with feedback questions the way it was shown to the facility staff is illustrated in figure 4.2. My concern was that the facility staff would not be able to use the forms due to lack of computer literacy, however, in the end, everything went well and only a few people struggled to some extent, but with our help, they managed as well. In case of complications with using online forms I prepared backup paper versions (see Appendix).

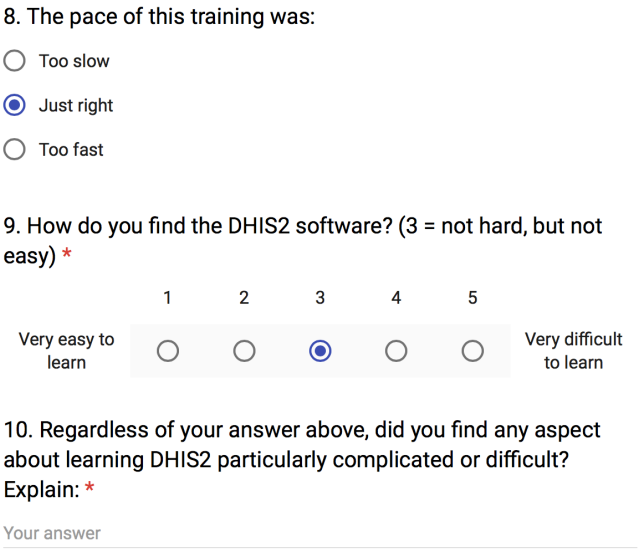

Figure 4.2 Visualization of the feedback questions

Online tests had multiple choice answers and after completing the test facility staff would get their grades and would see in which questions they made a mistake. This tool also allowed me to analyze results from the test (figure 4.3).

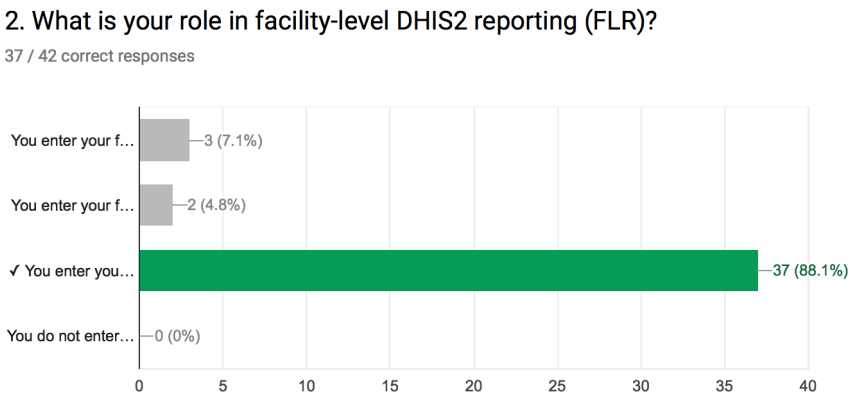

Figure 4.3 Example of summary of responses for the test

Online tests also had qualitative open questions to gather additional data. We worked on designing questions together with colleagues from Akros and it was a fairly challenging process as we tried to design questions that are not too leading but that would get us the answers we were looking for. Example of the question:

"Did you identify any piece of data you hadn't previously used to make decisions in your facility that you will start using now that we have discussed data use? If so, what data did you identify (be specific)"

Many of the answers were simply *"yes"*, *"no"*, or describing system related tools (that facility staff obviously couldn't use before the trainings) such as pivot tables. Some answers were poorly written and couldn't be interpreted. We got relevant detailed answers as well, but only one third or less. Here is an example of the answer we were looking for: *"The use of statistical data in terms of patient flow to decide which medical supplies should be of higher priority as we make our orders"*. This kind of answer provides us with insights about which data elements may be useful for decision-making at the facility level.

4.3.4 Collecting data remotely

It was interesting, in terms of advancing my research, to see the results of the trainings and as I could not travel to Zambia again; I had to gather this data remotely. My main source of continuous data was colleagues from Akros as they were conducting two supervision visits

after the training to check how facilities were performing and if they had any problems. I kept communicating with the colleagues from Akros through email. However, due to different circumstances, I received this data short period of time before the submission of this thesis, so there was limited time for detailed analysis.

4.4 Analysis

"Although we do not create data, we create theory out of data. If we do it correctly, then we are not speaking for our participants but rather are enabling them to speak in voices that are clearly understood and representative" (Strauss & Corbin, 1998)

The data analysis pertaining to this research took place at different points in time while further data collections were ongoing, as new information was getting obtained through electronic questionaries' and colleagues from Akros. Continuous analysis of already collected data can give new insights to the researcher with regards to probable themes, categories and patterns, which may further enhance the future data collection processes (Johnson & Christensen, 2008).

While conducting the interviews I wanted to listen closely to what people were saying and how they were saying it and made notes later, as I mentioned earlier in this chapter. I was attempting to understand how they were interpreting certain events. This prevented me from jumping precipitously to my own theoretical conclusions, taking into account the interviewees' interpretations. It assisted me with avoiding laying my first interpretations on data and forced me to examine alternative explanations (Strauss & Corbin, 1998).

I commenced the process of analysis with transcribing the audio recording of the interviews verbatim every day during the DHIO and facility trainings and read through the notes I took to comprehend their potential contribution to the study. The second step was the detailed line-by-line analysis (figure 4.4), that was necessary at the beginning of the study to generate initial categories and to suggest relationships among categories (figure 4.5); a combination of open and axial coding. Thus chunks of text were assigned codes according to their representation of a single theme or an issue associated with the research questions (Strauss & Corbin, 1998).

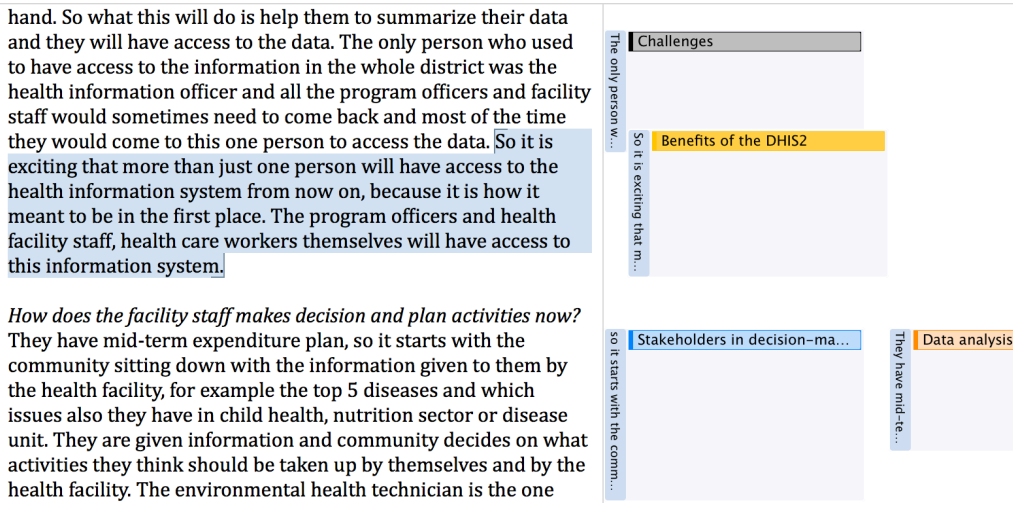

Figure 4.4 Transcripts analysis and open coding

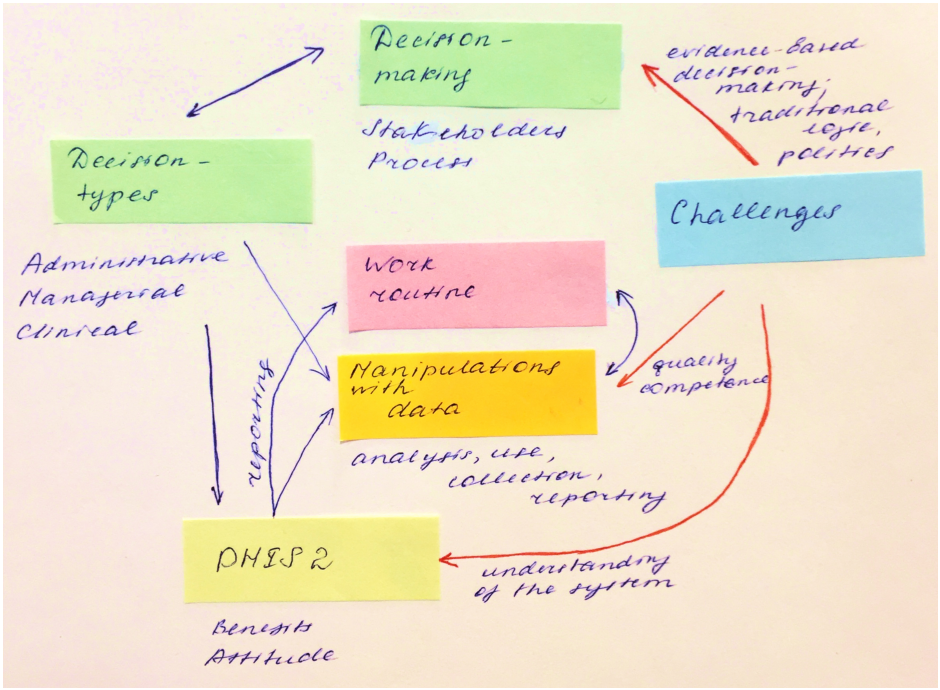

Figure 4.5 Mapping of categories and relationships between them

The main idea in content analysis is that the many words of the text are classified into much fewer content categories (Weber, 1985 cited in Tesch, 2013). The basic content analysis takes a systematic, deductive approach, bringing a clear a priory theoretical sense of analytic problems to an analysis of the substantive content of the text (Shaw, 1999). I followed a key procedure in content analysis, which is to design categories that are relevant to the research purpose and to sort all occurrences of relevant words or other recording units into these categories. Then the frequency of occurrences in each category was counted (figure 4.6 → blue bars on the right

from them identify frequencies) and certain conclusions were drawn from it (Tesch, 2013). I also applied a method of the exploration of word usage, where I wanted to discover the range of meaning that a word can express in normal use. The target words were extracted with a specified amount of text immediately preceding and following them. Furthermore, I grouped together the words in which the meaning was similar and established how narrowly or broadly a certain term is construed by the author of the text and compared word uses among groups of authors (Tesch, 2013).

Concerning analysis of qualitative answers on the test described in the sub-chapter above, I went through all the answers (297 responses) and filtered irrelevant ones (the process was also described in the sub-chapter above); when I selected only essential data I followed the same steps of analysis that I applied to field notes and transcripts. To analyze quantitate data from the tests I utilized Microsoft Excel and basic formulas to calculate the average percentage, prepare graphs, etc.

I used the software Atlas.ti to carry out qualitative analysis described above. The software made it easier to revise and interpret data as well as to find specific quotes. Field notes and transcripts were revised and coded by topics that emerged through the notes according to the decentralized evidence-based decision-making framework described in chapter 2 (table 2.1) Thus while analyzing the empirical data I kept returning to the literature to look for categories that matched and examined relationships, similarities and differences. An example from the interviews' transcripts is: *"If I have a woman in labor, then I assess and I have to decide whether she is able to deliver at the facility or she should be referred to the hospital. I decide whether or not to call an ambulance"*. A decision concerning immediate help and treatment for the patient is related to clinical decisions explained in chapter 2 and was grouped under the category "Decisions" → "Clinical" along with other labels like "Managerial", "Administrative", "Managerial/Clinical" etc. (figure 4.6). By knowing the contents of the categories, it was possible to map out all the categories and their labels on post-its and then visualize the relationships and dependencies between them on a single sheet of paper (Saldaña, 2015). Figure 4.8 depicts the same analysis applied to data from the questionnaire. After analyzing data from the questionnaire, I conducted analysis on transcripts and field notes again, but this time I only looked for similar codes as I attached to questionnaire data; this was done in order to see the link between decisions that are already being made and data that facility staff identified as useful for decision-making, but not used before the trainings (figure 4.7).

