

UiO : **Department of Informatics**
University of Oslo

Developing league tables in Malawi

A study of feedback mechanisms to support routine health management

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Master's thesis - May 2015



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Developing league tables in Malawi - A study of feedback mechanisms to support routine health management

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II

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“We should know where we are doing better and where we are lacking behind...”

If we know which are our strength and which are our weakness we know where to start again”

(Facility manager, about league tables)

Marte Hesvik Frøyen

May 2015

Abstract

Malawi has had an ongoing strengthening process of the national Health Management Information System (HMIS) for the past decade. Although the efforts have had good progress, the data within the system still shows poor quality. Because evidence-based decision-making is dependent upon available data of good quality, further strengthening efforts is needed to improve the system.

This thesis examines a development process of league tables as a feedback mechanism to support routine health management in Malawi. Further, the thesis looks to provide enabling and strengthening conditions within such a process. League tables should thus be relevant for users at different levels of the Malawi health system, and promote transparency and accountability between these levels.

The study is based on a bottom-up development process where future users at all levels have taken part in the preliminary research through fifteen interviews and focus groups, and three training workshops. In this study, the core focus has been on providing feedback to users at facility level, such as health workers in clinics. This has been done by involving users from zone and district level in the development process, to ensure that the league tables would be suited for this purpose.

Evidence shows that health workers at all levels would like to receive more feedback, such as comparative analysis, however due to lack in resources this has proved difficult. Lack of training, in order for users utilize the national HMIS-software, as an efficient work tool is further shown as a great issue. Since few users utilize DHIS2 in this manner, they are thus not aware of the data within the system.

As an initiative to strengthen, the HMIS in Malawi this thesis provides league tables as a feedback mechanism to strengthen lower levels, and thus possibly improve data quality.

Acknowledgment

First of all, I would like to thank my supervisor Johan Ivar Sæbø for guidance and encouragement in an intriguing project. In addition to Johan, I also want to thank the rest of the team members I was traveling with in Tanzania and Malawi; Christon Mesheck Moyo and Jens Johan Kaasbøll, for good practical help and for inspiring collaboration. Next, I would like to thank Marlen Stacey Cawani and Tasokwa Nkhonjera for taking good care of me in Malawi, showing me around, and especially for making my birthday fantastic. Additionally, I would like to mention participants that have contributed in my project.

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Marte Hesvik Frøyen

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Abbreviations

ALMA	African Leaders Malaria Alliance
ANC	Antenatal care
AR	Action Research
CMED	Central Monitoring and Evaluation Division
DHO	District Health Office/District Health Officer
DHIS2	District Health Information System 2
DHMT	District Health Management Team
GI	Global Infrastructure
HIS	Health Information System
HISP	Health Information Systems Program
HMIS	Health Management Information System
II	Information Infrastructure
ICT	Information and communications technology
ID	Interaction Design
IS	Information System
MDG	Millennium Development Goal
MoH	Ministry of Health
NHS	National Health System
OPD	Outpatient Department
Orgunit	Organizational unit (e.g. zone, district, facility)
PD	Participatory Design
RMNCH	Reproductive, Maternal, Newborn and Child Health
SWAp	Sector Wide Approach
TBA	Traditional Birth Attendant
UCD	User Centered design

1 Introduction

This thesis studies how league tables can be developed and implemented with the objective of strengthening the Malawi Health Information System (HIS). League tables are feedback mechanisms whereby individuals or groups are ranked based on their performance according to specific indicators. An indicator in this setting is a health-related variable, typically representing the provision of health services to a specific population. The thesis thus examines enabling and strengthening conditions within such a process, as a background for developing league tables that are relevant for users at different levels of the Malawi health system, and that promotes transparency and accountability between these levels.

1.1 Motivation

HIS's should support the decisions and actions of health personnel (Sandiford et al., 1992; AbouZahr & Boerma, 2005). In many cases, interventions through development processes have overlooked this objective, focusing on technical aspects; rather than behavioral and organizational issues (Moyo et al., 2014). As a result, challenges arise, preventing HIS from effectively providing data for decision-making. With less relevance, data quality is given less attention, subjecting the HIS to a vicious cycle. *“Poor data use is both a cause and a result of poor data quality and results in a vicious circle that is hard to break.”* (ibid., p. 107).

From the year 1999 and until today Malawi has gone through major changes in order to strengthen their HIS in general and Health Management Information System (HMIS) in particular (Manda, 2015). These efforts led to the implementation of a national HMIS-software, District Health Information System 2 (DHIS2), and to the health sector having monthly facility-level information, for the first time (Chaulagai et al. in ibid.). However, despite these efforts, poor data quality is still an issue within the Malawi DHIS2.

1.2 Research context

This thesis is a part of an ongoing project of HIS-strengthening in Malawi, supported by the Global Infrastructure (GI)¹ group at the Institute for Informatics, University of Oslo. In addition to me, the research team during the preliminary research consisted of three researchers within this group. The three other members were one PhD candidate, who is also the HMIS manager at

¹ GI is a research group at the University of Oslo. The research group is coordinating the development of the DHIS2.

the Ministry of Health (MoH) in Malawi and took part in the prior implementation of league tables in Malawi, one a professor with good knowledge of HMIS in Malawi, and one postdoctoral fellow who took part in developing league tables in Sierra Leone.

The empirical study was conducted over a one-month period, during September-October 2014, in Malawi. Because the Malawian PhD has been working on similar research questions during his studies at the University of Oslo (UiO), we submitted a collaborative research proposal in Malawi, and therefore worked together during the field studies. The first phase of field studies were conducted by the entire research team, the second by the Malawian PhD candidate and me, and the third by me, this will be described in chapter 3 – Research approach.

1.3 Scope

The theme for this thesis is how to design solutions to strengthen the Malawi HIS, in order to increase evidence-based decision-making and data quality. League tables are chosen as a tool to address these issues based on previous successful implementations. An example of this are the league tables implemented in Sierra Leone, where the process revealed significant improvements of data reporting and data quality (Kossi et al., 2013). The competitiveness of the league tables promoted awareness among the chiefdoms (sub-districts), leading chiefdoms that ranked at the bottom to in the first quarter, to rank at the top the following quarters.

1.4 Research questions and objectives

The purpose of this thesis is to investigate how league tables can be developed and implemented to support routine health management in Malawi. The research questions that will be addressed through this thesis are divided in two, with one overarching question and three secondary questions, presented below.

1. *How can league tables be developed and implemented to support routine health management in Malawi?*
 - a. *What are the enabling and constraining conditions for developing and introducing ranked league tables in the Malawi health sector?*
 - b. *How can league tables be developed to be relevant for different users?*
 - c. *How can transparency and accountability be promoted by league tables?*

The main objectives, and thus the process for answering the research questions, for this thesis is to (1) identify design requirements for the league table, (2) develop and evaluate early implementations for further development, (3) present problem areas and derive design implications for future work.

1.5 Chapter overview

Chapter 2 – Background provides an overview of the status of Malawi's economic conditions, infrastructure and health status. The chapter also describes the structure of the health system, as well as the HIS, HMIS and DHIS2. As earlier league tables implementations in Malawi have been discontinued the reasons for their discontinuance is presented as a background for the work done in this thesis.

Chapter 3 – Research approach introduces the research approach, methodology and methods used for conducting and analyzing the research within this thesis, as well as the philosophical foundation for this thesis.

Chapter 4 – Theoretical background presents the literature used as a theoretical background for this thesis. The section is split in four sections; understanding information systems, involving users in design processes, HIS development and strengthening, and related research on league tables and scorecards.

Chapter 5 - Prototyping provides a background for developing league tables in Malawi, as well as the methodological approach within the development. The chapter also presents prototypes developed during this study.

Chapter 6 – Empirical findings presents the findings from the field studies.

Chapter 7 – Discussion compares the literature presented in chapter 4 and the findings in chapter 6, and discusses the research questions for this thesis. The last section of this chapter provides a reflection upon the research approach and methods used for this study.

Chapter 8 – Conclusion and future work summarizes the discussion of the main research question. The chapter also provides some reflections on future work within this field.

2 Background

Before embarking on the objective and research approach for this thesis a brief overview of the research context will be given. Malawi's economic condition and infrastructure affects the health status and how the Health Information System (HIS) has been implemented and functions today. An overview of these subjects, as well as an introduction of the HIS and Health Management Information System (HMIS) will therefore be given as a basis of understanding the complexity of the Malawi health system. Additionally, a brief description of previous attempts at implementing league tables will be given as a background for the work described within this thesis.

2.1 Overview of Malawi

Malawi is a landlocked country in southeast Africa which borders Tanzania in the north, Mozambique in the east, south and southwest and Zambia in the west (Figure 2.1). It has a total land area of 118,484 km² and an estimated total population of 15.91 million. The country is densely populated with an estimated average of 129 persons' per km² (2013). Malawi's population had a growth rate of 3.2% during the years 2010-2015 and is the fastest growing country in Sub-Saharan Africa. Close to half of Malawi's population is aged 15 years and younger, and the proportion has continued to increase in recent years. In 2009 it was estimated that 39 percent of the Malawian population was living below the poverty line. (Ministry of Health, 2011; UNdata, 2013)

Malawi's socio-economic indicators remain poor compared to its neighbouring countries. Malawi's GDP per capita in 2011 was \$388 (a rise from \$215 in 2005), Tanzania's \$526, Mozambique's \$536, and Zambia's \$1426 (UNdata, 2013). Due to its socio-economic status, the country's operational budget is dependent upon donor support. As a result, 40 percent of the budget for the financial year 2012-2013 was expected to be met by donations (Manda, 2015). Over the past

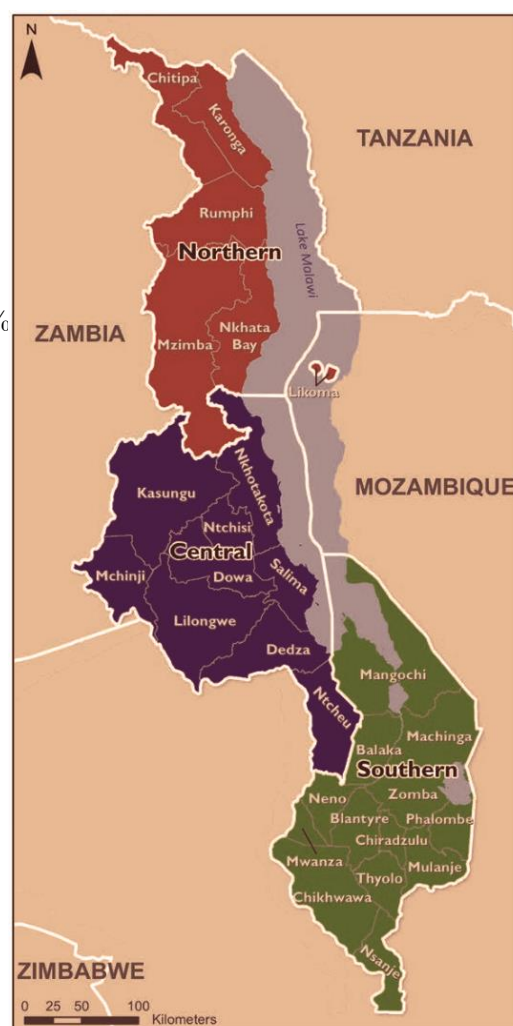


Figure 2.1 - Malawi map (Ministry of Health (MoH) [Malawi] and ICF International, 2014, p. xxvi)

years the country has experienced fallout with donors, leaving the public service delivery negatively affected, and the country in a deep economic crisis (ibid.).

Malawi is divided into three administrative regions; northern, central and southern, and 28 districts countrywide (Ministry of Health, 2011; Galimoto, 2007). The Malawi health system, however, is divided into five zones; north zone, central east zone, central west zone, south east zone and south west zone, and 29 districts country wide, where Mzimba is divided into two districts; Mzimba North and Mzimba South. The data presented in this thesis was collected in the northern and central region, in the districts: Karonga, Rumphi, Mzimba, Kasungu, Mchinji and Lilongwe.

2.2 Infrastructure

Although Malawi had already reached the Millennium Development Goal (MDG) target related to water in 2006, ten years before the deadline, and has made considerable progress towards developing its infrastructure, many challenges remain (Foster & Shkaratan, 2011).

According to a report by the African Development Bank Group (2013, p. 9) the objective for the Malawi Growth and Development Strategy (2011-2016) is *"...to create wealth through sustainable economic growth and infrastructure development as a means of achieving poverty reduction"*. When compared with other African countries Malawi currently ranks as 106 out of 140 because of its infrastructural challenges. Figure 2.2 shows that Malawi ranked between 75 and 105 in the national infrastructure index for 2008.

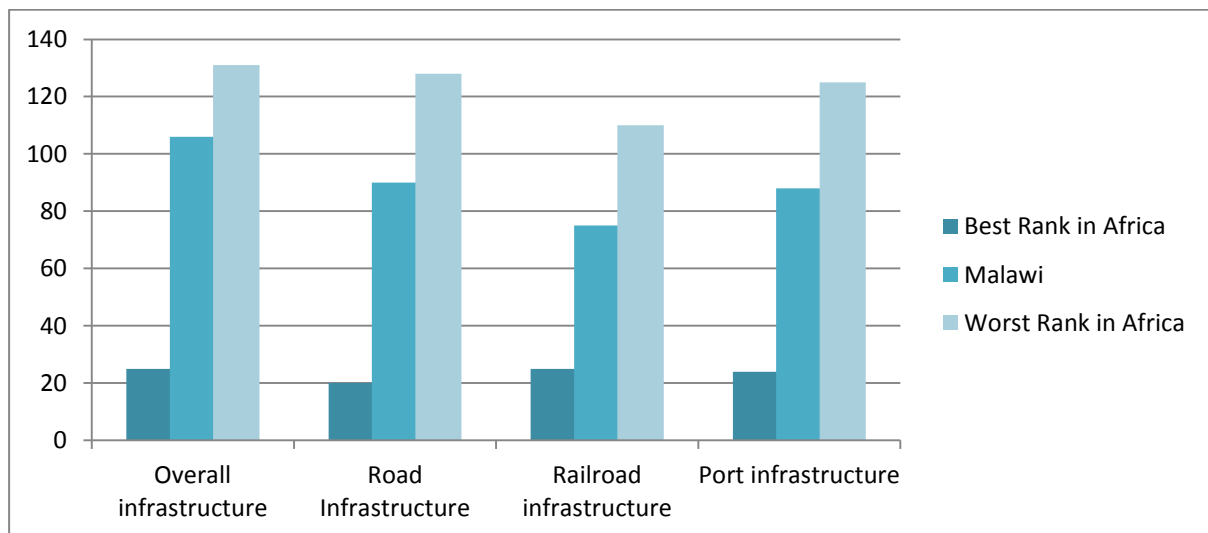


Figure 2.2 - Infrastructure Index, 2008 (African Development Bank Group, 2013, p. 10)

Evidence from enterprise surveys suggests that infrastructure constraints are responsible for about two-thirds of the productivity handicap faced by Malawi's firms (...), with the reminder due to poor governance, bureaucratic red tape, and financing constraints. No single sector bears the entire responsibility for this: power, customs, transport, and water all having a material impact on the productivity deficit (Foster & Shkaratan, 2011, p. 3).

Infrastructural challenges also affect the efficiency of Malawi's HMIS. The HMIS is dependent on having working information and communications technologies (ICT) and power for aggregating and accessing data, providing feedback, and conducting trainings, and roads for transporting data to the district level, since this is done manually.

When looking at the sectors one by one there are several challenges. For ICT the country scored close to 60 percent on an index of institutional best practices, and Malawi's GSM signal coverage reaches 93 percent of the population. However, the prices for ICT services remain relatively high, except from mobile phone (ibid.). With regard to the power sector, the main issue is power outages. *"Although installed generation capacity and power consumption per capita are typical for the region, outages in Malawi have been about three times the average levels observed in the peer group"* (ibid., p. 13).

The electricity suppliers have lost great amounts of their revenue due to outages, and face challenges with regards to collection of bill payments on invoices, of which only 60 percent are being collected (ibid.). This leaves the power sector in a challenging position. The road structure in the country has been developed over the past years, and Malawi has ranked high compared to its peers. However it has been argued that the road network is over-engineered in some places, leaving fewer resources to preserve the remaining, poorly developed, infrastructure (ibid.). The achievements and challenges of these sectors are summarized in Table 2.1.

Table 2.1 – ICT, Power and Roads achievements and challenges (excerpts from ibid., p. 4)

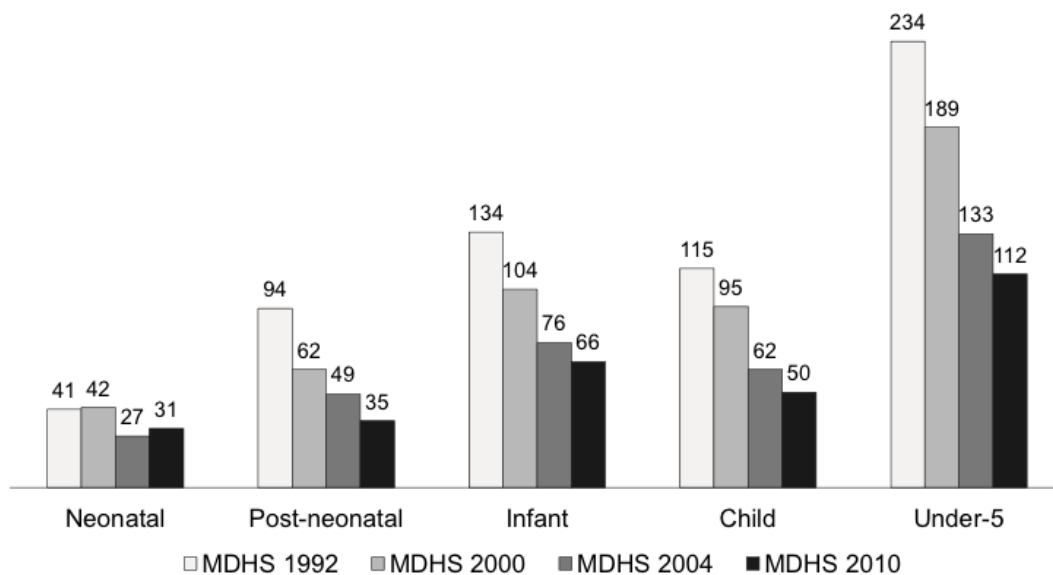
	Achievements	Challenges
ICT	Advanced sector reform GSM signal almost universal	Acquiring competitive access to submarine cable to reduce cost of international connectivity Expanding penetration of GSM services by improving affordability
Power	Adopt of modern legal framework and regulatory agency	Improving reliability of power supply Addressing under-pricing and operational inefficiencies
Roads	Adoption of modern road fund Large investment	Providing adequate funds for road maintenance Safeguarding against over engineering of road network Improving accessibility to high-value agricultural land

2.3 Health status

During the Millennium Summit² in year 2000 eight international development goals, namely the Millennium Development Goals (MDGs), were established with a deadline of 2015. The health related goals include *reducing child mortality*, *improving maternal health* and *combating HIV/AIDS, Malaria and other diseases* (Millennium Project, 2006). When describing the health status in Malawi, the MDGs will be used as a foundation in order to ensure that the overview given is relevant on a national and international basis.

Over the past decade, the average life expectancy at birth in Malawi has risen from 39 years in the 1990s to around 55 years in the 2000s (Ministry of Health (MoH) [Malawi] and ICF International, 2014). One of the main contributing factors has been a decline in childhood mortality, shown in Figure 2.3. Even though there is a long way to go the reduction shows promising results towards reaching the target of a *Neonatal Mortality Rate* at 12 per 1000, an *Infant Mortality Rate* at 45 per 1000 and an *Under five Mortality Rate* at 78 per 1000 by 2015-2016 (Ministry of Health, 2011).

Deaths per 1,000 live births



MSPA 2013-14

Figure 2.3 - Trends in childhood mortality, 1992-2010 (Ministry of Health (MoH) [Malawi] and ICF International, 2014, p. 1)

² The Millennium Summit was a meeting among many world leaders.

In 2010 the Malawi Demographic and Health Survey (MDHS) indicated an estimated maternal mortality ratio (MMR) of 675 maternal deaths per 100,000 live births, which shows a substantial decline from 984 in 2004 (MDHS in Ministry of Health (MoH) [Malawi] and ICF International, 2014). Although the decline is significant the figure is still unacceptably high and a great effort is needed to reach the target of 155 maternal deaths per 100,000 live births in 2015 (Ministry of Health (MoH) [Malawi] and ICF International, 2014; Ministry of Health, 2011).

The number of deaths resulting from HIV was greatly reduced from 99,000 in 2004 to 48,000 in 2013, and the national HIV prevalence, was 10.3 percent in 2013 (UNAIDS in Ministry of Health (MoH) [Malawi] and ICF International, 2014). For Malaria, the incidence (suspected cases) has declined by about 30 percent from 488 cases per 1,000 in 2010 to 337 per 1,000 in 2012 (Ministry of Health (MoH) [Malawi] and ICF International, 2014). Even though the numbers are decreasing, a high burden of disease persists in Malawi, and the MoH is working constantly to address these challenges. In addition to HIV/AIDS and malaria, lower respiratory infection and diarrheal diseases are the top four causes of disease in Malawi (ibid.).

2.4 Structure of the health system

2.4.1 Health providers

The Health Sector in Malawi has a plurality of health service providers. The providers can be divided into two sectors, traditional and modern (ONSD, 2005). Traditional health providers are present in most communities as Traditional Birth Attendants (TBAs) to support maternal and child health, and traditional healers who support cultural beliefs such as spirits. The MoH has engaged the TBAs in their work and they deliver approximately 25% of the pregnant women, while the traditional healers are being guided in their practices since some norms and practices have contributed to unsafe behaviour. (ibid.; Ministry of Health, 2011, p. 30, 91)

The modern health sector can be divided into three main categories; the public sector, the non-profit private sector and the for-profit private sector (ONSD, 2005). The public sector, the MoH, provides about 60% of the public health services. The Christian Health Association of Malawi, the main non-profit health service provider, provides 37%. The for-profit private sector provides 2% of the health services.

2.4.2 Levels of health care

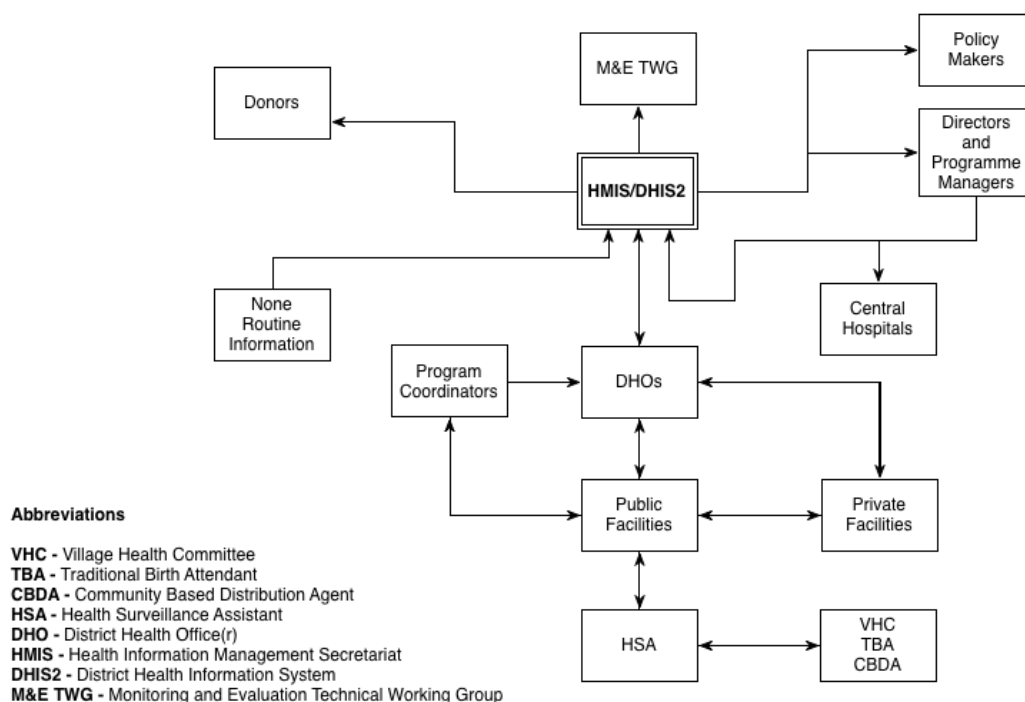
Health services are provided at three levels: primary, secondary and tertiary, all linked through a shared referral system within the health system (Ministry of Health, 2011). Primary health services are, according to ONSD (2005), provided through health centres, health posts and

outreach clinics. Secondary health services provide surgical services; obstetric emergencies, general medical and in-patient care for common acute conditions, mainly as a back up to the services at the primary level. The tertiary level provides similar services to those at the secondary level through central hospitals, in addition to specialised services such as obstetrics and gynaecology (ibid.; Ministry of Health, 2011).

2.5 The Health Information System (HIS) in Malawi

Lippeveld et al. (2000, p. 3) defines HIS' as "...a set of components and procedures organized with the objective of generating information which will improve health care management decisions at all levels of the health system." The HIS is the overall structure within health system acting as an umbrella for the HMIS and other information systems such as patient management systems. A HMIS is defined as a system that integrates "...data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services" (ibid., p. 3).

The HIS in Malawi consists of several stakeholders such as policy makers, directors and programme managers etc. An extract of the HIS is presented in Figure 2.4 showing the dataflow surrounding the national HMIS and the District Health Information System 2 (DHIS2). DHIS2 is a free, open-source HMIS-software and data warehouse. The software is a tool for data collection, aggregation, management, and analysis. Currently the software is used at various levels in 47 countries across the globe, including Malawi. (UiO, 2015; dhis2, undated)



10 **Figure 2.4 - Data flow or information process** (developed in collaboration with the Central Monitoring and Evaluation Division (CMED) based on Kanjo, 2011, p. 13)

Currently DHIS2 does not meet the requirements for all health programmes, in that it does not include services such as management of patients or lab results. As a result, several other HMIS-software's are present in today's HIS infrastructure to support these additional needs. Due to these complexities, giving an accurate overview of the HIS is a challenging task beyond the scope of this study. Only the national HMIS and DHIS2 are addressed in this thesis.

2.6 Health Management Information System (HMIS)

The HMIS encompasses data collection, processing, reporting and use of information in order to improve efficiency and effectiveness of the health services. The HMIS is structured across four levels, MoH or the national level, zone, district and facility (Figure 2.5).

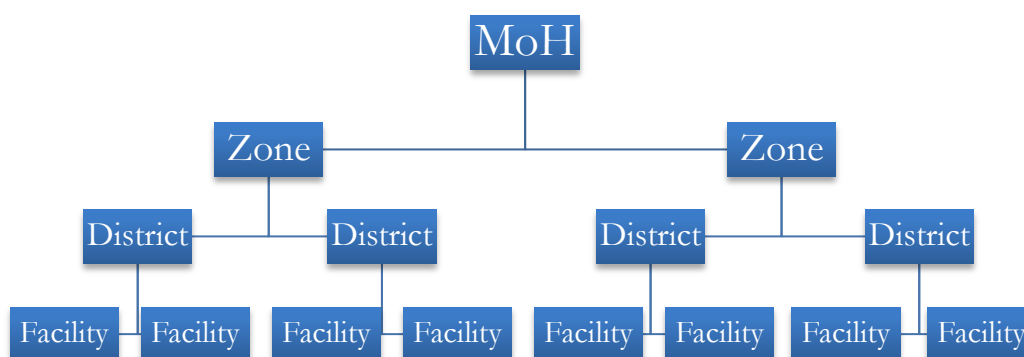


Figure 2.5 - Hierarchy of HMIS in Malawi

At the facility level, the information process is structured with mostly paper based data collection. At the district level, the data is transferred to DHIS2. Next, the data is analyzed at the district, zone, and national level. In addition to the routine health data, non-routine information such as censuses are also gathered and transmitted to the DHIS2.

2.7 Health Information Systems Program (HISP)

HISP is a global network spread across multiple countries and contexts, first initiated through a bottom-up participatory design project in South Africa in 1994/1995 (Braa & Sahay, 2013). HISP is currently supporting the HMIS strengthening process in Malawi. The development within HISP has been non-linear following different trajectories and experiencing several successes and setbacks. However, HISP has always tried to stay 'on top of' the changing environment, such as rapid political, technological and other changes, in order to avoid major setbacks. Additionally, HISP has gained further impetus through increased focus on global health, including achievement of MDGs. During development, funding and politics has been constantly changing and uncertain, making planning challenging. Although planning has been challenging the

“...stubborn willingness to apply participatory approaches in designing HIS in cooperation with various levels of users in a variety of context...” has been a consistent factor driving the project forward (ibid., p. 236). The design and development of the DHIS software has been a key focus of the application of participatory design techniques.