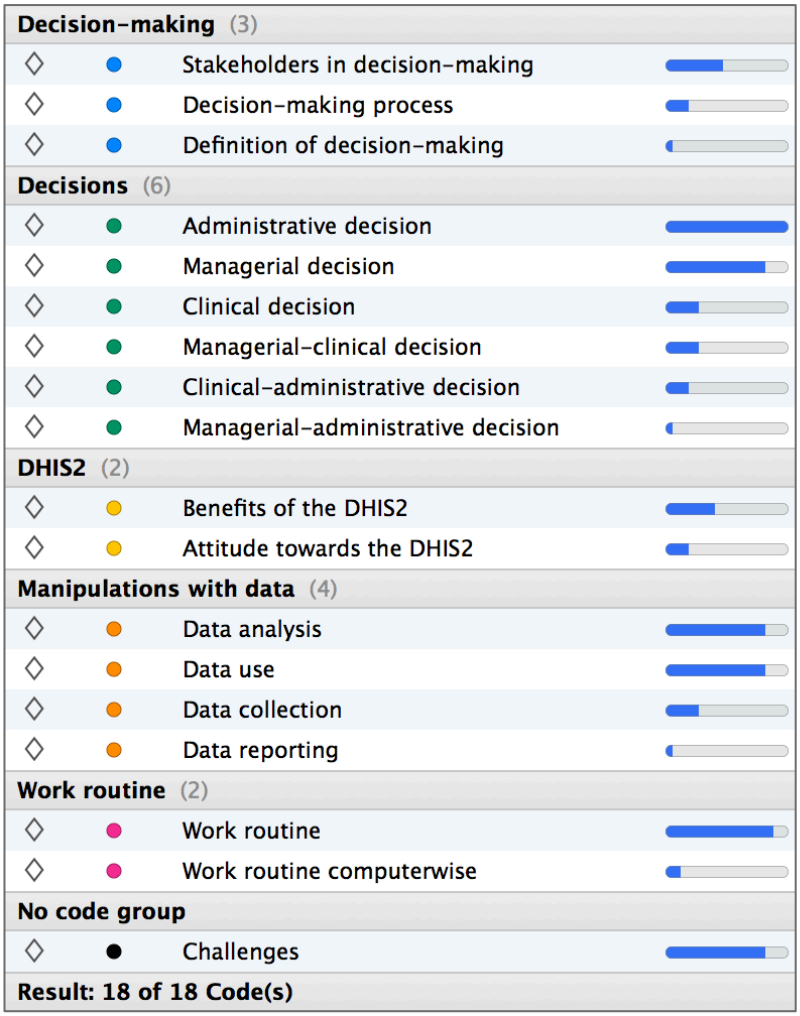

Figure 4.6 Codes and number of repetitions. Field notes and transcripts

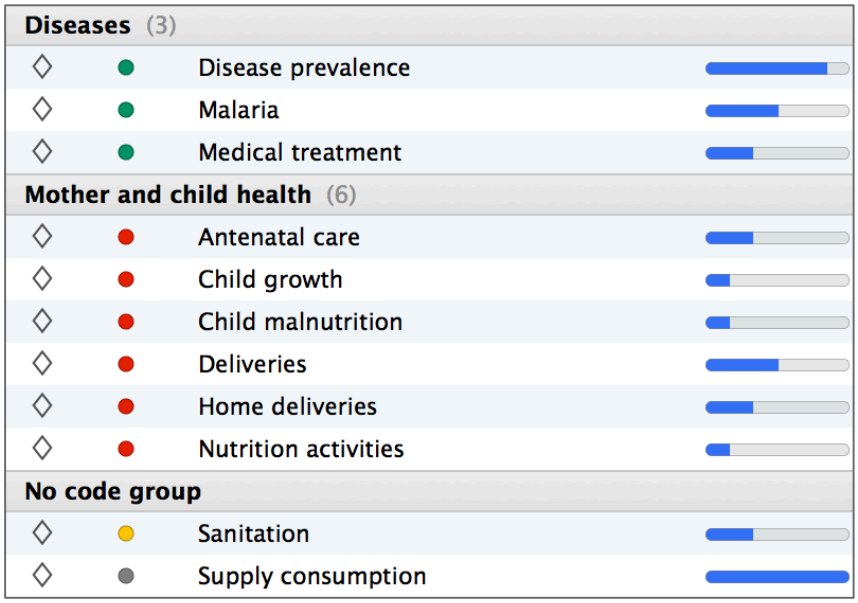

Figure 4.7 Codes and number of repetitions. Field notes and transcripts (second analysis)

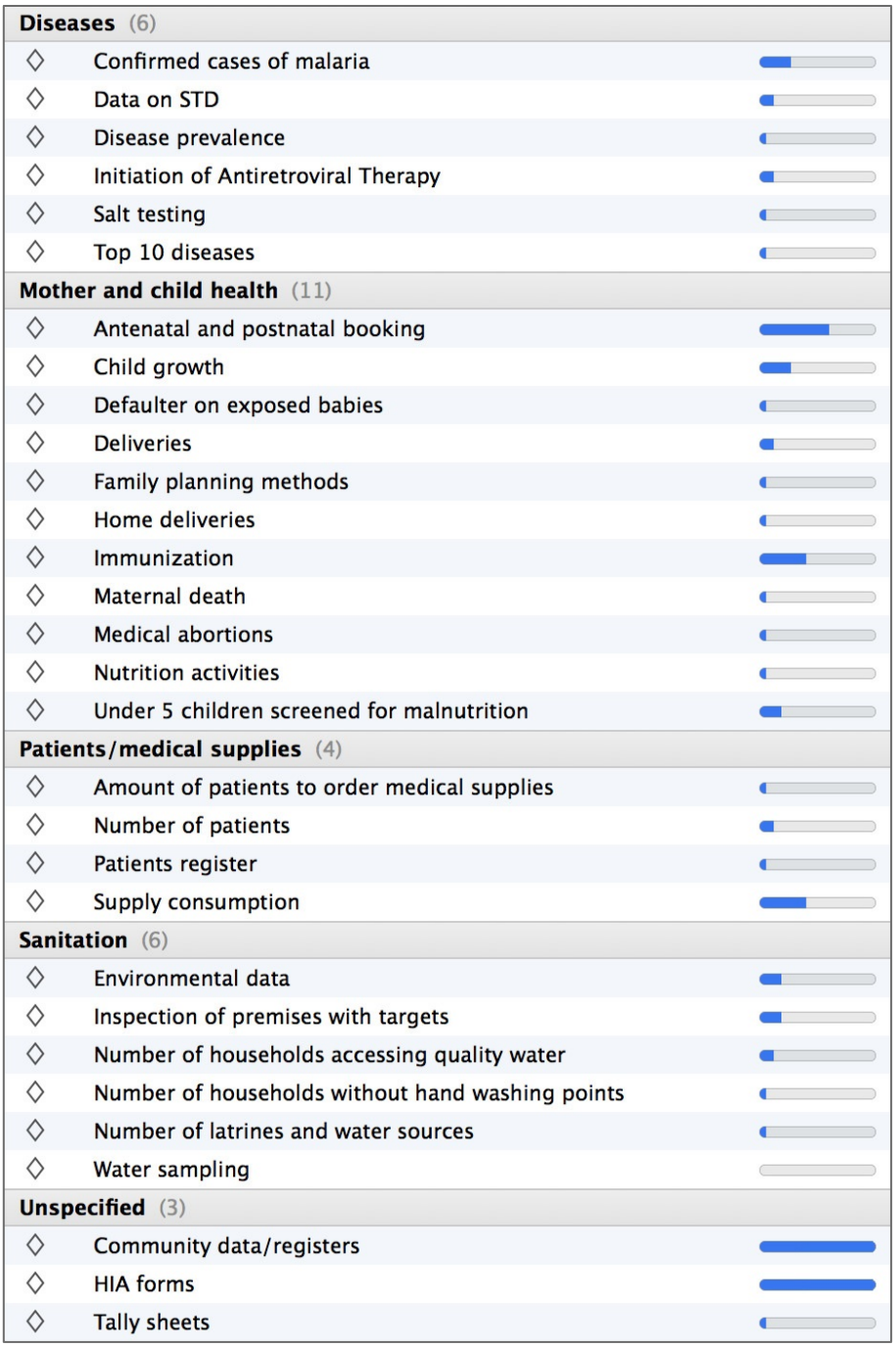

Figure 4.8 Codes and number of repetitions. Questionnaire

4.5 Ethical consideration

Conducting any kind of research one should always consider the possibility of any ethical issues; I believe that one of the most important issues is privacy and confidentiality. Iachello and Hong state that people can be segmented into three groups according to their privacy concerns: people with high concern – those who believe that their personal data being handled not securely and responsibly; people with medium concern – those who acknowledge risks to their personal information, but believe that sufficient security is provided; people with low

concern – those who do not worry about risks to their personal information (Iachello & Hong, 2007). Regarding the privacy of the data gathered during the research – I always made sure to obtain verbal informed consent from the interviewees and indicated that fair information practices would be employed and data would be proceeded under my control, I also informed the interviewees that I would not identify them by name or their specific position. By doing that I wanted to ensure that people with a high concern for privacy would feel safe and comfortable not less than other groups of people (Iachello & Hong, 2007).

When thinking about privacy issues there is more to that than just providing interviewees with informed consent, even though I did not mention names in my study, some readers might just make a guess who is being discussed, especially if they personally know the individual mentioned in the paper (Walsham, 2006). Thereby there is still a possibility of violation of confidentiality and unfortunately there is not much that I can do about it, although of course, I could reveal fewer details and descriptions of people that I am writing about, and thus make it harder to hypnotize the person's identity, however I assume that lack of specifications might lead to a lesser degree of understanding the case.

Another ethical tension that I encountered is related to informing the interviewees about the purpose of my study. For instance, if one was to study power relationships in an organization he/she would probably not mention it as it is not something that people are willing to openly share with strangers (Walsham, 2006). In my study I wanted to be frank about everything that I wish to research, first of all because it is always good to be honest, secondly I believe that my research question can be discussed with strangers and different kind of people openly and finally there is no really piquant area like "power relationships" that I wanted to look into that I could not discuss explicitly with the interviewees. However naturally I felt that during first day and even second day of my interviews facility staff were trying to say more good things about their facilities, presumably not wanting to reveal all the negative parts and I believe that this behavior could be explained by the phenomenon called *"Hawthorne effect"*, when people tend to act differently while being observed, with behavior that makes them look good (McCarney et al, 2007). In my case, they were not observed, but nevertheless, they could choose how to make themselves look by choosing which information to share with me. Therefore I tried to build mutual trust with these people and make them feel that I was not judging them; I tried to kindly imply that it was important for them to be open with me and to share as much information as possible not just for the sake of literature but for their own practical benefits as my research could make a contribution into improving their situation in the future.

5 Empirical findings

In this chapter, I provide the empirical insights of my research. The information is gathered mostly from the observations of the facility trainings and conversations with the participants. First I give a description of district health information officers' and facility staff' trainings as well as introduce different stakeholders and their roles. Furthermore, I discuss outcomes and impressions from the interviews and observations. Finally, I present data gathered during first supervision visits conducted by colleagues from Akros.

Figure 5.1 Urban health center (Akros, 2017)

5.1 The district health information officers training session

I arrived in Lusaka on Monday night and the next day early in the morning I was picked up and driven to Kabwe (the capital of the Zambian Central Province, located 100 km north from Lusaka) where training for the DHIOs was taking place. Akros hired 4 new people to carry out the trainings; they were given three weeks of intense training before they had to start conducting trainings themselves. They were responsible for carrying out most of the training for the DHIOs, however, they were under the supervision of senior staff from Akros. Later they conducted trainings for the facilities independently.

A purpose of the training for the DHIOs was to explain to them how to teach facilities to use DHIS2 in order to get their help for future facility trainings. At the beginning, DHIOs got a presentation on how to be a good facilitator, where different matters were covered such as responsibilities of the facilitator, common mistakes, different advice etc., furthermore they were shown all the presentations that were prepared for the facilities.

The DHIOs were asked to share their experiences throughout the training, as their feedback was considered valuable. Another purpose of this training was to enhance training material together with the DHIOs and to determine challenges with collecting, entering, validating and analyzing data that the DHIOs encounter. One of the remarks from the DHIOs was that none of them had access to "Min-Max Outlier Analysis" module. Also, they mentioned that when they enter data they just want to be finished with the task and submit it as soon as possible and they don't have time for data quality check. A suggestion for this problem was *"not to bother too much during data entry, but come back to that data later and check it and check data entered during past several months as well"* – Akros staff.

By the end of day two, all the training material was shown to the DHIOs, on day three each of them had to present parts of training material in the same manner, as they would present it to the facility staff. During the breaks, I had conversations with the DHIOs and I learned that they feel ambiguous about upcoming trainings as in their opinion the facility staff are already overworked and they will have even more duties after the trainings. Later I discovered that there are other complications related to this matter such as transferring responsibilities of entering data into the system to the facility staff might decrease importance of the DHIOs, however, on the other hand, the DHIOs would have less data entry work to do and could spend more time on analysing data and improving data quality. Nevertheless, the potential new tasks associated with their roles were not obvious to all the DHIOs after this training.

5.2 The facility training session

The facility-training course took place in a very pleasant hotel just outside of Lusaka, in conference rooms with air conditioners and provided water. There were workers with different roles present at this training session such as data clerks, nurses, RHCs (rural health center representative), health posts (smaller health centers). Altogether there were 36 trainees. Some people had computers from their facilities, which were used for smart care before (see chapter

3.5). All the facilities were given laptops with sim cards inside; every month after the training they would receive money for the Internet.

Initially, all the participants were gathered in one room for an opening speech. After the speech, everyone had to present themselves, then was given a sticky note and was asked to write 2 expectations for the workshop and the best thing about their job. The purpose of this was that at the end of the course we would run through all the expectations and see if they were achieved.

Here are some of the expectations that were named:

- to get a better understanding of the DHIS2;
- to learn more about data entry, data quality, and the analysis;
- to learn and make sure, they can implement what they learned when they are back;
- to learn how to collect data to help central level to make decisions.

What they love about their job:

Socially related:

- to interact with patients, not just physically but emotionality as well;
- to see people go home healthy, a joy to see people recover;
- to meet interesting and sometimes even strange patients (one patient had memory problems and thought a nurse was his wife and told her many stories about his life);
- *"Patients put a smile on my face, no matter how I feel"* – a nurse.

System-related:

- to record quality data;
- to be a link between the community and the facility;
- to analyze data.

I also had to present myself and answer the same questions. People appeared to be curious about what my role was. Next, some ground rules were introduced (the audience was asked to help with giving examples), such as – speak through the chair; start and end with a prayer; respect each other's opinion; phones have to be on silence; observe time; no mini-meetings.

After a general introduction, my task was to divide people into 2 smaller groups. While I was occupied with it, Akros team was arranging 2 new rooms. I just asked the participant to count 1 and 2 and that's how new groups were formed – 18 people in each. I joined group 1 (figure

5.2). The participants had notebooks (given by Akros) and were taking notes from the beginning.

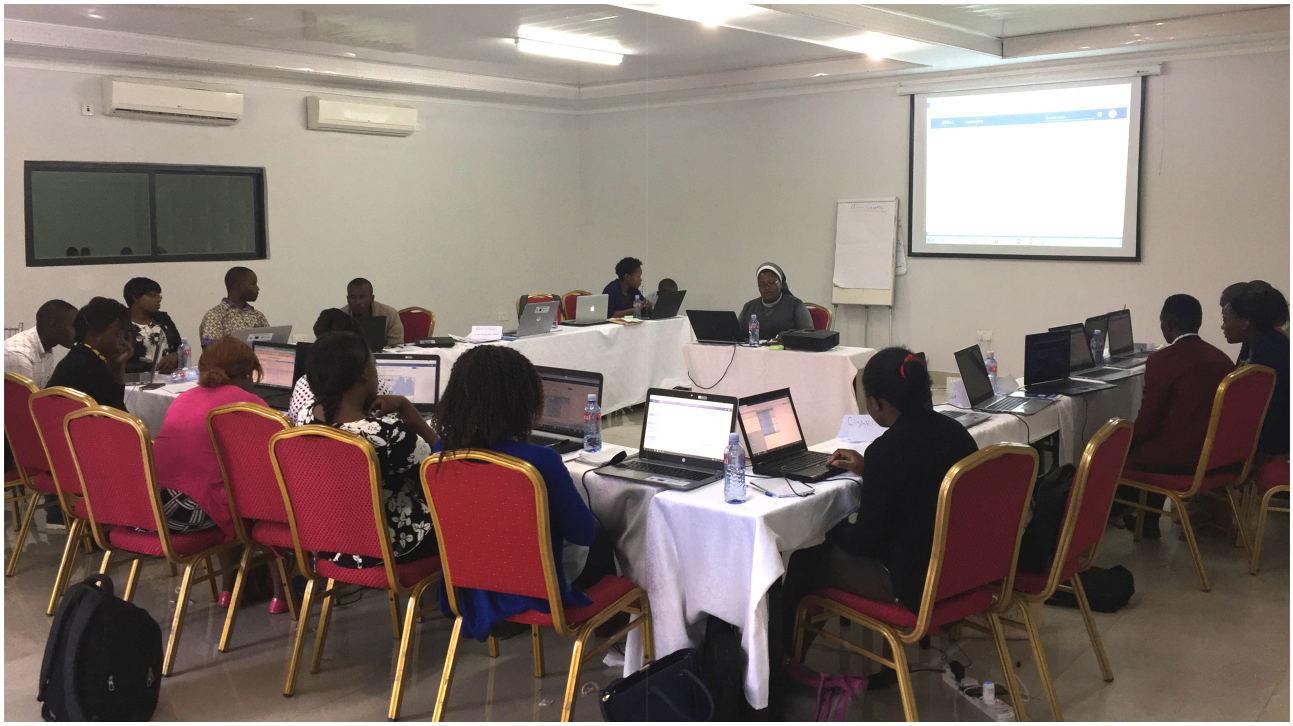

Figure 5.2 Training session. Group 1

When everyone settled into the new rooms, the participants were asked to collaborate on a question *"Where facility level staff fits in data wise – collecting data"*. Discussion revealed some issues with data collection and reporting (table 5.1).

Data collection	**Data reporting**
Registers are incomplete and too tedious	
Low manpower	
Bad attitude towards data entry	
Difficult to follow up on data coming from communities	Nurses and other staff have to report on the activities that they are not entirely involved in
Lack of understanding some of the indicators	No proper review of previously captured data
	Difficulties in reading of someone else's handwriting

Table 5.1 Issues with data collection and reporting

Further, we discussed more how data reporting is currently performed – reporting starts with the registration, recording the registers and tally sheets, then collected data is sent to the district. There are several challenges with delivering data to the districts, such as lack of transport – in some places there are no public buses, so unless facility owns a bicycle or other

kind of vehicle (normally facilities are provided with bicycles or motorbikes) it is hard to travel long distances, it is still hard even with a bicycle. The roads are not always in a good condition and during rains traveling becomes more challenging as well.

During the first day of training Akros staff already asked a question about planning and decision-making, people seemed slightly confused at first and only one person wanted to share an example from their work experience, which will be discussed later in this chapter.

5.3 Data analysis and decision-making discussions at the training

The second day of trainings started with a recap – facilitators used a paper roll, which they gave to the participants and asked them to tear off a piece depending on how much tissue they use every day. After the participants finished getting tissues, they were asked to tell a few things (depending on how much tissue they got) about what they learned during the previous day. They mentioned all the topics discussed yesterday, so they remembered fairly well. Then lessons continued with short breaks and practical exercises. Around 12 pm the participants were asked to stand up and again depending on how much tissue they got in the morning they had to say a few things about themselves that others didn't know yet. It was a very amusing and entertaining way to liven up the participants. Some stories were touching and some were humorous, for example, one woman shared that she achieved her father's dream by becoming a nurse; her father always wanted her to help people in need. It was hard for her to get accepted to school but she managed. Everyone applauded. Another young woman said that she had a checkbox for her future husband, she wanted him to be from a family that had a history of having twins because she wanted to be a mother of twins, everyone laughed. After this short "energizer", the participants seemed to be cheered up and were more eager to continue the training.

5.3.1 Dashboard analysis workshop

The third day started with a recap again – all the participants were divided into two groups and each group had to prepare questions for another group about what was learned during the previous day. The facilitators were counting scores for both teams, a winner was supposed to get a prize. However by the end of this game, not just a winner, but everyone got a candy.

This day the participants had to learn what a dashboard was (see chapter 2, figure 2.2). To understand dashboards better, students were divided into three groups and were asked to

discuss what they see on their dashboards (prepared by senior staff in advance), analyze it and find some solutions for problems if they would identify any. The results of this workshop are presented in table 5.2.

	Group 1	**Group 2**	**Group 3**
Dashboard	Antenatal Care	Immunization	Malaria cases
Problem	High level of syphilis in some facilities; low attendances at the facility for first antenatal care visits – people don't believe doctors and prefer traditional healers	Bad immunization level. Challenges: not all the facilities have vaccine fridges; some parents don't know the importance of receiving the vaccines; fuel and transport are not always available, therefore it is hard to get to the outreach posts	High level of malaria cases. Found out that data is not very accurate, by doing simple calculations like comparing clinical malaria cases and confirmed malaria cases
Solution	Educate people about contraceptives; create an outreach program – encourage people to come	Increase outreach activities in catchment areas, explain importance of the vaccines, and encourage parents to make sure their children get all the vaccines; ask facilities with better results how they achieved such results and try to implement similar activities; encourage the district office to deliver vaccines to the facility on time; there should be an outreach post within 5km	Technical support for those who still treat malaria clinically to use malaria rapid diagnostic tests (RDT); give mosquito nets to people who don't have it

Table 5.2 Results of dashboard analysis workshop

5.3.2 Decision-making analysis workshop

Last day started with a recap again, this time facilitators used a ball. Participants were asked to make a small circle and to throw the ball to each other, everyone who received the ball had to say what they learned through the whole session.

After one last lecture, the participants were divided into two groups and were asked to discuss decision-making at their facilities and what they would like to see on their dashboards (dashboard information gathering). As a matter of fact, people couldn't distinguish what exactly they wanted to see on the dashboards, but they shared many experiences from their days at work. The examples of decisions are presented in table 5.3. Table 5.4, on the other hand represents data that was mentioned to be used for analysis, but without any specific

decisions attached to it. Some people at the training were new employees and didn't have a lot experience yet, thus they didn't collaborate greatly.

Decision	Explanation/ Commentaries
What to use imprest for	The facility receives a certain amount of money for their needs (an imprest) from the government and they gather together to decide which material they need to buy for the clinic if they need to repair anything etc.
Which people to send for outreach, which people to send for community work	Decided at the beginning or end of each month
Make timetables for outreach programs	Decide how many outreach programs should be conducted
Order drugs / return drugs / purchase and distribution of other inventories	Count how many cases with deceases there are, to be able to order a certain amount of drugs, count leftover drugs at the end of each month. Some facilities order drugs 3 months in advance, so they make sure they don't run out, return drugs back to the district if they have extra. Purchase of chlorine and distribution of insecticide-treated nets (ITNs)
Prioritize areas that need interventions	See which areas are in worse situation regarding diseases, antenatal care visits etc.
Make an action plan for the whole year	Decided together with all staff at the facility. Which activities they tend to do and specify targets: how many outreaches they want to do etc.
Make up new activities	Decided based on new data from the registers
Send community health workers to check what is causing spreading of some diseases in some particular areas / Send community health workers with/or trained counselors to test people on diseases	When they find that there are many cases of certain diseases in some areas (for example areas with high HIV level)

Table 5.3 Results of decision-making analysis workshop (A)

Analysis	Explanation/ Commentaries
Results of water checks	Environmental health technician (EHT) checks water, everyone has to analyze the results
Current data from the registers	Medical staff analyzes if they are performing well enough and if not, they analyze why indicators are going down
Cause of deaths	If there are any deaths cases, they try to understand the cause

Table 5.4 Results of decision-making analysis workshop (B)

A representative of health ministry paid a visit at the end of this day and encouraged the participants to use the system, gave a speech on how important data entry at the facility level is. He mentioned he was going to visit facilities indiscriminately to check on them. He tried to encourage people to work with the recourses that they have even if they are limited.