2.8 District Health Information System 2 (DHIS2) as the national HMIS

Malawi began a process of strengthening its HMIS in 1999 after realizing that it had a lack of reliable data, poor appreciation and use of available information in health service planning and management, absence of indicators to guide data analysis, fragmentation of information systems along vertical health programme lines, and poor access to centralized data, for geographically distributed stakeholders (Chaulagai et al. in Manda, 2015). Between 1999 and 2002, a comprehensive review of the national HMIS setup was undertaken, with funding from the Dutch and the Malawi governments. As a result of this review an indicator handbook, data collection tools, training manuals for health workers and managers, and a national health information systems policy and implementation strategy were developed (Manda, 2015).

As an additional result of this process a digital HMIS solution, DHIS 1.3, was implemented in January 2002, in order to aid routine health data storage, analysis, and presentation at district and national level (ibid.). And “*For the first time in Malawi, the health sector had information by facility by month*” (Chaulagai et al. in ibid.). In 2003, the Dutch funded project phased out.

During the period 2002-2009 efforts were made to secure support from other donors. Within this period, the Malawi government, with support from various donors, designed a Sector Wide Approach (SWAp) to strengthen health service delivery and monitoring in Malawi by harmonizing donor support, channeling funds through one common basket (Manda, 2015). Despite these efforts, allocated resources for HMIS support were deemed inadequate. In some cases, the though funding provided was considered sufficient. However due to strict timeframes, administrative constraints, and inadequacy of sustaining prior goals, the ministry was unable to utilize the allocated funds by the time the projects phased out.

In 2009, a new wave of HMIS strengthening efforts commenced with a shift from DHIS 1.3 to DHIS2 managed by the Ministry of Health, through the Central Monitoring and Evaluation Division (CMED), with funding from HISP Oslo, the core group in the HISP network (ibid.). The intent of the strengthening process was to align the national HMIS setup with the objectives of the efforts that began in 1999. In addition to the change of software solution; pursuing integration of parallel health information systems with DHIS2 as the overarching national health

data warehouse, decentralizing access to routine health data across administrative levels, and building IT capacity to enhance end-user support and maintenance of existing solutions, were important key processes within this phase. To support the transition from DHIS1.3 to DHIS2 a team of three IT, DHIS2 coordinators, were established, since CMED did not have the necessary IT capacity to support this shift. The DHIS2 coordinators and the DHIS2 server were based in Blantyre, a city approximately 300km from Lilongwe, Malawi's capital, where CMED was located. Due to financial and logistical difficulties the transition process remained slow, and few of the planned pilot projects were commenced.

Through negotiations with various donors, funding and logistical arrangement for the migrations were in place midway through 2012 (*ibid.*). Due to limited timeframes for parts of the funds, the scaling was intended to progress quickly. Trainings were held for assistant statisticians, responsible for HMIS at district level, and programme coordinators at the district level. The following year, CMED prioritized strengthening of local area networks and internet connectivity at the district level, to enhance utilization of the online national DHIS2 server solution. To provide district health offices with reliable internet connectivity Mobile internet modems were purchased. Alongside this, efforts to migrate data from parallel programme centered legacy systems to the national DHIS2 solution were also on going.

Today, DHIS2 is present at district, zone and national level as a result of a long and challenging migration process.

2.9 League table introduction

An attempt to implement league tables was made in 2006, during the Malawi joint annual health sector review (Moyo et al., 2015). A district league table was presented at the national SWAp review meeting, where it received mixed reactions. While some stakeholders believed the concept would promote behavioral change and encourage teamwork, others, many of them ranked at the bottom, were critical and resistant. The League table was also criticized due to its methodological shortfalls, including the process for selecting indicators and weights. Additionally, the data used from the routine health information system, was considered of poor quality due to incomplete data and reports not being delivered on time. Due to these shortfalls the concept was discontinued after being in use for a couple of years.

2.10 Summary of main challenges

The main challenges that Malawi has stood up against has been poor data quality and low data use. Further, the infrastructure such as ICT, electricity, roads, and funding has challenged the

process of supporting the development and efficient use of the HMIS-software, DHIS2. The development process has also been affected by the distance between CMED in Lilongwe and the DHIS2 team in in Blantyre.

3 Research approach

The purpose of this chapter is to introduce the research approach, methodology, and methods of this thesis. However, in order to position the work I will start by presenting the philosophical foundation, before explaining the research approach in detail. The chapter will further describe the research methodology, the methods and framework used for data collection, and how the data has been analyzed.

3.1 Philosophical foundation

A researcher's perception of how the world is and how knowledge can be created, acquired, and communicated is based upon underlying ontological and epistemological assumptions we make, and will act as a guideline towards how we approach certain objectives within our research (Scotland, 2012). I subscribe to the state that "*What knowledge is, and the ways of discovering it, are subjective*" (ibid., p. 9), and hence this research lies within the interpretive paradigm.

This means that I share the idea that phenomena are understood through the meanings that people assign to them, and the "*...access to reality (given or socially constructed) is only through social constructions such as language, consciousness, and shared meanings...*" (Myers & Avison, 2002, p. 6). An example of this is the view of data collected within interpretive research; "*...what we call our data are really our own constructions of other people's constructions of what they and their compatriots are up to...*" (Geertz, 1973, p. 9). The world thus does not exist independently of our knowledge of it (Grix, 2010). Another side to this is that "*...interpretive methods of research in IS are aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context*" (Walsham in Myers & Avison, 2002, p. 6).

As opposed to interpretive paradigm, most positivists assume that the reality is not mediated by our senses (Scotland, 2012).

Positivists generally assume that reality is objectively given and can be described by measurable properties, which are independent of the observer (researcher) and his or her instruments. Positivist studies generally attempt to test theory, in an attempt to increase the predictive understanding of phenomena. (Myers & Avison, 2002, p. 6)

To answer my research question, gaining understanding of the health system in Malawi, and the user context of stakeholders and their interests, plays a crucial role. As an outsider, there will be a constant need for understanding phenomenon and its context, and the only way to do this will be

to ask participants to share their interpretation, thus leading me their subjective answer. One might argue that a phenomena such as league tables are objective, however when users feel that it is rather a tool for supervisors to micromanage them, their interpretation of the situation becomes their truth. When doing qualitative research the findings will not be absolute in how I or any other researcher interprets them, and I therefore acknowledge that my interpretation will be based upon my underlying ontological and epistemological assumptions.

In some way, it might be possible to argue that there are parts of the research that will be affected by an underlying critical approach. The reason for this is that as an outsider it will be almost impossible to avoid looking at the history behind the current situation, and how the social, critical, and political factors have affected the system (Myers & Avison, 2002). Although it was important during the conducting of the research to avoid such factors affect the way questions were asked, the discussion in, Chapter 7 – Discussion, will in some parts provide a comparison between Malawi's condition presented in Chapter 2 – Background and the findings presented in Chapter 6 – Empirical findings, which could be interpreted as critical.

3.2 Research methodology: Action Research

The methodological framework used for this thesis has been Action Research (AR). Rapoport (1970, p. 499) defines AR as aiming “...to contribute to the practical concerns of people in an immediate problematic situation and to the goals of social science by joint collaboration within a mutually acceptable ethical framework.” Susman and Evered (1978, p. 588) have added an additional aim to support the practical concerns of people and the goals of social science, “...to develop the self-help competencies of people facing problems.” AR is a participatory research approach where researchers, together with the users, combine theory and practice towards improving a stated problem (Sykes & Treleaven, 2009).

AR can be seen as a cyclical process with five phases (Figure 3.1): diagnosing, action planning, action taking, evaluating, and specifying learning. However, projects using AR may differ in the numbers of phases that are carried out in collaboration between the researcher and the practitioners (Susman & Evered, 1978). Prior to the first phase, diagnosing, a client-system infrastructure or research environment should be established (Baskerville, 1997). During the *diagnosing* phase the primary problems, underlying the organizations desire for change, are identified in a holistic fashion (ibid.). Further, on theoretical assumptions about the nature of the organization and its problem domain are defined. *Action planning* consists of researchers and practitioners collaborating in planning the organizational actions needed for relieving or improving the primary problems identified. The actions are planned based on the previously

defined theoretical framework indicating the desired future state for the organization and the changes needed to achieve such a state. The next step focuses on implementing the planned actions through an *action taking phase*, as collaboration between the researcher and practitioners. Because organizations react differently to change processes the intervention strategies are adjusted accordingly. After completing the actions an *evaluation* is undertaken by the collaborative researchers and practitioners. During this phase the goal is to determine whether the theoretical effects of the actions were realized in practice, and whether these effects relieved the problems. Depending on the outcome further evaluation and planning is done to ensure further progress towards easing the problems. The last phase within the AR cycle is *specifying learning*, where the knowledge gained is compiled so that the organization and the scientific community may utilize this knowledge when dealing with future research settings.

The action research cycle can continue, whether the action proved successful or not, to develop further knowledge about the organization and the validity of relevant theoretical frameworks. As a result of the studies, the organization thus learns more about its nature and environment, and the constellation of theoretical elements of the scientific community continues to benefit and evolve. (Baskerville, 1997, p. 27)

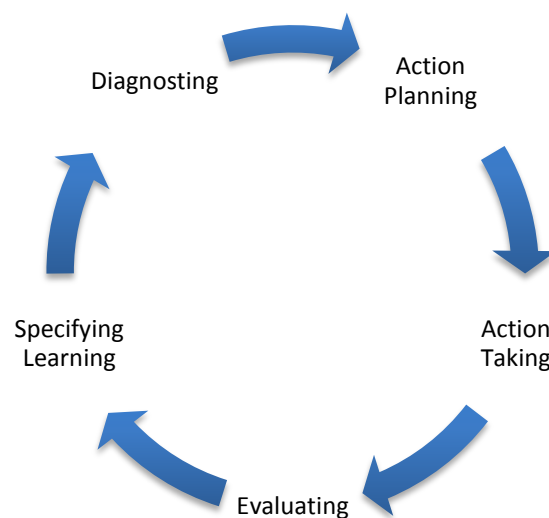


Figure 3.1 - Action Research cycle (adapted from Susman & Evered, 1978, p. 588)

According to Chein et al. (in Susman & Evered, 1978), there are three ways of conducting an AR approach *empirical action research*, *participant action research* and *experimental action research*. Within this thesis *participant action research* has been used, focusing on collaborating with users during the diagnosing and action planning phase (Susman & Evered, 1978, p. 588). This focus has been important in order for ensuring that the planned actions correlate to the users' needs. Participant action research differs from *participatory action research (PAR)*, where participant action research

focuses on involving users within specific phases, while PAR is based on critical theory and constructivism, and posits that the observer has an impact on the phenomena being observed (Baum et al., 2006).

Further, Sykes & Treleaven (2009) defines three levels of positions of researchers; first-person: the *insider-researcher*, second-person: *Co-researchers* and third-person. The role of the researcher within this thesis lies between second and third-person, where the users have been involved with the research, however they have not been as closely involved as Co-researchers. The process has neither had a direct focus on actions, representing and disseminating knowledge generated by inquiry, rather than the process of including users' through the fieldwork (ibid.).

3.2.1 Interaction design

Interaction Design (ID) is “...*designing interactive products to support the way people communicate and interact in their everyday and working lives*” (Sharp et al., 2011, p. 9). Another way to explain ID is that it is done by creating a user experience, enhancing, and augmenting the way that people work, communicates and interact (ibid.). The four basic activities of ID are “...*establishing requirements for the user experience, designing alternatives that meet those requirements, prototyping the alternative designs so that they can be communicated and assessed, and evaluating what is being built throughout the process and the user experience it offers*” (ibid., p. 329). User-centered design (UCD) is one approach within ID, the focus within UCD is the use of a product, where the user needs, wishes, and limitations play an important role during the design process. During the design process, or lifecycle of it, it is important to involve users throughout the process, having several iterations between the four basic activities mentioned earlier (Figure 3.2).

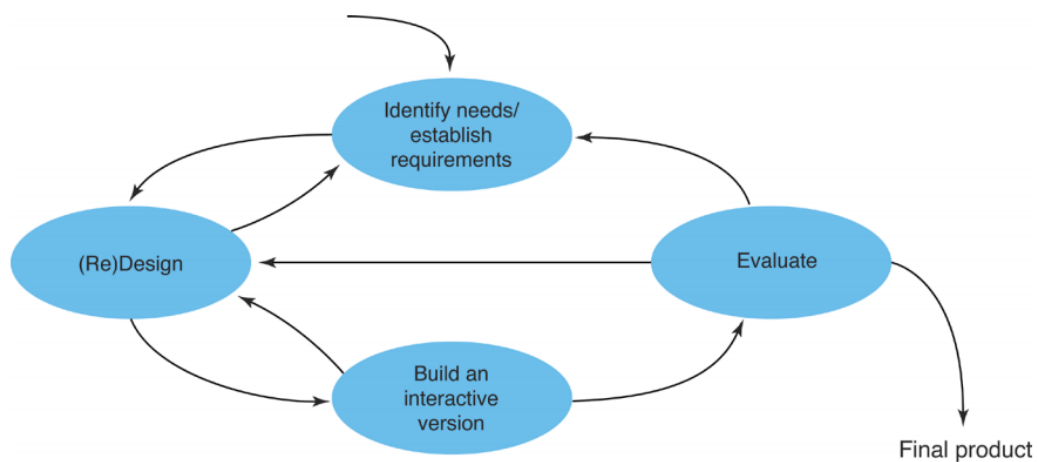


Figure 3.2 - A simple lifecycle model (Joshi, 2014, p. 42)

3.2.2 Combined research methodology

The research methodology used within this thesis has been a combination of both AR and ID. AR has been the overall approach with one main cycle of intervention, where the research environment was set to the health system in Malawi and the client-system infrastructure was indirectly the DHIS2 used in Malawi. During the diagnosing phase, the primary problems were established through a preliminary research period of initial discussions, interviews, focus groups and document analysis, resulting in league tables being planned as a proposed action. Later, users were trained to develop league tables during action taking phase through mutual learning, including further discussions with users. The result of this process was an evaluation of the previous steps of the process. This is a product specifying the learning on how to develop and implement league tables.

During the AR cycle, several prototypes have been developed, tested, and evaluated. Due to the fact that not all prototypes have been implemented as standalone interventions, this process has a simple lifecycle development process based on ID and UCD within the AR process. This because several prototypes were made in order to establish one final league table prototype, along with the development process of determining how league tables could be developed and implemented within this context. The steps of the league table prototypes thus reflect shorter AR cycles during the fieldwork in Malawi, where feedback from various users were periodically evaluated, and changes implemented. Table 3.1 shows an overview of how these two methodologies were used in a combined research approach, and how they relate to the methods used, the prototyping and the activities before and after the fieldwork in Malawi.

Table 3.1 - Activities related to the combined research approach

AR	Diagnosing		Action planning	Action Taking	Evaluating and specifying learning	
ID	Iterations of establishing requirements, designing alternatives, prototyping and evaluating				Evaluating	
Data collection methods	Discussions	Discussions	Interview Focus groups Document analysis Observations	Training Workshop Observations	Analysis	
Prototyping	Sketch	Prototype 1.0	Prototype 2.0	Prototype 3.0	Prototype 4.0	Future work
Where	Norway	Norway	Malawi	Malawi	Malawi	Norway
Phase	1	2	3	4	5	6

3.2.3 Interventions in Malawi

The process of developing league tables to be used in Malawi, started with an initial discussion with the HMIS manager from Malawi as he has been working on similar research questions during his PhD studies at the University of Oslo (UiO). During the initial discussions, scorecards and league tables were studied, described in section 4.5, to determine what would be the most useful approach in Malawi. Additionally discussions were held with representatives from the African Leaders Malaria Alliance (ALMA) since they were in a process of implementing Scorecards in Malawi. After the initial round of research, it was decided that the first prototype should be developed within the DHIS2 as a ranked league table.

After developing a prototype within the DHIS2, further investigations were conducted on-site in Malawi. Altogether 15 interviews and focus groups at national, zone, district, and facility level were conducted, were eight were recorded, leaving the recorded material to be 307 minutes. All the interviews started off with a situational analysis of the HMIS in terms of data flow and feedback, and secondly several feedback mechanisms were discussed. At the end of the interviews, the prototype of the league table was presented and the participants took part in discussion of how they would like the league table to be presented. Additionally, three training workshops were held at district and zone level. The first eleven interviews and focus groups included all members from the research team, where most of the interviews were led by the PhD candidate, while the remaining members were active in asking follow up questions. The PhD candidate and I held the last four interviews, and trainings were conducted by me. A complete list of the interviews and training workshops including the number of participants and the level they were held at is displayed in Table 3.2. Table 3.3 is showing the designations of all participants included, along with the number of participants within each designation. The number of participants in the latter table does not correlate with the number of participants in the first, because some participated in more than one activity.

Table 3.2 – Interviews, focus groups and training workshops held, including level and number of participants

	Health System level	Number of participants	Methods used
1	MoH	3	Focus group
2	Zone	2	Interview
3	Zone	2	Interview
4	Zone	1	Interview
5	Zone	6	Training workshop
6	Zone	8	Training workshop
7	District	9	Focus group
8	District	12	Focus group
9	District	2	Interview
10	District	2	Interview
11	District	1	Interview
12	District	2	Interview
13	District	5	Interview
14	District	1	Training workshop
15	Facility	1	Interview
16	Facility	2	Interview
17	Facility	3	Interview
18	Facility	1	Interview

Table 3.3 - Designations of the participants included in the research, including level and number of participants

Participants	Health System level	Number of participants
Central Monitoring and Evaluation Division (CMED)	MoH	3
Officers at Zonal health Office	Zone	15
District Health Officers	District	3
Programme coordinators	District	7
HMIS Officers	District	5
Officers at District health Office	District	13
Statistical clerk	District	4
Student intern	District	1
In charge	Facility	3
Statistical clerk	Facility	1
Nurse	Facility	2
Hospital attendant	Facility	1

3.3 Data collection

In this section, the framework for the data collection will be presented. The first part will introduce the goals and how participants were selected. Next, a brief introduction to triangulation will be given, before the methods applied for data collection are presented. As a part of methodological triangulation, different methods have been utilized, such as document analysis, interviews, observations and training workshops. Supplementing the more formal methods note taking within a field diary, email achieves and photographs were also gathered throughout the data collection. Finally, the pilot study will be presented.

3.3.1 Goals

The fieldwork conducted in this study had three primary goals. First, it was necessary to get an overview of the Malawian health system to get a clear view of the user context. The second goal was to gain understanding how the data flow is structured and feedback and how feedback mechanisms are currently utilized. Third, the study investigated whether league tables would be suitable as a feedback mechanism in this context, and how it could be developed and implemented to suit the needs within the health system in Malawi.

3.3.2 Participants

The participants to be included in the study should both represent the user context and cover the various aspects of the HMIS. The study should therefore include both end users and experts within different aspects of the health system, such as health workers, managers etc. and cover all levels of the health system such as zones, districts, and facilities. Since the end users of league tables could be managers, statistical personnel, HMIS officers, programme coordinators etc. the study will refer to them as health workers to avoid any confusion on this.

For the preliminary research, and the first eleven interviews and focus groups, the destinations were defined beforehand based upon the most practical travelling route, but also trying to cover areas where dataflow is working well and areas where this is more challenging. When the destinations were decided, the zonal and district offices were informed about our visits. Since they all have their own schedules to follow we had to base our sampling upon convenience, including those who were available rather than selecting the interview objects independently of these considerations (Sharp et al., 2011). The sampling can therefore also be related to a strategic selection of the personnel present in a particular place at a particular time (Grønmo, 2004). A selection like this does not ensure a sample representing all different aspects of the HMIS, since it is not based on a randomized sample, and the results can therefore not be generalized. However since the focus was on gathering qualitative data to gain understanding of the user context,

insight in the use of feedback mechanisms and study how league tables could be useful within this context this selection was determined to be most suitable, and to provide good insight.

During the second part of the research, including four interviews and three training workshops, the sampling patterns were similar to the previous. However, in this case the selection was based within a smaller geographical area. One can also say that these selections were based on the sampling techniques from of gonzo testing, where the users were met in their workplace, their natural environment; enabling them to use equipment they were familiar with, such as computers, in order to make the testing within the training workshops as realistic as possible (Toftøy-Andersen & Wold, 2011).

All data from the field study was gathered in the users' natural environment, in either an office, or a meeting room. This was done in order to meet the users in their natural environment; however, it also led to several interviews being held in locations where it was challenging to communicate with the participants due to disturbing noises, such as people talking or children crying. An example of this is that many of the district offices were placed close to health facilities. Because most of the facilities were very busy and saw large amounts of patients each day, many patients were waiting to be attended both inside and outside facilities. Since we usually visited the offices during the day, the clinics were busy, and the people then became a disturbing but natural factor. Figure 3.3 shows a health facility in Malawi.



Figure 3.3 – A health facility in Malawi

3.3.3 Triangulation

Triangulation means that a phenomenon is investigated from at least two different perspectives (Jupp in Sharp et al., 2011). Within this thesis, data triangulation has been used gathering with similar data gathered in different locations, at different times and from different people (Sharp et al., 2011). And, methodological triangulation has been used by applying different data gathering techniques, such as document analysis, interviews, focus groups, observations and training workshops.

3.3.4 Data collection methods

The data collection within this empirical study has been qualitative. This in order to obtain detailed descriptions from the participants involved, instead of numerical data such as statistics (Sharp et al., 2011).

3.3.4.1 *Document analysis or Literature review*

As Merriam points out documents “...of all types can help the researcher uncover meaning, develop understanding, and discover insights relevant to the research problem” (in Bowen, 2009, p. 29). A document analysis is a procedure for systematically reviewing or evaluating documents both printed and electronic material, where the data is examined and interpreted in order to elicit meaning, gain understanding and develop empirical knowledge (Corbin et al. in Bowen, 2009).

Within this thesis document analysis has been utilized as an approach to gain further insight of the user context and other relevant insight towards answering the research question. The documents have been obtained from the research sites in form of monthly, quarterly and annual reports, graphs and tables. One particular theme that has been addressed through these documents has been various feedback mechanisms that have been used within the different zonal and district offices, and at the facilities. The documents related to this will be presented in Chapter 6 – Empirical findings.

3.3.4.2 *Interview and focus group*

Interviews are often divided into three categories: structured, unstructured and semi-structured, based on the degree of control the interviewer has over the interview process (Sharp et al., 2011). Within this study semi-structured interviews have been used, allowing the research team to combine features from both structured and unstructured interviews. By combining structured and unstructured interviews, the participants were asked some predefined questions, but the participants were also free to lead the conversation and visit topics of their interest. The participants could also choose to answer as fully or briefly as desired. As researchers this

approach also let us be free to ask follow up questions and improvise throughout the interviews in order to obtain the most important and relevant information (ibid.). One negative factor with using this approach is that it generates large amounts of data to be structured and analyzed afterwards (ibid.).

During the interviews a basic script with questions was used in order to make sure that the themes we wanted to look into were covered (Appendix A).

Some examples of questions asked are:

- How does data flow from the lower to the higher levels?
- How do you use the data you have collected?
- What kind of feedback are you provided with, and from whom do you receive feedback?

Because the sampling of participants was based upon convenience, we had little control of the number of participants that would take part in our interviews. We therefore had ‘interviews’ with as few as one participant and as many as nine. Since there are many methodological differences connected to the number of participants involved, the interviews that turned out to include more than two participants were categorized as focus groups. This because focus groups normally involves between three to ten people (Sharp et al., 2011). The benefit of having many participants within a focus group is that it allows diverse or sensitive issues to be raised that we otherwise might have missed. It also enables participants to put front their opinions in a supportive environment. Another positive factor when using focus groups is that the “...*method assumes that individuals develop opinions within a social context by talking to others, which means that this approach is more appropriate for investigating community issues rather than individual experiences*” (ibid., s. 232). One negative factor with having focus groups, as oppose to interviews, is that some participants might not be comfortable to discuss or raise issues, and could then leave out important aspects.

One of the goals for the interviews and focus groups group discussions was to investigate the feedback mechanisms that were in use and if league tables would be a suitable feedback mechanism within this context. After visiting the themes data flow, the various forms of feedback provided, and feedback mechanisms used, the research team introduced a league table prototype as a proposed feedback mechanism. Following the interview or focus groups, some participants that were using DHIS2 regularly were invited to learn more about league tables, and comment on how it was presented and its functionality.

In order not to influence the participants' opinions on league tables, we consistently let the participants discuss the concept before introducing our prototype. An example of a league table presented is shown in Table 3.4.

Table 3.4 - League table ranking health zones in Malawi

	Measles coverage rate †	Deliveries by skilled health personnel †	Antenatal care during first trimester †	OPD utilization rate †	Total Score League Table V2 †
North Zone	115.9	99.8	17	248.8	120.4
South East Zone	79	66.5	10.2	106.4	65.5
South West Zone	65.1	44	7.2	104.5	55.2
Central West Zone	75.2	63.8	6.8	97	60.7
Central East Zone	64.8	51.6	8.4	122.3	61.8

Most of the interviews or group discussions were audio recorded, and later transcribed and thematically analyzed. The audio recording was used in order to let the research team focus on the participants and the conversation, instead of being focused on note taking. Additionally, some participants talked very fast, spoke softly or with a challenging dialect, and it was therefore beneficial to have a second source of data to go back to, if parts of the conversation were hard to follow.

3.3.4.3 Training workshop

At the end of the data collection period three training workshops were held with one, six and eight participants, where I was responsible for conducting two. The third training workshop was held by a representative from Malawi, however during parts of the training the instructor had to leave and I was therefore asked to take over. Each training session lasted for approximately two hours.

The objective for the trainings held was to teach the health workers how to use DHIS2, but also how to create and use league tables. The users were asked to discuss how the league tables were presented, its functionality and its methodological approach. During the trainings I held the focus was on having an interactive session where the participants were given assignments towards creating a league table as well as a user guide (Appendix B); explaining how to solve the tasks. An example of a task was to find the pivot table application in DHIS2 and create a league table for districts or facilities in their area. The participants were free to ask questions throughout the session. The approach of training workshops was based on mutual learning, where the participants were taught to use DHIS2 and league tables, and we learned from the participants sharing their interpretations.

3.3.4.4 Observation

Observations may be performed in the field where the users are in their natural setting doing their normal day-to-day tasks or in a controlled environment where the participants are asked to do specific assignments (Sharp et al., 2011). During the early stages of a development, process observation helps the designer to understand the users' context, tasks, and goals. During the later phases, such as evaluation, observation may be used to investigate how well the prototype developed supports the former established tasks and goals (ibid).

Within this thesis, observation has been done in the users natural settings. In the early phases, observation has been used in the process of developing league tables, and in the later phases to evaluate the prototypes. During the early phases, observation was used as a method to gain understanding of the participants natural work environment, where they were working and how they performed their assigned tasks. The observations were documented as an addition to the interviews and focus groups by note taking, in order to capture personal thoughts and reflections that an audio recorder does not include. As mentioned in section 3.3.4.2 some participants were introduced to the league table prototype, and were trained briefly on how to create and use it. During this session the participants were observed when performing assignments such as opening the pivot table application within DHIS2 and creating a league table. During the later phases observation was used during the training workshops, observing how they chose to solve the tasks they were given.

3.3.4.5 Prototyping

Throughout the field studies, prototyping was used for two main purposes. First, the prototypes were used to give the participants within the interviews, focus groups and training workshops and example of a league table so that they would understand the concept. Second, the prototypes were used to as a tool to base discussions around presentation and functionalities within the league tables on. *"It is often said that users can't tell you what they want, but when they see something and get to use it, they soon know what they don't want"* (Sharp et al., 2011, s. 390). The prototypes were therefore crucial in order for users to understand the concept and be involved in discussions around it.

Because we were looking to involve the users in the process of developing league tables, the first prototype, described in section 5.3.1, was designed as simply as possible (ibid.). Within this study five different prototypes have been developed, ranging from low-fidelity sketches to high-fidelity prototypes within the DHIS2 (Sharp et al., 2011). The process of prototyping will be presented in Chapter 5 - Prototyping.

3.3.5 Pilot study

A pilot study is a trial round of the main study, done in a smaller scale, aiming to make sure that the proposed method and approach is viable before starting off the real study (Sharp et al., 2011). In this case the pilot study was used in order to test the methodological approach. Pilot studies differs from pilot projects, where the latter is a trial project used in early phases of implementing a system. For this case in particular, the focus was on testing the questions to be used during the interviews and focus groups in order to make sure that they were formed in a way easy to understand by the participants so that the product of the interviews would support the research question.