After this speech, the facilitators distributed logins and passwords for the live server and made sure everyone managed to connect. At the end of the training session, the participants were given a test – electronic version of it (see chapter 4). There were concerns about online test as it could be time-consuming for the participants to type their answers, but it went fairly well. Most of the people managed to use a computer quite easily, everyone could type, but some participants were slow.

Already by the end of day three, I had been able to chat with most of the participants, they were very friendly and welcoming. They often made a small talk with me and joked, they also asked a lot of questions, most of them were just about how I liked Zambia and which places I already visited there. They all appeared to be greatly excited about the new coming changes in their work routine and improvements that DHIS2 could introduce.

One of the matters that I also noticed through the whole time of my field trip – religion plays an important role in people's daily life, for example, every day people would start and end work with a prayer.

5.4 Current and future division of facility and district level work

5.4.1 Interviews with district health information officers (DHIOs)

From conversations with the DHIOs, I learned that there are various staff levels at the facility. This includes cleaners, daily-specified employees, volunteers (volunteers can be community people who are just helping), data entry clerks, or in other words record clerks who record the data and there are health care workers who provide the health services.

According to the law and the structure of the health information system, the health worker is also involved in data collection. After the trainings facility staff will be engaged in data reporting as well and they will be able to use the system directly (health workers and the support staff).

"What will happen then is that everyone will enter the data" – one of the DHIOs

The staff input the data weekly and monthly, they can even input it daily, at hospital levels. After the trainings facility staff will enter the data into the system; the strategy of the trainings is to encourage facilities to use the data, this means to transfer data use all the way down to the facility level (figure 5.3). This hierarchy includes the community as a sub-entity that communicates with the facility. However, the community level is not part of the formal health system structure. In order for data to inform actions, for example in the child health care unit, staff should know how many children they have seen or immunized against the target, in order for them to plan their daily work. In the past facility staff relied on the freehand drawing of graphs based on paper reports at health facility level. They are still depending on paper-based HMIS to a great extent.

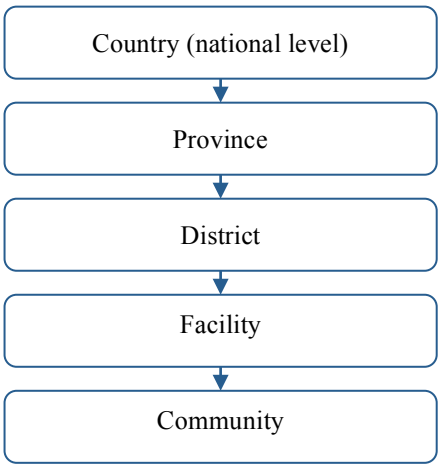

Figure 5.3 Hierarchy levels for data use and decision-making

There have been a lot of delays in taking the data upwards and furthermore there's a delay in analysing data and using it for decision-making. The focus of the HMIS project under UNICEF is that people at the health facility have to be able to look at their data in the shortest possible time and make decisions, the other focus is that district health management team have to able to receive the data earlier and not go through the papers of aggregating it again. When the health facility will enter the data into the system, the district will be able to see it and with the creation of dashboards be able to make more effective decisions. The facilities will not have to prepare graphs by hand anymore, they will see it on the dashboards, and therefore this process will be automated.

"We are hoping to have standardized dashboards. Of course, you allow for people to make dashboards for what they need, but they need to learn…" – one of the DHIOs

There is a necessity to reduce the burden on the healthcare workers because there is always a shortage of staff. With the new public health care system there is a goal to reduce the disease burden as it has been increasing. The aim is to use the same amount of staff that already exist now but to use them more efficiently and HMIS system is one way to accomplish that. DHIS2 is very helpful for public services, so there is hope that it will impact decision-making and in the end health outcome through more efficient data use.

Currently, facility staff enters all the information on paper, at the end of a quarter or in the middle of the year. When they are doing performance assessments, they sit down together and adapt numbers by hand. Implementation of the system will help them summarize their data and give them a better access to this data. The only person who at the moment has admission to the information in the whole district is the DHIO and all the program officers and facility staff has to come back to this one person if they need access the data as well. It is obviously exciting from district level point of view that data will be available to all the stakeholders in the near future, just like it was meant to be in the first place.

5.4.2 Interviews with the facility staff

After conversations with many different facility employees, I got an image of how their days at work look like, their responsibilities, positive and negative aspects. Most of the people start work approximately 7.30-8 am and continue until 4-5 pm. The variety of roles is wide, at the trainings there were present mostly nurses (according to the online questionnaires), also EHTs, data clerks, clinical officers, dental therapists, nutrition technologists etc.

Everyday responsibilities of different staff vary to some extent; here are several examples:

- *"Everyday I check around all the departments to see if all workers are there and greet them, asking how they are"* – a nurse.
- Screening and treating patients, antenatal care, delivering babies.
- Helping pharmacist, giving medicine to the patients, instructed by the pharmacist; sometimes helping another department – checking blood pressure, temperature etc. and writing it down in registers.
- Supervising dental department, ensuring that the department runs smoothly, all the instruments are properly cleaned, all the equipment works well. When the dental department is not overly busy, they would do the screening at the OPD (outpatient department), as general practitioners.

- At the facility where there are only 3 members of staff (2 nurses and environmental health technician), they start their day organizing the place and then they divide responsibilities among each other: one does the screening, another dispensing the drugs. The facility is very remote and people have to come from far distances. Thus they give days for certain procedures, for example, once a month there is a booking day, every second week patients can revisit, and there is time for an outreach. They have a bike to go to outreach and they get fuel from the district.
- At another facility that is located in very rural area staff attends the outpatient department, also maternal/child health department. First, they register patients, and then they receive people in the treatment room to cure them.
- From an environmental health technician perspective – every day at the workplace they have to check if all the bins are in place. Mainly they work with sanitation, when they work at the health center, they check if all the rooms are clean. Some days they do administration at the health center, other days they travel to the community as the facility has a sanitation project under community; the project aims to encourage people to use latrines. Therefore they go to the community and check if people have soap, if some places cannot afford soap, they advise to use ash for hand washing; they check if latrines are appropriate, then they do water quality monitoring, use rapid water test to see if water is safe for drinking and when the results come back, if water is not good, they chlorinate it and educate the community on how to boil water or use chlorine. They also do inspections in the markets and check if there are any expired goods and if there are, then they throw it out and talk to the owner in order to encourage him/her to sell only food that is acceptable.
- From data clerk perspective – mostly just enters data into smart care. If there's a new client, they find this client's file for a clinician, clinician updates information in this file and then the clerk updates data on the computer.

Some interviewees mentioned that it is not enough staff and that they have a lot of work to do, leading to lack of time for proper data recording.

5.5 Data collection, reporting and analysis at the facility level

From one of the interviews with facility staff, I learned that tally sheet was *"the best thing"* and that everyone should make sure that tally sheets are filled every day before they go home. At this facility some time ago there were fewer staff and tally sheets were not filled very often,

therefore afterward it took too much time to fill them out; however, now more staff were hired and they can do it every day. Registers are completed regularly, for example, one interviewee treats children under 5 years old, and each time when meeting a child, they have to write down some information in the register: child's name, age, weight etc. Some other interviewees mentioned similar procedures regarding data recording. However in one of the facilities, there are only 3 workers alltogether, and they analyze their data in the end of the month, therefore this process is too tedious and there is no time for proper analysis.

Another interviewee mentioned that they use both tally sheets and registers for data analysis. They sum up their tally sheets and registers and when there's a malaria peak, for example, they identify which area is affected the most, and they make this area their first priority.

Regarding mother and child health data is compared from delivery reports for instance (comparison between home deliveries and facility deliveries for example) and if the coverage on facility deliveries goes low then stakeholders meet and discuss what the problem is, then some actions take place to encourage women to come to the facilities. Facilities also check antenatal bookings to see how much work was done during last month; they compare data and consider if they performed well or not. When they have a nutrition check-up, they check if a child is gaining enough weigh, if he/she is malnourished or not. Nurses also check registers to ensure that the child got all the vaccines.

5.6 Current and future decision-making at the facility level from district staff perspective

From an interview with one of the DHIOs, I gained another perspective on current decision-making at the facilities. Facilities have middle-term expenditure plan. Decision-making starts with the community meeting up together and analysing the information given to them by the health facility, for example, the top five diseases and which issues they have in child health, nutrition sector or disease unit, etc. The community decides on what activities they think should be taken up by them and by the health facility. The environmental health technician is the one who coordinates the facility. The community uses paper graphs, registers and action plan from the facility to make decisions.

"Our health care system is so, that the community is always involved in the decision-making"
– district health information officer

Health facility management team discusses the situation with the community and then staff gatherers together to plan activities; neighbourhood health committees, community health assistants (CHAs) and secretary are commonly taking part in such meetings as well. They use different data (for example again top ten diseases, HIV statistics etc.) to plan for the following year; they also use population statistics, projected by the central statistic office (CSO). When it is possible they use head counts, meaning the neighbourhood health committees would have counted a number of people they have, how many babies were born and how many people died. Generally, they have this data, especially in rural areas with chiefdoms. They estimate how many under 1/under 5 children to be immunized, how many women of childbearing age they expect to be pregnant and how many would deliver, they also estimate how many people they anticipate to be sick, using the outpatient department data (the trends).

5.7 Attitude towards DHIS2 and new work routine

In general, all the people I interviewed appeared to be excited with coming changes and new data reporting routines. Most of the people confirmed that the DHIS2 will ease the work and will give an opportunity for data to be updated on a daily basis. To challenge them, I argued that they would have to do some more work as they would have to type data into the system, the answer on this was that they already do it in a way, but just on paper, thus people did not perceive using the system as more work, but rather a better way to do the work. There are existing computers at some facilities already (often used for smart care, or donated by charity organizations), however, not all of them are properly utilized. One of the interviewees stated that their facility has a computer, but nobody would use it, as access is very limited and people are very skeptical about the technology and try to not interact with it.

Nurses mentioned that data entering at the facility level will help significantly as there will be *"fewer worries"*; health staff used to *"run against time"* to take the reports to the districts, so those information officers there could also report to the province. Reporting data from the facility means that data will be sent on time; medical staff will not have to travel far to deliver a report (many interviewees complained that it was very time-consuming). One of the facilities couldn't even travel to the district office, so they would pass reports only if someone from the district was visiting, therefore many reports would never reach the district.

Some of the interviewees mentioned that the DHIS2 would improve decision-making at the facility level, as everyone would assume that data is accurate – *"it won't have to go through*

many hands". Otherwise, data gets lost, collectors get to fabricate some figures, and with the DHIS2 such things can be avoided. The DHIS2 did not appear to be too difficult to learn for most of the facility staff (figure 5.4) and confidence level of using the DHIS2 after the trainings was high (figure 5.5). Evaluated DHIS2 knowledge of the facility staff is presented in the subchapter below.

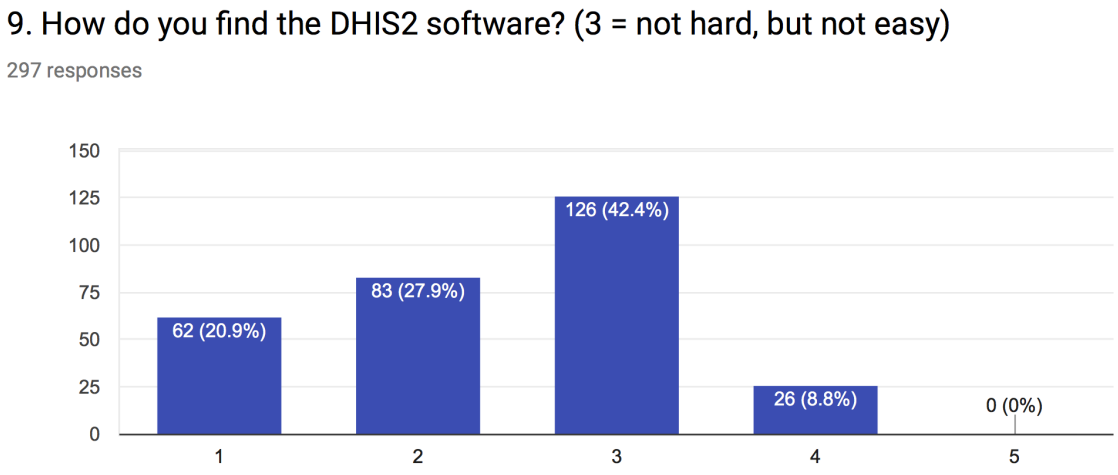

Figure 5.4 Perception of difficulty of the DHIS2 (1 – easy to learn; 5 – hard to learn)

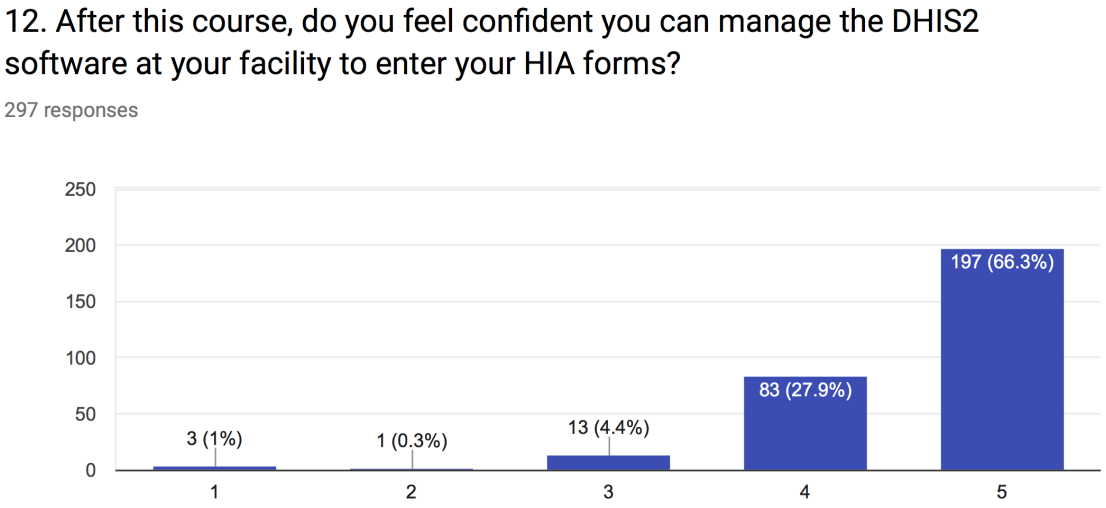

Figure 5.5 Confidence level of using the DHIS2 (1 – very uncertain; 5 – very confident)

5.7.1 DHIS2 knowledge test

Data is accumulated from 10 different training sessions. The number of participants' varied from 25 to 56 (36 average). The average grade which people received from all 10 trainings is 78%, the lowest average per training is 67% and the highest is 84%. There is a tendency of the average grade being increased towards present time, assumingly in connection with improving

facilitators' teaching skills. Performance of the facilitators was also assessed and 72% of the participants answered 5 out of 5, that is – best possible performance.

Most frequently missed question was *"How do you correct wrong data that was previously entered in DHIS2?"* This was relevant to almost all the training sessions (paper version of the test is presented in Appendix B).

5.8 Relevant details from district level perspective

The success of facility trainings strategy depends on the performance of coaching on information use. There were no trainings for facilities since 2012 and the Minister of Health has just finished revising the HMIS, therefore DHIS2 trainings were coming at the right time. In the recent past, the vaccination and HIV eradication guidelines were changed, several data elements were removed and some were added, thus people need to learn guidelines now, new data elements and also how to use new systems. The trainings will assistance facilities and communities to plan better and to work more efficiently. Paper-based documents and reports can be lost, but data in electronic systems will remain to be reviewed for many years.

Very few facility health workers know how to use computers, however, data entry clerks and environmental health technicians possess this knowledge. Generally, people who are able to aggregate monthly reports are also able to use a computer. Some facilities have smart care (patient record system) program, and during this program, a lot of workers were trained how to use a computer.

Districts have to be very careful with choosing right people to train; these people have to be the ones who will use the system after the training. Also, have to be careful and not only train people who are supervisors, but people who are in fact responsible for the work.

5.9 Supervision visits

By the end of October only 1st supervision visits to the facilities were conducted (figure 5.9). The 1st round aimed to provide technical support in community data aggregation and data use. During the 2nd round, the technical support team intends to emphasize facility-level data use. According to the report, provided by the colleagues from Akros, the DHIO and the Akros Technical Support Officers facilitated a one-day workshop to start the technical support visits.

All 99 facilities that were trained in Lusaka province were represented at the one-day workshops. The objective of this workshop was to identify challenges with data use, develop problem-solving skills and strengthen data use in facilities and districts using DHIS2 dashboards and the self-assessment (Akros, 2017).

Before the workshop, most facilities needed a data analysis refresher and lacked direction on how to use data. Only a few facilities were using data from their dashboards for planning and decision-making. The workshop provided much-needed analysis support plus direction to facility In-Charges and Environmental Health Technicians (EHTs) on data use, especially related to action planning and goal setting using their own dashboard data (ibid).

According to the Akros' report, completeness and timeliness of reporting at the facilities varied, some facilities show improvement, some – inconsistent results and some – decreasing rates. Inconsistent and decreasing results are due to technical problems, such as trained staff not received their DHIS2 user account details or poor network, lack of user accounts in the system; some facilities in one district entered data on behalf of facilities that were not trained in DHIS2 (these facilities were not listed as MDGI (The Millennium Development Goal Initiative) facilities since they are not managed under MoH). These and other challenges are being addressed (ibid).

Figure 5.6 Supervision visit at the facility (Akros, 2017)

6 Analysis: decision-making and planning activities at the facility and community level

After interviewing facility staff, I was impressed with how many different decisions they are already making every day. It was not difficult to get them to share their experiences either. I was not entirely sure that people would understand what decision-making actually is, so I was trying to give some examples and lead them in the right direction. Arkos team also facilitated this process as they gave lectures on decision-making and planning at an early stage of the training. The decisions were different – from smaller everyday decisions to patient's life depending on decisions. Theoretical framework from the literature suggests that decisions can be divided into three types: *managerial* (performance data, service planning data, demographic information, epidemiological statistics), *administrative* (procurement, contracting data, resource utilization, education and training) and *clinical* (test data, diagnostic information, evidence-based medicine, care pathways and procedures) (Norris, 2002). However, in many cases, it is challenging to divide decisions as they can relate to both managerial and administrative types; clinical and administrative or managerial and clinical.

6.1 Managerial and administrative decisions

From one of the interviews, I discovered that a dental clinic has heads of department and management meetings every Monday, where they discuss different matters, such as what has to be improved etc. They use a number of patients that were treated as the most important indicator and it is a major burdening point because they can see a number of clients and how wide the catchment area is as there are very few dental clinics around. They count the patients and products that were utilized (for example medical gloves) in order to anticipate next month they use statistics from the registers. They also consider such factors as environment and weather; for instance, during the cold season a situation with dental care gets worse, therefore clinic must prepare. They strengthen outreach programs, and decide which places have to be prioritized, depending on different factors:

"We get to intensify outreach programs depending on the number of clients coming from a particular area, then we would say, we need to concentrate on this side, they are having so many issues" – a doctor

In some areas the poverty level is so intense that people cannot afford to buy a toothbrush that cost only 5 kwacha, thereby the facility intensifies the outreach program in order to distribute toothpaste and toothbrushes (they also advice to use small branches from the trees as toothbrushes) as well as give people oral health education and treatments. In rural areas, people use a lot of tobacco, so the outreach program educates them about the harm of it. Some other interviewees mentioned that they invite everyone from the staff to discuss issues and make decisions, thus many facilities have similar procedures for decision-making.

Example of an administrative but also a managerial decision – strengthening of health education: during first pregnancy women are not always aware that they should come to the facility, consequently, health staff tries to educate them and encourage to share the knowledge with their friends. When proper education is given the outcome is visible. Facility staff distributes education through presentations and demonstrations. Examples of reasons why women deliver at home: a husband would tell his wife to deliver at home nevertheless her desire to come to the facility because she always delivered at home before; staff's attitude or long distance.

An example of an administrative decision is how to use the imprest (also discussed earlier in table 5.3). Different facilities use imprest for different purposes. For example one of the interviewees shared that they buy drugs with this money, however it is normally not enough for the demand (they receive the same amount of money every month), so they have to use their own money and later provide receipts to the district to get this money reimbursed, or they take the money back from the next month's imprest. They try to reduce the budget and buy exactly what they need, using reports to get a better image of what it is. If they need new equipment, they order it from the district. Many other interviewees discussed drug ordering as their routine procedures, they use registers to calculate how many drugs they need.

Some decisions are made based on data analysis or simply when the facility gets an indicator that something is going wrong. For example, if there is a big number of children underweight, the facility makes cooking demonstrations in that area, so that mothers understand how to feed their children and give them proper nutrition (it is a decision based on data). Several facilities shared similar experiences with nutrition programs; especially it is common in urban areas. Sometimes facility also asks parents to come, in order to teach them how to cook nutritious food for the children; facility staff, in fact, cooks in front of the parents to show them how it is

done and prepared food is given away afterward. Sometimes the mother has to feed her child in front of the nurse to prove that she can give her child proper nutrition.

Another example of both managerial and administrative decision is when it becomes visible that there are a lot of home deliveries, facilities make outreach activities; if patients come from remote areas, facility staff tries to meet them halfway and educate people to come to the facility to give birth there, if they live near. At one of the facilities there is a mother shelter, thus pregnant women could come two weeks before they delivered to stay there (initiated by UNICEF). One of the interviewees shared:

"Recently we are low on institutional delivery rates, so we've decided we are meeting now the stockholders, and the community leaders to see what is happening, because some male staff was recently posted, so the women are shunning away..." – a nurse

To solve this problem, they gathered the community leaders and some community members to inform them about the benefits of delivering at the clinic; explain to them that all doctors are well trained and that women should not feel shy to come to the facility.

6.2 Clinical decisions

There are some situations that require immediate attention and rapid decisions. For example deciding whether a woman is going to deliver at the facility or she should go to the hospital (in that case facility staff has to call an ambulance). When women are in labor, all the data from antenatal care record is used: name, age, etc. With the other patients medical staff decides what type of treatment/care they should receive, if they are not confident, they consult their colleagues. If a patient is very ill, the facility also has to make a decision whether to call an ambulance from the district or not.

6.3 Clinical-administrative decisions

An acute problem that was mentioned by most of the interviewees is malaria. When facilities see that there are many cases of malaria, they try to tell patients who come in with precautionary measures such as digging waste holes further away from their house as these holes attract the mosquitos, to use mosquito nets, to clean surroundings, to cut the grass, to get rid of the ponds and to wear clothes with long sleeves at nights. From the registers, they can

see in which areas there are more malaria cases and they try to distribute more mosquito nets to these areas. Health workers who travel to more rural places (outreach) educate people, which they interact with. The district supplies the facility with malaria tests, but with limited quantity. Some patients who come in, present symptoms of malaria but nurses do not test everyone, they have to be selective, otherwise, they will run out of tests. The facility orders tests every week and they check the registers on daily consumption (as well as population data) to decide how many they need to order. The district pharmacy has to supply all the facilities and if one facility orders too many, others might not receive enough, thus facilities must give tests accordingly. One interviewee stated that they usually do not run out of tests, as they order slightly more in case of people outside of their catchment area come to the facility.

One of the facilities uses OPD (outpatient department) register for decision-making. For example, if they can see that in a certain village there are a lot of diarrhea cases, they will not go to all the villages, but only to this certain one. They would have a meeting with these village inhabitants to educate them about health and distribute chlorine (if they have some available). They can see which villages have problems from the data and they take actions accordingly.