Since we had limited time to conduct our field studies in Malawi, the pilot studies were held in Tanzania, because we were traveling through Tanzania on our way to Malawi. Again, the sampling was based upon convenience. However, since the health sector in Tanzania are using the same national HMIS-software as Malawi, the approach was found relevant in that setting. In addition, they had been looking into utilizing league tables as a feedback mechanism and relevant discussions could therefore be conducted. During the pilot studies we met with key actors within the health administration as well as health workers at one clinic. Because the results of the field study were only used to ensure relevance of the research approach, the results from this study will be excluded from this thesis.

In preparation for the field studies, the equipment such as audio recorder and the league table prototype were tested in Norway, prior to the pilot study in Tanzania and the field studies in Malawi.

3.4 Data Analysis

Data analysis serves as a tool to gain greater understanding of the content and the correlations between the parts of the content (Braun & Clarke, 2006). However, if one set of data is analyzed by two persons the results would most likely not be the same due to the techniques being used and the utilization of them. When presenting information, such as analyzed data, it is therefore also important to present how the analysis was done in order for the reader to understand and compare the results with similar studies (*ibid.*).

In the following section, I will explain how the data gathered in Malawi has been thematically analyzed and interpreted, before it is presented in Chapter 6 – Empirical findings. As we were conducting two to three interviews each day during the first period in Malawi an, initial analysis was done concurrently to ensure that the questions asked were yielding relevant insight. This

determined through discussions within the research team. In addition, a paper (Appendix C) has been written by the research team for the IFIP 9.4 conference³, where further analysis of the subject was done in two cycles; one before and one after getting feedback from the review team. A thematic analysis made as a second part of the analysis, and will be presented below.

3.4.1 Thematic analysis

“Through its theoretical freedom, thematic analysis provides a flexible and useful research tool, which can potentially provide a rich and detailed, yet complex, account of data” (Braun & Clarke, 2006, p. 78). According to the guidelines presented by Braun and Clarke (2006), a theoretical analysis can be done within process consisting of six phases where the data is read, coded, arranged in themes and reported on. A theoretical thematic analysis is either done in an inductive or bottom-up way or in a theoretical and top-down way, one can also categorize the level at which the themes are identified as a semantic or explicit level, or a latent or interpretive level (Braun & Clarke, 2006; Boyatzis in Braun & Clarke, 2006).

As the fieldwork started, some assumptions were made towards which themes would be brought up during the interviews and focus groups. Parts of the questions were formulated in order to cover these themes, such as data flow, feedback etc. This was done in to ensure that the data would be associated with the research question, and not in order to place the data within an existing framework of themes. The analysis done may therefore be placed within an inductive approach, where themes were generated based on the data gathered (Patton in Braun & Clarke, 2006). The themes within the analysis were identified by using a semantic approach, looking at the explicit or surface meanings of the data, and not beyond what the participants said (Braun & Clarke, 2006). The analysis was done through three stages, *familiarizing*, *defining patterns or codes*, and summarizing the patterns by *creating themes*.

The process of familiarizing was conducted through reading and re-reading the transcribed material from the fieldwork (ibid.). Next, initial codes were identified by naming separate features of the data (ibid.). The last step of the process of analysis was done by categorizing the codes identified into themes (ibid.). The themes identified and the main findings are presented in Table 3.5.

³ International Conference on Social Implications of Computers in Developing Countries

Table 3.5 – Overview of themes and main findings

Themes	Main findings	Key observations or quotes
<i>Infrastructure</i>	Lack of internet connectivity	Users are unable to access DHIS2 to report data
	Power outages	Users are unable to use the internet to access DHIS2
<i>Funding and partners</i>	Lack of funding	No available resources to pay internet bills
	Various partners and donors	Partners and donors support various causes within different areas, not always suited to the users' needs
<i>Data flow</i>	Between levels	The system for reporting is operational
	Variations in how reports are transported from facility to district level	Reports are transported in the most convenient manner
<i>Access and usage of DHIS2</i>	Users without credentials	Users are unable to access DHIS2
	Users without training	Users are unable to utilize DHIS2 efficiently
	Computer illiteracy	Some use DHIS2 efficiently, while some use it less or not at all
	Variations in degree of use	
<i>Data quality</i>	Issues related to timeliness of delivering reports	Reports are not delivered in time
	Lack of completeness	Reports delivered are incomplete
	Reports including errors	Reports include errors
	Two sets of population figures	Different use for each set
	No population data for lower levels in DHIS2	Users are unable to make comparative analysis at lower levels
<i>Feedback and feedback mechanisms</i>	Lack in feedback between levels	Most participants report lack in feedback
	Various feedback mechanisms	Graphs and tables are used as feedback mechanisms. Some hand drawn and some made with DHIS2 or Excel
<i>Ranked feedback</i>	Would like ranked feedback and/or comparative analysis	Most participants would like more ranked feedback, possibly in form of comparative analysis
	Could encourage, but also demotivate	League tables could contribute both positively and negatively

4 Theoretical background

The purpose of this chapter is to introduce the literature used as a theoretical background for this thesis. First, concepts for understanding information systems are provided, followed by a presentation for user involvement in design processes. Next literature concerning HIS development and strengthening is presented, and finally, research related to the work in this thesis, such as league tables and scorecards, will be presented and compared.

4.1 Understanding Information systems

4.1.1 Information systems as social systems

Context plays an important role when developing and implementing information systems. This is because factors such as people, hardware, techniques, support resources and information structures are all part of information systems, and will differ between organizations and between and within countries, meaning that one development or implementation strategy may not be suited in all cases. The concept of viewing information systems as social systems is therefore introduced in order to establish understanding of why context plays an important role during development and implementation processes, such as the one presented in this thesis.

Between 1960 and 1980, computer use and productivity gains were linked together; creating an assumption amongst many people believing that computerization would directly and drastically improve productivity (Kling, 2007). In order to explain why this approach of technological determinism does not have explanatory value, Kling (2007, p. 207) provides three social explanations for what he refers to as the *productivity paradox*:

- (a) many organisations develop systems in ways that lead to large fraction of implementation failures; or
- (b) few organisations design systems that effectively facilitate people's work; or
- (c) we significantly underestimate how much skilled work is required to extract value from computerized systems.

Further, he argues that technological artefacts and social systems should not be looked at “side by side,” but analysed as complex, interdependent socio-technical networks, and that computerized information systems therefore should be viewed as social technical systems. He thus suggests that

the productivity paradox indicates that “...*technology alone, even good technology alone, is not sufficient to create social or economic value*” (ibid.; Thorseng, 2008, p. 12).

“*Social informatics is the new working name for the interdisciplinary study of the design, uses, and the consequences of information technologies that takes into account their interaction with institutional and cultural context*” (Kling, 2000, p. 218). Socio-technical systems comprises of people, hardware, software, techniques, support resources and information infrastructures, which are all interrelated within a matrix of social and technical dependencies (ibid.). When designing systems he therefore suggests that all these factors need to be taken into consideration in order for the designers to understand features and trade-offs future users will find appealing. As stated Kling suggests that technology alone will not create social or economic value on its own, which indicates that context plays an important role when developing and implementing information systems.

4.1.2 Information infrastructures (IIs)

While the previous section looks at how information systems should be viewed as socio-technical networks, where the context of an information system plays an important role, this section provides wider understanding of the abilities of an infrastructure. This is done in order to understand how an II is enabled to evolve without input from external controlling mechanisms.

IIs are defined as “...*a shared, open (and unbounded), heterogeneous and evolving socio-technical system (which we call installed base) consisting of a set of IT capabilities and their user, operations and design communities*” (Hanseth & Lyytinen, 2010, p. 4). Hanseth & Henningson (2014, p.2) further explain that “*Infrastructures have no life cycle – they are ‘always already present’.*” Although it is mentioned that this only counts for some IIs, a part of the infrastructure, the *installed base*, will to some extent always be present, and the ‘new’ infrastructure will be dependent upon adaptability of the existing one (Hanseth, 2000).

An II is *shared* in the sense that multiple communities utilize the same object in several unexpected ways, it should be seen as irreducible, which means that it cannot be split into separate parts to be used independently by different groups. In principle IIs exhibit unbounded *openness* with making it possible to add and integrate new components in unexpected ways and contexts, and with having unlimited numbers of users, developers, stakeholders, vendors and components. The openness therefore leads to having open access to using and designing or altering the II. Altogether this leads to heterogeneity. Hanseth (2000) explains the II *heterogeneity* in two ways. Firstly as *social-technical networks* in the sense that they constitute of more than just technology, they also comprise humans, organizations, institutions etc., and they are all

dependent on each other. And secondly that they are connected and interrelated, constituting *ecologies of infrastructures*, in the sense that the infrastructures are composed of other sub-infrastructures built on top of each other; linking logical related networks and components, making them interdependent. (ibid.; Hanseth & Lyytinen, 2010)

IIs can in many ways be regarded as a living organism, with no clear boundaries of purposes or people it may serve, with an ability to adapt and change over time, based upon its installed base and external surroundings. Many biological metaphors have thus been applied to explain how II evolve (Sanner et al., 2014; Ciborra, 2000).

4.2 Evolving information infrastructures

IIs are always present, if not as technological artefacts there will still be people, routines or organizations. The boundaries of IIs are not definite, and thus IIs evolve in unpredictable ways, leaving designers to formulate goals in terms of how such a process may be influenced or enabled, rather than controlled or constructed (Hanseth & Lyytinen, 2008; Shaw et al., 2007). *Path dependence* and *reflexivity* are two effects resulting from choices being made during a development process (Hanseth, 2000; Hanseth et. al, 2006). As a result from both of these, initially successful projects may turn into failures by prior decisions leading to unexpected results.

As a part of implementing league tables in Malawi, preexisting condition must be considered, in order to enable the change process and avoid failures due to path dependencies or reflexivity. The next section will therefore propose concepts to support this process, such as bootstrapping for developing and implementing, and generativity for further development.

4.2.1 Bootstrapping

In this thesis, bootstrapping will be used as a concept for enhancing user dedication in the process of developing and implementing league tables in Malawi. The work within the thesis will be used as a process for increasing knowledge, amongst future users in Malawi, on how to develop and use league tables in their work practices, in order to enable them to continue the development on their own.

Bootstrapping is defined as “...to promote or develop initiative and effort with little or no assistance, <bootstrapped herself to the top>” (Merriam-Webster, 2015). Hanseth & Aanestad (2003) gives an example of a successful bootstrapping case through an implementation of a telemedicine system in ambulances in Østfold, Norway. The case shows that through single initiative from a doctor, a system, MobiMed, that facilitated transmission of text and ECGs from ambulances to a receiver (e.g. in a hospital), was implemented in ambulances in a whole county and led to similar projects

being started in other counties. When the project started, the doctor approached the county's health administration to ask for financial support. They were not convinced; however they gave the doctor permission to try out the system. Based on the doctors own initiative, the project was successfully and effectively scaled up, within two years, as a result of a process without much support.

As seen in this case, successful bootstrapping is dependent upon highly motivated users to start the process, in order to engage those willing to adapt and the latecomers throughout the process (ibid.). If a bootstrapping process is overrun by e.g. standardization before the number of engaged has reached a considerable amount and the implementation has matured, the risk of resistance and failure increases significantly (ibid.). It is therefore crucial that the process is not disrupted so that the building blocks may be added one by one, growing together instead of trying to add them all at once without knowing how they all fit together.

4.2.2 Generativity

In addition to enable users to develop league tables through bootstrapping, a goal for this study is also to engage users of the league tables in further development of solutions that are useful to them. The concept of *generativity* is useful in this regard.

The term *generativity* has been used in several different settings that have given the concept adapted properties and a broader meaning. A definition based on Information Systems, is given by Zittrain (2008, p. 70) "*a system's capacity to produce unanticipated change through unfiltered contributions from broad and varied audiences.*" To determine a system's generativity he further describes five principal factors to be considered (ibid., p. 72):

1. *Leverage* - how extensively a system or technology leverages a set of possible tasks
2. *Adaptability* - how well it can be adapted to a range of tasks
3. *Ease of mastery* - how easily new contributors can master it
4. *Accessibility* - how accessible it is to those ready and able to build on it
5. *Transferability* - how transferable any changes are to others – including (and perhaps especially) non-experts

Hanseth and Bygstad (undated) build on the concept of generativity with assessing IIs and then also adding an architectural perspective. They define generative architectures as "*...one that is bootstrappable, adoptable and extensible; has a fit with (generative) development and user collectives*" (ibid., p. 1).

4.3 Involving users in design processes

This thesis presents a bottom-up development process, through participatory design (PD). The aim of this approach is to enable the end users of the system, in this case league tables, to take an

active role throughout the development, forming a result to suit their needs (Simonsen & Robertson, 2012).

The goal of user participation is to involve future users of a computer based system in decisions regarding the system development, letting them influence the development process' outcome (Bjerknes & Bratteteig, 1995). Within this lies the assumption that users' knowledge and skills are valid when exploring and evaluating all decisions to be made (Bratteteig & Wagner, 2012). An example a study focusing on user participation is the Florence project, aiming at building computer systems for nurses' daily work, based on their professional language and skills (Bjerknes & Bratteteig, 1995).

The following three reasons are normally given for user participation in design (Bjørn-Andresen & Hedberg in *ibid.*, 1995, p. 73-74);

1. Improving the knowledge upon which systems are built.
2. Enabling people to develop realistic expectations, and reducing resistance to change.
3. Increasing workplace democracy by giving the members of an organisation the right to participate in decisions that are likely to affect their work.

Participatory design has been widely used within HISP-projects, combining both the political empowerment argument from the Scandinavian Participatory design tradition and the practical learning through hands-on participation argument from the more technically oriented Participatory Design projects (Braa & Sahay, 2013; Bjerknes & Bratteteig, 1995). An example of this is the development and implementation of DHIS in South Africa, where participatory design was used for developing datasets and a HIS, using the DHIS as a means of engaging users and stakeholders at all levels, and in the process of developing the DHIS as a software application, engaging the 'activists' (Braa & Sahay, 2013). The methodology led interested or innovative users, regardless of his or her place in the hierarchy, to have full access to the development team and the users that were used to long periods of waiting were astounded by the rapidly deployed versions being available to them.

4.4 HIS development and strengthening

Within this section various factors for strengthening HIS in development countries will be described. As the focus is on HIS, I will not go into the details of the ICT4D (Information and communication technologies for development) literature. Furthermore, many of the concepts and phenomena around HIS are equally valid for all countries, even though the challenges apply to varying degree based on the context.

“Good management is a prerequisite for increasing the efficiency of health services. The need to do more with less is especially important because the health sector faces ever increasing demands while receiving stagnant or decreasing resources” (Lippeveld et al., 2000, p. 1). Health is a specialised sector, and both ministries of health and foreign assistance typically focus on single programmes rather than the entire health system. This causes a vertical line of information systems, rather than one integrated system (ibid.). Since information systems were not initially planned to provide support the health services in an integrated way in most development countries, they tend to be inadequate in providing the needed management support (ibid.). Lippeveld et al. (2000, p. 2) state a hypothesis that *“...development of rationally structured routine information systems, closely adapted to the information needs of health services at the district, health centre, and community levels, can potentially contribute to the overall improvement of health service management.”*

They further state that health information systems are seen as management obstacles rather than tools, and suggest five reasons for this; irrelevance of the information gathered, poor quality of data, duplication and waste among parallel health information systems, lack of timely reporting and feedback, and poor use of information. Accordingly a framework for restructuring health information systems in six steps is presented (ibid. p. 25):

- (i) identifying information needs and indicators, (ii) defining data sources and developing data collection instruments, (iii) developing data transmission and data processing procedures, (iv) ensuring use of the information, (v) planning for the required health information system resources and (vi) developing a set of organizational rules for health information system management.

The core focus of this process is to improve the health information system in order for it to provide specific information support to the decision-making process at each level of the organization, through two entities: the information process and the health management structure (figure 4.1) (ibid.; Hurtubise, 1984).

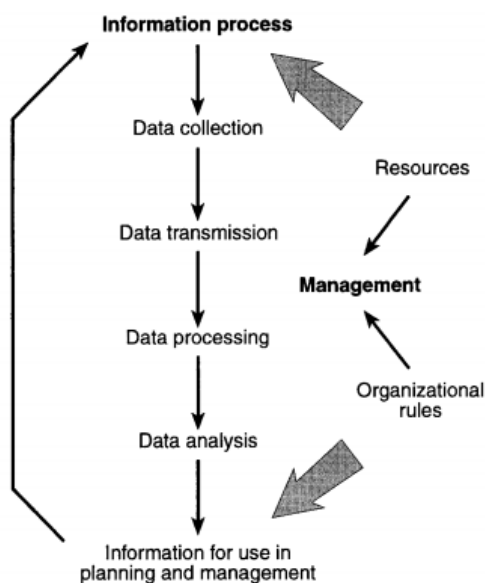


Figure 4.1 - Components of a health information system (Lippeveld et al., 2000, p. 16).

As the objective of this thesis is not on how to develop a health information system, but on how to improve decision-making through assessing feedback mechanisms the core focus through the next sections will be on data collection and use of data.

4.4.1 Collection of relevant data

One of the issues with current health information systems is that the data collected are not relevant, and they may therefore not support health service staff in the tasks that they perform (Lippeveld et al., 2000). This is because of a lacking consensus between the producers and the users of data at each level of the health care system regarding the information needed. Another issue they address is that parallel health information systems cause duplication and waste of data due to lack of coordination. The result of both these issues combined is that health workers are faced with a myriad of register books and reporting forms to fill out in order to collect the data they are asked to (Shaw, 2005). In order to comply with these issues and ensure comparability between the different levels of the health system and the parallel health information systems it is therefore essential to standardize definitions of both individual data elements and indicators, and collect only data that is used in management (Heywood & Rohde, 2002).

As a part of standardization Shaw (2005) suggests developing an essential data set. An essential data set may be defined as a set of “...the most important data elements, selected from all primary health care vertical programmes, that should be reported by health service providers on a routine basis, with the aim of being able to generate indicators that monitor the provision of health services in an integrated manner” (ibid., p. 632). Heywood and Rhode (2002) suggest the information pyramid as a schematic way of

determining the amount of data items to be collected at each level of the health system. A similar approach is presented by Shaw (2014, p. 68), shown in Figure 4.2.

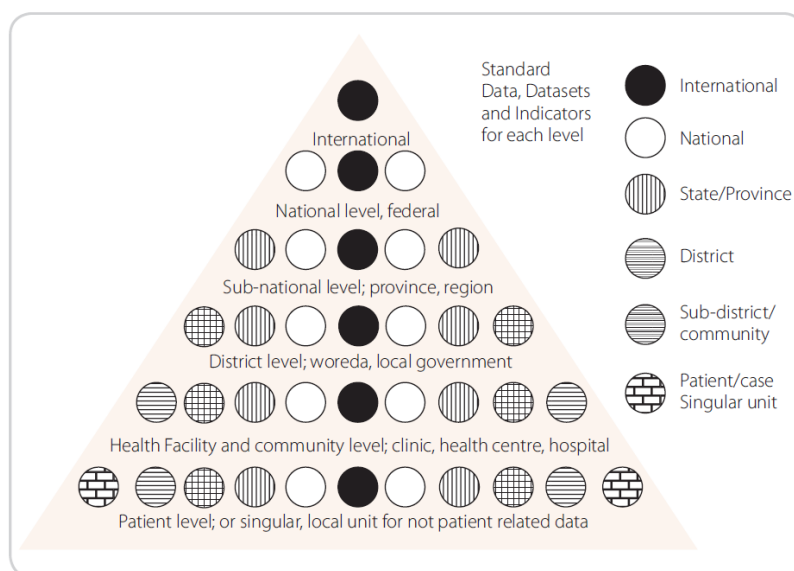


Figure 4.2 - Information Pyramid (Shaw, 2014, p. 68)

The information pyramid is built on essential data sets, where each level of the health system only receives data that is essential to their level (Heywood & Rhode, 2002). In this way each level of the health system is made aware of their own needs, but also the needs of the higher levels in order to know what data to report to these. As a part of this process it is also important to ensure continuity so that when new data elements are added they will be coordinated and integrated in the already existing data set and report.

4.4.2 Data quality

Data quality is a widely discussed subject when assessing HIS. The nature of these issues include a lack of technical skills amongst health workers collecting data, lack of motivation among health services personnel, lack of completeness in reports, delays in submission of reports, high work burden linked to data collection and reporting, fragmentation and duplication in data collection, inconsistencies in data reporting etc. (Lippeveld et al., 2000; Garrib et al, 2008; Kanjo, 2011; Moyo et al., 2014; Braa et al., 2012; Mavimbe et al., 2005; Mate et al., 2009).

Studies from South Africa show several cases of data incompleteness and lack in accuracy, where lack in accuracy is caused by values being widely divergent between the clinic registers and the monthly summary sheet, and incompleteness is caused by data missing from the clinics' registers (Mate et al., 2009). Another case shows that similar issues are caused by clinics' limited time in

ensuring data completeness (Garrib et al., 2008). A third example of similar issues shows that inconsistencies may also result from health workers falsifying results due to pressure from superiors threatening to withhold salaries if they are not performing on target (Mavimbe et al., 2005).

Compromised data quality may also be caused by fragmentation and duplication in data collection, due to varying interests between governments' donors and implementing partners (Shaw in Kanjo, 2011). Health programmes may also duplicate each other when creating reporting forms (Shaw, 2005). In the latter case duplication in data collection leads to an increased workload for the health workers (ibid.).

Braa et al. (2012, p. 379) state a hypothesis, that *"...poor quality data will not be used, and because they are not used, the data will remain of poor quality; conversely, greater use of data will help improve their quality, which will in turn lead to more data use."* When looking at the cases mentioned, both lack of time and high pressure from superiors, are factors that may support this thesis.

According to Heywood and Rohde (2002, p. 42) good quality data should be:

1. Available on time and at all levels
2. Correct, complete and consistent
3. Reliable and accurate enough to support decisions
4. Represent all recorders of similar data
5. Comparable i.e. using the same definitions of data items

Methods to improve data quality may be increasing awareness of the importance of the data quality through having data-use workshops or peer based reviews (Braa et al., 2012; Moyo et al., 2014). Data-use workshops include participants from districts or programmes presenting, and assessing their own data, followed by a session with discussion and critique given based on the presentation by their peers (Braa et al., 2012). The results of a data-use workshop held in Zanzibar was that forms were simplified by reducing the number of data elements collected, integration of previously separated data sets, and that participants gained an increased appreciation for data quality, while team work improved (ibid.). The data quality also improved drastically due to increased use of quality checks. Peer based reviews are similar to data-use workshops, though these also include exchanging experiences and joint problem solving which enhances collaboration (Moyo et al., 2014). Peer based reviews may thus promote the skills necessary for improving data quality and use by establishing a network for learning and sharing experiences (ibid.).

4.4.3 Data for decision making

“Good health information systems are crucial for addressing health challenges. However, the quality of the data produced by such systems is often poor and the data are not used effectively for decision-making” (Braa et al., 2012, p. 379). In order to improve decision-making it is therefore crucial to both make sure that the data collected is relevant, and that the quality of the data is held to a high standard. Additionally, decision making should not only be done at higher levels, but care providers, such as doctors, health technicians and community health workers should also be given the information and included in this process (Lippeveld et al., 2000).

In order to make evidence-based decisions the HIS should include a basic framework for how an information process should proceed;

For example, relevant information will be gathered and analysed prior to decision making; information gathered for use in a decision will be used in making that decision; available information will be examined before more information is requested or gathered; needs for information will be determined prior to requesting information; information that is relevant to a decision will not be gathered (Feldman & March, 1981, p. 172).

4.4.4 Capacity building for information use

As Malawi is currently using DHIS2 as their HMIS-software for reporting and analyzing data, training in utilizing it as an efficient work tool might improve the data quality and then also strengthen the HIS. Because Malawi is a developing country with constrained resources, this section will address eLearning as an approach to training based on a study done by Bjørge et al. (2015).

They suggest that eLearning courses in areas with low connectivity due to constrained resources should fulfil nine conditions. The first five conditions concern factors that will enhance learning, based on studies done by Cook et al. (2010). These conditions include *feedback*, *practice exercises*, *repetition*, *online discussions* and *audio* (ibid.). The following four conditions look into factors that can be affected during training in order to increase the users’ ability to use what they have learnt in their work (Bjørge et al., 2015; Grossman & Salas, 2011). These factors include *motivation*: when participants are motivated to learn and find the training useful, they will also be motivated to apply the new competence at work; *self-efficacy*: when watching a peer with similar abilities solving an assignment, a person’s own self-efficacy can be improved; *realistic training environment*: meaning that there should be close resemblance between the subjects thought and the users’ work tasks, e.g. the same software should be used; and finally users should learn to *anticipate and handle problems* (Bjørge et al., 2015; Grossman & Salas, 2011).

As a result of the study done by Bjørge et al. (2015) a training program for users of DHIS2 has been developed and implemented in the DHIS2. They have also tested a mentoring program where some users have been given more training than others, in order for them to train new users.

4.4.5 Feedback

Moyo (2014) states that feedback is a key factor in strengthening processes of HIS. He further proposes a hypothesis that feedback can potentially break the vicious circle of low data quality. However, since feedback comes in various forms and frequencies, answering the question of how feedback best should be provided is difficult.

Feedback provides information based on performance towards achieving a specific goal, the efficiency of the process and the effort required for achieving specific objectives (Lam et al., 2011; Freeman, 1985). In essence, feedback is a tool used to motivate, direct and instruct performance (Ashford & Cummings, 1983). Feedback should be useful both in an organizational perspective, as well as on an individual level (ibid.). *“The ultimate test for determining the effectiveness of feedback may be whether it changes the knowledge, attitudes, or behaviour of the individual in the desired direction or to the extent desired”* (Freeman, 1985).

The frequency of feedback is discussed; where it was formerly assumed that high frequencies of feedback would improve performance, recent studies suggest that this only applies up to a certain frequency, and that too much feedback could in fact decrease the work efficiency (Lam et al., 2011; Lurie & Swaminathan, 2009). Further, Freeman (1985) suggests that systematic feedback may be more effective, since such feedback tends to be objective, accurate and consistent. Feedback should also be timely, both in cases of failure in order to maintain motivation and hope for change, and in cases of success to maintain the good progress (ibid.). Within the process of giving and receiving feedback, both parties should be active, where the person giving the feedback should ensure that it is clearly defined and the receiving person should ask for clarification if it is not understood (ibid.). The person giving the feedback should then also be open for receiving feedback and questions of clarifications. In order to maintain motivation amongst the receivers, feedback should include both positive and negative comments – though not necessarily in equal proportions (ibid.).

In the section above, the core focus is on feedback received from a higher level, such as from a coordinator or manager to someone subordinate. However, feedback could also be exchanged between peers (Moyo et al., 2014; Adalety et al., 2014). Peer based reviews, as described in

section 4.4.2, is an approach where the focus is on collaborative learning, where peer assess each other's work, exchange experiences and solve practical problems as a group (Moyo et al., 2014). The strength of having peer based reviews, as opposed to receiving feedback from a manager, is that skills are developed within a community of practice where they all have the same focus, e.g. of improving data quality and use of data for decision making (ibid.).

4.5 League tables and scorecards

Ranking systems have a long history and have been utilized in several sectors such as comparing sports teams or individuals, institutions, companies, or other entities, by ranking them based on their performance. According to Foley and Goldstein (2012) performance rankings serve two purposes. Firstly, rankings provide 'public accountability,' where the public decision makers are presented with statistics in order to provide resources according to the present needs (ibid.). Secondly, they provide users of services with information to assist them, e.g. parents choosing schools for their children (ibid.). Such rankings appear under a range of names, like *scorecards*, which show performance according to a few key indicators, or *league tables*, which are ranked scorecards (Moyo et al., 2015).

There are many arguments to be made for or against transparency of ranked performance indicators within the health sector. Adab et al. (2002) present an example of criticism, where they suggest that ranking provokes anxiety and concern among health service providers. On the other hand, Brook (1994) suggests that such publications simulate competition amongst service providers, where services are encouraged to review and seek to improve their practices, resulting in an improvement of the overall quality of services. Transparency of ranked performance indicators such as league tables holds institutions accountable for their performance and provides them with an incentive for improving (Goldstein & Leckie, 2008). League tables may also be used as a screening system to identify institutions that may require special attention (ibid.).

4.5.1 Examples of implementations in the health sector

The use of performance league tables has seen some application in the health sector, necessitated by the introduction of health reforms based on the notion of transparency and institutional accountability (Goldstein & Leckie, 2008; Moyo et al., 2015). Within this section examples of such implementations will be presented.

4.5.1.1 Sierra Leone

The HIS in Sierra Leone was reformed during the period 2006-2011 (Kossi et al., 2013). This was done through a process with community based participatory design, looking at the broader

perspective, aiming to develop systems to “*serve and support the whole community*” (ibid, p. 3). The two main challenges during this phase were:

- 1) to cultivate the system at local level in order to become relevant and useful to the local community, and
- 2) ‘scaling’ the system to multiple communities in order to ensure that local decision makers had access to not only their own, but data from across the country to allow for comparison and evaluation (ibid, p. 4).