6.4 Unmet information needs in decision-making at the facility level

On-line questionnaires revealed information on data elements that facility staff didn't use before the trainings but perceive as useful for evidence-based decision-making. In table 6.1 I present filtered answers – only relevant compiled under the same topic answers without duplications, I chose more detailed responds for this table if there were many similar answers. The question is *"Did you identify any piece of data you hadn't previously used to make decisions in your facility that you will start using now that we have discussed data use? If so, what data did you identify?"*

Diseases
Confirmed cases of severe malaria will lead to weekly clinical meetings to review malaria treatment policy of Zambia
Data on Sexually Transmitted Infections in relation to drug usage. Number of clients managed with various STI's per age group
Community data you get a lot of diarrheal diseases from areas with very few toilets so when it comes to distribution of chorines we will consider them first
The data from the Initiation of Antiretroviral Therapy department
Salt testing in the community, it will help know the levels of iodine in salt hence help prevent common diseases affecting people
Top Ten diseases, as this will help us to plan what to do in the community and how which disease will need to be given more money

Mother and child health
1st antenatal visit before 14 weeks as compared to 1st antenatal visit after 20 weeks, so in this regard, I will use this data to generate activities like sensitization to the community on the importance of early 1st ANC visit and scale up outreach services in order to reach out to all pregnant mothers before 14 weeks of their pregnancies
Number of children weighed in the community; number of underweight children; child growth monitoring
Data on defaulter on exposed babies especially after six months
Deliveries in the community; the number of home deliveries in the various zones
Family Planning Methods
The relationship between the measles and the fully immunized that fully immunized is dependent on measles; number of immunizations
Community suspected maternal deaths
Medical abortions; how the abortions can be linked to causing low first antenatal booking.
The data on nutrition activities, because the activities are done but measuring what the community-based volunteers (CBVs) are doing has been a challenge
Patients/Medical supplies
The use of statistical data in terms of patient flow to decide which medical supplies should be of higher priority as we make our orders; drug usage and commodities such as family planning methods on HIA2 this will help us to avoid stock-outs at the facility
Total number of patients enrolled into care every month; patient register
Sanitation
The Environmental data; targets on the environmental data were not consistent and as a result, my facility was failing to come up with adequate activities to curb some of the health issues in the community
Data on premise inspections e.g. schools, bars, butcheries
The number of households accessing quality water
The number of households without hand washing points
Water samples
Unspecified
Community data/registers/HIA forms
Tally sheets

Table 6.1 Data that was identified as useful for the decision-making (facility staff' questionnaire)

Table 6.2 presents most useful data elements recognized by the facility staff (with the highest number of repetitions, see chapter 4.4).

Confirmed cases of malaria
Data on STD/ Initiation of Antiretroviral Therapy
Antenatal and post antenatal booking
Child growth
Immunization
Medical supply consumption
Environmental data (access to quality water, sanitations etc.)

Table 6.2 Data elements that should be used (facility staff' questionnaire)

7 Discussion

Throughout this chapter, I suggest improvements for better evidence-based decision-making at the facility level. I begin by evaluating conducted facility trainings and level of preparedness of the facility staff to enter and analyze data. Next, I discuss how the facility and district staff perceive benefits of implementation of the DHIS2 at the facility level and related to it political challenges. Further, I discuss all the other challenges in regard of decision-making at the facility level and compare HMIS assessment made in 2016 with the current situation. Finally, I look at facility staff work routine, different types of decisions that are being made and which data elements and DHIS2 related tools could best support decision-making at the facility level in Zambia.

7.1 The facility training session

Facility training program carried out by Akros starting May 8th 2017 and still continuing during present time aims to transfer data use all the way down to the facility level. Data should inform actions of the facility staff and with help of the DHIS2, analysis and reporting procedures would become easier and more efficient. The outcome of the trainings will also allow all the higher levels to receive better quality data within a shorter timeframe. It was broadly discussed in the literature that data should be used at all levels and especially at the level where it is collected (Sandiford et al, 1992; Stansfield et al, 2006; Weeks et al, 2000; Wickremasinghe et at, 2016), however there is a little evidence that managers are using the information for facility level decision-making in many countries with low-recourse settings (Garrib et al, 2008). Therefore there is a lack of experience of proper data use and evidence-based decision-making at the lowest level.

What did health workers learn from the trainings that I witnessed? They learned basic computer and Internet use; concepts of health information and health information systems; operational use of the DHIS2 (data entry, data quality, dashboards, data analysis and decision-making). Training course lasted for 4 days, and in my opinion, it gave enough room to overcome how to manage a computer, give a good enough understanding of DHIS2 software and in addition explain concepts of data analysis and decision-making. People at the training had different computer literacy level, as some facilities already had computers and used them for other programs, such as smart care. Nevertheless, everyone appeared to be able to operate a computer well by the end of the training.

Average grade from the test showing how well people understood the training material is 78%, which is a good grade, considering that some questions were fairly tricky. 42% of participants assumed that the software is *"not hard, but not easy"* to learn, for 20% it appeared easy; 66% felt very confident about using the DHIS2 after the trainings at their facility for entering their HIA forms, and only 1% answered that they are *"very uncertain"*. Thus I can argue that the facility staff is well prepared to use the software and hopefully apply their knowledge to practice for better analysis and decision-making. However supervision visits showed that most facilities still lacked direction on how to use data and only a few facilities were using data from their dashboards for planning and decision-making; hopefully, one-day workshop and supervision visits reinforced their knowledge. The literature review revealed that intense training in data analysis and interpretation is one of the key factors in improving evidence-based decision-making (Sandiford et al, 1992).

7.2 Perceived benefits from the DHIS2

My findings revealed only positive attitude towards the implementation of the DHIS2 from the facility staff and some conflicting opinions from the DHIOs. Some of the DHIOs mentioned that the facility staff is extremely overworked and after the trainings they will have even more duties. I said exactly the same sentence to the facility staff to challenge them and to see what they really think and from their body language and from what they said, they appeared not to be worried about it as they did not think of using the system as having more work but rather doing their existing work more efficiently. I believe that the positive attitude was also due to well-structured trainings, which stressed benefits of the system for the facilities.

Attitude from the DHIOs is understandable as transferring data reporting down to the facility level could mean losing familiar work tasks and legitimacy associated with their roles as information gatekeepers. Before the trainings only the DHIO could have access to the information in the whole district and anyone who needed data would have to approach this one person. As described in chapter 3 hierarchical power relationships are pronounced in Zambia and one could often prioritize personal benefits over everyone's prosperity. However giving up data entering responsibilities, DHIOs would have more time for data analysis and data quality improvements, thus they will not lose their importance; they have to be reassured about it to guarantee positive attitude from the district level. According to Saaty (1990), needs and personal motives are the driving forces in human behavior, and therefore to achieve successful

decision-making it is important to prove to decision makers (or to make sure) that what is good for common welfare also correlates with their personal motives and desires.

In my findings there are also obvious benefits of the DHIS2 from both facility and district staff as program officers and health care workers will have access to this information system. The district will also receive data earlier, avoid going through the papers of aggregating it and with the creation of dashboards will be able to make decisions on where they have to be made. There will be fewer worries for health staff to *"run against time"* to take reports to the district and it will save a lot of time for them as well, as they won't have to regularly travel far to deliver reports. Traveling in rural areas is challenging, the condition of rural roads is extremely poor and only 17% of the population lives within 2 km of an all-season road. Use of the DHIS2 will also improve decision-making at the facility level because everyone would assume that data is accurate, as it won't have to go through many hands; paper-based reports can get lost, but data in the system will be stored there and could be reviewed for many years.

7.3 Challenges with evidence-based decision-making

According to the literature review, there are many challenges that can be faced during decision-making (Bhattacharyya et al, 2016; Mutemwa, 2006; Shaw, 2005; Weeks et al, 2000; Wickremasinghe et al, 2016). Many aspects have to be considered for good evidence-based decision-making. Core components are data quality and staff competence to use and analyze data. Good data quality depends also on data use as these two elements are interrelated as mentioned above (Sandiford et al, 1992; Stansfield et al, 2006). My empirical findings disclosed that some facilities are lacking staff and are overworked and it affects data quality, as there is no time for proper data reporting and aggregation. Some other facilities mentioned that they had new staff hired and that they can work on improving data quality now. However, the situation really varies in different facilities.

The assessment made in 2016 states that most of 200 aspects of facility performance are outside of the control of the managers at facility level in Zambia. The performance assessment (PA) had minimal reference to the HMIS and no reference to DHIS2. PA did not follow up on past assessment, what gave little incentive to make improvements before next PA. There was an uncontrolled increase in the number of data elements and quality was not well controlled (Heywood et al., unpublished assessment). My findings revealed that the ministry of health has just finished revising the HMIS and adjusted sets of data elements. This might make a

difference along with ongoing facility trainings. 2016 assessment also showed that there were no guidelines to lead health workers to the idea of which decisions can be made, or how to use data, what can also be overcome with ongoing facility training as topics such as data use and decision-making are covered well according to my analysis – people gave adequate answers on questions about data use, analysis and decision-making in the test.

Literature also suggests that to improve decision-making at the facility level culture of evidence-based decision-making should be built. Decisions are often driven as much as by politics as by evidence and therefore it is important for the information system to meet the needs of decision-makers and to implement incentives and accountability for evidence-based decision-making (Stansfield et al, 2006). However, according to Mutemwa (2006) in Zambia, different forms of information from a variety of sources are indeed used in district decision-making despite these challenges. I assume that described above suggestions will be possible to implement now, when people will enter data at the facility level – they can be responsible for performance too and should be rewarded for good results or for an effort to make actions in order to improve health situation in their catchment area.

From district staff point of view, the government and ministry of health aims to use the same amount of staff but more efficiently. As mentioned before, from the data I can see that this situation varies in different facilities, some facilities have very limited human resources and do not have enough time to properly aggregate and analyze data. Human recourses could be distributed more equally among different facilities.

7.3.1 Financial constrains

The assessment made in 2016 states that facilities received insufficient funds from the government to make improvements and upgrade their facility. My findings also revealed similar situation, thus there was no change in that area. Some facilities argued that they didn't receive enough money and had to use their own money for facility needs and they would take their money back from next month's imprest, it sounded like a never-ending circle. However, some facilities mentioned that they received enough drugs from district pharmacy and could even order a little extra for people coming from outside of their catchment area. I argue that now with using the DHIS2 at the facility level financial funds should be better distributed among different facilities as financials needs can be better calculated and analyzed using the system. My findings proved that some facilities are busier than the others, funds should be distributed accordingly. The facilities will also be able to view each other's information

(depending on how much access they will get) and compare each other's performance, they can share messages through the system and communicate with each other, therefore they can analyze the situation, perhaps share experiences as if some facilities managed to spend their financial funds more frugally and implement improvements.

Literature also confirms that in low-recourse settings decisions are often compromised by financial constraints. Local decisions have to be made correspondingly to available funding (Wickremasinghe et al, 2016). However there is evidence, that significant financial resources are being directed towards the generation of health information in developing countries, but money has to be spent in a more coordinated manner, without being fragmented or duplicated (AbouZahr and Boerma, 2005).

7.3.2 Data use and quality

Using data at the level where it is collected contributes to improved data quality, as according to the literature poor data quality is not a cause of its underutilization, but is a consequence. Once data is being used, errors and anomalies are quickly discovered and corrected (Sandiford et al, 1992). From my findings, I can present data elements and data collection techniques that facility staff uses consciously (table 7.1).

Data element	Purpose
Antenatal care records	Used when women are in labor
Registers and tally sheets	Unspecified or to order drugs; mentioned by many facilities; tally sheet is mentioned as the best tool for all kind of purposes
Number of patients that were treated (statistics from the registers)	Most important indicator for one of the facilities, used to anticipate how many drugs (and medical material) to order and to see how wide catchment area is
OPD (outpatient department) register	Used to identify problematic areas (disease outbreaks)
Population data	Used to order malaria tests

Table 7.1 Data elements and how they are used

From looking at the table above it becomes obvious that the facility staff indeed use certain data for actions. Concerning data analysis, my findings also revealed that people already analyze data to some extent, such as comparing data from delivery reports and analyzing why the institutional delivery rate is becoming low. Empirical data disclosed that facility staff usually find a reason for such decreases or increases of rates and further carry out some

activities to improve the situation. Good example of this was from one of the nurses – at her facility institutional delivery rate started to become low, thus the facility staff gathered together and after a discussion they realized that this is due to new male staff and women were just shy to come to the facility, to rectify this they decided to gather the community leaders and community members and inform them about the benefits of delivering at the clinic. Some facilities mentioned that they analyze data systematically, but only approximately once a month and this activity becomes tedious, as by the end of the month it's too much data to work with. Therefore it is important to implement more frequent systematic data analysis activities.

Literature suggests designing expectations of data use into routine job requirements, including the use of evidence for planning, information requirements for periodic reporting to supervisors, and use of information during a performance review. The informational system should be designed to ensure that clients, providers, and managers seek and use data to inform decisions; standard procedures should be implemented for data usage (Stansfield et al, 2006).

7.4 Facility staff' work routine and decisions

My empirical data gave a good insight of facility health workers daily work routine and it showed indeed that there is not much free time for many extra activities, especially at some facilities. From a district representative, I learned that people at facilities draw graphs by hand to analyze data, however from the interviews that I conducted I didn't get many similar examples. There is a great amount of different facilities; therefore a reason for this is probably that it is common in some areas more than in the others. The DHIS2 would automate the process of drawing graphs and save time this way, leaving more time for actual analysis.

Based on the collected data and literature review I can suggest preparing manuals and DHIS2-based tools for better support of different types of decisions. As it was discussed in the literature review there are three types of decisions: managerial, administrative and clinical (Norris, 2002). Empirical findings disclosed that it is hard to differentiate some decisions and place them under a certain type. For example, facility staff intensify an outreach program before cold season starts and this could be defined as a managerial decision, however, they also might initiate an outreach program to provide health education to people based on, for instance, increased malaria rates, which could be both managerial and administrative decision. Education and training relate to administrative decisions according to Norris (2002), however, it is not indicated in the article if this education has to be carried out among health staff or

health services receivers. Generalization of all the examples of decisions that I gathered is presented in table 7.2. Different dashboards in the DHIS2 can assist in evidence-based decision-making, with specified time and frequency for reviewing dashboards (described in the manuals) for different kinds of decisions. Systematic performance reviews should be also implemented with the use of dashboards for data analysis. Saaty (1990) states that for a decision to be successful, outcomes have to be predicted correctly. Decisions must be both desirable and survivable, rather than ones that are preferred without the regard of how lasting they can be. There could be a possibility of developing a tool that would allow prediction of the results of different decisions within the DHIS2 and that would contribute to improved evidence-based decision-making as well.

Managerial	Intensify/initiate outreach program
	Strengthen/initiate health education
Administrative	How to use imprest
	Which drugs or other medical material to order
Clinical	Which treatment to give to patients
	Refer patients to the hospital

Table 7.2 Decisions according to decision types

My findings revealed that facility staff that was present at the trainings had very different responsibilities and work routines, therefore it is challenging to achieve standardized plan for decision-making for all the facilities regarding of how much time should be spent on data analysis, when exactly it should be done etc.; the plan should be flexible and facility staff have to decide themselves what works best for them, although the existence of standards is essential. Different types of dashboards in the DHIS2 could support different types of decision-making; there is a need for a flexible tool, which could be effective in different facilities – large with a bigger amount of staff and very small facilities with only a staff of 3, for instance.

7.4.1 Data elements for evidence-based decision making

Questionnaires disclosed which data elements should be used for decision-making, but were not used before. Data elements were divided into 5 groups: diseases; mother and child health; patient register and medical supplies; sanitation and unspecified data elements, which included community data and HIA4 forms. From gathered information, I learned that it is important to involve community-based volunteers (CBVs) for data analysis and decision-making, as these people are responsible for collecting that data. Facility staff believes it will improve service delivery. Literature also suggests involving different stakeholders and initiating debates and discussion of different views for successful decision-making (Saaty, 1990). Empirical data

shows that some facilities try to gather all the workers for decision-making, but these practices do not apply to all the facilities.

Community data appears to be strongly neglected before the trainings, as I counted more than 90 repetitions in answers about community data in general and HIA forms. According to the questionnaires, Antiretroviral Therapy (ART) and Antenatal Care data is not properly documented nor well reported but could be very useful for decision-making.

After analyzing decisions that are already being made at the facilities, I discovered that most decisions are affecting four domains – disease treatment/prevention, mother and child health, ordering drugs as well as other medical supplies and sanitation. All the domains in which decisions are currently being made are presented in table 7.3. Table 7.4 depicts the correlation between different domains, decision types and data elements that should be used for evidence-based decision-making.

Deceases	Disease prevalence
	Malaria
	Medical treatment
Mother and child health	Antenatal care
	Child growth
	Child malnutrition
	Deliveries/Home deliveries
	Nutrition activities
Sanitation	
Supply consumption, new equipment etc.	

Table 7.3 Domains of decisions

Decision type	Domain of decision	Example of data elements
Managerial	Disease prevalence	Confirmed cases of malaria; data on STD/ Initiation of Antiretroviral Therapy
	Nutrition activities	Child growth – community data
	Sanitation	Environmental data – community data
Managerial/ Clinical	Antenatal care	Antenatal and post antenatal booking
	Child growth	Child growth, immunization – community data
	Child malnutrition	Child growth – community data
	Deliveries/Home deliveries	Registers, community data
	Malaria	Confirmed cases of malaria
Administrative	Supply consumption, new equipment etc.	Medical supply consumption – registers
Clinical	Medical treatment	Own expertise

Table 7.4 Decision type for each domain

To prevent disease dissemination facility staff intensifies outreach programs, they check registers to see which areas are getting worse and try to focus on these certain locations. To order medical supplies they also check registers and count how much was utilized in the previous month, some facilities simply order the same amount every month. The most severe disease-related problems appear to be malaria, HIV, and diarrhea.

To conclude this chapter I would like to notice that successful implementation of the DHIS2 at the facility level depends also on eventual replacement of paper-based tools, as the main purpose of the system is to automate and make data entry and data analysis easier. If workers will have to use both system and paper-based tools, they might perceive the computer-based system as an extra effort, and as it was discussed before, negative attitude from users will hinder benefits of the system. First supervision visits revealed that there are many challenges in the beginning of transitioning to facility-level electronic reporting, the system is not being used at its full capacity just yet and it is understandable, it requires time and good technical support for workers to adjust to a new, more advanced work routine. Acknowledgment of the existing and possible issues and adherence to suggestions for improvements and overcoming different challenges discussed above will certainly help implementation of the DHIS2 at the facility level to bring fruitful results. Besides developing appropriate system-based tools such as dashboards that can support different types and domains of decisions, the benefits of the systems also depend on other circumstances such as level of data access available to the facility staff – what kind of features will they be able to use and what kind of data will they be able to view – this has to be decided with careful consideration and proper weighting of advantages and disadvantages by central authorities of the Ministry of Health.

8 Conclusion

In this chapter, I conclude the conducted research according to the research questions and present thoughts and ides on future research.

8.1 Conclusive remarks

The research in this thesis has aimed at discovering how everyday work routine for facility workers in Zambia looks like; which information they use for planning or other activities; whether they already make some decisions or not, and if yes, what kind of decisions, based on what data and more importantly how can computers and data analysis software at facility level of the health system support different types of decision-making, such as clinical, administrative and managerial. I also aimed to provide rich insights on how facility staff perceive changes to their information-oriented work and the introduction of computers and the DHIS2 software, as personal experiences and motivation of the stakeholders play an important role in the success of promoting decentralized decision-making.

The empirical data disclosed that facility workers have different responsibilities as some facilities are bigger and therefore have more staff and more defined roles, in smaller facilities one person has to complete the same tasks as tasks that are distributed among different people at bigger facilities. Facility workers that will be responsible for entering data into the DHIS2 that is the ones that were present at the trainings have different positions and thus their responsibilities and work routines vary to a great extent.

Facility staff already uses many different data elements for decision-making, but not always very effectively as paper-based reports don't provide good analyzing tools, thus the analysis they already make is rather vague. Paper-based reports also get lost and destroyed leaving lack of accurate data for planning and decision-making. Decisions that were being made before the implementation of the DHIS2 at the facility level affected all the health domains and included all sorts of actions, therefore it is fair to argue that with a proper education in system use and a suitable tool future decisions will become much more successful. The research has shown that facility staff is receiving a decent education, thus there is only a necessity for an effective tool. Dashboards can be created based on different decision types, domains where these decisions are made and data elements that were suggested for evidence-based decision-making.

Facility staff has positive attitude towards the implementation of the DHIS2 and it appears that they understand well the importance of good quality data and evidence-based decision-making and planning and their role in it. The research has also disclosed that it is strongly important to involve community-based volunteers for decision-making. However, attitude from the district level staff is not unambiguous. Any adjustments in systems can lead to political tensions and therefore there is a need to have a strategy how to overcome such challenges and mind the ones who lose their work task or have some dramatic changes in it, these people should not feel like they are going to be dismissed from the loop, but rather that they are being endowed with new and more rewarding work tasks, such as data analysis and planning.

The existing HMIS literature on evidence-based decision-making describes many challenges and the ways of overcoming it for improved decision-making, the study has shown that there are some similar challenged currently faced in Zambia, but there is also a lack of experiences of data entry at the facility level from the literature. There are different types of decisions but literature does not specify how different types should be approached and supported. Decision-making based on the DHIS2 tools is also tied to computer literacy of health workers and the size of the facility – amount of staff in it, it is challenging to develop a single tool that can work effectively for all the facilities; there are also obstacles such as financial constrains that have to be taken into consideration when implementing any kind of changes.

8.2 Future research

Final reflections about future research could be of interest, and I could raise a question: What would I do next time or in a second research to follow up the scaling process? It would certainly be interesting to visit facilities again and observe their work routines, how they interact with the system, how it assists them in decision-making and which experiences they receive. Of course, I obtained some information about it already from Akros, but it would be essential to see how decisions and planning activities are changing over a longer period of time. It would also be significant to develop a more detailed plan for implementation of all the suggested improvements from the framework for decentralized evidence-based decision-making at the facility level (see chapter 2) and follow up with the process of implementation of these changes. Furthermore, it would be possible to evaluate if these measures strengthen health management and increase consciousness about HMIS principles and concepts.

As mentioned before, different decision types and how they should be approached are not discussed widely in the literature and there is a lack of knowledge how decision-making process differentiates depending on different kinds of decision in the context of health management and which tools can support different types of decisions (i.e., clinical, administrative and managerial). Making profound research in this direction could also contribute to improved – more organized and effective evidence-based decision-making. It would be interesting to also evaluate how knowledge of using DHIS2 and making decisions based on dashboards is spread among more facility workers, as people presented at the trainings now have to educate their colleagues and new staff. Will the main idea of the trainings be carried on to new people? As my research has shown, already trained staff understood correctly the main purpose of the DHIS2 and their role in it, will they apply their knowledge in a way that trainings aimed them to and if so, will new DHIS2 users at the facility level follow the same strategy?

References

AbouZahr, C., & Boerma, T. (2005). Health information systems: the foundations of public health. Bulletin of the World Health Organization, 83(8), 578-583.

Access to electricity (% of population) (2017). Retrieved April 13, 2017, from http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?locations=ZM

Akros. (2017). Second Lusaka Technical Support (Supervision) Visits Report

Avan, B. I., Berhanu, D., Umar, N., Wickremasinghe, D., & Schellenberg, J. (2016). District decision-making for health in low-income settings: a feasibility study of a data-informed platform for health in India, Nigeria and Ethiopia. Health policy and planning, 31(suppl_2), ii3-ii11.

Bhattacharyya, S., Berhanu, D., Taddesse, N., Srivastava, A., Wickremasinghe, D., Schellenberg, J., & Iqbal Avan, B. (2016). District decision-making for health in low-income settings: a case study of the potential of public and private sector data in India and Ethiopia. Health policy and planning, 31(suppl_2), ii25-ii34.