The objective of this process was to build an infrastructure to support evidence-based decision-making, as well as providing training for the staff using the system. As mentioned this was done through community based participatory design, by including the whole community in the process, and by cultivation, with its ability to learn and grow on its own.

During the process of reforming the HIS and implementing a new HMIS, using the same DHIS2 software as in Malawi, issues such as low data quality were revealed. As a strategy to improve data quality quarterly bulletins were implemented in 2009, using charts from the DHIS2, comparing and ranking all districts based on health indicators and indicators on data quality. The implementation resulted in a significant improvement of the data reporting, and the next bulletin could therefore be presented with more complete data. Additionally, a national league table was developed and was presented at the annual review meeting at the Ministry of Health, with participants from all districts. The introduction of the league table raised discussions due to methodological issues such as selection of indicators. However, the introduction also engaged districts to pursue awareness amongst the chiefdoms (sub-districts), by creating league tables for these with further tailoring of indicators. This process raised a competitive feeling among the local communities in Moyamba district, where Kongbora chiefdom improved to take the first place in both second and third quarter reviews, after coming last in the first quarter (Table 4.1). By comparison, between themselves, and knowing more about health indicators, local community leaders decided to organize health service delivery better in their community and put more pressure on upper level for additional resources and support.

Table 4.1 - Chiefdom league table in Moyamba district (Kossi et al., 2013, p. 10)

Chiefdoms	% Full Immunized 2nd Quarter	% PHU Delivery 2nd Quarter	% 3rd ANC Visit	% 2nd Dose of IPT	% MMRC Submitted	% Exclusive Breastfeeding at Penta3	Average Score	Ranking
Kongbora	98.2	45	170.9	96.6	86.6	93.3	5.3	1
Fakunya	124.3	62	154.3	86.2	100.0	48.1	5.0	2
Dasse	134.9	57	90.5	86.3	100.0	45.9	4.8	3
Kaiyamba	90.3	55	162.7	93.4	75.0	71.3	4.8	3
Timidale	140.3	46	106.8	91.7	91.7	33.0	4.8	3
Kowa	118.4	52	96.5	46.7	100.0	78.2	4.7	6
Lower Banta	88.3	48	201.6	120.8	100.0	35.6	4.7	6
Bagruwa	61.4	37	110.3	92.4	93.0	32.1	4.3	8
Kamaje	55.6	35	69.7	140.7	100.0	86.5	4.3	8
Kargboro	80.4	45	93.2	77.6	100.0	36.5	4.3	8
Kori	49.8	40	92.6	89.4	86.6	64.0	4.3	8
Ribbi	71.8	26	53.7	57.4	100.0	60.5	3.7	12
Upper Banta	61.1	29	68.0	101.2	77.8	38.6	3.7	12
Bumpch	54.9	29	73.8	38.2	100.0	28.3	3.2	14
Total	91.4	43	114.3	32.4	93.6	20.8		

4.5.1.2 Uganda

Uganda has been utilizing league tables with an objective of assessing the district performance based upon available resources (Ministry of Health, undated). When developing the league tables eleven indicators were selected for consistency with the 26 core indicators, within the current Health Sector Strategic Investment Plan, reliability of the data source and frequency of data collection. The indicators were separated in two groups, with eight indicators based on coverage and quality of care weighted at 75% of the total score, and four indicators based upon management and accounting weighted as the reminding 25%.

Alongside the development of league tables' issues such as low data quality, missing data and inconsistencies between reports have been revealed. In addition, new districts have been defined, causing difficulties when looking at trends over time. The league table thus does not reflect the current health status and may therefore not be utilized fully for the planned purpose. However the tables still provides an indicator of how the country is performing, which areas that are doing well and which that are doing poorly. The league tables may therefore assist when planning interventions. Examples of league tables used in Uganda are presented in Table 4.2.

Table 4.2 - League tables from Uganda (Ministry of Health, undated, p. 42)

District	Total Score	Rank
KAMPALA	77.5	1
BUSHENYI	74.2	2
KABAROLE	73.1	3
MBARARA	70.3	4
GULU	69.0	5
BUTALEJA	68.0	6
LYANTONDE	67.7	7
BULIISA	67.0	8
JINJA	66.7	9
KATAKWI	66.4	10
ABIM	66.4	11
RUKUNGIRI	65.8	12
MUKONO	65.3	13
KABERAMAIDO	65.2	14
SIRONKO	65.1	15

District	Total Score	Rank
ADJUMANI	42.7	97
LWENGO	41.8	98
LUUKA	41.6	99
NAPAK	41.6	100
GOMBA	41.2	101
MOYO	40.7	102
KOLE	40.4	103
BUHWEJU	40.1	104
NAMAYINGO	39.7	105
KAABONG	37.0	106
SERERE	30.1	107
AMUDAT	23.2	108
NTOROKO	22.9	109
KWEEN	17.8	110
BULAMBULI	17.8	111

4.5.1.3 Afghanistan

A balanced scorecard (BSC) was implemented in Afghanistan in 2004, with a goal of improving the delivery of basic health services, the Basic Package of Health Services (BPHS), which prioritizes services to address the major disease burden in vulnerable population segments (Edward et al., 2007). The BSC was designed through a series of workshops and discussions with the Ministry of Public Health (MOPH), nongovernmental organizations (NGOs) and other partners active in the health sector such as health workers and managers (Peters et al., 2007). As a result of this process a shortlist of indicators was defined and upper and lower benchmarks were set to indicate levels achievable for Afghanistan (ibid.). The development of the league table was based upon a yearly sample of up to 25 randomly selected facilities from each province, and league tables were made to present both national and provincial level (ibid. Edward et al., 2007). The league tables for the provincial level were color-coded (green for top quintile, yellow for the middle half and red for bottom quintile) to make the league table easier to read and interpret for the users (Peters et al., 2007). An example of a national league table is presented in Table 4.3.

The BSC has been used at review meetings at the national level, where it has been a major part of discussions, and in meetings between provincial health director and the central government giving the province evidence to put pressure on the government in particular cases (ibid.). BSCs have thus helped stakeholders focus on specific areas for improvements and particular provinces, and provincial health directors to identify areas of weakness and establish performance targets (ibid.). They have further been a key factor in developing a learning organization with fostering

healthy competition and creating a culture of using evidence to determine factors of success or failure, leading to enhanced evidence-based decision-making (Edward et al., 2007). However, the BSC also has its limitations. Firstly, the BCS does not provide much information on health-service coverage, since these data are not yet available on a routine basis. Secondly, the BSC only measures functional health facilities, and therefore does not take into account places that are not yet functional (ibid.). Finally, the BSC does not provide explanations for differences in performance. It is thus important to consider that results may be affected by factors beyond the control of health managers such as security, preferences of the population, poverty, climate, access to roads and so on (ibid).

Table 4.3 - Balanced scorecard for health services in Afghanistan, 2004 (Peters et al., 2007, p. 148)

Indicator or benchmark	Measure	N	National media ^a	Bottom quintile ^b	Top quintile ^c
Domain A: patients and community					
1 Overall patient satisfaction	%	5 525	83.1	65.6	90.9
2 Patient perception-of-quality index	%	5 351	76.0	65.3	83.9
3 Written <i>shura-e-sehie</i> activities in community ^d	%	594	34.2	17.7	66.5
Domain B: staff					
4 Health-worker satisfaction index	%	1 307	63.5	54.8	67.9
5 Salary payments current	%	1 551	76.7	49.0	92.0
Domain C: capacity for service provision					
6 Equipment functionality index	%	540	65.7	59.0	74.1 ^e
7 Drug availability index	%	591	71.1	52.9	81.8
8 Family planning availability index	%	565	61.4	39.0	80.3
9 Laboratory functionality index (hospitals and CHCs)	%	294	18.3	3.8	31.7
10 Staffing index—meeting minimum staff guidelines	%	617	39.3	5.8	54.0
11 Provider knowledge score	%	1 127	53.5	41.6	62.3
12 Staff received training in last year	%	1 569	39.0	25.2	56.3
13 HMIS use index	%	582	67.7	46.3	80.7
14 Clinical guidelines index	%	480	34.8	22.3	51.0
15 Infrastructure index	%	585	55.0	47.8	63.2
16 Patient record index	%	5 574	65.6	54.4	92.5
17 Facilities having tuberculosis register	%	616	15.8	4.3	26.6
Domain D: service provision					
18 Patient history and physical examination index	%	2 714	70.6	54.2	83.5
19 Patient counselling index	%	2 602	29.6	22.5	48.9
20 Proper sharps disposal	%	611	62.2	34.0	85.0
21 New outpatient visit per month (BHC >750 visits)	%	245	22.2	0.0	57.1
22 Time spent with patient (>9 minutes)	%	5 580	18.0	2.4	31.2
23 BPHS facilities providing antenatal care	%	616	62.0	28.2	82.8
24 Delivery care according to BPHS	%	594	25.4	8.7	39.3
Domain E: financial systems					
25 Facilities with user fee guidelines	%	428	90.6	73.6	100
26 Facilities with exemptions for poor patients	%	417	84.7	64.0	100
Domain F: overall vision					
27 Females as % of new outpatients	%	475	55.2	46.0	59.7
28 Outpatient-visit concentration index	CI (-1 to 1)	5 234	-0.010	0.042	-0.055
29 Patient-satisfaction concentration index	CI (-1 to 1)	5 199	0.002	0.024	-0.018
Composite scores					
1 Percent of upper benchmarks achieved	%	33	17.2	6.9	30.8
2 Percent of lower benchmarks achieved	%	33	82.8	72.4	89.7

BHC, basic health centre; BPHS, basic package of health services; CHCs, comprehensive health centres; CI, concentration index; HMIS, health-management information system.

^a Score between bottom and top quintiles.

^b Score below bottom quintile.

^c Score above top quintile.

^d *Shura-e-sehie*, community health forums.

^e Benchmark set at 90%.

4.5.1.4 United Kingdom

While the previous articles present examples of good progress towards enhancing league tables or scorecards in the health sector, a study from the UK has a more critical approach and suggests an alternative tool to avoid resistance amongst the health service providers (Adab et al., 2002).

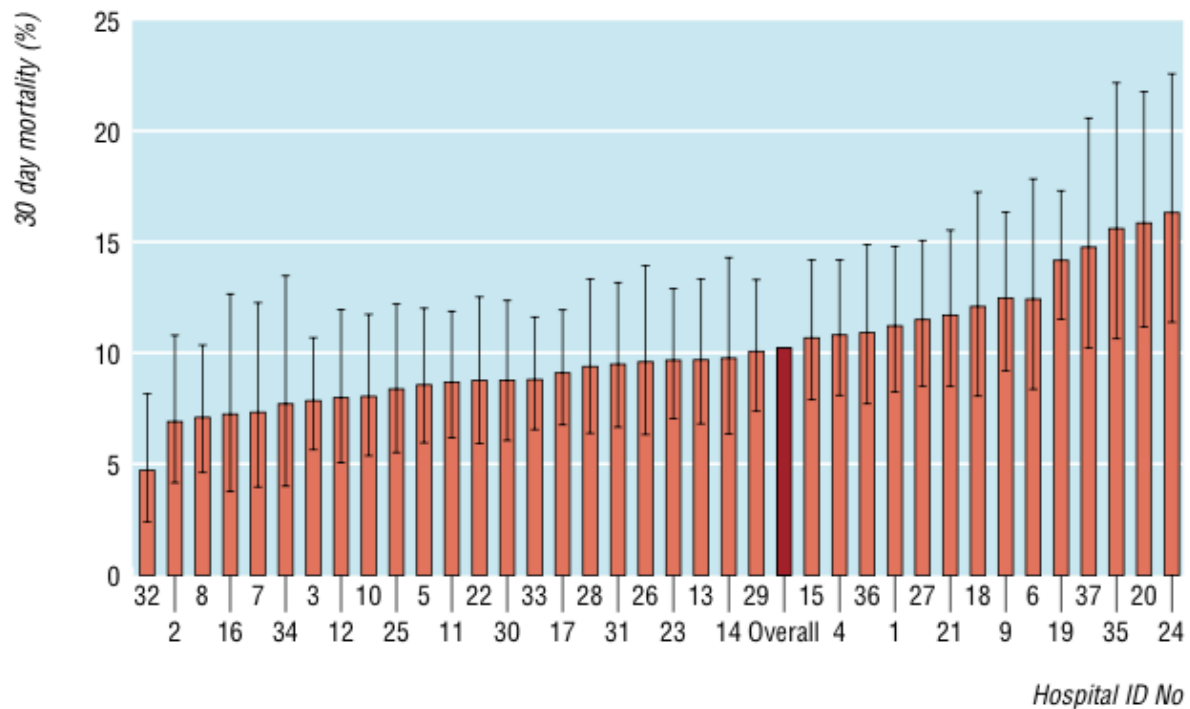


Figure 4.3 - League table for mortality (with 95% confidence interval) in hospital within 30 days of admission for patients admitted with myocardial infarction (patients aged 35-74 years admitted to the 37 very large acute hospitals in England during 1998-9) (Adab et al., 2002, p. 96).

The league table used as a basis for this study is a performance league table prepared by the National Health Service (NHS) (Figure 4.3).

League tables have been used to rank quality of services provided by competing organization, however in many cases the basis of the league tables have not been properly defined, causing comparison and ranking between similar services produced by different production systems (ibid). Even though the outcome of the service is similar, they suggest that evaluating the resources available is just as important as the outcome.

The main intention of publishing league tables is often to look for sources of large and unexplained variations in performance in order to make efforts of improvements. They therefore suggest that a publication showing monitoring or assessment of the units will have negative impact on the public trust and professional morale. Even though some publications show evidence that the quality of service has improved based on simulating competition, improvements might also be caused by “creative reporting” from parties knowing that they are

under observation or targets being met at the expense of other important objectives (*ibid*). Another issue that they mention is the selection of indicators, where the selection process is based on available and practical data, rather than what would be meaningful in each particular case.

The strongest argument in favour of league tables is that they are one of the few aids available to health system regulators for monitoring and ensuring the accountability of providers. Regulators can use league table rankings to identify clinicians or hospitals with a high frequency of selected adverse outcomes as a starting point for further inquiry. (Adab et al., 2002, p. 96-97)

Many dislike league tables because someone must be at the bottom of a league. League tables are also often difficult to comprehend e.g. the example presented in Figure 4.3 (*ibid.*). A solution to overcome these issues is therefore proposed in form of a “control chart” (Figure 4.4) with “control limits” representing the upper and lower limits of common cause variation. The control chart does not rank the providers; however it is still possible to identify the outliers.

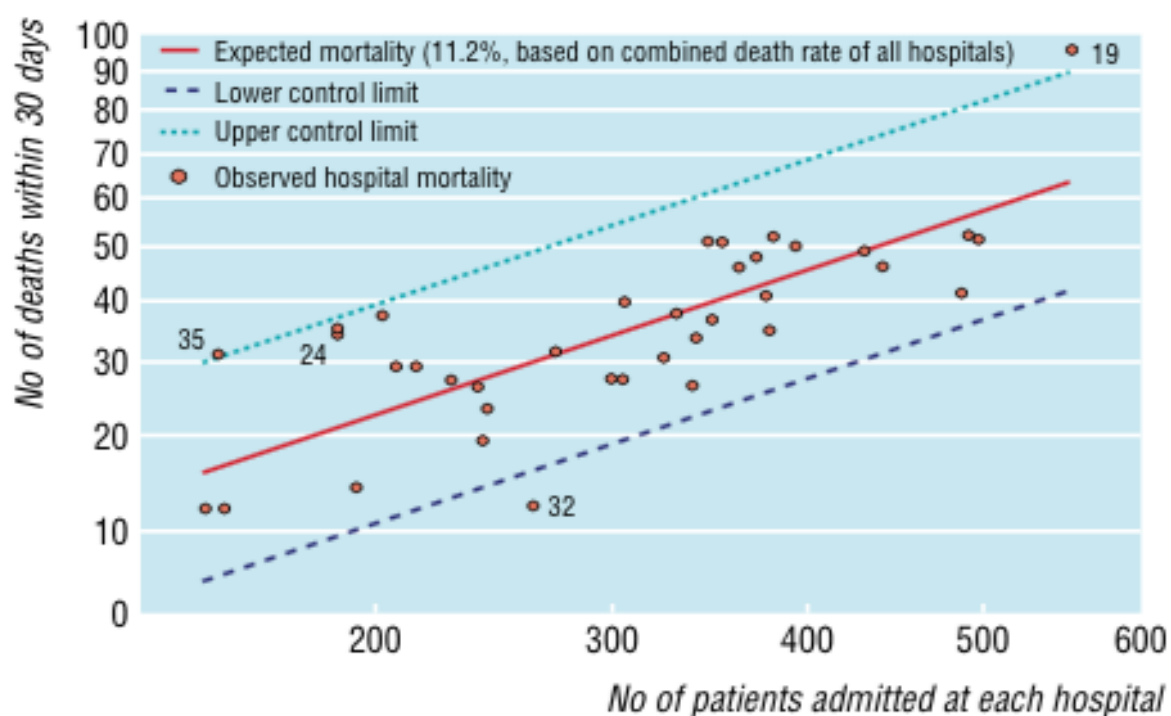


Figure 4.4 – Control chart for number of deaths in hospital within 30 days of admission for patients admitted with myocardial infarction (patients aged 35-74 years admitted to the 37 very large acute hospitals in England during 1998-1999 (Adab et al., 2002, p. 97).

4.5.1.5 *Indonesia*

Because of the Indian Ocean tsunami in December 2004 the local health care, in Aceh province, Indonesia, was often unavailable, since health workers were missing, and facilities destroyed (Chan et al., 2010). Further, clinics lacked health promotion activities, stock of supplies, and health workers were newly trained, isolated, and unsupervised. In order to provide the DHOs and the Ministry of Health with information of this setting a balanced scorecard was developed as a tool to document quality issues for each clinic. Because Aceh did not have a database at that time, information was generated through onsite surveys.

The scorecard was presented with each clinic in a column and each measure in a row, and the measures were highlighted according to their status towards the target (green as met target, yellow as partially met target and red as below target), an example of a scorecard is presented in Table 4.4. As a result, of implementing the league tables several aspects of health services were improved, such as clinic staff receiving training, health programmes being revitalized, the inventory of drugs being actively managed and communication between management, staff, and accommodation center residents being improved.

Table 4.4 - Balanced scorecard measuring health services to displaced persons in Aceh, Indonesia, August 2007 (ibid. p. 710)

Measures	Alpen	Seulamat	Seumeur	Leuhan	Suak Raya	Langkak	Cot Mee
Staff							
Job satisfaction	4	3	4	4	4	3	3
Weeks since last pay	3	3	3	3	3	16	16
Months since training	1	1	1	1	1	1	1
Months since supervision	1	1	1	1	1	0	0
DHO supervisory visit	no	no	no	no	no	no	no
Disposal of used needles	fair	poor	poor	poor	fair	fair	poor
Needle reuse	excellent	excellent	excellent	excellent	excellent	excellent	excellent
Thermometer skills	excellent	excellent	excellent	excellent	excellent	fair	fair
Sterilization skills	fair	fair	fair	fair	fair	fair	fair
Health facilities							
Running water	yes	no	yes	no	yes	yes	no
Overall facility	fair	fair	excellent	fair	excellent	fair	poor
Waste disposal	poor	poor	excellent	poor	poor	poor	poor
Equipment (%)	65	61	61	61	65	61	48
Supplies (%)	83	94	94	94	88	76	94
Drugs (%)	73	48	58	91	58	54	64
Community							
Satisfaction (%)	100	100	100	100	100	25	67
Knowledge (%)	83	75	57	100	60	0	33
Outreach (%)	58	100	57	83	60	63	100
Active kaders (n)	9	.	7	10	5	5	3
Service Provision							
Hours of operation	no	yes	yes	no	no	no	yes
Child health (1-9)	7	.	4	7	6	6	.
Antenatal care (1-9)	4	.	4	4	4	4	.
Postpartum care (1-9)	0	.	.	7	.	6	.
PPH clinic (1-9)	6	.	7	6	5	4	.
PPH barracks (1-9)	6	.	7	6	5	4	.

Met target
 Partially met target
 Below target

DHO, district health office; Kaders, community health workers; PPH, postpartum haemorrhage preparation.

^a Missing data were represented with "."

^b Hours of operation per week.

4.5.2 Comparison of the presented scorecards and league tables

Because the scorecards and league tables have been developed for different purposes the focus areas are different. For instance, the league table from the United Kingdom is focused on one indicator, the one used in Sierra Leone provides a few, and the remaining scorecards provide several. This might be because the league table from Sierra Leone is used at district level, while the others are mainly used at national level. The example from Indonesia and Afghanistan (at provincial level) also included color-coding in order to make the scorecard easier to interpret.

When looking at the findings provided, it is evident that the current situation of the HMIS in the country plays an important role. In a country where the HMIS is more mature, the league table or scorecard, provides greater data quality. However, despite the data quality, most cases show positive results based on the implementation of league tables or scorecards, all except from the findings presented in the section about the UK, which presents a few critical observations worth noting.

5 Prototyping

The purpose of this chapter is to introduce the background for developing league tables in Malawi, as well as the methodological approach within the development. The development has been done in two main phases, one prior to the fieldwork in Malawi and one throughout the fieldwork.

5.1 Phase I

As one of the primary goals in the field studies was to investigate if league tables would be a suitable feedback mechanism within Malawi HIS, the goal within this phase was to develop a prototype in order to explain the concept during the field studies in Malawi.

During the initial discussions, as mentioned in section 3.2.3, the focus was on exploring various solutions and possibilities. Within this phase we were both scorecards and league tables were looked at, in the matter of having ranked tables or not, since prior implementation had met resistance from districts ranking at the bottom. Secondly, we looked into the methodological approach, because that was the main reason for discontinuing the league tables in the earlier effort. We therefore proposed that a second attempt would have to include the health workers to a greater degree. The methodological process would therefore have to be bottom-up, rather than top-down.

Because African Leaders Malaria Alliance (ALMA) were in the process of developing and implementing Reproductive, Maternal, Newborn and Child Health (RMNCH) Scorecards in Malawi we initiated a discussion with some of the participants within the project to gain further insight and look at the possibilities for a collaboration. The discussions revealed that ALMA was mainly focusing on developing RMNCH Scorecards customized for the national level with a great deal of details, such as high number of indicators. An example of RMNCH Scorecards made for Malawi is presented in Table 5.1 and an excerpt in Table 5.2. Additionally, ALMA had developed a specific platform for managing the scorecards. Since Malawi were currently using DHIS2 for reporting data the process of a collaboration would have to include transferring the collected data to ALMA's platform for developing scorecards. Utilizing the external platform would also include trainings the Malawi health workers in using the platform, which would be an additional cost. The initial goal was to implement league tables for lower levels with a smaller

number of indicators that would be easy accessible for the health workers within the Malawi HIS and reasonably cheap to implement, a collaboration with ALMA would not suit this purpose.

Table 5.1 - Malawi RMNCH Scorecard, January-June 2013 (ALMA, undated, p. 19)

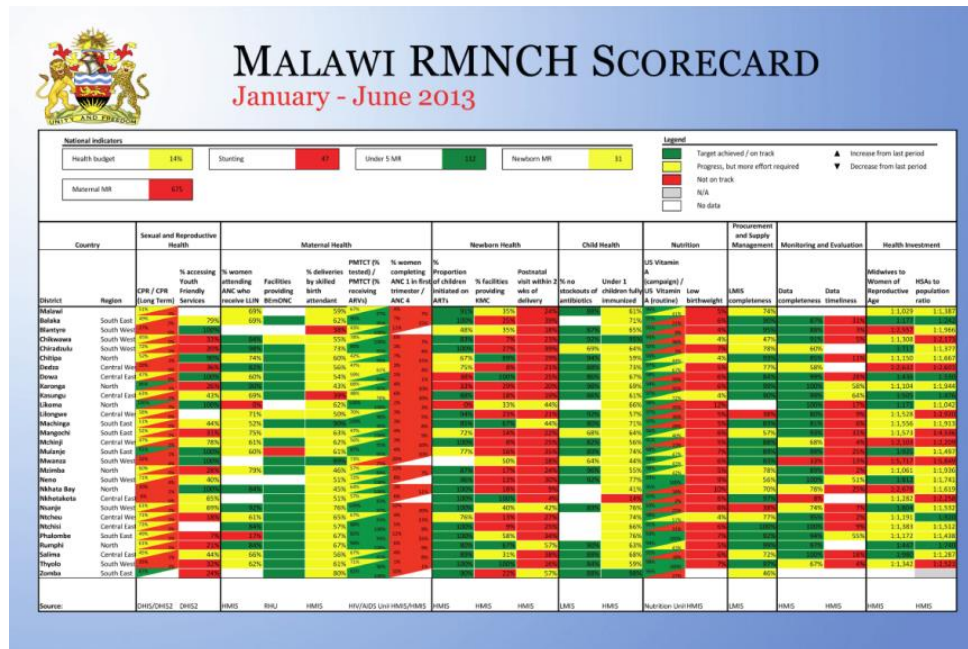


Table 5.2 - Excerpt from Malawi RMNCH Scorecard, January-June 2013 (ALMA, undated, p. 19)

Maternal Health					Newborn Health		
% women attending ANC who receive LLIN	Facilities providing BEMONC	% deliveries by skilled birth attendant	PMTCT (% tested) / PMTCT (% receiving ARVs)	% women completing ANC 1 in first trimester / ANC 4	% Proportion of children initiated on ARTs	% facilities providing KMC	Postnatal visit within 2 wks of delivery
69%		59%	67%	4%	91%	35%	24%
69%		62%	90%	7%	100%	25%	39%
		38%	43%	11%	48%	35%	18%
84%		55%	78%	6%	83%	7%	23%
98%		73%	90%	3%	100%	27%	39%
74%		60%	42%	7%	67%	89%	19%
82%		56%	47%	3%	75%	8%	21%
60%		54%	59%	1%	38%	100%	25%
90%		43%	68%	4%	33%	29%	20%
69%		39%	48%	6%	88%	18%	19%
0%		62%	100%	2%	0%	33%	44%
71%		50%	70%	3%	94%	23%	21%
52%		90%	100%	3%	85%	67%	44%
75%		63%	47%	4%	72%	14%	22%
61%		62%	56%	3%	100%	8%	25%
60%		61%	87%	4%	77%	16%	35%
		89%	73%	20%		50%	18%
79%		46%	57%	10%	87%	17%	24%
		51%	72%	8%	96%	13%	30%
84%		45%	64%	3%	100%	18%	9%
		51%	57%	6%	100%	100%	4%

We therefore did further research investigating other implementations of scorecards and league tables, presented in section 4.5.1, in order to decide how to approach the feedback mechanism should be developed. Based on successful implementations of league tables in Sierra Leone and promising results in the remaining implementations, the choice fell on developing a ranked league table. It was further decided that the prototype should be developed within the DHIS2 in order to make it easily accessible for health workers in Malawi. It should also be simple to alter and utilize in the health workers' daily routines. Additionally, the data needed would already be available in DHIS2. Using DHIS2 was also done in order to ensure that the league table would be presented as simply as possible, so that the users we met during the field study would easily understand the concept and would be comfortable discussing the content and potential improvements during the data gathering process.

5.1.1 Early sketch of the table

During the early phase a low-fidelity prototype in form of a sketch (Figure 5.1) was developed in order to determine the number of functionalities that should be included in prototype to be used during the field study in Malawi.

	Indicator 1	Indicator 2	Total Score
OrgUnit 1	51	45	48
OrgUnit 2	84	55	69.5
OrgUnit 3	21	80	50.5
OrgUnit 4	43	12	27.5

Figure 5.1 - Early sketch of the League Table

The main categories presented in the sketch are *organizational units* (orgunits), such as zones, districts, or facilities, and various *health indicators*. Around the league table possible functionalities and factors affecting the methodological approach are presented:

1. There should be a *predefined number of indicators* and a defined selection process in order to ensure that the league table would be easy to understand and read, and to make sure that the indicators included maintains a certain standard.
2. The table should be *sorted*, by a total score, in order to make it easy to get an overview of the results.
3. The indicators should be *weighted* either equal or according to the importance of each particular indicator to make sure that the total score shows a fair result.
4. The table should be *ranked* according to the total score so that it is easy to see who the best-ranked orgunits are, and who are doing poorly.
5. The table should be *color-coded* according to pre-set values to increase the readability of the table, making it easier to detect high, average, and low values.
6. Each orgunit should have *individual targets* for each indicator over a period in time, so that orgunits with lacking infrastructure or resources are given an equal opportunity to score high as the orgunits with well-developed infrastructure and stable resources.
7. The league table should make it possible to *drill down* in order to see the underlying orgunits, for example the districts within a zone, and their indicator values within that same table to see how each of the underlying orgunits are affecting the total score of each indicator value making it easier to get a complete picture of the situation.

5.1.2 League table 1.0

Alongside the brainstorming and development of the primary sketch, it was decided that the league table were to be developed within the DHIS2, as mentioned earlier.

5.1.2.1 Use of DHIS2

The strength of the DHIS2 with regard to this purpose is that all the data collected from the facilities will be stored within the central database. The DHIS2 is also set up to calculate indicators based upon a *numerator* data element originating in various facilities measuring core health services, such as mother and child health, antenatal care, immunization etc., and a *denominator* data element from the national census measuring population data across the various population groups. Together these give a calculated indicator or coverage rate. If we for example look at the indicator *Antenatal care during first trimester* the numerator this indicator would be *Antenatal first visit in first trimester* and the denominator *Expected pregnancies* in Malawi. Figure 5.2 shows how an indicator is developed in DHIS2.

Edit indicator

Details

Name *	Antenatal care during first trimester
Short name *	ANC visit 1st trimester
Code	
Description	
Annualized	Yes ▼
Decimals in data output	[Default] ▼
Indicator Type *	Percentage ▼
Legend set	[Please select] ▼
URL	
	<input type="button" value="Edit numerator"/> <input type="button" value="Edit denominator"/>
	<input type="button" value="Save"/> <input type="button" value="Cancel"/>

Figure 5.2 – Developing an indicator in DHIS2

Since all information needed to create a league table were already present within the DHIS2, the national HMIS was a natural choice as our data source and development context. Additionally, managers and health workers at national, zonal and district level are given credentials to access the DHIS2 online, as it has been deployed as a web-based application. One downside with using the DHIS2 is that it was not developed with league tables in mind, which results in some constraints to the development.

Moving from the early sketches and a low-fidelity prototype, to a functional high-fidelity prototype developed within the DHIS2, included some adjustments to the number of functionalities to be included. However, for the first high-fidelity prototype, the goal was to make a league table that was simple to understand and manage, and easily available to its users. The DHIS2 was suited to serve this purpose. The requirements that were addressed at this stage were making a *customized league table*, and making it possible for the users to *choose or create indicators* and a *customized total score*. The users should also be able to *rank orgunits based on the total score*, *share league tables with other users* and *create favourites* by saving the league tables within the software.

After defining the league table according to the possibilities within the DHIS2, some additional issues were discovered, which had to be addressed before the league table could be considered operational. First, many of the indicators within the Malawi DHIS2 had been defined incorrectly. The solution to this was to go through all the indicators that were to be used (described in the following section), look up the definitions, and correct any errors. Second, population figures for the facilities were missing, meaning that they had not been entered into the DHIS2 along with the population data at national, zone and district level. Since population data is an essential part of creating indicators, creating league tables for the facility level was excluded at this stage. The population data for the district level was mostly correct; however, the population data for Mzimba was not divided according to the two districts; Mzimba North and Mzimba South. The first prototype was therefore developed to show the zone level, with an additional plan to investigate the issue of the population data during the field study in Malawi. Finally, because creating indicators usually happens at the national level, the users at the remaining levels are not given access to alter or define the new indicators. They are therefore not be able to make customized indicators, nor create a total score if they decide to make their own league table. In the early phase, we would therefore have to provide assistance in doing so for users without access, in order to enable them to take part in the process of choosing and defining indicators and creating a league table tailored to their needs.

5.1.2.2 Selecting indicators

When choosing indicators the main focus was on key public health programmes and services given at most facilities (antenatal care, deliveries, immunization etc.). The indicators were also selected in coordination with the MDGs, making sure that the indicators selected are given high priority both globally as well as at the community level. In addition, the chosen indicators should both benefit specialists and users at facility and community levels. The indicators would therefore have to be specified based on common services that health workers provide, e.g. not all facilities provide the same services, in order to make the feedback relevant. This would then make it possible for the health workers to act on their results, for example improve if they are doing poorly. A constraint at this point was data availability, since Malawi is still in a process of improving the data quality, making sure that reports are handed in on time and that they are complete and correct. Because we were focusing on including health workers as future users in the process of choosing the number and content of the indicators the number of indicators in our first prototype was kept to a minimum.

The indicators chosen were: *Measles coverage rate*, the estimated population under 1 year that has received the 1st measles dose at 9 months; *delivery by skilled health personnel*, how many of the expected deliveries that are done with assistance of skilled health personnel and *antenatal care during first trimester*, the number of expected pregnant woman that go to their first ANC visit within the first trimester. In addition to the three indicators, a total score was defined as an average of the three mentioned indicators to be used for ranking the facilities. The first version of the league table to be presented during the fieldwork in Malawi is displayed in Table 5.3.

Table 5.3 - League Table 1.0 ranking Health zones in Malawi

	Measles coverage rate †	Deliveries by skilled health personnel †	Antenatal care during first trimester †	League table total score †
Central East Zone	41.9	33.7	5.4	27
South West Zone	39.3	30.5	5	24.9
South East Zone	55	43	7	35.4
North Zone	78.8	66.1	13.4	52.8
Central West Zone	48.4	40	4.5	31
Central Hospital				

5.2 Phase II

Alongside the data gathering several prototypes were developed based on the participants' feedback. This was done in order to ensure a bottom-up development process by involving users in each iteration based on the lifecycle process mentioned in section 3.2.1. Chapter 6 – Empirical findings provides a summary of all findings throughout the whole field study in Malawi. In this section, the findings concerning trainings, population data and league tables will be broken down, according to prototypes, showing each stage of the development process.

5.2.1 League table 2.0

After about one week of data collection in Malawi, the second version of the league table was developed. The reason for developing further prototypes was to enable the users to take part in the development process. Even though one goal was to provide users with knowledge towards creating their own league tables, the prototyping was seen as a phase of establishing one basis league table, so users with less computer experience could use this as a basis when creating customized league tables for their level. At this stage, the league table had been shown to health workers in order for them to provide feedback on the first solution, in addition to some HMIS-officers who had also been given brief training on how to use the league table and customize it on their own. The data gathering revealed that users wanted the possibility to make league tables showing districts, and to include their own indicators.

As a result, the second version of the league table included the districts as orgunits. Further, two indicators were added; *OPD utilization rate*, the outpatient department attendance⁴ in relation to the total population and *neonatal death rate*, the number of neonatal deaths compared to the total number of newborns. An example of the second version of the league table is displayed in Table 5.4. The league table total score for Dedza-DHO is very high, this is most likely due to either the population data or the health specific data elements for the indicators not being entered correctly, prompting an error in the software giving such values. Another issue here is the low reporting rates of the neonatal death rate, making the indicator blank in most districts due to the fact that such cases are rare. This indicator might therefore only be useful at higher levels such as zone.

Table 5.4 - League Table 2.0 ranking districts in Malawi

	Measles coverage rate ↕	Deliveries by skilled health personnel ↕	Antenatal care during first trimester ↕	OPD utilization rate ↕	Neonatal death rate ↕	League table total score ↕
Dedza-DHO						922 337 203 685 477 600
Likoma-DHO	61.1	84.1	7.1	439		147.8
Mwanza-DHO	93.4	112.9	12.3	213.6		108
Machinga-DHO	96.2	126	18	103.5		85.9
Neno-DHO	71.5	56.8	10.6	191.1		82.5
Nkhokhota-DHO	75.7	52.8	6.6	182.9		79.5
Rumphi-DHO	64.8	68.7	11.3	167.1		78
Salima-DHO	77.7	69.6	11.2	151.3		77.5
Ntchisi-DHO	67.3	67.1	15.8	158.4		77.1
Nsanje-DHO	82.6	73.3	9.8	140.3	9.6	76.5
Karonga-DHO	69.6	56.2	6.1	153.1		71.2
Nkhata-Bay-DHO	45	48.7	4.6	174.4		68.2
Phalombe-DHO	92.4	63.6	18.3	96.6		67.7
Mzimba-North-DHO	77.2	52.1	13.1	127.9		67.6
Balaka-DHO	71.4	68.7	8.6	115.1		66
Mulanje-DHO	76.3	59.4	8.6	117.7		65.5
Chiradzuku-DHO	76.6	56.8	11.8	115.9	128.2	65.3
Zomba-DHO	66.7	54.9	8.9	125.3		63.9
Ntcheu-DHO	69.8	69.3	6.2	105.6		62.7
Mzimba-South-DHO	75.2	60.1	12.4	99.7		61.9
Mangochi-DHO	82.1	61.6	7.4	91.4		60.6
Chikwawa-DHO	79	54	5.2	98.1		59.1
Chitipa-DHO	60.2	58	7.6	98.7		56.1
Kasungu-DHO	61.3	48.6	6.6	107.9		56.1
Thyolo-DHO	63.1	49.1	5.6	97.2		53.8
Dowa-DHO	62.1	46.6	8.5	92.8		52.5
Mchinji-DHO	59.4	63.3	4.8	82.1	0	52.4
Lilongwe-DHO	62.5	50.1	5.8	78	4.6	49.1
Blantyre-DHO	59.5	28.5	7.4	95.4		47.7

⁴ Patients' not needing hospitalization, as oppose to *inpatient*.

5.2.2 League table 3.0

The third version of the league table was developed shortly after the second. As mentioned there were no population figures for the facilities within the DHIS2 when development of the league tables started. It was therefore not possible to create league tables at the facility levels. However, since we were able to obtain the population figures during the field studies, and had been given permission to enter these into the DHIS2, this was done during this process. When entering the data we discovered some differences in growth rates and the rates indicating each group within the population, e.g. under-fives, various districts. Due to time constraints chose the most common growth rate and reported the problem to the MoH. Next, each value had to be entered into the DHIS2. There were nine values for each facility and approximately 400 values for each district, which soon proved to be a time consuming task. We therefore chose only to enter the population figures for two the districts that we were visiting during the next phase. An example of the third version of the league table is displayed in Table 5.5. As in the previous prototype, we see that the neonatal death rate has very low reporting rates at facility level.

Table 5.5 - League Table 3.0 ranking facilities in Lilongwe district (including an excerpt of the facilities)

	Measles coverage rate †	Deliveries by skilled health personnel †	Antenatal care during first trimester †	OPD utilization rate †	Neonatal death rate †	League table total score †
Bwaila Hospital	82.8	154.8	6.9	139.3		90.9
Chadza Health Centre	42.7	6.1	2.3	60.5		27.9
Chikowa Health Centre (Lilongwe)	77.5	9.6	1.9	22.9		28
Chileka Health Centre (Lilongwe)	84.8	51.9	6.7	99.9		53.3
Chilobwe Majiga Health Centre	91.4	0	103.9	273.5		117.2
Chimbalanga Health Centre	66.5	29.1	2.4	38.3	0	34.1
Chitedze Health Centre	72.5	45.4	4.4	78.6		50.2
Chiunjiza Health Centre	74.1	23.2	5.1	57.7		40
Chiwamba Health Centre	30.1	21.4	3.4	37.8		23.2
Chiwe Health Centre	101.1	0	0	30.9		33
Daeyang Luke Hospital	61.6	74.4	6.6	88.6		52.8
Diamphwe Health Centre	97.7	57.7	7.3	155.4		79.5
Dickson Health Centre	92.1	42.2	8.8	65.1		52.1
Dzenza Health Centre	100.6	11.1	1.9	73.1	0	46.7
Kabudula Rural Hospital	86.2	194.8	10.2	159.8	15.6	112.7
Kachale Health Centre	73.1	59.2	30.7	105.3		67.1
Kang'oma Health Centre	109.2	44.4	4.7	167.4		81.4
Kawale Urban Health Centre	27.8	6.7	3.5	41.6		19.9
Khongoni Health Centre	54.8	28.8	3.3	58.7		36.4
Likuni Hospital	89.4	80.4	5.2	59.4		58.6
Lumbadzi Health Centre	62.3	39.9	7.7	166		69
Malembo Health Centre (Lilongwe)	70.5	34.8	5.5	107.4		54.6
Malingunde Health Centre	76.2	30.2	5.3	20.2		33
Maluwa Health Centre	36.3	1.7	0.42	90.1		32.1
Matapila Health Centre	54	59	8	122.7		60.9
Mbavvi Health Centre	75.5	46	7.8	72.5		50.5
Mbang'ombe 1 Health Centre	92.9	86.1	14.8	133.7		81.8
Mbang'ombe 2 Health Centre	60.4	25.3	3.2	45.5	0	33.6
Mbwatalika Health Centre	62.4	21.9	5.5	55.7	0	36.3
Mo Quire Wellness Health Centre	67.7	0	0	213.3		70.3
Ming'Ongo Health Centre	63.6	78.8	6	80.5		57.2
Mitundu Rural Hospital	39	66.8	3.6	42.3		37.9
Miale Hospital	82.8	43.3	2.7	207.2		84
Menthera Health Centre	67.9	45.6	5	77.8		49
Nambuma Health Centre	90.2	254.6	22.3	111.9		119.7
Nathenje Health Centre	40.3	28.7	3.7	49.5		30.6
Ndaula Health Centre	74.4	25.6	1.8	51.8		38.4

5.2.3 League table 4.0

The fourth version of the league table was developed after the three training sessions. Based on a suggestion of including color-coding to make it easier to get an overview and to separate the good results from the poor, this was implemented in the fourth version. Because we were not able to have a discussion of where the thresholds for the color-coding should be set, the thresholds used in the ALMA Scorecards were used, where the values below 40 are red, the values from 40-79 are yellow and the values from 80 are green. As oppose to the previous league tables presented, this league table is developed using Excel, since DHIS2 does not support color-coding. The process of making the league table in Excel is however not very challenging since DHIS2 provides an opportunity to export a league table created within the system, and the effort done in Excel was only to add colors. An example of the fourth version of the league table is displayed in Table 5.6.

Table 5.6 - League Table 4.0 ranking facilities in Lilongwe district

Organisation unit	Measles coverage rate	Deliveries by SHP	ANC visit 1st trimester	OPD utilization rate	Neonatal death rate	Total score
St Gabriels Hospital	51	346,7	18,8	549,8	0	193,26
Chilobwe Majiga Health Centre	51,9	0	30	214,7		59,32
Mc Quire Wellness Health Centre	55,6	0	0	179,7		47,06
Area 25 Urban Health Centre	80,7	80,9	17,1	172,5		70,24
Kang'Oma Health Centre	84,1	27,9	3,4	139,5		50,98
Diamphwe Health Centre	84,8	45,1	6,6	130,1		53,32
Kabudula Rural Hospital	63	143	7,7	124,2	15,6	70,7
Miale Hospital	50,6	28,7	2	131,5		42,56
Bwaila Hospital	21,7	101,9	4,7	107,1		47,08
Matapila Health Centre	46,8	48,5	7,2	104,5		41,4
Mbang'ombe 1 Health Centre	67,9	67,6	11,1	97,3		48,78
Lumbadzi Health Centre	47,7	29,2	5,8	88,6		34,26

6 Empirical findings

The purpose of this chapter is to introduce the research findings based on the themes identified in the thematic analysis presented in Chapter 3 – Research approach. While running the interviews and group discussions it became clear that to understand the context fully the underlying practical issues such as infrastructure, funding, and partners etc. would have to be addressed. This became clear when listening to one District Health Officer's (DHO) complaints about the DHIS2:

DHIS2 it still has its own tipping problems I should say as a new project that has just been introduced... we used to have some challenges in the past with internet and stuff like that, and the system is not all that perfect so that the utilization of this feedback from the DHIS2 is not there yet. We are not putting it much into practice... - DHO

As we see from the example, none of the issues mentioned are directly connected to the DHIS2, however this misunderstanding was quite common amongst the users of DHIS2 in Malawi.

The chapter will therefore start by introducing the context and the general issues such as infrastructure; internet connectivity and electricity, and funding and partners. Further on the themes more directly connected to the research question will be introduced; data flow, access and usage of DHIS2, data quality, analysis and use of data, feedback and feedback mechanisms, ranked feedback, and at last league tables.

6.1 Status of HMIS

6.1.1 Infrastructure

As mentioned in the background chapter the infrastructure plays an important role in having a functioning HMIS. The main infrastructural factors are information and communications technologies (ICT), power and roads. Since it would be hard to measure to what extent the road structure is satisfying I have chosen to exclude assumptions based on that, however Figure 6.1 provides an example of how roads with poor infrastructure could be.



Figure 6.1 – Example of poor road infrastructure

The internet connectivity varies a lot from district to district, where the most common solutions are wireless, cable, dongles⁵ or more than one of these. A common factor for all districts is that internet connectivity is according to available resources, meaning that most preferred monthly payments instead of yearly and that ISC is often given low priority when competing needs arise. One of the interviewees mentioned that *“The main concern [within the HMIS] is the Internet problem (...) the problem is that we have an outstanding ticket, due to financial concerns, so they disconnected Internet some time back, so in terms of Internet we just use dongles which are not quite reliable.”* Due to financial issues, many districts are unable to maintain the internet connectivity, and they are therefore dependent upon funding from donors. This issue leaves many districts in a challenging position when it comes to reporting on time, as well as users practicing their skills on DHIS2.

The electricity within the clinics and offices is varying, and very few have backup systems for data or power. Because of this, many of the clinics that are currently using the National Health System (NHS)⁶ have continued using their old registers in addition to the NHS, which has then resulted in a doubled workload. This also leads to having to check both registers when compiling reports and in case of errors. When it comes to district and zone offices the power outages affect their ability to do their work and conduct trainings, and it has on several occasions forced them to change venue or time for meetings, trainings or their normal day-to-day tasks.

Another part of the infrastructure that is lacking in some areas is hardware. One HMIS-officer mentioned that: *“Because we don’t have many computers data entry is usually done in this office...currently we have two computers, so it’s working, but now we have a challenge that it is not enough, and when the time comes*

⁵ A dongle is a Mobile Broadband for connecting a single device to the internet.

⁶ The NHS is a standalone health system for routine data, alternative to paper forms, developed by Luke International Norway (LIN) and Baobab Health Trust (BHT).

for data entry people queue to wait for data entry.” Although this is important for the efficiency of reporting, it does not necessarily affect the ability to report.

6.1.2 Funding and partners

The public health services in Malawi are free of charge, both the consultations and the medicine. Because of this, the public clinics are dependent upon receiving funding from partners and donors, in addition to the resources granted by the MoH. Although many partners are actively involved with the HMIS and provide funding, they often have very specific targets, causing difficulties for the recipients if there are more pressing issues to address. During the interviews health workers also mentioned that they have been forced to pay their own traveling expenses, airtime and/or phone bill in order to complete their work tasks, without being refunded as promised, leaving them in a difficult position.

6.1.3 Data flow

The data flow is organized in four steps from a patient visit to when the data is available within the DHIS2, Figure 6.2.

- 1) Data is usually gathered in the patient’s “health passport” and in the register⁷ at the facility.
- 2) A monthly report is compiled at facility level.
- 3) The report is delivered to the District Health Office (DHO) either by a health worker at the clinic, riders for health⁸, an ambulance, mobile phone or by a zonal or district officer collecting it.
- 4) The aggregated data is entered into the DHIS2 at the DHO.

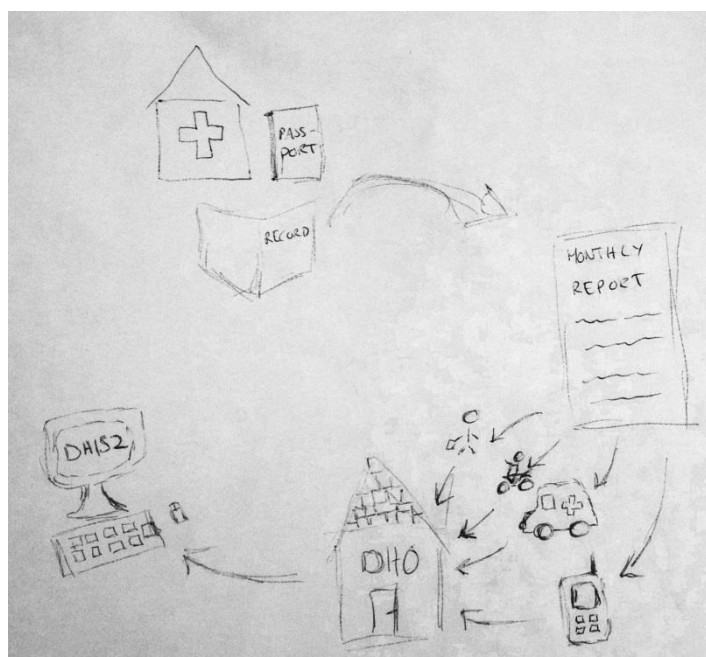


Figure 6.2 – Data flow within the HIS in Malawi

In addition to these common steps some also mention that they do a data quality check before passing on the monthly report.

⁷ Register book or the NHS.

⁸ Riders for Health is a charity raising money for motorcycle transportation for health workers in Africa.

6.1.4 Access and usage of the DHIS2

The DHIS2 is a work tool that should be used frequently by the HMIS personnel and the programme coordinators for entering and retrieving data. When interviewing the health workers and administrative staff it became evident that this is not the case, and that there are three main issues causing this; having credentials and access to the system, computer illiteracy and having received training in how to use the system.

The MoH is responsible for managing credentials for all users. Because of some lacking communication between the users and the MoH, many of the users end up not having credentials or being unaware that credentials have been made for them. As a result many users are unable to access the system. A suggestion of improvement was made by a HMIS-officer asking if it would be possible to decentralize the distribution of credentials. Others mentioned that centralization is good for security reasons and that the wait is therefore inevitable.

To continue on the issue of not having credentials, the users without credentials are dependent upon users with credentials being available to help them when needed. The help needed may be entering data, or pulling out data or reports. In many cases both at district and zone level few have credentials, and the workload is therefore heavy on the users with credentials.

Another issue is that many of the programme coordinators are asked to enter data in addition to their health-related work: *“...we encountered a little bit of problems because these coordinators have their own duties to do, some of there are nurses, clinicians, environmental health officers so after a bit of struggle (...) our setup is like there is a coordinator (...) then he or she has a clerk to assist in data collection and data entry to the system...”* Most districts with this issue or with people with computer illiteracy therefore had additional staff helping out with the reporting of data; however this is an extra cost for the districts and zones.

Due to the fact that a high number of health workers that are supposed to utilize the DHIS2 are computer illiterate, thorough trainings are crucial. In some districts, the management is able to detect these issues and have resources to resolve them: *“They have trained the programme coordinators, but will now do a second round since they have detected low use of the system. It would have been very good to have an online training program because it is very expensive to train new users and they are changed frequently.”* While in other zones and districts, trainings have been close to none-existing. Because the cost of training new users is high, it was suggested that online training could be introduced as an attempt of reducing it.

The lack of trainings has resulted in few users being able to utilize the DHIS2 as an efficient work tool. An example of this is that many users were unaware that they were able to look at and

compare their data with data from other districts. This was a result of them trying to pull out data from the data entry point, where they only have access to their own data, instead of from the section called reports, where they have access to view data from the whole country. Another example is that very few create graphs within the system, instead they pull out the data and create the graphs in Excel. There is also evidence that many users that have been trained spend little time practicing their skills afterwards, and therefore forget what they have been taught shortly after. An example of this is that a HMIS-officer mentioned that he knew how to use the DHIS2, however when we asked him to perform a task he hesitated while trying to complete it.

Regarding training, I held two trainings on DHIS2 and attended one held by a Malawian instructor as a part of the fieldwork. During the trainings, I was responsible for I was focused on involving the participants, giving them assignments, and making sure that they were all coping with the pace we were moving in. I spent little time talking about each of the functions that we were looking at, but more time letting the participants explore the functionality with my guidance. The Malawian instructor was focusing more on the general functionality of the software and spent more time explaining the background of each function, and therefore spent less time with practical assignments and the daily use of the system. The training held by the Malawian instructor was started one day and discontinued due to a power outage, and when the training resumed the next day he had to start at the beginning again since the participants did not remember what they had learnt the previous day.

Throughout the trainings the participants were eager to learn, and based on that few of them had much knowledge on how to use DHIS2 beforehand they had many discoveries of new functionalities such as being able to create reports, graphs and tables. Additionally, the participants seemed to understand how to approach the assignments given after being introduced to the various aspects of the system, and became more independent in exploring the system towards the end of the trainings. Most of the participants during the trainings were novices in using DHIS2. It was thus evident that additional functionalities, within the DHIS2 pivot app used for creating league tables, confused the participants when trying to find the functionalities they needed. Participants' were also confused by the menu being grey, and some of them were unaware that they were constantly pressing the wrong buttons, and were therefore unable to find the content they were looking for. The menu in the pivot table app shows more than 35 options, where the participants were to use three or four, an excerpt of the menu is presented in Figure 6.3.

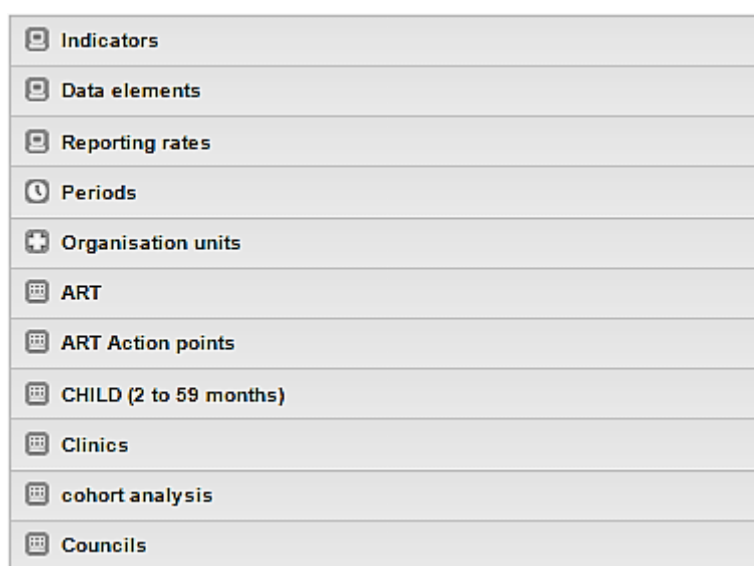


Figure 6.3 – Menu inside pivot application in DHIS2

6.1.5 Data quality

Several of the interviewees mentioned that data quality is a large problem due to reports not being delivered on time, incomplete reports or reports including errors. As a reason it was mentioned that some of the people responsible for reporting did not appreciate the importance of the data collection and their performance may therefore have been accordingly; collecting data incorrectly or inaccurately, collecting the data but losing the document, or collecting the data but not submitting it in time. It was also mentioned that some health workers feel that their work is taken for granted because they do not receive any feedback on the data they have collected and submitted.

The district that were struggling to get all the reports in time mentioned that they had been discussing the possibility of using mobile phones for reporting; they were however concerned that introducing mobile phones would increase the number of errors and again lead to incomplete reports.

Additionally, some of the people asked mentioned that they did data quality assessments before sending the data to the DHO. An example of this from a DHO is:

Every first week of the month they need to sit down and go through the data sheets that they have collected and they can start analysing their data at the health facility using the dash board and they can see how they are progressing with the programmes and when they say that the data is ok they send it to the district.

Another issue revealed was that most of the districts use both the NSO population projections and headcounts when calculating indicators and analyzing the data from the clinics within their catchment area. The NSO projections are mostly used for national indicators, while the headcount is used for local once.

Many of the users complained that the population data was not in the DHIS2 and that they were not able to calculate indicators below district level within the system. To solve the problem the users pulled out the data, added it in Excel and calculated their own indicators; however this was a very time consuming task.

The MoH was approached with the question of why the population figures were not in the DHIS2 and they provided two answers. The first was that there had not been done a data quality analysis of the received population data, and the reliability of the information was therefore questioned. Secondly to enter these data into the DHIS2 is a time consuming, and it was therefore queued behind other more urgent matters. Since we were looking at developing league tables for the facility level we were given permission to enter the population figures that they had for the facility level into the DHIS2.

6.1.6 Analysis and use of data

When data is entered into the DHIS2 users with credentials and adequate training can create reports, pivot tables, graphs etc. within the system. Another alternative is to download the data from the DHIS2, enter them into Excel, and create tables and graphs from there or export the data from DHIS2 to an Excel format. As mentioned earlier many of the users preferred Excel because they were unable to calculate indicators within the system due to the missing population figures. The users mentioned that they primarily use data for four purposes: monitoring, ordering of medicines and other equipment, in review meetings and during evidence-based decision-making.

Monitoring purposes includes monitoring the facilities and making sure that they are performing on target. Ordering supplies is simply making sure that the orders are according to their prior use. Within review meetings, the data was used to create presentations using graphs or tables. Evidence-based decision-making includes evaluating the situation as it is, and when planning further improvements and interventions to address challenges.

In one particular district the HMIS-officer had noticed that the programme coordinators were not using DHIS2 as much as he would have liked them to. He therefore made some simple graphs using the DHIS2 and posted them on several corkboards for them to see, Figure 6.4. His

explanation of making these graphs was: “I wanted to allow the interest of the coordinators for DHIS2 (...) sometimes the coordinators give much emphasis to the parallel database instead of the DHIS2 (...) so I wanted for them to see on their own what is there for people to see outside there, so it might allow some interest in there.” Although he had not gotten much feedback on the graphs at that moment due to changes in programme coordinators, he was very hopeful that it would increase the interest of using of data from the DHIS2.



Figure 6.4 – Graphs made within DHIS2.

6.1.7 Feedback and feedback mechanisms

When discussing the issue of feedback we got a variety of answers. Firstly there were large gaps between the answers given when talking about feedback provided by one level and the next level down e.g. district to facility level. This gap was varying throughout the interviews, but a common factor was that that the districts and zones mentioned that they were providing more feedback than the facility mentioned receiving. In Table 6.1 I have therefore only included feedback each of the levels mentioned that they were receiving and feedback they would like to receive. It then excludes any feedback that a higher level mentioned providing if that lower level did not confirm receiving it. Within the table, *feedback wanted* is the feedback the level would like to receive, and *feedback received* is the feedback they currently receive.

Table 6.1 – Feedback received and feedback wanted

	Feedback received	Feedback wanted
Facility and lower levels	<ul style="list-style-type: none"> - Zonal review meetings - District review meetings (monthly) - When errors - When missing data - When planning interventions at lower levels - Validation and quality assurance - Supervision by DHO or Zonal office (immediate and written feedback) 	<ul style="list-style-type: none"> - Ranked feedback - On their performance e.g. monthly - On their progress towards goals - Review meetings - Errors - Comparative analysis between facilities - Feedback when the district has received their reports
District Level	<ul style="list-style-type: none"> - Phone call reminders - Annual bulletin - Errors in data - Joint Annual Swap Review - Programme specific zonal monitoring and review meetings - Supervision by zone or MOH 	<ul style="list-style-type: none"> - Frequent feedback - Reminders and updates as SMS' on their mobile phones - Monthly or quarterly bulletin - Zonal reviews - Comparative analysis both for zones and districts - Performance and potential problems - Review meetings (zonal and national)
Zone level	<ul style="list-style-type: none"> - Supervisions - Review meetings - Reports 	<ul style="list-style-type: none"> - Bulletins (have been given out earlier) - Reports from supervisions

The table shows that all levels mention being invited to or attending review meetings regularly, however, in addition to these answers many mentioned that the meetings are not being held regularly due to lacking funds. I therefore assume that some of the answers given were based on a best-case scenario, and not on their current situation.

Another common factor was that all levels wanted more feedback. For the zone and district level the majority of the participants mentioned that had previously received bulletins. They also mentioned that if the release of bulletins were resumed, their need for feedback would be covered through that, in addition to having frequent review meetings. For the lower levels the emphasis was on resuming the review meetings in addition to receiving ranked feedback in order to compare themselves with their peers. Due to lacking resources having regular review meetings has been proved difficult. A solution to this was proposed by a HMIS-officer mentioning that instead of doing a review meeting including participants from all facilities within the district they

have started to do cluster review meetings including participants from only parts of the facilities each time as a more cost efficient approach:

We do HMIS cluster review meetings where, we have clustered our facilities into zones...at first we used to call them, for example the in charge, maybe the coordinators and maybe the HMIS focal person from the health centres, but now because of financial [problems]... we do cluster reviews.

During the data gathering it was evident that feedback mechanisms such as graphs and tables were well appreciated amongst the health workers at all levels. At facility level many of the health workers mentioned that donors working in their area had provided them with graphs. Others had made hand drawn graphs because they were interested to look at trends over time. Most of the graphs presented at facility level were only showing data from one particular facility, and the health workers were therefore eager to receive a comparison analysis from e.g. all facilities within their district. One in charge at a facility said, *“We should know where we are doing better and where we are lacking behind...If we know which are our strength and which are our weakness we know where to start again.”* At district and zone level the graphs and tables were usually showing comparison analysis looking at trends across their health area. Some examples of the graphs and tables we saw are shown in Figure 6.5.



Figure 6.5 - Examples of graphs and tables from districts and facilities

6.1.8 Ranked feedback and league tables

When discussing ranked feedback many participants mentioned that they had either been using feedback mechanisms similar to league tables or that they were interested in implementing some. As the theme, league tables, was usually brought up by the interviewees based on conversations about feedback mechanisms it was reasonable to assume that there was a general interest in the concept. During these discussions both positive and negative aspects were mentioned. Some meant that it would be challenging for low ranked units, especially if they were lacking resources in order to improve their situation, while others meant that ranking would cause competitiveness amongst the groups and would then be a factor towards improvement. One zone officer said: *“We have been discussing how best to do it because we find it to be good and it also encourages the district. When the districts that are seen to be performing and you appraise them in front of their peers, they feel good and are encouraged to do even more.”*

One zone had been using league tables and other ranked feedback mechanisms since the discontinuance of the earlier attempt at implementing league tables. The zonal officer mentioned that those that were doing well appreciated the feedback. When the officer was asked about the ranked units feedback on the method the officer said *“They were more defensive I would say, because we don’t have resources...but they really accepted to see that it was their data.”*

Several of the participants mentioned that league tables would be a good tool for getting an overview and for providing feedback as the results come, and also for comparison between zones, districts and facilities. They therefore suggested that separate league tables should be made presenting districts and facilities, in addition to the one presenting zones. It was also mentioned that having it within DHIS2 would be practical since they already have their data within the system. Some mention that they would like to pick their own indicators to suit their needs, while others were talking about having a national standard to make sure that the indicators picked were not picked by for example a district to make themselves look good. Choosing own indicators was usually brought up as a theme prior to our presentation of the prototype, and the participants were therefore unaware of which indicators we had chosen to include before they mentioned indicators they would like to include. The indicators they wanted to include were: ANC during first trimester or ANC coverage, deliveries by skilled health personnel, fully immunized or measles coverage, OPD attendance, maternal or antenatal deaths, family planning coverage, QRH for TB and HIV.

During the trainings the health workers were able to do some hands on work with the prototype and were therefore able to discuss the prototype more thoroughly. The participants mentioned

that the table was a bit hard to read and get an overview of, and it was also hard to separate the good from the poor results. They therefore suggested that color-coding should be included in the table. The reason for suggesting this was that many had seen similar tables with color-coding, and they were also familiar with doing this in Microsoft Excel. Another result of the trainings was that when the participants were creating league tables for their area discussions commenced based on the results displayed in the tables, e.g. participants discussed why some values were abnormally high or low, and how they could solve these issues.

While discussing the league tables a group of participants mentioned that they had been presented with a similar solution earlier, a scorecard from the ALMA-association. However when using these they had only been given a brief introduction and therefore thought that the scorecard was meant as a tool for ALMA to gather data, and not a tool to assist them on a regular basis. They therefore filled it out only that one time.

6.2 Findings after returning to Norway

6.2.1 Population data

While looking into further development of the league tables DHIS2 was accessed to look if there had been any evidence of usage of the league tables, e.g. if any users had saved a new league table in the favorites. There was no such evidence, and the process therefore went on to look if everything was working, as it should. As a part of this process, it was discovered that there was no population data at either zone, district or facility level within the DHIS2. Because it was then 2015 the MoH will need to manually update all the new population figures, and this had not been done, making it impossible to create league tables for any of the mentioned levels.

6.2.2 League table

A follow up round was also conducted, by email, to see if any of the participants in the study had started using league tables in DHIS2. During this round, only one Zonal officer that had attended one of the training sessions replied. The officer mentioned that they had started creating league tables; however they were using Excel instead of DHIS2. The officer also mentioned that they had used Excel because of lack in knowledge of using DHIS2 for this purpose. In addition to using some of the indicators that had been proposed through our solution, they had added several more, some that were not available in DHIS2. The league table that the officer sent is shown in Table 6.2.

Table 6.2 – League table created by a Zone in Malawi

		Total score	District		District		District		District	
			%	score	%	score	%	score	%	score
1	% ANC in 1 st trimester	5								
2	% HIV+ mothers on ART	5								
3	% pregnant mothers rcvd full FANC pkg	8								
4	Timely reporting MDs to Zone by DHO	5								
5	Timely auditing of MDs	5								
6	% Audited Neonatal deaths	8								
7	% Delivery by skilled health personnel	6								
8	BEmONC facilities fully functional	5								
9	OPD utilisation rate	5								
10	% Measles 1 st dose at 9 months	5								
11	% under ones fully immunized	5								
12	% ¼ry blood mobilization campaigns	5								
13	HMIS submission	5								
14	Timeliness of HMIS submission	5								
15	Submission of DHSI2 reports	5								
16	Timeliness of DHSI2 submission	8								
17	% HF supervised by DHMTs	5								
18	% ¼ry DHMT comparable supervision reports compiled	5								
	Total Scores	100								
	%									

7 Discussion

Within this chapter, findings and literature presented will be discussed in light of the research questions. The research questions are structured with one overarching question and three secondary questions, presented below. The three secondary questions will be discussed in this section and answered, along with the overarching question, in the conclusion.

1. *How can league tables be developed to support routine health management in Malawi?*
 - a. *What are the enabling and constraining conditions for developing and introducing ranked league tables in the Malawi health sector?*
 - b. *How can such league tables be developed to be relevant for different users?*
 - c. *How can transparency and accountability be promoted through such league tables?*

7.1 Enabling and constraining conditions for developing and introducing ranked league tables

Table 7.1 - Summary of enabling and constraining conditions

Enabling	Constraining
HMIS-routines	Infrastructure
HMIS-software, DHIS2	Resources
Existing practices	Access to DHIS2
Wish for more comparative feedback	Training
	HMIS-routines
	HMIS-software, DHIS2
	Time constraints

7.1.1 Infrastructure and resources

In section 2.2 the condition of the general infrastructure related to the HMIS such as ICT and power is presented, pointing out two issues greatly concerning HMIS; high prices for ICT services and frequent power outages (Foster & Shkaratan, 2011). The field studies revealed that both zones and districts were struggling with reporting on time and completing their daily work tasks due to these failures. Firstly, some lacked an internet connection, for monetary reasons, others had stable internet connection but were unable to utilize it continuously because of an unstable power supply. Furthermore, it was revealed that unstable power supplies were causing a doubled workload for facilities using the NHS, since they were reporting data both in the system

and in paper based registers. Another issue concerning the infrastructure was a lack of hardware, such as computers in district offices. Altogether, except from unstable power supplies, these issues were a result of lacking economic resources.

The process of developing and utilizing league tables presented within this thesis is based on having a working HMIS-software, such as DHIS2, where the DHIS2 is dependent upon a stable internet connection, power supply and sufficient equipment, such as computers. Since these factors are crucial in this process, but compromised in reality, they support the fact that context plays a key role in a development and implementation process.

7.1.2 Access to and training in the use of DHIS2

The Malawi HMIS is not only a technical system, but also reliant upon routines and communication between different people and across different levels. The field studies revealed that many of the people that are supposed to utilize DHIS2 in their daily work tasks did not have access to the system or sufficient training in how to use it. Having credentials and receiving training in the use of DHIS2 are crucial factors in order for data to be reported, analyzed and used for evidence based decision-making, as well as for creating league tables. Because there is no defined protocol on how to request access, users without credentials are dependent on users with credentials to access the system. As one of the primary goals of having a HMIS is to improve evidence-based decision-making, all key users should be able to utilize the DHIS2 for this purpose.

Furthermore, while some users, at least at the district level, had received training in the use of DHIS2 it is also relevant to discuss the sufficiency of the training received. Users that had received training were struggling when asked to complete basic tasks, such as creating a table with specific properties. As observed during a training session held by a Malawian instructor, the focus was on explaining the functionalities in detail, with little practical assignments. During two days of training it was revealed that the users did not remember what they had learnt from the previous day, leaving the trainer to start from the beginning the next day. Although I only attended one training session with these circumstances, I believe that trainings with more time for practical assignments would be better suited for this user group. This assumption is based on my experiences from the trainings I held, where the focus was on letting the participants explore the system by solving assignments. During these sessions, the participants were more active in asking questions when I was walking around the room looking at their work, than when the other instructor was asking for questions from his teaching position. Practical assignments are also typically “best-practice,” for IT-learning (Cook et al., 2010; Bjørge et al., 2015). I believe a

contributing factor during the trainings I held was that the participants were able to work at their own pace, instead of rushing through all the functionalities within the software. In addition to having sufficient trainings, it is also necessary for the users to practice their skills regularly. It was evident that few users did this, and they therefore had to spend time familiarizing themselves with the software each time they were to use it.

Cook et al. (2010) and Bjørge et al. (2015) support the hypothesis that *practical work* and *repetition* will enhance learning. As described in section 4.4.4., Bjørge et al. (2015) used these two, and seven additional conditions when developing an eLearning application for DHIS2. The eLearning application is also developed for areas with low internet connectivity, and is deployed within DHIS2, making it easily accessible and utilizable free of charge. Because Malawi has constrained resources this eLearning application is especially well suited for their use, and it could improve the skills of many users within this context.

Through enhanced eLearning, users will most likely become more confident in the use of DHIS2, and utilize it more efficiently in their work. Since many of the current users of DHIS2 choose to export data to Excel in order to make graphs and tables there, increased knowledge of the functionalities available within DHIS2 might also increase their motivation to use other functionalities within the system, instead of simply using it as a database.

7.1.3 HMIS

In order for league tables to be efficiently utilized in Malawi, they are dependent on the collection of relevant data, indicators being defined correctly, and an increase in data quality. An enabling factor in this case is that both HMIS-routines, such as collecting data, and a HMIS-software, DHIS2, to store the data, are present in Malawi. Although the field studies revealed several issues related to this, we were still able to develop a league table within the current conditions, though with poor data quality. The DHIS2 also provided an easy approach to creating league tables, which was also easily accessible for the users to test and discuss.

The HMIS-routines and DHIS2 can be seen as both enabling and constraining factors. Although the HMIS-routines are theoretically present in Malawi, evidence of errors, duplication of indicators, missing population data, and poor data quality, suggest that the HMIS is not utilized as a work tool to support management. This is firstly based on the assumption that the data collected might not be seen as relevant to support health workers in the tasks they perform (Lippeveld et al., 2000). Secondly, if the system was used efficiently, such errors would most likely have been discovered and resolved. An example of this is that while searching through the

database to find indicators to be presented in the league table, several core indicators were found to be incorrectly defined, e.g. a missing a population related denominator. Furthermore, this could also be a result of users not being aware of the possibility of having population data to calculate indicators, because it has never been present at their level, and they might thus not have reported this as a problem.

One major disadvantage with using DHIS2 to develop the three first prototypes, described in Chapter 5 – Prototyping, was the constraints it put on the development process. Firstly, because the software is already built, the input from users could only be implemented if the functionality was supported by existing feature, which excludes color codes for instance. The fourth version of the league table, which included colors, was therefore developed using Excel. Secondly, as the league tables were developed within the pivot table application, the only way to add a total score showing the average based on the prior indicators was to create a new indicator. This means that for each specific league table a new total score indicator would have to be specified, rather than relying on a generic formula. Creating an indicator in DHIS2 is a difficult process for users without knowledge of this feature. Figure 7.1 displays the numerator for one league table. To the right a user may choose the data elements to be included, and further calculate the indicator to the left.

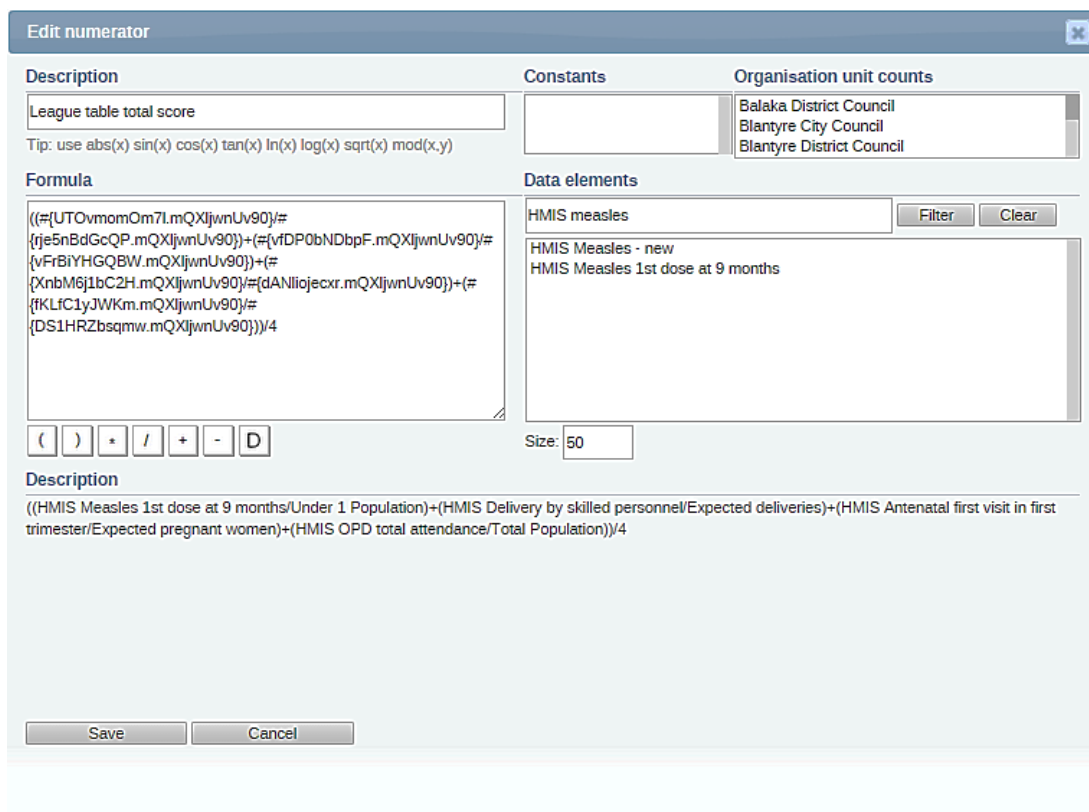


Figure 7.1 – Editing a numerator in DHIS2

Because the total score is calculated based on an average of the list of indicators, the whole indicator is calculated within the numerator to make it easier to understand the calculation, and the denominator field only includes the number one, however this could also be set to the total number of indicators, in this case four. The numerator field thus includes both numerators and denominators for each specific indicator, making the calculation:

$$\frac{((\text{HMIS Measles 1st dose at 9 months}/\text{Under 1 Population})+(\text{HMIS Delivery by skilled personnel}/\text{Expected deliveries})+(\text{HMIS Antenatal first visit in first trimester}/\text{Expected pregnant women})+(\text{HMIS OPD total attendance}/\text{Total Population}))/4}$$

1

As we were not familiar with the calculation of such indicators prior to this research, the first attempt at creating a total score was compromised due to miscalculations, the error was later corrected. The formula also makes it difficult to develop specific calculation based on individual thresholds, such as if a district would like to weight each indicator individually within the total score, instead of giving a flat average. Thirdly, some participants struggled when completing assignments, and found the system challenging to use. Because many of the end users have received little training, the users will be dependent upon a system that is intuitive and easy to comprehend. As this approach is based on an existing system, this has been a factor out of the scope of this project. These three issues suggest that the DHIS2 is to some extent insufficient for developing league tables at this moment.

7.1.4 Fit in current management practices

It was evident during the field study that many of the health workers, such as programme coordinators, did not enter the data they were responsible for into the DHIS2 due to time constraints. It is therefore reasonable to assume that adding league tables to their work assignments would be a burden. A fit in the current management practices therefore needs to be motivated through replacing or easing an already existing work task.

As presented in section 6.1.8 league tables are currently used within some units as a feedback mechanism, however these are mostly developed for higher levels using Excel. League tables in DHIS2 could therefore ease this task, since the process of developing these league tables is very simple when the process of doing so is understood. Further, section 6.1.7 describes that many users wanted more feedback than what is currently provided. For the zone and district level, the users would like monthly or quarterly bulletins including tables and graphs with comparative analyses. The district level would like to receive feedback that is more frequent. The facility level mentioned that they would like to receive ranked feedback, feedback on a monthly basis and

feedback showing their progress towards goals. They were also looking to receive comparative analysis of facilities. All these functionalities, except for feedback showing progress towards goals, are supported by the current prototype of the league table. Because the league table is developed within the DHIS2, zones and districts may also access the system and create league tables frequently, or look at league tables created by other users, such as at a higher level.

7.2 Creating relevant league tables for different user groups

7.2.1 Participatory design (PD)

This thesis is based upon a bottom-up approach, developing league tables through PD. As bottom-up processes are driven merely by participants' motivation, ensuring interest and positive attitudes is crucial for the development process to move forward.

During the interviews and trainings, the participants were eager to take part in the development process and to be a part of choosing and creating indicators, discussing how the league tables should be presented. Participants also started to discuss the results presented in the league tables they had created during trainings, and ways of resolving these issues, which shows that they were unaware of the current results and were interested in improving them. This indicates that league tables could be useful for zones and districts for getting an overview of the status of the districts and facilities within their area.

Using PD as an approach proved to be useful for letting the participants take part in the development process, and forming the league table to suit their needs. However, since few of the participants were familiar with DHIS2, the process was constrained by the fact that they did not know the possibilities it provided. On the other hand, the users had good insight in which indicators that would be useful to include. Because many of the users that we met during the field studies were interested in using league tables, the users asked to take part were glad to contribute.

7.2.2 Bootstrapping

During the fieldwork, we saw several cases of local initiative, independent of central governance. Although these cases could not directly be defined as bootstrapping, they could pose as a first phase in such a process, and therefore be a factor enabling a bootstrapping process of implementing league tables.

The first example was that one zone had been using league tables ever since the discontinuance, based on their own initiative (section 6.1.8). The league tables made were well appreciated among the receiving districts, and the zone was eager to learn more about league tables to improve their

current implementation. It was also mentioned that although some recipients had been defensive when receiving the league tables, they still accepted that it was their data. A second example was one district which had started to do HMIS cluster review meetings, because they were unable to hold reviews including participants from the whole district, due to lack of funding (section 5.1.7). Another example was an initiative from a HMIS-officer, with a focus of increasing the use of DHIS2, where he created graphs within the system and posted them on corkboards for programme coordinators and the public to see (section 5.1.6). All the examples presented show that there is a great interest in providing feedback to lower levels, and increasing the use of DHIS2. They also show that there is initiative among the workers at zonal and district level, toward improving the HMIS through bootstrapping.

Although the fieldwork revealed great interest in utilizing league tables, enabling bootstrapping of the specific league tables within DHIS2 would also be dependent on the users understanding the concept of league tables fully and being able to develop them themselves. After returning to Norway, emails were sent to the users that were trained during the fieldwork in Malawi, to follow up on their progress in developing own league tables. One zone officer answered by sending an example of a league table they had developed (section 6.2.2) It was very positive to see that the zone had developed a league table, and one could say that this is an example of bootstrapping in progress. However, since one of the objectives of the study was to enable users to develop league tables within DHIS2 to increase the efficiency of their work, this study does not determine if the knowledge given to the participants at trainings was sufficient for this purpose. The examples given above still show that great initiative to improve HMIS routines is present. It could therefore be possible to develop and implement league tables through bootstrapping, given minimal input and with some adjustments to the DHIS2 to better support league tables.

7.2.3 Bottom-up development process

The former implementation of league tables in 2006 was based on a top-down approach, leading to questions being raised based on the methodological approach, and resistance from users being ranked at the bottom (Moyo et al., 2015). Within this thesis the development process started top-down with creating a preliminary prototype in collaboration with the HMIS manager from the Malawi MoH. However, since the core development process was done in Malawi through participatory design, the main focus was on a bottom-up approach. During the field studies the project met little resistance, thus leading to users being engaged in the process of strengthening the HIS through the utilization of league tables. Although league tables have not been implemented in Malawi as a result of this thesis, the process has revealed that users taking an

active part in the development process has been fruitful. The approach within this thesis met little resistance, although it is not possible to state whether the positive feedback was a result of enabling a bottom-up approach or not, the fieldwork suggests that users were interested in utilizing league tables in their feedback routines and eager to contribute.

Since many of the participants involved in the development process were unfamiliar with DHIS2, presenting a prototype was important in order to establish a basis for the discussions around this concept. The prototype was not used to lead the users' answers, but rather to give them something to relate the ideas to. An example of this was that users wanted districts and facilities to be presented in the league tables, on the basis of the league table that only presented zones. Further I believe that the simple prototype led to the participants being engaged in discussing and criticizing the solution, and thus feeling that they were taking part in the development process by being given new prototypes including their suggestions.

Due to many issues being revealed during the development process such as poor infrastructure, data quality, feedback routines, and lack in training, one might also argue that in order for league tables to fill its purpose a top-down strengthening process of the HIS would also be necessary. However as these issues are closely connected to the work done at the grass root level it could also be argued that these issues could be resolved by a combined top-down-bottom-up approach. The top-down process could then focus on resolving issues such as poor infrastructure and strengthening the lower levels through training, while the lower levels, and the bottom-up process could be focused on addressing issues such as data quality.

7.2.4 Generativity

Generativity is described as a concept to engage users of the league tables in further development of solutions that are useful to them. As mentioned in section 4.2.2 Zittrain (2008) describes five principle factors to consider; *leverage*, *adaptability*, *ease of mastery*, *accessibility*, and *transferability*. As the league tables are present within the DHIS2, both of these components, the league tables and DHIS2, will be discussed in order to determine the systems generativity.

The field study revealed that many of the users of DHIS2 were unfamiliar with the various functionalities within the system. A broader understanding of this would therefore promote the system's capacity of *leverage*, meaning that difficult jobs would be made easier (Zittrain, 2008). An example of this was that many users exported data to Excel in order to make graphs and tables instead of making these within DHIS2. If they were aware of the possibility of doing this within DHIS2, this task would most likely take less time. Furthermore, league tables would also ease the

task of providing feedback, as described in section 7.1.4. With knowledge of DHIS2, health workers would be able to develop league tables within a few minutes. After the league tables are developed, DHO's may present them to facilities during their monthly visits, ensuring feedback through a simple mechanism. The facility manager's task of making decisions would also be eased, since the league tables are based on actual real time data, instead of general assumptions.

DHIS2 is under continuous development, and in times when new needs occur, changes can be made in a quick manner. In section 4.3, an example of this is described, where users were astounded by the rapidly deployed versions of DHIS being available to them (Braa & Sahay, 2013). DHIS2 also supports a high number of indicators and users from various levels, the league tables could therefore be *adapted* to a range of tasks, such as creating simple league tables for lower levels, or more detailed league tables for higher levels. The league tables could also be built on or modified to broaden its range of uses through creating league tables for specific purposes, as well as monitoring change over time. New indicators may also be created within DHIS2 in order to support these changes, e.g. if a district would like to monitor one particular data element.

Ease of mastery and *transferability* depend on the same factors, computer literacy, and prior knowledge of the DHIS2. Among the people that use DHIS2 as a work tool, there were both people that were confident in the use of computers, and others who were computer illiterate. The ones that were confident in the use of computers were able to master DHIS2 and create league tables, while the people with less computer experience were struggling. The ease of mastery and transferability of DHIS2 is therefore dependent upon the prior knowledge of how to use computers, and likewise using league and creating tables is dependent upon prior knowledge of how to use DHIS2. The size of the group that will be able to master these and/or transfer the knowledge without training, will be constrained to users with prior knowledge of computers or DHIS2. Mastering league tables is also dependent upon deeper understanding of some features within DHIS2, such as how indicators are defined, how to weight the specific indicators and how to create a total score, mentioned in section 7.1.3. In addition, specific knowledge such as understanding which indicators are useful at each level in the health system is important. Many of the people that use DHIS2 directly are statisticians or managers, and they are not always familiar with health specific terms. Since DHIS2 does not provide any assistance toward understanding the objective of relevant indicators, this is a constraining factor, in the process of mastering league tables, transferring this knowledge, and adapting league tables further.

DHIS2 is in itself easily *accessible* because it is an open source software available for download on a public website. Within a specific country, users need credentials, in order to access the software.

Currently the MoH is responsible for creating credentials in Malawi; the process of receiving credentials inconsistent, due an unclear protocol for requesting access, as is the accessibility. Since league tables are present within DHIS2 users with access to DHIS2 would also be able to access the league tables.

DHIS2 and league tables are generative in many aspects. However, because many of the health workers utilizing DHIS2 are computer illiterate, the generativity is diminished in some aspects. Further, the degree of mastery, transfer of knowledge and adaptability of league tables is constrained by factors such as deeper knowledge of DHIS2 and health specific subjects, leaving the generativity dependent upon previous knowledge.

7.2.5 Relevance for users at all levels

The field studies revealed that feedback routines were an issue. As described in section 7.1.4 there were large gaps between the groups in answers given. Higher levels mentioned giving more feedback than the lower levels mentioned receiving. Many participants also mentioned being invited to or attending review meetings. However, as review meetings were revealed not to having been held regularly due to lack of funding, these answers were not considered as probable. Among most participants, it was also evident that feedback mechanisms such as graphs and tables were well appreciated, where the lower levels made these by hand and the higher levels made these within DHIS2 or Excel. A refrain at all levels was that they would like to receive more feedback, and were especially interested in receiving feedback in form of comparative analysis.

League tables could be utilized as a standalone feedback mechanism delivered to facilities each month. Since some DHOs' visit all facilities within their districts regularly, for monitoring and data gathering purposes, it would not take much effort to also supply league tables, except for the effort required to print out the tables beforehand. If facilities had received league tables each month along with a short summary of how they are performing and where they need to improve, the facilities would gain better insight into their own data, and would also be able to compare themselves with their peers. League tables could also be used to provide feedback to district and zonal level within bulletins, as mentioned in section 7.1.4.

Because league tables are based on indicators being available, the quality of the league tables would be varying. The denominator of an indicator is a population related data element, and since these are not available in DHIS2 for all levels (section 6.1.5; section 6.2.1), creating league tables, especially for lower levels, would be difficult. Some indicators are also not relevant at

lower levels, because they occur rarely or only some facilities provide the specific services, such indicators will only be relevant to analyze at higher levels, such as the zone and national levels.

As described in section 4.4.5 feedback should be provided frequently, but not too frequent (Lam et al., 2011; Lurie & Swaminathan, 2009). Feedback should also be systematic, timely, include both the giving and reviving party, and include both positive and negative factors (Freeman, 1985). If league tables were provided as a frequent feedback mechanism, e.g. on a monthly basis, health workers would most likely adapt to the frequency and it would thus promoting work efficiency. Developing league tables frequently would also ensure that the information provided would be current. In addition, the feedback would most likely become systematic after some time, because units will develop similar league tables for subunits within their area each month. Furthermore, as the results for each facility will vary, league tables could include an explanation of the results, in order to maintain both positive and negative feedback, to motivate change when poor results occur and maintain good progress during phases where facilities are performing well. Because the factors mentioned towards how feedback should be provided, are extracted from other studies, it is not possible to state if these factors would ensure good feedback within this context.

For all levels, having review meetings is an important forum for peers to be updated on their status compared to others, and for discussing issues. Review meetings should therefore be held in addition to implementing league tables, when funding is available. Within these review meetings, league tables could be used as a basis for discussions and learning where peers share their experiences. An alternative to having review meetings for the entire district could be having cluster reviews with smaller groups of facilities, districts or zones, as described in section 7.1.7. As these reviews will include less participants, the resources demanded for each review would decrease, and the reviews could be held on an alternating basis. One key difference between receiving feedback within the unit and receiving feedback at a review meeting is that in the latter case peers are present to see their peers be appraised for their good work.

As described in section 7.2.4 league tables may be adapted to support various needs. For managers at district and zone levels they may be used to gain an overview of the units within their area. League tables could also be formed to address specific health programmes to track progress over time. The core of league tables is that although they may be used for specific purposes as the ones mentioned above, they are also flexible and may be altered to support needs, such as different indicators, and individual weighting and targets.

7.3 Promoting transparency and accountability through league tables

The starting point for developing league tables was in many ways the previous discontinued league table implementation, which had met resistance (Moyo et al., 2015). The research team therefore set out with an expectation of meeting resistance during the fieldwork. Although some mentioned negative factors, such as low ranking units being demotivated since they would not have the resources to improve their lacking results, the general impression was that most participants were interested in implementing league tables. Positive factors mentioned were that league tables would provide comparative analysis, as well as transparency and accountability, which could improve both data quality and the health workers motivation to do their assignments. In this sense both zones and districts were eager to provide more feedback to their subordinates in order to increase accountability, and facilities sought transparency in order to compare themselves with their peers and improve their work.

Because some health workers felt that their work was taken for granted because of lacking feedback on the data they had collected and submitted (section 7.1.5), the relationship between the lower and the higher levels had in some cases become constrained. By enhancing transparency by providing the facilities with feedback and accountability through ranking, the feedback to users would increase awareness of current results as well as increase accountability for the result presented. If additional feedback describing how the situation could be improved, with focus on good and poor indicators, the relationship between these parties would most likely be improved.

League tables promote transparency through openly presenting data and by comparing units. They further promote accountability by ranking units, and by higher levels indicating objectives through weighting the total score. An example of this is if a district chooses to weight *Measles coverage rate* higher than other indicators, to signal that facilities are being held accountable based on this particular service.

7.4 Reflection upon the research conducted

7.4.1 The research team

For a research team with several agendas, is important to stay objective when conducting the interviews in order to avoid influencing the participant's answers, however this might not always have been the case within this empirical study. Although the representative from the MoH was a part of our research team and not conducting research on behalf of the MoH, some of the participants might have felt the need to present their situation more positively, due to him being

their superior. Likewise, he might have focused on asking questions in a positive way, to avoid criticizing his subordinates. The two participants associated with DHIS2 might also have led the participants to avoid criticizing the system and by not coming forward with all issues related to that.

On the other hand, having a member from the MoH in our team led to easier access to information due to the fact that he could send formal invitations to the interviews and group discussions, and because he knew most of the people we were visiting. This led to more data some of these data might however have been biased by the research team's roles.

7.4.2 My role in the research team

Being a co-researcher with a foreign background and limited knowledge about HIS, HMIS and health related issues was at times challenging because I needed more time, than the remaining team members did, to understand the user context and how to approach the participants. It was therefore very helpful to work with a Malawian that could explain these issues. However, I also believe that being a foreigner with limited knowledge of the research context made it easier for me to stay objective during the interviews.

7.4.3 Research approach

Based on the research context and the timeframe, the fieldwork was conducted in an opportunistic manner, where the focus was on including participants from all levels of the HMIS hierarchy, presented in section 2.6. The participants included provided insight in the user context at all the levels of the HMIS, and I therefore believe that the selection of participants was appropriate for this research approach.

The research methodology used within this thesis is a combination of Action Research (AR) (section 1.2) and ID (section 1.2.1), described in section 1.2.2. If the research was done over a longer period in time, it would have been beneficial to work through several AR cycles in order to increase the *action taking* part of this process, such as doing more trainings and implementing league tables, but also to strengthen other parts of the HIS that the league tables are dependent on. However, this might have led to project into a more critical approach, rather than interpretive. Within the limited timeframe, the research serves as one complete cycle of AR, which ends with *specifying learning*. I therefore believe that the research methodology has been sufficient in order to establish a basis for further research within this field. The ID lifecycle within the AR approach has further made it possible to develop, discuss, and test prototypes in order to determine the functionality and appearance of the final league table.

During data collection, the methods used were interviews, focus groups, training workshops and observations. Although the approach has resulted in good insight as a basis for further research, I believe it would have been preferable to do data collections over two periods, with the first period being preliminary research and the second including follow up interviews and further focus groups. In addition, the first phase could have included both observation and interviews, in order to observe how the users work and let them elaborate on it. One of the challenges with the limited amount of fieldwork was that I was not able to analyze all the data gathered while I was still in Malawi, and follow up questions were done by email. After several attempts at sending emails to the interviewees, I have only received a few answers, making it challenging to gain further knowledge.

We had little control over the number of participants in interviews because we were sampling based on convenience with a goal of interviewing users from various levels and with various backgrounds. One third of the planned interviews turned about to be focus groups. Using focus groups instead of interviews might have weakened the participants' ability to provide the truth based on their own perception. The research approach could be strengthened by having more interviews with fewer participants. However, an effect of this could also be that the research team would intimidate participants, forcing us to reduce the number of members in the team. As focus groups, on the other hand, provides a more safe environment for the participants, it is challenging to provide a good answer to how this situation may have been improved.

7.4.4 Validity of the research

Historically, principles from quantitative approaches, such as reliability, validity, objectivity, and generalizability, have been borrowed and used in order to determine the trustworthiness of qualitative research (Marshall & Rossman, 2010). Qualitative and quantitative approaches differ in core focus, where quantitative is more focused on numerical results, instruments and research designs, qualitative approaches focus on the views of people who participate in the studies (Creswell & Miller, 2000). Further, "...*validity of action research is achieved through the knowledge created in a particular context being taken up in action*" (Sykes & Treleaven, 2009, p. 224). As this research is based on qualitative methods in an opportunistic manner, and a combined AR and ID methodology, evaluating it based on the previously mentioned principles would not do it justice. In order to determine the validity of the research validity, procedures such as *triangulation*, *researchers reflexivity*, *disconfirming evidence*, *member checking*, *prolonged engagement in the field* and *collaboration* will be used (Creswell & Miller, 2000).

Triangulation has been done in two ways within this thesis, data triangulation by gathering similar data in different locations, and methodological triangulation by using several methods, such as document analysis, interviews, focus groups, observations, and training workshops described in section 3.3.3 (Sharp et al., 2011). Because the findings are based on multiple sources, rather than a single incident, the narrative account is valid (Creswell & Miller, 2000).

Creswell and Miller (2000) also discuss lenses that the research is viewed through. Because this research lies within the interpretive paradigm, the lens used by the researcher is particularly important. The reason that this lens is important to discuss is that it “...*suggests the importance of checking how accurately participants’ realities have been presented in the final account*” (ibid. p. 125). As an example of how this has been pursued in this thesis. I will refer to the findings in section 7.1.7, describing how feedback is passed from higher to lower levels, and the amount of feedback confirmed to be received at the lower levels. These results show inconsistencies between the answers from the higher and lower levels, suggesting that they had different perceptions of the truth. In order to rule out inconsistencies and to ensure that the realities presented would be presented accurately the information presented only includes answers provided from higher levels that were confirmed by lower levels, in addition to the answers provided from the lower levels themselves.

The same example could be used when talking about *disconfirming evidence*, where the evidence found either supports or disconfirms the prior findings (ibid.). The case showed that through enabling users to provide their interpretation of the truth, we were able to compare the evidence by confirming and disconfirming. This leads the discussion to whether the truth provided in this thesis is accurate. Because the sampling is done based on convenience we cannot be sure that the sum of these individual interpretations necessary will be the same as the totality we are looking to change or improve. Meaning, that this approach might not have revealed the most relevant information, in order to provide the truth of how the user context or any discovered issues actually are. A weakness of this study might therefore have been that we did not pursue *member checking* actively, by involving users in going through our data samples and interpretations.

Within this study there has partially been a *prolonged engagement in the field*. Some participants have been involved in more than one activity, and the data from interviews could then be confirmed by doing observations, e.g. when doing training workshops. By involving some participants on more than one occasion, they could also have been more comfortable with the situation, and therefore have disclosed more information (ibid.).

7.4.5 Ethical issues

Because the fieldwork was carried out in Malawi, I had to apply for concession both in Norway and Malawi. The proposal in Norway was approved without any notification requirement (Appendix D). In Malawi, my proposal as co-researcher was submitted and approved as a part of the PhD candidate's proposal (Appendix E). Through most of the fieldwork, the PhD candidate was therefore leading the interviews, while I had the opportunity to ask follow up questions.

Prior to each interview a verbal permission for use of an audio recorder was collected, and the research group was introduced. Additionally, a written confidentiality agreement was presented within the Malawian concession proposal. However, this was never used during the interviews. Because the research does not include gathering of any sensitive or identifying information, a written consent is not a necessary measure. I still believe that participants' rights could have been presented more thoroughly throughout the research, e.g. voluntary participation and the right to withdraw from the study at any moment.

One member of the research team was also a member of the Malawi MoH, and as mentioned previously he participating might have affected the data quality. An ethical issue in this perspective could be that the participants experienced the interviews and focus groups as monitoring, rather than as an external process of data collection.

Another issue has been whether to include the transcription of the recordings within this thesis, this was determined as a breach in trust, since the participants were informed that the recordings would be deleted after the study was completed. Since the recordings will be the same as the transcription, they will therefore not be presented in this thesis as an attachment.

A third issue worth mentioning is our approach in total. Since Malawi is a developing country with constraint resources, presenting a new feedback mechanism or tool that requires training, which then also requires resources, could be seen as inconsiderate. Since the approach is based on using DHIS2, which should be used in this setting, this issue diminishes. However, in further work that might increase the need for training, this would have to be considered.

8 Conclusion and future work

The purpose of this chapter is to conclude on the work done in this thesis according to the research questions, and present thoughts on future work.

8.1 Conclusion

Combining elements from action research, interaction design, user centered design and participatory design within a study has proved to be a useful approach, to enhance mutual learning, but also with some challenges such as varying knowledge of DHIS2 amongst the participants. The participants involved have been able to contribute with their knowledge, and the study proposes that there is great initiative amongst health workers to improve the health information system.

8.1.1 Developing league tables to support routine health management in Malawi

There are several enabling and constraining conditions to consider when implementing league tables in Malawi. The constraining factors include poor infrastructure, inadequate funding, no defined protocol for requesting access to DHIS2, lack of training and insufficiency in training provided, poor data quality, the fact that DHIS2 was not built with league tables in mind and high pressure on health workers leading to time constraints. The enabling factors include HMIS-routines and HMIS-software being operational, existing feedback practices and wish for more comparative feedback.

In order to develop league tables to be relevant for different user groups, both users with technical and health related knowledge should be involved in the development process. If user groups that are defensive when talking about league tables are included, they could also ensure that the product would provide support for low ranking units to improve. Users with initiative to improve the HMIS should be enabled to use this within the process.

League tables promote transparency and accountability through openly presenting data through ranking and comparing units. The openness of the data presented provides transparency by letting users know how they are doing compared to peers, and the ranking provides accountability through increasing awareness amongst units by indicating objectives that users are held accountable for. Contrasting earlier experiences in Malawi, users at all levels were in general positive towards the transparency and accountability the introduction of league tables promoted.

Although there are more constraining, than enabling factors mentioned, we were still able to develop league tables within these constraints. League tables could therefore be developed with

an objective of reducing some constraints such as poor data quality. However, external processes would have to be included to ensure a protocol for requesting access to DHIS2, increase trainings, establish a stable infrastructure and ensure better support of league tables in DHIS2. This means that in addition to a bottom-up process of developing league tables, an external process of improving the HMIS is necessary. Further, because DHIS2 is used within the development process and has proved to not be an optimal solution, either further development of the software or an alternative approach of implementing league tables is required.

8.2 Future work

First, in order for the HIS's-routines and the HMIS to support league tables fulfilling its purpose, a strengthening process should be pursued in further studies. This process should include diminishing or eliminate issues such as wrongly defined indicators and low data quality, through increasing understanding of data collection and reporting. The framework for restructuring health information system (*ibid*, p. 25-26) could be used for this purpose.

Second, since many of the users of DHIS2 the software challenging to comprehend, a further process of making DHIS2 more user-friendly, especially for users without prior knowledge of using computers, should be pursued.

Third, I propose creating a specific application within DHIS2 for creating league tables. With developing such an application, the tool could be developed with user experience in mind, focusing on functionality only relevant for creating and editing league tables, and reducing the perceived complexity of DHIS2, and thus be more suited for future users' needs.

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Appendix

Appendix A – Interview guide

Data flow

1. How does data flow from the lower to the higher levels?
 - a. How is data collected at facility level?
 - b. How is data reported to the DHIS2?

Feedback

2. What kind of feedback are you provided with, and from whom do you receive feedback?
3. How often do you receive feedback?
4. What kind of feedback do you provide to lower levels?
5. What kind of feedback would you like to receive?
6. How often would you like to receive feedback?

Use of data

7. How do you use the data you have collected?

DHIS2

8. What is your experience with DHIS2?
9. Do you have access to DHIS2?
10. How do you use DHIS2?

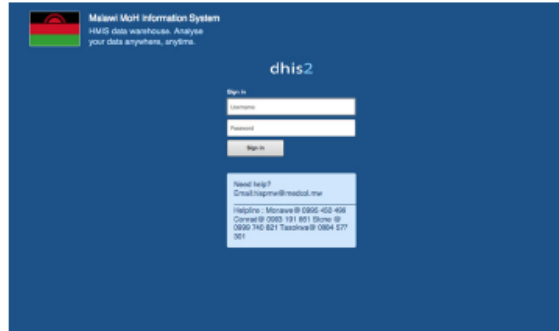
League table using DHIS2




User guide

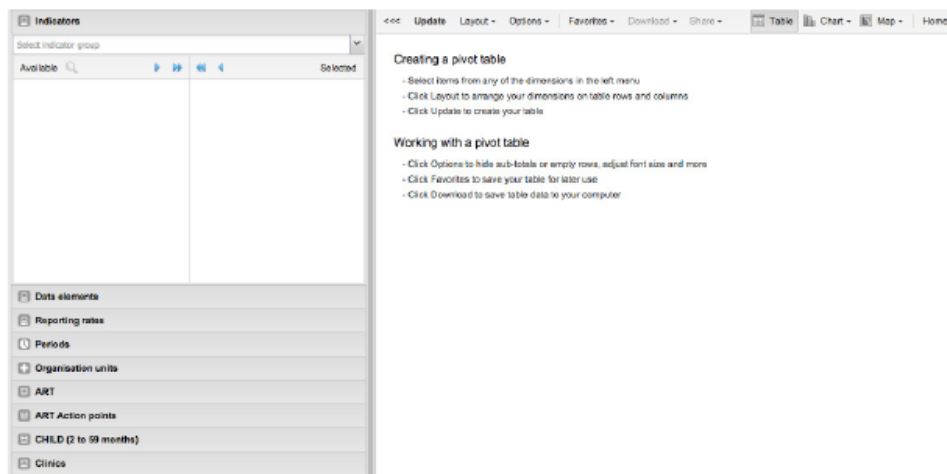
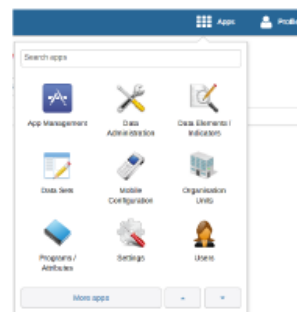
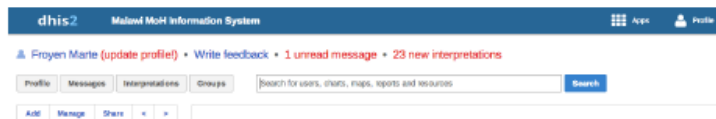
	Measles coverage rate ↕	Deliveries by skilled health personnel ↕	Antenatal care during first trimester ↕	League table total score ↕
Central East Zone	41.9	33.7	5.4	27
South West Zone	39.3	30.5	5	24.9
South East Zone	55	43	7	35.4
North Zone	78.8	66.1	13.4	52.8
Central West Zone	48.4	40	4.5	31
Central Hospital				

Need help? Contact: Marte H. Frøyen (marte.froyen@gmail.com)

1. Log on to the Malawian DHIS2 using your username and password. (<http://hispmalawi.org.mw/dhis2>)



2. Open the app  by clicking on  in the right top corner. If it is not in the first view, shown below, scroll down by using the .



3. Choose a predefined league table from your *Favourites* by clicking on *Favourites*, and writing the name of the table in the text field. You may also save your customized league table by clicking on *Add new*.




4. Example of Zonal league table from january to august in 2014. In this example we have made a league table with the *indicators*: Measles coverage rate, Deliveries by skilled health personnel and Antenatal care during first trimester. In addition we have added our customized League table total score. The *period* we have chosen is this year, and it is therefore showing the values from january to august in 2014. The *orgunits* that we have chosen are the six zones.

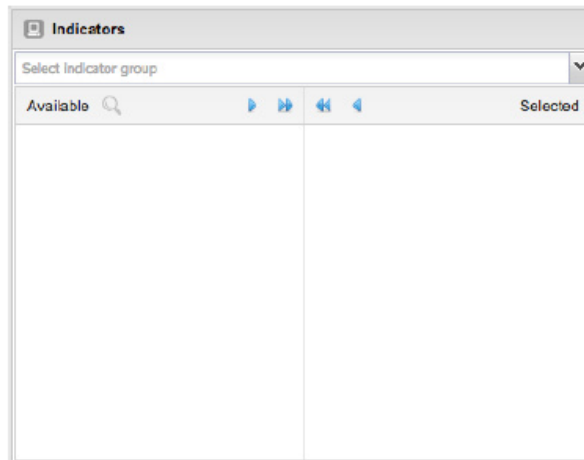
You may also customize this league table by opening it and adapting the *indicators*, *period* and *orgunits* to your needs by looking at the customized league table in section five.



	Measles coverage rate ↕	Deliveries by skilled health personnel ↕	Antenatal care during first trimester ↕	League table total score ↕
Central East Zone	41.9	33.7	5.4	27
South West Zone	39.3	30.5	5	24.9
South East Zone	55	43	7	35.4
North Zone	78.6	66.1	13.4	52.8
Central West Zone	48.4	40	4.5	31
Central Hospital				

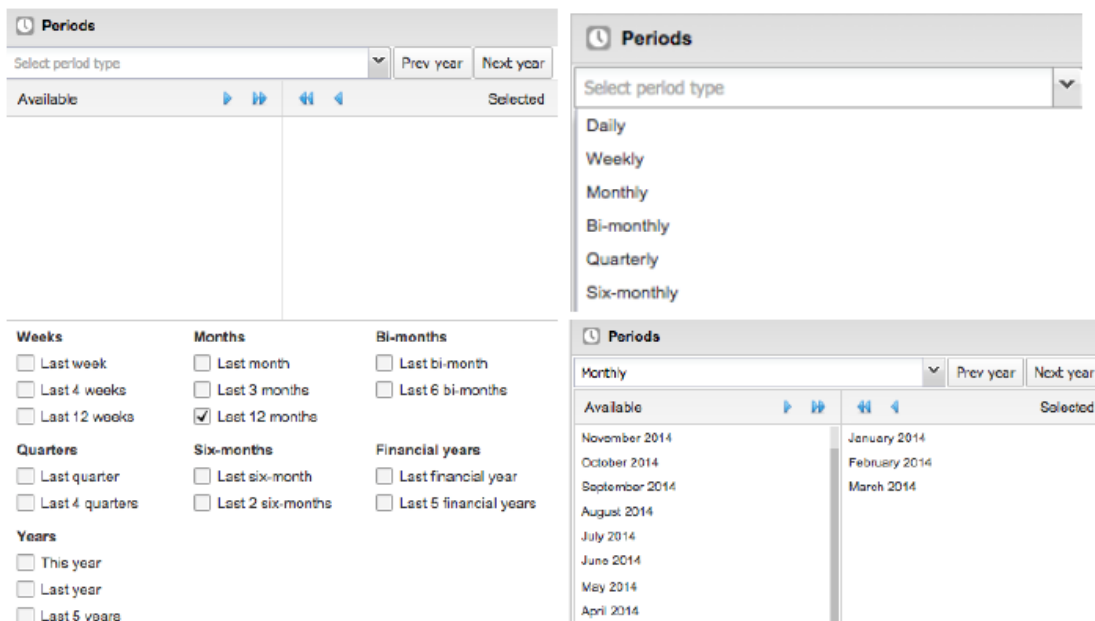
5. Customizing your league table

5.1. Choose the indicators that you wish to display in your

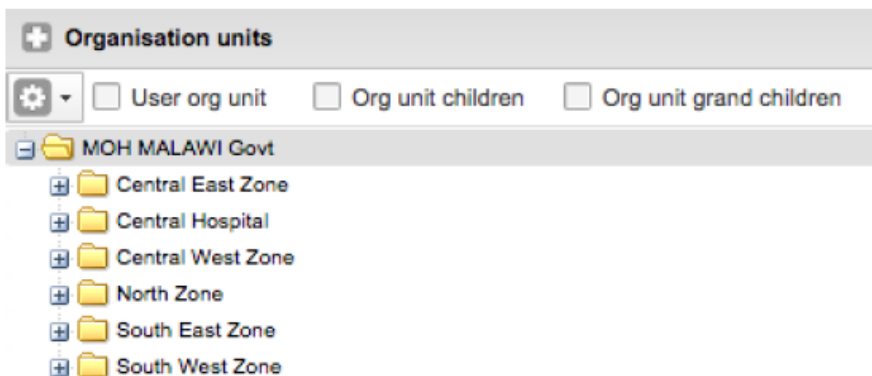
league table from the list of indicators. You may also search for the indicator by choosing [All indicators] and clicking on the . Remember to include your customized total score or learn how to do this in section six.



5.2. Choose the period that your league table should represent. This may be done by ticking off in the boxed shown below to the left, or by selecting the period type, shown below to the right - first image, and moving the appropriate periods to the right, shown in the second image, by double clicking on them or with a single click and the . If you wish to choose all the months use the .

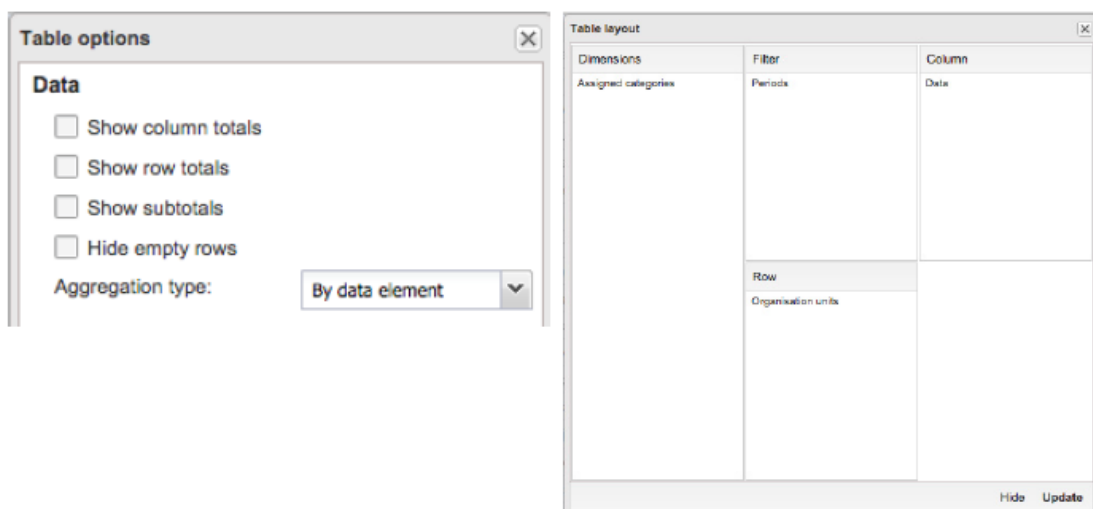


5.3. Choose the orgunits that the league table should represent. If you would like to create a league table representing all the zones choose *Org unit children* and for districts choose *Org unit grand children*.



5.4. Update your league table by clicking on *Update*.

5.5. Finish your league table by removing the predefined total values by clicking on *Options*, and then untick the checkboxes named *Show column totals*, *Show row totals* and *Show subtotals*. You also need to change your table layout by clicking on *Layout*, and then moving *Organization units* to the *Row* box and the *Periods* to the *Filter* box.

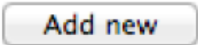


5.6. Your finished league table should look similar to the league table below.

	Measles coverage rate †	Deliveries by skilled health personnel †	Antenatal care during first trimester †	League table total score †
Central East Zone	41.9	33.7	5.4	27
South West Zone	39.3	30.5	5	24.9
South East Zone	55	43	7	35.4
North Zone	78.6	66.1	13.4	52.8
Central West Zone	48.4	40	4.5	31
Central Hospital				

6. Creating a customized total for your scorecard. For this part you need to have administrator access in DHIS2.

Go to *Home* and open the app  as shown in *section 2*.

Choose *Indicator*, and on the next page choose  in the top right corner. Type in a *name* for your indicator.

The next step is then to calculate the total by creating a *numerator* and a *denominator*.

To calculate the *numerator* add together the *numerators* for the *indicators* that you are using by clicking on the *Data elements* to the right with a + between each *Data element*. Finish it by deviding in on three by placing the whole calculation in brackets, (). Do the same for the *denominator*.

Example:

$$\frac{(\#{\text{UTOvmomOm7l.mQXljwnUv90}}+\#{\text{XnbM6j1bC2H.mQXljwnUv90}}+\#{\text{vfdP0bNDbpF.mQXljwnUv90}})/3}$$

USING PERFORMANCE LEAGUE TABLES TO PROMOTE ACCOUNTABILITY AND FEEDBACK IN HEALTH MANAGEMENT IN MALAWI

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Abstract: One of the challenges of health management in developing countries is the existence of weak accountability and feedback practices. This paper assesses the conditions for introducing performance league tables for promoting accountability and feedback in health management. A qualitative approach with an interpretive perspective has been adopted in this study. Data was collected using interviews, prototyping, observations and document analysis. The assessment revealed the importance of having a participatory process in the design and implementation of league tables used within the existing management practices. This ensures flexibility in the use of performance league tables. In addition, appropriate technology should facilitate availability and accessibility of data to stakeholders so that they manipulate it to suit their needs. Collaboration among stakeholders is a critical condition for ensuring access to additional resources for the implementation of performance league tables. A decentralized approach to league table definition allows districts to choose and weight indicators according to their own goals. Relevance, local choices through a participatory bottom up design process leads to broader acceptance and use of the performance league tables.

Keywords: Feedback practices, performance league tables, health management, participatory approach, accountability

1. INTRODUCTION

Ranking systems have been developed to measure the performance of institutions in various sectors such as sports, education, banking and finance, and health to achieve accountability and comparative evaluation (Kossi, Sæbo, Braa, Jalloh, & Many, 2013; ALMA, 2013; Edward, Kumar, Salehi, Burnham & Peters, 2011; Republic of Uganda, (undated); Peters, Noor, Singh, Kakar, Hansen, & Burnham, 2007); Adab, Rouse, Mohammed, & Marshall, 2002). One such mechanism is the league table which can be used as an internal tool to improve performance of the institutions (Foley & Goldstein, 2012). A league table can be defined as a *'technique for displaying comparative rankings of performance indicator scores of several similar providers'* (Adab, et al, 2002, p96). Roberts & Thompson (2007) have defined it as *a set of quantitative data designed to present comparative evidence regarding the quality and performance of organizations*. The criteria used in determining these rankings are based on a particular standardized set of performance indicators so that institutions are compared.

While the policy on performance measurement sounds good and easy to implement, it is complex and problematic in practice. Providers may have difficulties agreeing on suitable performance measures to use (McGinnes & Elandy, 2012), on alignment of performance

measures (Micheli & Neely, 2010) and may not represent the whole performance picture of an organization. National rankings are based on the availability of existing data from sources such as routine HMIS data, survey data from national statistics offices or other surveys by stakeholders. In most cases, the selection of indicators is based on data availability that can measure change over time and not necessarily on relevance of the indicators for health service goals. In such cases, ranking is largely based on what can be measured and not what is relevant and important (Stella & Woodhouse, 2006). As Harvey noted 'the construction of indices by which institutions or departments are ranked is arbitrary, inconsistent and based on convenience measures' (Harvey, 2008, p189). While league tables have been popular in recent years, no single model has been accepted as such there is no one size fits all approach.

League tables for performance monitoring were first used in the Malawi joint annual health sector review in 2006, using selected health sector indicators (Ministry of Health, 2006). The district performance league table was presented at the national SWAp review meeting and received mixed reaction. Some of the stakeholders welcomed the concept as it would promote behavioural change and encourage teamwork. In some cases the league table attracted resistance, criticism and anxiety especially from those districts that were at the bottom of the table. Furthermore, the use of the league table to measure district performance was criticized because of its methodological shortfalls including the selection process of indicators and weights. Some participants wondered what criteria were used for assigning weighting to the selected indicators. Participants expressed concern that the weighting was arbitrary and therefore there was no transparency regarding the methodology used for coming up with the rankings. The data used was from the routine health information system which at that time was considered of poor quality in terms of completeness and timeliness. In addition, others participants reacted by saying that the data used was not audited and verified.

The concept was then used for a couple of years before it was discontinued. However, there has been growing impetus among various stakeholders to revive the use of the league table for comparing district performance. This has resulted in the launching of the African Leaders Malaria Alliance (ALMA) scorecard in Malawi in 2013 (ALMA, 2013). While these efforts are using the scorecard to measure and compare district performance at national level, without an explicit ranking, this paper looks at the ranked performance of health facilities at district level. It identifies parameters that the district considers most important, appropriate and relevant for local action.

The aim of this paper is to assess the conditions for introducing league tables in health management. In this paper, we discuss the current status, challenges and prospects of the scorecard in the form of league table used for promoting accountability and feedback at district level. In particular, the paper draws data from the assessment that was conducted in Malawi.

The paper is structured as follows. The next section presents the relevant literature on the concepts of scorecards and league tables, feedback and open data. Section 3 presents the research setting and this is followed by section 4 on methods. Findings and analysis are presented in section 5 and finally is the discussion and concluding remarks section.

2. LITERATURE REVIEW

2.1 Scorecard and League Table

Ranking systems has a long history and presently, it is generating a lot of interest in many fields. A performance league table is one of the tools used in ranking systems. Arguments for and against performance league tables have been advanced in literature. Proponents of league tables argue that they may stimulate competition among service providers (Adab, et al, 2002), help monitoring and ensure accountability of providers (Smith, 1990). On the other hand,

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league tables have been criticized in a number of ways. While it may have been used in other sectors without many problems, the use of the league tables in the health sector has ‘attracted resistance, criticism and anxiety’ (Adab, et al, 2002, p95).

The use of performance league tables has been necessitated by the introduction of health reforms based on the notion of transparency and institutional accountability (Goldstein & Leckie, 2008). League tables show not only that the institutions are held accountable for their performance but also provide an incentive to improve their performance. In addition, performance league tables can be used as a screening system to identify those institutions that may require attention (Goldstein & Leckie, 2008). As such league tables would promote performance monitoring, review and responsiveness. In some instances, the league tables may foster a competitive culture among institutions (Hallgarten, 2001). Performance rankings can provide critical information to help make management decisions by a variety of audience (Hazelkorn, 2007); can stimulate competition among institutions (Harvey, 2008); and promote transparency and accountability (Smith, 1990). These comparative rankings can also be viewed as devices used as part of an institutional improvement programme. This would encourage service providers to review and seek to improve their performance. They can be used for providing feedback regarding their performance. In addition, league tables can enhance learning as institutions and individuals can learn from each other.

Many countries and organizations have used one form of league tables - the scorecard - in the health sector. Scorecards contain the same indicators and calculations as the league tables, but they are not ranked according to the total scores. League tables are used for comparative performance in Sierra Leone (Kossi, et al, 2013), in Uganda, (Republic of Uganda (undated); and in Malawi (Ministry of Health 2006); managing the delivery of primary health care services in Afghanistan (Edward, et al, 2011; Peters et al, 2007); comparing National Health Services (NHS) performance in the United Kingdom (Adab, et al, 2002); monitoring performance for Reproductive, Maternal, Newborn and Child Health (RMNCH) (ALMA, 2013).

2.2 Feedback

The concept of feedback is from the learning theories. It is multi-dimensional and plays a variety of functions including as a provider of information (Kulhavy & Wager, 1993). The role of feedback and the effects of different types on performance and learning have generated a lot of interest of researchers for a long time (Lam, DeRue, Karam, & Hollenbeck, 2011; Lurie & Swaminathan, 2009). Organizations are using feedback for not only motivation but also as a mechanism for both individual and organizational performance improvement (Thurlings, Vermeulen, Bastiaens, & Stijnem, 2012).

2.3 Open data

Open data efforts are gaining momentum worldwide. These efforts are intended to make data widely available and accessible so that it can be reused and redistributed by stakeholders. The open data solutions fit very well into the domain of transparency and create an environment for providing feedback and ensuring accountability. There are many benefits of open data which include user adaptation, feedback and promotes interaction between data producers and users (Zuiderwijk, Janssen, Davis, 2014; Janssen, Charalabidis & Zuiderwijk, 2012). In order for open data efforts to be useful they require infrastructure that can be used for accessing the data, discussion and feedback (Alexopoulos, Loukis & Charalabidis, 2014). However, institutional and technical barriers in many poor resourced settings are some of the major barriers to realizing the benefits of open data (Janssen, Charalabidis & Zuiderwijk, 2012).

2.4 Implications for our study

Based on the above literature review, we summarize some key concepts that seem relevant to guide our research. First, and absolute key for league tables, is *availability of and access to data*. This is dependent not only on data being open, but on the *awareness and skills* of health workers related to properly make benefit of it, and the enabling or constraining effects of *technology*. Previous experience with league tables in Malawi has shown that *interest and attitudes* are important, and that league tables need to *fit in existing management practices*. In addition, we see that *institutional collaboration* is important, given that league tables should include indicators across health programs. Lastly, the design process of the league table, both related to the layout and content, will be examined.

3. RESEARCH SETTING

The organizational structure of the Ministry of Health (MoH) in Malawi has four levels: national, zone, district and facility. The country has a network of health facilities managed by different organizations and delivered at primary, secondary and tertiary levels. In 2014, there were 977 health facilities providing health services in the country (Ministry of Health & ICF International, 2014). Of these, Government manages the largest number of facilities (48%), followed by private for profit (22%). The Christian Health Association of Malawi (CHAM), which is made up of independent church related health facilities, manages 17% of the facilities. The rest (13%) is managed by non-governmental organizations (NGOs) and companies.

The Ministry has a decentralised organizational structure for health information from the health facility level up to headquarters. The Ministry has established a dedicated cadre for information recording and compiling at health facility level. There is the health information officer located at the district health office with a dedicated computer for data management. At each facility there is a statistical/data clerk to assist in data processing and report generation and reporting.

The routine health information system is paper based at health facility level and is computerised at district and national levels, using a web based District Health Information System version 2 (DHIS2.0) since 2012. The Ministry maintains DHIS2 central database for routine data received monthly from all districts and central hospitals. It produces comparative reports for use by different national programmes and other stakeholders, and users can also define their requirements and generate reports according to need.

Since 2004, Malawi has been implementing a health service delivery strategy based on the Essential Health Package (EHP) (Ministry of Health, 2011; Ministry of Health, 2004) under the SWAp implementation framework. The ministry of health compiled the first national league table for the period 2004-05 in 2006 (Ministry of Health, 2006). The league table presented a comparative performance analysis of districts on selected indicators drawn from the national SWAp core indicators matrix. The aim of the league table was to assess district performance; compare performance among districts; provide information to facilitate analysis of circumstances behind performance; form a basis for rewarding better performing districts and develop appropriate corrective measures for poor performers (Ministry of Health, 2006). The indicators used in the league table were selected based on data availability; alignment with health sector goals and other strategic documents such as the Millennium Development Goals and the Malawi Growth and Development Strategy; and weight assigned to each indicators. The weighting was done centrally based on the importance of the indicator and linked to the priorities in the national SWAp programme of work (Ministry of Health, 2006).

4. METHODS

4.1 Overall approach

The research presented in this paper comes out of an action research project on health information systems in Malawi. Specifically, the project aims at strengthening local use of information, by improving local access and knowledge on how to analyse relevant data. A qualitative approach with an interpretive perspective has been adopted in this study.

The research was carried out in Malawi through two main work streams; situational analysis of feedback routines and level of information use, and prototyping of a league table with testing and input from district and zonal levels (Table 1). The league table was based upon findings from former document analysis, experiences from other countries and practices, and implemented in the DHIS2 software. The goal was to present it as simple as possible to let the users/health workers influence its functionality and design during the data collection period.

	Measles coverage rate ±	Deliveries by skilled health personnel ±	Antenatal care during first trimester ±	OPD utilization rate ±	Total Score League Table V2 ±
North Zone	115.9	99.8	17	248.8	120.4
South East Zone	79	66.5	10.2	106.4	65.5
South West Zone	65.1	44	7.2	104.5	55.2
Central West Zone	75.2	63.8	6.8	97	60.7
Central East Zone	64.8	51.6	8.4	122.3	61.8

Table 1: A prototype league table at zonal level, Malawi

4.2 Data collection

Data collection for the study took place in 6 districts health offices, 4 health facilities, 3 zonal health offices, and at the Ministry of health headquarters between July and November 2014. During the meetings, the assessment team was briefed on how data flows from the lowest level to the highest, the feedback practices and flows at district level. The teams also observed how the DHIS2 was functioning, and presented the prototype league table. In addition, focused training sessions on the league table prototype were conducted.

The following methods were used for data collection: semi structured interviews, observations and document analysis. At district level, discussions, with district programme coordinators, health facility in-charges and other informants were guided by open-ended questions. The discussions were audio taped. Participant observations of work practices around health management information system processing were done; and document reviews at both national and district levels.

Using open-ended questions, the study team had face-to-face group discussions with the district health management teams (DHMTs), HMIS officers and district programme coordinators. At the health centre level, the team met with the facility in-charges and facility members.

A total of 69 health personnel, the majority were district programme officers (29), were interviewed or participated during the data collection as summarized in Table 2 below.

Persons consulted or participated	Number
Central Monitoring and Evaluation Division (CMED) (MoH)	5
District health officers	4
District programme coordinators	29
District HMIS officers	7
Officers at zonal health office	14
Health facility in charges	3
Data clerks at health facility	3
Student interns at district level	2
M&E Technical advisors in projects	2
Total	69

Table 2: Individuals interviewed or participated in the discussions

Another data source for the study was document review, including the national SWAp semi-annual and annual review reports. Analysis of official documents such as health information system policies, strategies, procedures and guidelines was done in order to contribute to the interpretation of the significance of the SWAp reviews.

4.3 Data analysis

Data analysis has been conducted through two stages; one in direct relation to daily work in Malawi, and the second more specifically in the development of this paper. First, at the end of the workday in Malawi, after visiting a clinic, district or zonal office, the authors would have a brief discussion about the findings, and usually carry out some work related to updating the league table design. This forms the basis for the situational report in general. Second, we have had more focused discussion around the experiences of the league table in the process of writing this paper, which has been centred on topics as presented in section 2.4.

5. FINDINGS AND ANALYSIS

5.1 Availability and accessibility of data

The Malawi Ministry of Health has been implementing DHIS2, a web based system aimed at supporting an integrated Health Information System (HIS) at district and national levels since 2012. It is aimed at improving data capture and analysis for programmes, data flows at facility and district and national levels, and establishing a national data repository for indicator data. Aggregate raw summary and programme level health data is available in DHIS2 by different organization unit levels. Available catchment population data by facility can also be incorporated in DHIS2 making it possible to calculate indicators at health facility level. This would make it possible to compare facility performance over time and also do facility or district comparison. Accessibility of data in DHIS2 is possible if one has appropriate users rights. Many district programme coordinators have user rights to view data of their district

obtained during initial orientation on the software. However they expressed the need to view data from other districts in order to compare performance. The district programme coordinators had user rights to access such but they were not aware of it. Due to high staff turnover, many new district programme coordinators do not have user rights to access and manipulate data in DHIS2. The districts suggested decentralizing the issuing of user rights to the districts improve timely issuing of user rights at district level.

5.2 Skills levels and awareness

There is a dedicated cadre of HMIS officer at the district level responsible for managing HMIS and DHIS2. The district HMIS officer is responsible for data entry in DHIS2, data analysis, report generation and sending data to the central server. These officers have acquired the necessary skills and experience in using DHIS2. While the district programme coordinators are aware of the DHIS2, most of them have not been oriented on the system. For those that had been trained some were not using the system because of intermittent internet connectivity or had forgotten their usernames and/or passwords.

5.3 Availability of Technology

The assessment revealed that there is an integrated DHIS2 that has been rolled out in all the districts throughout Malawi. The software is used for data entry, analysis, presentation and storage. DHIS2 central server for data storage is located at ministry of health headquarters. The use of DHIS2 web based software at district level is constrained by lack of reliable Internet connectivity and subscription.

5.4 Fit in management practices

Although the league tables were not continued, the team observed that there are ways in which feedback was provided, including quarterly reviews, supervision and HMIS bulletins (Table 3). Most of the feedback is provided through reviews, which are aimed at providing information as well as motivating the health workers. Ideally, league tables should be used within the existing management practices such as quarterly reviews. Having the league tables in DHIS2 would help to improve management practices.

The assessment team also noted that facilities get feedback from the districts when there are errors and not as a routine practice. As observed by one district programme coordinator, *'Feedback from national programme managers is given when there are errors. Otherwise there is no feedback given'*. The coordinator suggested the need to be given feedback frequently or when a report is submitted.

	Channels of feedback	Frequency	Level	Function
1	Joint Health Sector reviews	Semi-annually, Annually	National	Information, Motivation
2	Programme Specific reviews	Quarterly, Annually	Zonal, District	Motivation, Information
3	Individual Performance reviews	Annually	Individual	Information, Motivation
4	District Implementation Plan (DIP)/HMIS reviews	Quarterly	Zonal, District	Information, Motivation
5	Health Facility HMIS	Monthly	Facility	Information

	reviews			
6	HMIS bulletins	Semi-annually, Annually	National, District	Information
7	Supervision	Quarterly	District, Facility	Reinforcement, Motivation
8	Messaging using mobile phones	Immediately	District, Programme	Reinforcement, Information
9	Data Quality Audits	Quarterly, Immediately	Zonal, District, Facility	Reinforcement, Information
10	Messaging in DHIS2	Immediately, Monthly	Zonal, District	Information, Reinforcement

Table 3: Typology of feedback practices in health management in Malawi

On the other hand, districts expressed the lack of feedback on data sent to higher levels. As one district programme coordinator commented, *'There is no feedback from the zonal officers. The zonal officers come every quarter during supervision to collect the data and they do not provide any feedback. They ask us if there are any challenges, which we mention, and we do not see any changes in the challenges. Every day they ask us the same things'*.

The majority of the informants expressed that the feedback they received from the national level was inadequate or non-existing. Feedback mostly took the shape of corrections on the data quality and completeness, rather on the performance of the health services. However, contrary to the earlier experiences, most were positive to be compared through performance league tables. The authors were thus able to pilot and get reactions on a new league table, set up inside the DHIS2 application which they were already using for data collection and processing.

5.5 Interests and attitudes

The assessment revealed that there is general interest expressed among the district programme coordinators on the importance of comparing performance with other districts. The districts and the zones are also interested using a ranking system for comparing district performance. The assessment team noted that one of the five health zones was using a performance league table for ranking the districts using selected indicators. The district performance is linked to the reward or recognition scheme where the best performing district is given a reward. Although the use of performance league table has been discontinued, it is interesting to note that the health zones are reviving the use of the concept for providing feedback to the districts and therefore motivate the health workers. Feedback is important as it motivates the health workers as well as use indicators to compare facility performance. As one district programme coordinator indicated: *'District programme officers feel that feedback is important in the sense that it is a way of acknowledging the role of those collecting the data play. It also helps to correct some of the deficiencies in the systems in terms of data collection, analysis and reporting'*.

When questioned about their opinion on acceptability and usefulness of scorecards and league tables, the responses from the district, zonal and ministry of health levels were encouraging. While some of the zones are not using the league table during review meetings, discussions have been going on, regarding the importance of introducing the league table at zonal level. As observed by one of the zonal health officers: *'A league table has not been produced in the zone, but it is being discussed on how best it can be done...we find it to be good, it also*

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encourages the districts, when the districts that seem to be performing are praised in front of their peers, they feel good and encouraged to do even more'. The districts also made suggestions to extend feedback to the community and the general public. This was emphasized by one of the district environmental health programme coordinator who proposed that: 'when giving feedback, even the community members need to know what is happening in their health facilities...like for example immunizations if we can display the data to the general public so that they can know how their facility is performing, as they have direct impact on the indicators'.

5.6 Collaborations

Collaboration among stakeholders within the district was observed at two levels. For instance, within the district health offices there was close collaboration between district HMIS officers and the programme coordinators in the production of district HMIS reports. The programme coordinators ensured that all programme level data was available for the production of the bulletin. On the other level, collaboration between the district health offices and NGOs working in the health sector to strengthen health management. One of the NGOs was invited and participated in the meetings we had with the district health management team. It was observed that various NGOs were supporting districts in DHIS2 implementation in the provision of internet connectivity and subscription, support district and facility review meetings and providing logistics for support supervision to health facilities. However, these activities have huge cost implications districts are unable to sustain from their own budget. Through this close collaboration, districts have mobilized and accessed additional financial and technical resources for managing their districts.

5.7 Process of designing layout and technology

The assessment revealed that the majority of the health workers were interested in utilizing league tables in their management, however they had some concerns regarding the implementation, and it was therefore crucial to involve them in the further development. One of the major concerns was that they wanted to be a part of choosing the indicators to be presented in the league table, to make sure that they would be appropriate. During the discussions we therefore invited the participants to suggest indicators. Many of the indicators mentioned were already included in the league table. However as a result of the discussion one additional indicator was added.

Further on trainings were conducted at two zonal offices and one district office. The trainings were held to teach the participants how they could create the league tables themselves, but also to invite them to discuss further improvements. Both during the trainings and the assessment interest was shown upon having a coloured league table easing the readability for the users. The second version of the league table (Table 4) therefore included colours, as well as a new indicator.

Organisation unit	Measles coverage rate	Deliveries by SHP	ANC visit 1st trimester	OPD utilization rate	Neonatal death rate	Total score
St Gabriels Hospital	51	346.7	18.8	549.8	0	193.28
Chitobwe Majiga Health Centre	51.9	0	30	214.7		59.32
Mc Quire Wellness Health Centre	55.6	0	0	179.7		47.06
Area 25 Urban Health Centre	60.7	80.9	17.1	172.5		70.24
Kang'oma Health Centre	64.1	27.9	3.4	139.5		50.98
Diamphwe Health Centre	64.8	45.1	6.6	130.1		53.32
Kabudula Rural Hospital	63	143	7.7	124.2	15.6	70.7
Miale Hospital	50.6	28.7	2	131.5		42.56
Bwaisa Hospital	21.7	101.9	4.7	107.1		47.08
Matapila Health Centre	46.8	48.5	7.2	104.5		41.4
Mbangombe 1 Health Centre	67.9	67.6	11.1	97.3		46.78
Lumbadzi Health Centre	47.7	29.2	5.8	88.6		34.28

Table 4: A district league table for selected facilities and indicators, Lilongwe district, Malawi

5.8 Process of selecting indicators and weights

Concerning the selection of indicators, districts suggested a participatory bottom up and decentralized process of selecting the indicators in the performance league table as this would ensure flexibility and usefulness of the league table. Districts and health zonal offices suggested that they should propose the indicators while the central office should provide advice on the suitability of such indicators. The assessment team observed that since there are common data elements in the districts and facilities, it is easy for the zonal offices and districts to identify indicators for comparing performance across districts. What was needed was to select a minimum set of indicators to be used for providing feedback in the performance league table. The zonal offices, and districts have suggested potential indicators that could be in the league table including the ones on: Management (Reporting status); Reproductive health (Antenatal coverage, Deliveries by skilled health personnel, Family planning coverage); Immunization (measles); and diseases specific indicators (TB cure rate, HIV/AIDS). The selection of the indicators was based on their linkages. As one District Reproductive Health Programme Coordinator noted, *'These indicators are selected because they are interrelated and reinforce each other. The performance of one indicator will affect or impact on the performance of the other'*.

6. DISCUSSION AND CONCLUDING REMARKS

The feedback practice of using performance league tables at national level is not new in Malawi. It was introduced some ten years ago. However, it was quickly discontinued due to methodological challenges. The stakeholders were minimally involved in the process of indicator selection and weighting in the league table. Some stakeholders interpreted it as an assessment of individual heads of the districts and not the performance of the district as an organization. In order to gain acceptance, stakeholder involvement in the development process of the league tables is crucial. Unless the stakeholders are engaged from the beginning, they may not appreciate the concept of league tables and use it for providing feedback.

Both the facility staff and the health managers at district, zonal and national levels were surprisingly positive towards the re-introduction of league tables. Health workers in the districts have expressed the need to have rights to access data from other districts so that they can compare their performance with other districts in order to stimulate competition among service providers which is line with the findings of Adab et al (2002). The league table can establish trend analysis and compare performance of a facility or district itself over a period of time; or compare a facility or district with other facilities or districts. It is able to align with the district and national review processes as it provides an input to the reviews. Furthermore, it complements accountability and management processes at all levels. By focusing on few selected indicators at a time, the league table can promote the use of information for local action. The league table can empower the health facility staff to have rights to make changes in the indicators for their use. The DHIS2 web based software makes the health data to be easily available and accessible to users, can be re-used and distributed at various levels thereby improving openness and accountability (Zuiderwijk et al, 2014; Janssen et al, 2012).

In order to counter the previous resistance in the use of the league table, there is need to address institutional, technical and methodological challenges that were encountered. Stakeholders should be involved in the process of indicator identification in the league table in order to appreciate and buy in the concept. The need for greater district and zonal involvement in the selection of indicators for inclusion in the league table to build consensus among the health workers should be encouraged (McGinnes & Elandy, 2011). There is need to identify indicators based on relevance for local use and aligned with health sector goals rather than on data availability. Furthermore, the performance league table should be flexible enough so that districts can select indicators that are relevant for local use. This can promote

accountability and transparency as highlighted in other studies (Kossi, et al, 2013; Goldstein & Leckie, 2008), ownership and local participation in the feedback processes.

The three criteria for selection of indicators were data availability, alignment with goals and weight. The Malawi DHIS2 contains a large number of health and service indicators, while financial data are not included. On the national level, indicators can be selected according to health plans, while a decentralized approach to league table definition allows districts choosing and weighing according to their own goals. Availability and use of technology combined with appropriate skills and attitudes of the users would make data easily accessible for the development of the league tables. The importance of collaboration among stakeholders is also a critical condition that enables the mobilization of additional resources for implementing the league tables. More relevant, local choices through a bottom-up design may lead to broader acceptance and use of league tables in local health management.

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Appendix D – Research approval Norway

Norsk samfunnsvitenskapelig datatjeneste AS
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Vår dato: 06.10.2014

Vår ref: 39770 / 3 / JSL

Deres dato:

Deres ref:

TILBAKEMELDING PÅ MELDING OM BEHANDLING AV PERSONOPPLYSNINGER

Vi viser til melding om behandling av personopplysninger, mottatt 11.09.2014. Meldingen gjelder prosjektet:

39770

Behandlingsansvarlig

Daglig ansvarlig

Student

Transparency and accountability within the Malawian HIS

Universitetet i Oslo, ved institusjonens øverste leder

Johan Ivar Sæbo

Marte Hesvik Frøyen

Etter gjennomgang av opplysninger gitt i meldeskjemaet og øvrig dokumentasjon, finner vi at prosjektet ikke medfører meldeplikt eller konsesjonsplikt etter personopplysningslovens §§ 31 og 33.

Dersom prosjektopplegget endres i forhold til de opplysninger som ligger til grunn for vår vurdering, skal prosjektet meldes på nytt. Endringsmeldinger gis via et eget skjema, <http://www.nsd.uib.no/personvern/meldeplikt/skjema.html>.

Vedlagt følger vår begrunnelse for hvorfor prosjektet ikke er meldepliktig.

Vennlig hilsen

Katrine Utaaker Segadal

Juni Skjold Lexau

Kontaktperson: Juni Skjold Lexau tlf: 55 58 36 01

Vedlegg: Prosjektvurdering

Kopi: Marte Hesvik Frøyen martehfr@ulrik.uio.no

Dokumentet er elektronisk produsert og godkjent ved NSDs rutiner for elektronisk godkjenning.

Avdelingskontorer / District Offices:

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Appendix E – Research approval Malawi

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All Communications should be addressed to:

The Secretary for Health and Population



In reply please quote No.

MINISTRY OF HEALTH AND POPULATION

P O. BOX 30377
LILONGWE 3
MALAWI

21st October, 2014

Christon Moyo/Marte Hesvik Froyen (Co-Researcher)

MOH
Lilongwe.

Dear Sir,

RE: PROTOCOL # 1342: 'INFORMATION USE FOR LOCAL ACTION: FEEDBACK PRACTICES FOR HEALTH INFORMATION SYSTEMS STRENGTHENING'

Thank you for the above titled proposal that you submitted to the National Health Sciences Research Committee (NHSRC) for review. Please be advised that the NHSRC has reviewed and approved your application to conduct the above titled study.

- **APPROVAL NUMBER** : 1342
- The above details should be used on all correspondences, consent forms and documents as appropriate.
- **APPROVAL DATE** : 21/10/2014
- **EXPIRATION DATE**
This approval expires on 20/10/2015. After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the NHSRC Secretariat should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING:** All serious problems having to do with subject safety must be reported to the NHSRC within 10 working days using standard forms obtainable from the NHSRC Secretariat.
- **MODIFICATIONS:** Prior NHSRC approval using forms obtainable from the NHSRC Secretariat is required before implementing any changes in the protocol (including changes in the consent documents). You may not use any other consent documents besides those approved by the NHSRC.
- **TERMINATION OF STUDY:** On termination of a study, a report has to be submitted to the NHSRC using standard forms obtainable from the NHSRC Secretariat.
- **QUESTIONS:** Please contact the NHSRC on phone number +265 888 344 443 or by email on mohdoccentre@gmail.com.
- **OTHER:** Please be reminded to send in copies of your final research results for our records (Health Research Database).

Kind regards from the NHSRC Secretariat.

For: CHAIRPERSON, NATIONAL HEALTH SCIENCES RESEARCH COMMITTEE
Promoting Ethical Conduct of Research¹

Executive Committee: Dr C. Mwansambo (Chairperson), Prof. E. Molyneux (Vice-Chairperson)
Registered with the USA Office for Human Research Protections (OHRP) as an International IRB
IRB Number IRB00003905 FWA00005976