Braa, J., & Sahay, S. (2012). Integrated Health Information Architecture: Power to the Users: Design, Development and Use.

Braa, J., Heywood, A., & Sahay, S. (2012). Improving quality and use of data through data-use workshops: Zanzibar, United Republic of Tanzania. Bulletin of the World Health Organization, 90(5), 379-384.

Crang, M., & Cook, I. (2007). Doing ethnographies. Sage.

DHIS2 In Action. (2017). Retrieved October 23, 2017, from https://www.dhis2.org/inaction

Flyvbjerg, B. (2006). Five misunderstandings about case-study research. Qualitative inquiry, 12(2), 219-245.

Foster, V., & Dominguez, C. (2011). Zambia's infrastructure: a continental perspective.

Garrib, A., Herbst, K., Dlamini, L., McKenzie, A., Stoops, N., Govender, T., & Rohde, J. (2008). An evaluation of the district health information system in rural South Africa. SAMJ: South African Medical Journal, 98(7), 549-552.

Heywood et al., unpublished assessment, external consultant assessment report (on behalf of the ministry of health).

Heywood, A., & Rohde, J. (2002). Using information for action: a manual for health workers at facility level. South Africa: EQUITY Project.

Hjortsberg, C. (2003). Why do the sick not utilise health care? The case of Zambia. Health economics, 12(9), 755-770.

House of Chiefs (2016). Retrieved July 20, 2017, from http://www.mocta.gov.zm/index.php/house-of-chiefs

Hurtubise, R. A. (1984). Managing Information Systems: Concept and Tools. Kumarian Press, Incorporated.

Iachello, G., & Hong, J. (2007). End-user privacy in human–computer interaction. Foundations and Trends in Human–Computer Interaction, 1(1), 1-137.

Johnson, B., & Christensen, L. (2008). Educational research: Quantitative, qualitative, and mixed approaches. Sage.

Kvale, S., & Brinkmann, S. (2009). Interviews: Learning the craft of qualitative research interviewing. Sage.

Lippeveld, T. (2001, March). Routine health information systems: the glue of a unified health system. In Keynote address at the Workshop on Issues and Innovation in Routine Health Information in Developing Countries, Potomac, March (pp. 14-16).

Magnussen, H. J. A. (2011). Childhood disability in rural Zambia: a qualitative study on the use of health care services (Master's thesis).

Mavimbe, J. C., Braa, J., & Bjune, G. (2005). Assessing immunization data quality from routine reports in Mozambique. BMC public health, 5(1), 108.

McCarney, R., Warner, J., Iliffe, S., Van Haselen, R., Griffin, M., & Fisher, P. (2007). The Hawthorne Effect: a randomised, controlled trial. BMC medical research methodology, 7(1), 30.

Ministry of Health (2006). National Health Strategic Plan 2006- 2010 "... Towards Attainment of the Millenium Development Goals and National Health Priorities...". Lusaka, Zambia: Government of the Republic of Zambia.

Mutemwa, R. I. (2006). HMIS and decision-making in Zambia: re-thinking information solutions for district health management in decentralized health systems. Health Policy and Planning, 21(1), 40-52.

Muya, M., Kaluba, C., Banda, I. N., Rattray, S., Mubemba, C., & Mukelabai, G. (2017). Infrastructure Watch Culture: Zambia's Infrastructure Report Card.

Myers, M. D. (1997). Qualitative research in information systems. Management Information Systems Quarterly, 21(2), 241-242.

Norris, A. C. (2002). Current trends and challenges in health informatics. Health Informatics Journal, 8(4), 205-213.

Ommundsen S. O. (2017). Designing an Education Management Information System – A case study on the introduction of a digital, mobile-to-web Education Management Information System in Zambia (Master's thesis).

Picazo, O. F., & Zhao, F. (2009). Zambia health sector public expenditure review: accounting for resources to improve effective service coverage. World Bank Publications.

Saaty, T. L. (1990). Decision making for leaders: the analytic hierarchy process for decisions in a complex world. RWS publications.

Saldaña, J. (2015). The coding manual for qualitative researchers. Sage.

Sandiford, P., Annett, H., & Cibulskis, R. (1992). What can information systems do for primary health care? An international perspective. Social science & medicine, 34(10), 1077-1087.

Shaw, I. (Ed.). (1999). Qualitative evaluation (Vol. 137). Sage.

Shaw, V. (2005). Health information system reform in South Africa: developing an essential data set. Bulletin of the World Health Organization, 83(8), 632-636.

Silverman, D. (1998). Qualitative research: meanings or practices? Information systems journal, 8(1), 3-20.

Silverman, D. (2013). Doing qualitative research: A practical handbook. SAGE Publications Limited.

Stansfield, S. K., Walsh, J., Prata, N., & Evans, T. (2006). Information to improve decision making for health. Disease control priorities in developing countries, 2, 1017-1030.

Strauss, A., & Corbin, J. (1998). Basics of qualitative research techniques. Sage publications.

Taylor, S. D. (2006). Culture and customs of Zambia. Greenwood Publishing Group.

Tesch, R. (2013). Qualitative research: Analysis types and software. Routledge.

The Government of Zambia (2011). Sixth National Development Plan 2011- 2015, Sustained Economic Growth and Poverty Reduction. Lusaka, Zambia: The Government of Zambia.

The World Bank. (2011). Zambia's infrastructure: A continental perspective. The World Bank. Retrieved from http://dx.doi.org/10.1596/1813-9450-5599

The world factbook (2017, December 1). Retrieved July 17, 2017, from https://www.cia.gov/library/publications/the-world-factbook/geos/za.html

Velez, O., & Foster, A. A. (2016). ANI Emerging Leader Project: Enhancing the Role of Nurses in Zambia Through mHealth. CIN: Computers, Informatics, Nursing, 34(1), 6-7.

Venkatesh, V., Brown, S. A., & Bala, H. (2013). Bridging the qualitative-quantitative divide: Guidelines for conducting mixed methods research in information systems. MIS quarterly, 37(1).

Vledder, M., & Campbell, K. (2011). The human resources for health crisis in Zambia: an outcome of health worker entry, exit, and performance within the national health labor market (No. 214). World Bank Publications.

Vogt, W. P. (Ed.). (2011). SAGE quantitative research methods. Sage.
Walsham, G. (2002). Interpretive Case Study in IS Research, Sage. Ch 6 in Myers and Avison (eds) "Qualitative Research in Information Systems".
Walsham, G. (2006). Doing interpretive research. European journal of information systems, 15(3), 320-330.
Walshe, K., & Rundall, T. G. (2001). Evidence-based management: from theory to practice in health care. The Milbank Quarterly, 79(3), 429-457.
Weeks, R. M., Svetlana, F., Noorgoul, S., & Valentina, G. (2000). Improving the monitoring of immunization services in Kyrgyzstan. Health Policy and Planning, 15(3), 279-286.
Wickremasinghe, D., Hashmi, I. E., Schellenberg, J., & Avan, B. I. (2016). District decision-making for health in low-income settings: a systematic literature review. Health policy and planning, 31(suppl_2), ii12-ii24.
Yin, R. K. (2013). Case study research: Design and methods. Sage publications.
Zambia (2017). In Encyclopædia Britannica. Retrieved July 18, 2017, from http://academic.eb.com/levels/collegiate/article/Zambia/109719
Zambia Central Statistical Office. Zambia in Figures (2016). Retrieved August 8, 2017, from http://www.zamstats.gov.zm/phocadownload/Dissemination/Zambia%20in%20Figure%202016.pdf
Zambia county profile (2017). Retrieved July 17, 2017, from http://www.bbc.com/news/world-africa-14112449

Appendix

Appendix A – Training Feedback Form

Data Entry Training in _____ (please write your district/province)

Date: _____

Feedback:

Use the list of modules below to remember the topics discussed:

- HMIS Overview and Structure
- Reporting Challenges
- Facility Level Reporting
- Your Data Collection Tool
- Basics of Computer Use
- Into DHIS2
- Data Entry and Quality During Entry
- Data Quality and Running Analyses
- Dashboards
- Dashboard Information Gathering

Rate your facilitator(s):

1. Facilitator name: _____
2. How well did your facilitator implement the DHIS2 data entry training? Rating scale from "very poorly (unprepared, did not answer questions well, etc.)" (1) to "s/he was exceptional (prepared, helpful, etc.)" (5) _____
3. What do you feel is the most important thing you learned during this training?
4. What do you think could be improved about this training?
5. The difficulty level of this training was:

☐ Too easy (I almost didn't learn anything new)

☐ Just about right (I learned new things and refreshed on old things and was able to follow all topics)

☐ Too difficult (I was not able to follow many of the activities/topics)

Please write additional comments about the difficulty level of the training here:

6. How do you find the DHIS2 software? Rating scale from "very difficult to learn" (1) to "very easy to learn" (5) _____
7. What is difficult to learn about the DHIS2?

8. I think the following training activity/topic should be added/removed …because:

9. Do you feel confident about managing a computer after this course? Rating scale from "very uncertain" (1) to "very confident" (5) _____
10. Do you feel confident about managing the DHIS2 software after this course? Rating scale from "very uncertain" (1) to "very confident" (5) _____
11. In what ways do you think DHIS2 may increase or decrease the quality of services at your facility? Please give an example:

12. Please write any other comments or feedback on the training here:

Appendix B – Post Evaluation for Facilities

Post Evaluation for Facilities

You will have 45 minutes to complete all of the questions on this test. If you finish earlier, you can submit your responses to the facilitators. Do not share your answers.

1. What is the DHIS2 used for? (1mark)
   a) Policy making
   b) Decision making
   c) Providing information for health service delivery
   d) All of the above

2. What is your role in facility level reporting (FLR)? (1mark)
   a) You enter data on HIA forms and submit it to the district
   b) You enter data on HIA forms and keep it at the facility
   c) You enter data on HIA forms then into DHIS2
   d) You do not enter any data into DHIS2

3. When should we do data entry? (1mark)
   a) Before 7th of the following month
   b) Every after two months
   c) Every after 6 months
   d) Before new year

4. How do you correct wrong data that was previously entered in DHIS2? (2mark)
   a) Click on month, when, and what form you need to correct. Click incomplete, then edit the form then complete
   b) Click min max analysis, select facility, click analyze, mark the results then finally edit
   c) Click follow up, then unmark the results, then correct the mistake, and then click complete.
   d) Click data entry, select the entry form, select month, and enter correct data

5. What is the min max outlier analysis? (1mark)
   a) It is a method used for logging into DHIS2
   b) It is a method used to spot entries that are not in the usual range
   c) It is a method used to share analyzed graphs
   d) It is a method used for chatting with other users

6. Name the data collection tools used for the following: (3 marks)

   Patient registration: _____

   Data collation (tallying): _____

   Data aggregation (submission): _____

7. What is the importance of data quality? (1mark)
    a) Good data quality helps to make right decisions at all levels
    b) Good data quality improves data use
    c) Good data quality is important for targeted interventions and proper resource allocation
    d) All of the above

8. How can facilities ensure the data submitted is of quality? (3 marks)
    .....
    .....
    .....

9. What will facilities use DHIS2 for? Circle the correct answer(s) (2mark)
    a) Data entry
    b) Data tallying
    c) Data quality
    d) Data design

10. Put the steps below in the correct order from 1 to 8. These are the steps required to access and enter data once you have logged into DHIS2. (4 marks)

    - Click complete
    - Select your facility
    - Click data entry
    - Enter data
    - Go to apps
    - Select the entry form
    - Select the month
    - Run validate

Step	What you do
1	
2	
3	
4	
5	
6	
7	
8	

11. What is a DHIS2 dashboard? (1mark)
    a) It is a tool that allows you to view your performance
    b) It is a tool used for data entry
    c) It is a tool that gives a shortcut to the messaging/feedback options
    d) A and C

12. What is "decision making"? Give an example(s) from your experience (5 marks)

Bonus Question:

13. Provide two tips for improving data collection
    a) Tip one:

    b) Tip two: