

**University of Oslo
Department of Informatics**

**A study of health information
systems at local levels in
Tanzania and Mozambique:
*Improving the use and management of
information in health districts.***

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Master Thesis

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Dedication

To Hellen Mukama for her love and beliefs in me.
To Teddy Igira for his love, support and encouragement.

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LIST OF ACRONYMS

- AIDS - Acquired Immune Deficiency Syndrome
- ANC - Antenatal Care
- APES - “Agentes Polivalentes Elementares”
- ARI - Acute Respiratory Infection
- BES - “Boletim Epidemiológico Semanal”
- DDS - “Direcção Distrital de Saúde”
- DEO - District Education Officer
- DHIS - District Health Information Software
- DTC - Diarrhoea Treatment Corner
- DHMT - District Health Management Team
- DMO - District Medical Officer
- DNO - District Nurse Officer
- DPF - District Processing File
- DPS - “Direcção Provincial de Saúde”
- EDS - Essential Data Set
- ELAT - “Estratégia de Luta Anti-Tuberculose”
- ELAL - “Estratégia de Luta Anti-Lepra”
- EPI - Expanded Program for Immunization
- EPR - Electronic Patient Record
- FP - Family Planning
- HF - Health Facility
- HEP - Hepatitis
- HIS - Health Information System
- HISP - Health Information Systems Project
- HIV - Human Immune Deficiency Virus
- HMIS - Health Management Information System
- ICT - Information and Communication Technologies
- IFM - Institute of Finance Management
- INE - “Instituto Nacional de Estatística”
- IS - Information System
- ISDM - Demographic Health Survey, Mozambique
- IT - Information Technology
- MCH - Maternal and Child Health
- MISAU - “Ministerio de Saúde”
- MoH - Ministry of Health
- MTUHA - “Mfumo wa Taarifa za Uendeshaji wa Huduma za Afya”
- MTUHADB - MTUHA computer database

- MUCHS - Muhimbili University College of Health Studies
- NACP - National Aids Control Program
- NEP - “Nucleo de Estatística e Planificação”
- NGO - Non - Governmental Organization
- NORAD - Norwegian Agency for Development Co-operation
- NUFU - Norwegian University Council
- OPD - Outpatient Department
- PAV - “Programa Alargado de Vacinação”
- PESS - Health Sector Strategic Plan
- PHC - Primary Health Care
- RHINO - Routine Health Information Network
- RMO - Regional Medical Officer
- SIS - “Sistema de Informação de Saúde”
- SISDB - SIS computer database
- SMI - “Saúde Materno Infantil”
- STDs - Sexually Transmitted Diseases
- TB - Tuberculosis
- UEM - Eduardo Mondlane University
- USAID - United State Agency for International Development
- UTI - Urinary Tract Infections
- WHO - World Health Organization

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ABSTRACT

The main aims and objectives of this study are, to explore the procedures, tools and problems related to primary health care data collection, storage, use and information flows and to offer ideas and suggestions on how to improve the systems of routine data collection, storage, analysis and use of information and more generally to improve the flows of information and health care information systems. The study also provides a comparison between the results of the field studies in two developing countries: Tanzania and Mozambique.

The study employed qualitative research methods, including ethnographic methods; interviews, observations in the health facilities settings, analysis of patient records for varying recording tools and content, reviews of documents, and the analysis of existing computer systems within the health information systems in study. The study was carried out in Xai – Xai district, Chokwe district, Chibuto district and Bilene district in Gaza province, in Mozambique (April to May 2002), and Kibaha district in Coastal region, in Tanzania (June to August 2002).

This research focuses on the various information flows originating at the local health facility, how the data are collected and stored, use or/and non-use of data, sharing or communication of important information between primary health care and hospital levels, data flows from the health facilities to the districts to the region or province and to the national level.

The research shows that the system of data collection and vertical data flow is rather complex; a number of data collection tools are in use: patient cards, registers, tally sheets and forms. The data collection tools and flows of information reflect the needs of the various health programmes: Community Health, Maternal and Child Health (e.g. family planning, antenatal care, deliveries), communicable diseases, Tuberculosis and Drug programmes.

The study's empirical findings are discussed in relation to the literature review. The literature review ranged from various writings on existing health information systems (HIS) in developing countries, socio-cultural factors shaping the HIS, the role of Information and Communication Technologies (ICT) in health systems in developing countries, and decentralization of information management toward the district level as a way of restructuring the health information system in the broader process of health sector reform. My discussion is to a large extent based on the social systems perspective; information systems should be conceptualized as social systems in which technology is only one of the elements. Changing an information system involves the change not only of a technical solution but of a social system.

Through a cross-case analysis of my empirical data and discussion, I found that there are several problems related to the use and management of information at local levels within the HIS. In summary, the availing problems can be grouped into three broad categories:

- 1. Lack of clear understanding of the purpose of data collection.*
- 2. Information flows reflecting the requirements of higher levels without addressing the local level's information needs.*
- 3. Poor and inadequate resources and infrastructure for health care activities.*

To improve the use and management of information at local levels within the HIS the following should be done: Local learning and discussion of essential HIS needs, and the role of routine data collection in meeting those needs. Establishing an information culture in HIS and health care organizations. Investing in health data collection, use and management of health information at local levels within the HIS.

Key words: Data, information, local levels, information systems, social systems, and decentralization

Chapter 1

INTRODUCTION

Health workers collect and report data routinely on all their activities. Studies show that very little of this vast amount of data is used by those who are collecting the data and by local health management at health facility or district levels. Ideally, local data should be collected, analyzed and used in order to support local health management and local health service delivery. This thesis focuses on routine health care information systems at local levels with the main objective being on exploring the procedures, tools and problems related to primary health care data collection, storage, use and information flows and to offer ideas and suggestions on how to improve the systems of routine data collection, storage, analysis and use of information and more generally to improve the flows of information and health care information systems. The study also provides a comparison between the results of the field studies in two developing countries: Tanzania and Mozambique. The thesis is based on the fieldwork done in Mozambique during the period of April and May 2002 and Tanzania during the period from June to August 2002.

1.1 Who can read this thesis

This thesis is intended for new Masters students in Health Information Systems as well as healthcare information systems workers, researchers in Information Systems (IS) and developing countries and anyone who will have an interest in Health Information Systems (HIS) in general. Brief background knowledge on health information systems in developing countries is required in order to get the full picture of what is discussed in the thesis.

It is my hope that this thesis has value for IS researchers, developers and designers that are currently involved in processes similar to those that it describes. Results from the study potentially contribute to the improvement of management and use of health information, especially at local levels, that is, in health districts.

1.2 Motivation

The health sector can be considered as an important and relevant sector within which countries or societies can learn about information systems, where experiences relevant to local settings can be made. The health sector is important and relevant in this respect because it extends to the most peripheral areas of the society and effective use of information is crucial to primary health care delivery and health management. One central characteristic of developing countries is the health problems experienced by the majority of the population. There is generally low level of use and management of local information within the HIS in developing countries, and very little research and development is aimed at the health sector in the world's poorer countries.

Being developing countries, Tanzania and Mozambique have to restructure the existing HIS to reflect and support the use and management of information at local levels. At local levels, most of the health care services are being delivered, and it is this level, which is the origin of the health care data and statistics being generated in health systems.

My focus is on routine healthcare information systems, which are based on data collected by health workers at local levels where problems with healthcare service delivery are highlighted and where the need for improvement in healthcare service delivery is much greater. By local levels of the HIS, I refer to the health facility and district levels. At local

levels health workers are able to collect data that they think are relevant, and direct its use to address the everyday problems they are engaged in. This can be done with support from higher levels, for example, providing training, better tools and resources for health care activities to local level health workers.

1.3 The study

The main goal of this study has been to gain knowledge and understanding of the health information systems at local levels in developing countries using Tanzania and Mozambique as case studies, in order to explore the procedures, tools and problems related to primary health care data collection, storage, use and information flows and to offer ideas and suggestions on how to improve the systems of routine data collection, storage, analysis and use of information and more generally to improve the flows of information and health care information systems. The study also provides a comparison between the results of the field studies in Mozambique and Tanzania. In Mozambique, the study was carried out at the Ministry of Health and in Gaza Province, in Xai – Xai district, Chokwe district, Chibuto district and Bilene district. In Tanzania, the study was done at the Ministry of Health and in the Coastal Region, in Kibaha district.

1.3.1 The case studies

During my study, I have been looking at the health information systems in two developing countries: Mozambique and Tanzania. In Mozambique, the study was part of the Health Information Systems Project (HISP) (see a description on HISP in Mozambique in Chapter 2). In Tanzania, the study helped to initiate HISP work at the University of Dar es Salaam and the Ministry of Health.

In the following sub-sections, I describe the overall health system organization structure in Mozambique and Tanzania. The description includes background information on the health system and the overview description of the existing Health Information Systems in Mozambique and Tanzania.

1.3.1.1 Mozambique

In Mozambique the health information system is called SIS, which is an acronym for the Portuguese meaning of Health Information System (HIS) -“Sistema de Informação de Saúde (SIS).” Health planners at the Ministry of Health, donor agencies and researchers use the SIS system, which operates in governmental health facilities only.

The most radical and important health system reforms in Mozambique occurred after independence, in 1975. During that period, that is, after 1975, the health sector was faced with a shortage of qualified staff, fragmentation and a severe bias towards urban and curative services rather than rural and primary health care (PHC). Less than 10% of the population had effective access to health care (Mwaluko *et al.* 1996).

After independence, the Mozambican government adopted policies and strategies based on the concept of primary health care (PHC) and essential drugs to extend health services to the most peripheral areas in the country. The government nationalized the health sector, and prohibited the practice of private medicine. This step was taken as a political demonstration of the people’s right to healthcare and the end of exploitation (Carvalho *et al.* 1980). At the same time, preventive programmes for mass immunization and for environmental health and hygiene (for example, building latrines and boiling water before drinking) were developed. The network of PHC was intended to decrease the imbalance between the urban and rural areas as well to promote better accessibility to health care, particularly for those living in rural areas, where the colonial system did not

give any attention. Unfortunately, due to the civil war, which lasted 16 years after independence, the achievements of PHC were below expectation (Ministry of Health Mozambique 1992; Mwaluko *et al.* 1996).

The current Health Information System (HIS) in Mozambique dates back to 1982 and covers the primary and the secondary levels of health care. The HIS was revised in 1989 due to constraints related to lack of defined objectives, complexity of the forms (too many, lack of data definition), and data duplication. The revision of HIS led to a reduction of the number of forms used for data collection, from 60 to 12, and some basic indicators were included in the forms for use at district and health facility levels. The forms have fields for calculation of indicators or coverage rate. The idea beyond calculation of basic indicators was to promote the local use of information, but the intention has not materialized at the district and health facility levels. Later, in 1992, a computer-based system at provincial level was introduced to the provincial capitals in Mozambique (Brown *et al.* 1997), representing the first national computer based information system.

The information system was designed in order to report on the activities of the various vertical health programmes (e.g. immunization, family planning, drug distribution) from the districts, via the provinces to the national level. This design was based on upward reporting to support the national level and the various vertical health programmes needs for information, and the needs of provincial and district health management were not focused upon (Braa *et al.* 2001, page 3).

An overview of Mozambique's existing health information systems

The health care information system in Mozambique comprises health facilities that are distributed in different places in the country. Most of these health facilities are situated in remote areas where there is limited or no access to technology and infrastructure advancement.

The health information system (SIS) is a collection of data from the health facilities to the district to, the province and the national department of health (see figure 1.1). There is a database application at the province and national levels. Procedure definitions and data collection forms are described in a manual. Most of the data collection forms are based on the activities of the various vertical health programmes (for example, immunization, family planning and drug distribution) (Braa *et al.* 2001).

Due to lack of personnel skilled and trained in data collection, sometimes the data collected are incomplete. At the district, the health information system is based on the data from various health facilities (health posts, health centers and district hospitals). The data from the health facilities are aggregated into district data and sent to the province. At the province it is not possible to validate data per facility.

Mozambique is currently in the process of strengthening and further developing the health information and management systems at district level as part of a broader process of the health sector reform to support decentralization of the health system (see Chapter 2). In terms of information systems development, this reform process aims at enhancing local control and health information handling.

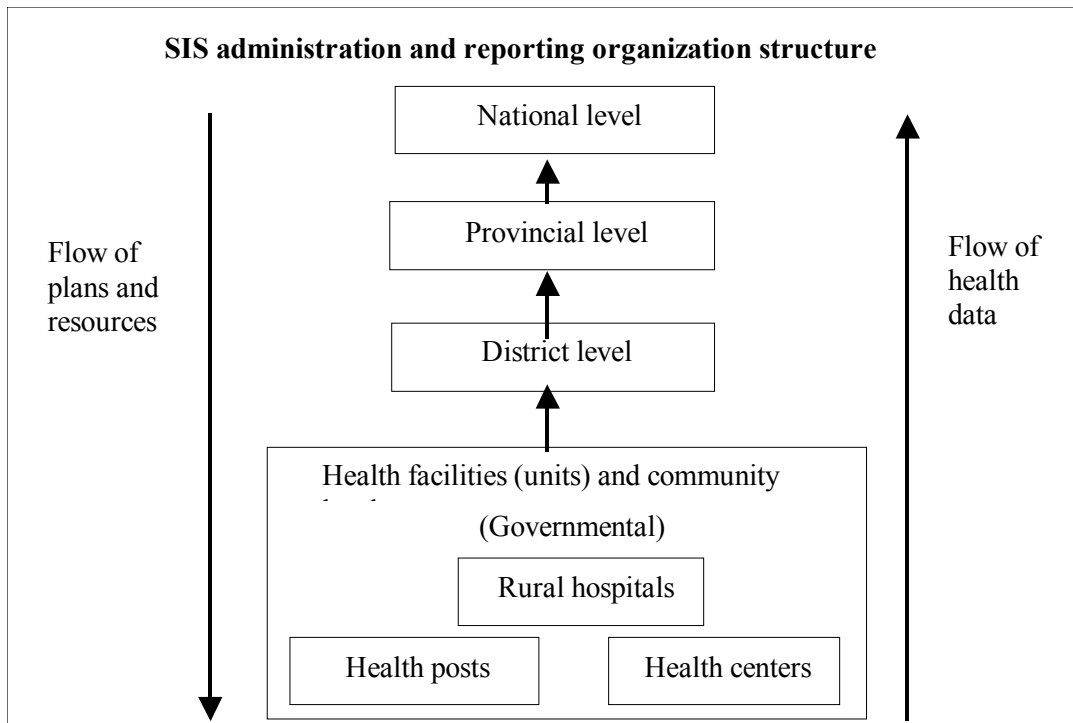


Figure 1.1: Health information system (SIS) administration and reporting organization structure in Mozambique

Source: Fieldwork in Mozambique, April to May 2002

The key challenges facing the HIS in Mozambique can be summarized as follows. Most of the health facilities are situated in remote areas where there is limited or no access to technology and infrastructure advancement. At district level, the reports from various health facilities are aggregated into an overall district report and not kept in a systematic way on a health facility basis. The district reports are then submitted to the provincial level without local analysis for local decision-making. There is lack of feedback, training and support at all levels of data collection and lack of skills to analyze data. This research explores the procedures, tools and problems related to primary health care data collection, storage, use and health information flows in Mozambique and offer suggestions on the

improvement of the use and management of information at local levels within health information systems.

1.3.1.2 Tanzania

In Tanzania the health information system is called MTUHA, which is an acronym for the Kiswahili meaning of Health Management Information System (HMIS) -“Mfumo wa Taarifa za Uendeshaji wa Huduma za Afya.” The system covers all health programmes and health care services. All health facilities (Government, Private, NGOs and Parastatal organizations) use the MTUHA system (Ministry of Health Tanzania 2002).

Before MTUHA came into existence in 1993, several systems were operating. Most of these systems existed in the public and non-governmental organization (NGO) health facilities. In addition, programmes such as the Expanded Program for Immunization (EPI), tuberculosis (TB) and Leprosy and the National AIDS Control Program (NACP) had their own separate reporting systems (Rubona 2001).

In the 1980s, internal and external consultants undertook several studies of existing systems, and they revealed the following weaknesses (Rubona 2001):

- The systems were fragmented. Data were collected with little capacity for analysis, interpretation, or use at all levels of health service delivery, but most of the vertical programmes had limited capacity to analyze and use the data.
- The flow of data was from the bottom up. There was no significant feedback between the higher and lower levels.
- Health facility workers were overburdened with having to fill out several forms from different programmes.
- Resources were wasted.

- Policy and legal guidelines from the Ministry of Health (MoH) directing data collection activities in the health sector were lacking.

These problems rendered the existing systems ineffective and unreliable. During the design stage of MTUHA, which started in 1989-1990, one of the objectives was to have a decentralized, integrated, functional, and reliable system.

Also, different stakeholders were involved to ensure that their interests were addressed. Thus, the new HMIS provided a comprehensive picture of health service performance at each level of administration (Rubona 2001, page 184).

MTUHA now includes the above programmes, that is, EPI, TB and Leprosy and NACP in its reporting system.

The health care system in Tanzania, and especially the government's referral system assume a pyramidal organization structure of health services, which is from the primary level (village health posts, dispensaries, and health centers) to district hospitals, regional hospitals and finally, consultant hospitals (Ministry of Health Tanzania 1998).

An overview of Tanzania's existing health information system

Tanzania's health care information system structure comprises of the village (community) level, the health facility level, district level, regional level and the national level (see figure 1.2). All the village health posts are staffed by village health workers primarily providing first aid services. Dispensaries provide basic curative and Maternal and Child Health (MCH) care. They are usually headed by a rural medical aide who is responsible for curative services, and who is supported by a MCH aide and other less trained nursing staff, that is, staff with less training than nurses and/or without formal training for health care services. In addition to the basic curative and maternal and child services, health centers offer inpatient and obstetric services. They are physically larger

institutions than dispensaries and are served by a large staffing complement (Gilson 1995).

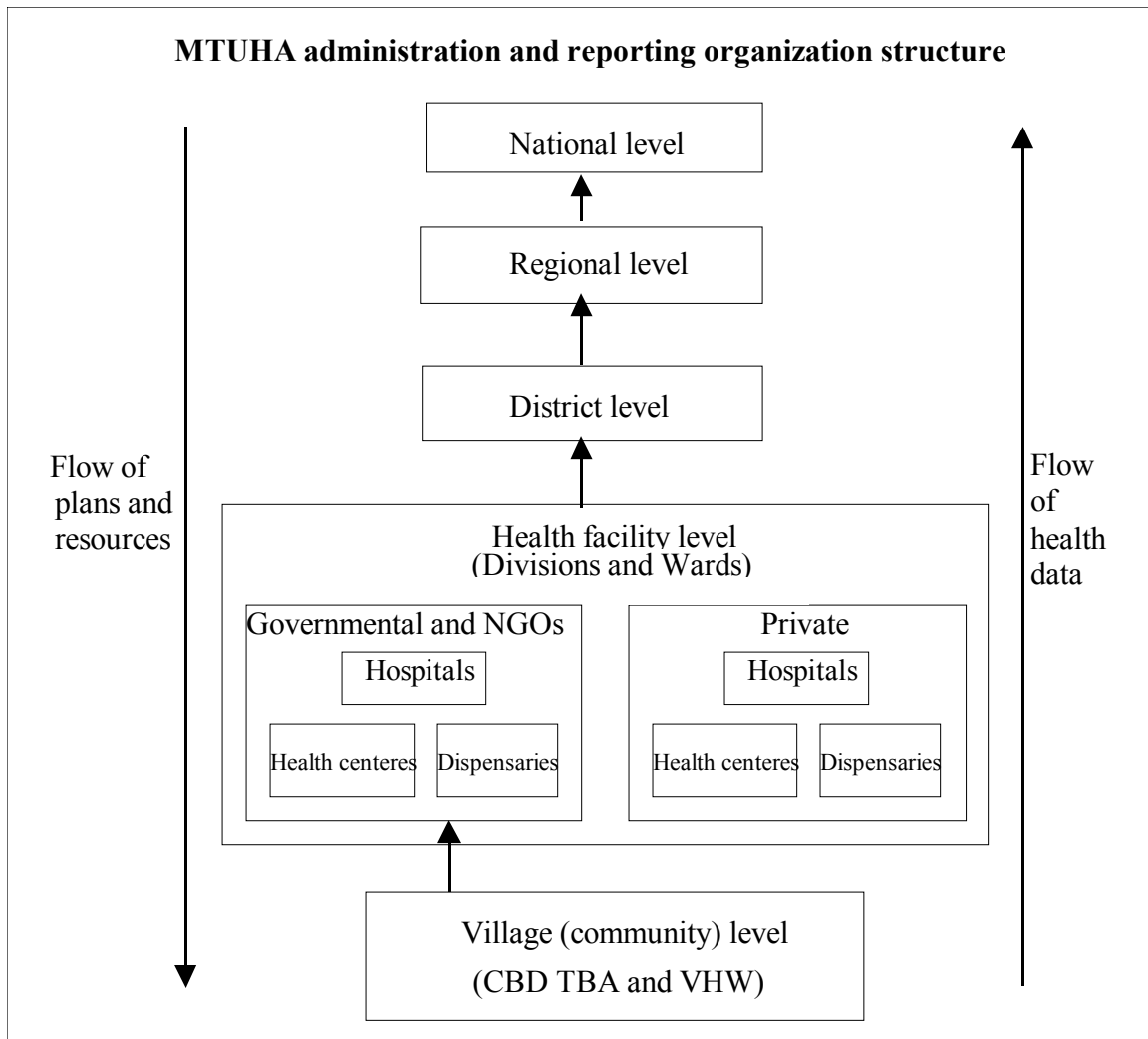


Figure 1.2: Health information system (MTUHA) reporting organization structure in Tanzania

Source: Fieldwork in Tanzania, June to August 2002

Most of the health facilities are located in remote areas where there is inadequate access to reliable electricity, telephone lines and poor infrastructures as a whole. This has contributed to major problems in the provision of health services to the population. The health facilities collect data, which are then collected and aggregated at the district level where the reports for the particular district are being generated. This is being done manually, that is, using paper-based forms. Data from the districts are sent to the regional level, where the reports for a particular region are being generated and sent to the national level. At the regional levels reports generation is being done using a computer system. The HMIS includes all data collected at all the health units in all levels.

Tanzania, like any other developing country, has lived with a number of shortcomings in its health information system. The HMIS in Tanzania has the following weaknesses (Rubona 2001):

- Data quality and accuracy are not sufficiently assured through simple validation or verification procedures.
- Information is generally not sufficiently used for local decision-making.
- Data presentation, analysis, and feedback are generally very weak.
- Late reporting of health information from one level to another.
- HMIS-related activities result in higher workloads, especially for health staff at the dispensary and health center level where data are being collected.
- Software and hardware problems at the regional and central levels cause major inefficiencies in the system.

The above mentioned problems imply a need for improvement in the use and management of health information.

In both countries (Mozambique and Tanzania), the processes of the existing health information systems show that local use of information is a stated intention in the design of the system. However, information is still flowing from the district and provincial levels to the national level without local analysis for local decision-making and there is lack of feedback from the national level to local levels.

1.3.2 Study objectives and problem areas

The main objectives of this study are, to explore the procedures, tools and problems related to primary health care data collection, storage, use and information flows and to offer ideas and suggestions on how to improve the systems of routine data collection, storage, management, and analysis and use of information and more generally to improve the flows of information and health care information systems. The study also provides a comparison between the results of the field studies in two developing countries: Tanzania and Mozambique.

The main problem area is expressed in the research question:

How can use and management of information be improved at local levels of the health information system?

Based on the main objectives of this study, the research addressed the following questions:

- How are primary healthcare data being collected?
- What are the tools used to collect and store (record) the collected data? How are primary health care data being kept and managed over time?
- Where are the collected data sent? Which of the data collected are used?
- Who uses the data and what do they use it for?

- How is the patient information shared when, for example, a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, or from one hospital to another, and when she leaves the hospital?

Taking into consideration the various issues related to routine primary health care data collection, storage, use and flows in the health care information system in Mozambique and Tanzania, this study evaluates and analyzes the existing primary health care data collection, storage, use and flows for a comparison of processes, tools and problems between Mozambique and Tanzania.

By carrying out a comparison between the research findings in Mozambique and Tanzania, I discover and explain the important processes, tools and problems related to data collection, storage, use and flows of information within and across the health information system in Mozambique that could help the improvement of the health information system in Tanzania, and *vice-versa*. Despite the differences in context, culture, and distribution of expertise among health care personnel at the health facility, district, province/region and national levels of the health system, the comparison between the research findings in Mozambique and Tanzania provide a stronger basis for my analysis and conclusions.

My conclusions are drawn on the basis of the examples from the research case studies. It is my hope that the study will be useful to the improvement of the use and management of information in health districts in Mozambique and Tanzania, and for other developing countries that are currently in the process of restructuring their health information systems as a broader process of the health sector reform to improve the use and management of information in health districts.

1.3.3 Main discoveries and results

The study has shown that the system of data collection and vertical data flow is rather complex. A number of data collection tools are in use: patient cards, registers, tally sheets and forms. The data collection tools and flows of information reflect the needs of the various health programmes; mother and child health, immunization, communicable diseases, tuberculosis and drug programmes. There are several problems related to the use and management of information at local levels within the HIS. The availing problems are grouped into three broad categories:

- Lack of clear understanding of the purpose of data collection.
- Information flows reflecting the requirements of higher levels without addressing the local level's information needs.
- Poor and inadequate resources and infrastructure for health care activities

1.4 Additional exposure to the field

Before starting the fieldwork for my thesis project, I was fortunate to have opportunities that provided me with exposure to some of the issues I would encounter when dealing with health information systems and healthcare settings. Below, I briefly describe my prior exposures to computer based patient records, an Electronic Patient Record (EPR), in a developed country, Norway, and the health care system in Mozambique.

During the first semester of my Masters studies in Information Systems, August to December 2001, I carried out a study at Rikshospital in Oslo, Norway, as a way of practicing the use of qualitative research methods: observations and interviews. My colleagues and I conducted observations at the hospital to see the use of the EPR in clinical practice and interviewed three of the doctors with experience in using the EPR. We were also provided with an orientation to

the Norwegian health care system, that is, the health care system levels, information flows and the essence of the EPR, that is, the aim of introducing the EPR and when its introduction started.

Another prior exposure and practice in using qualitative research methods was in Mozambique during the second semester, March to May 2002, whereby I conducted observation at José Macamo hospital and five health workers were interviewed.

From these studies, I learned about two general issues, which were useful for my thesis project. I was first introduced to the research design and methodology whereby I had methodological questions and concerns for my thesis project. Secondly, I was introduced to levels of the health care system and information flows within a national health care system in Norway and Mozambique. In particular, the study in Norway provided special interest in comparing how referral systems work (in Norway and in Mozambique and Tanzania). The study in Mozambique enabled me to test the research methods and experience difficulties and limits in understanding in another culture, particularly with Portuguese as a communication language, and what it took to ‘partially’ overcome these.

The main methodological questions and concerns I had about my thesis project were as follows:

- Should I make use all the methods (observations and interviews including orientation) we used?
- How should I organize the methods (what method should be done first and what should be done last) during my research?
- How many times should I observe the setting and how many interviewees should I interview to enable me to obtain reasonable information?

My main concern was on getting data from a range of individual in order to avoid being biased.

I was introduced to levels of the health care system and information flows across the health care system. In particular, I learned how patient information is shared between primary health care and hospital levels in Norway, which I describe in figure 1.3.

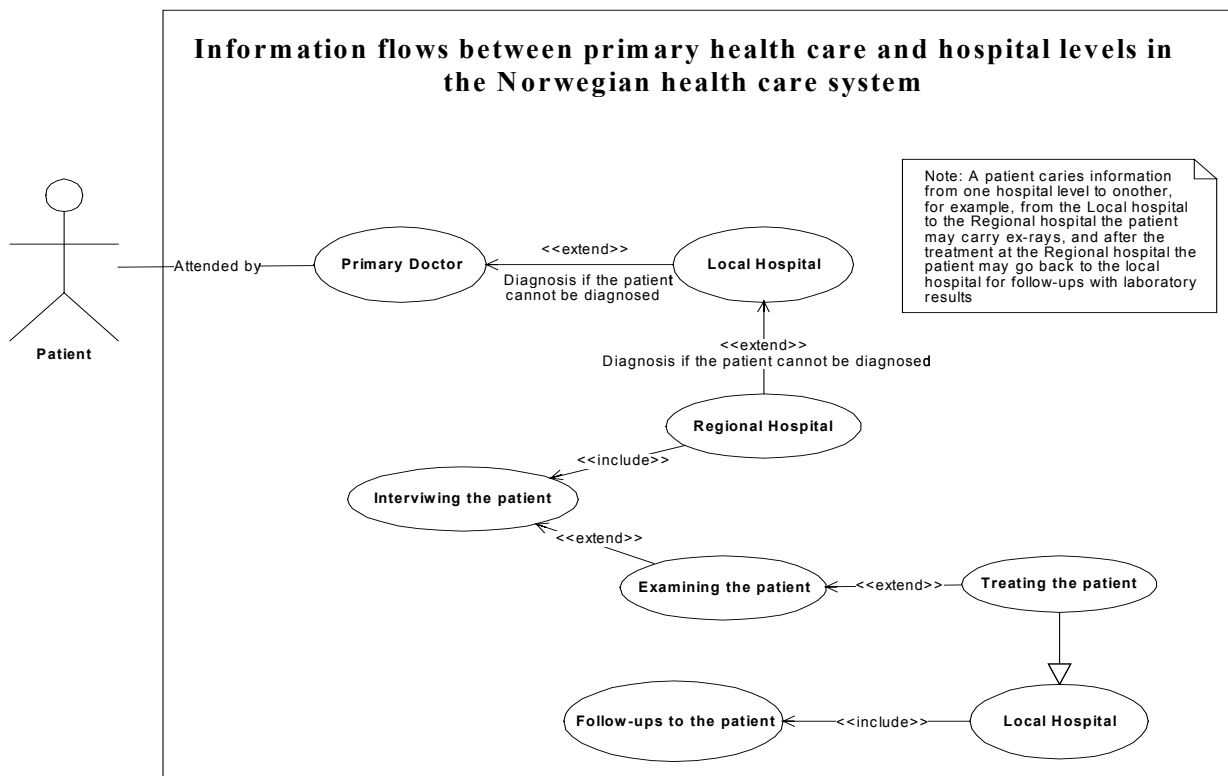


Figure 1.3: Information flows between hospitals in Norway

Source: A study at Rikshospital in Norway, October to November 2002

1.5 A summary of thesis chapters

The thesis is organized as follows. Chapter 1 presents an introduction of the study; personal motivation, the case study and problem areas. Chapter 2 provides a description of the study methods and the theoretical framework for my fieldwork. Chapter 3 discusses the related literature and theoretical focus. Chapter 4 introduces the research settings, describing the situation analysis of Mozambique and Tanzania to show the countries' historical and existing situation, including an overall description of the province/region, districts, people and communities who make them up. The first four chapters provide the reader with background knowledge sufficient for understanding the main findings, discussions and conclusions drawn in this thesis. Chapter 5 describes the research findings: including the health information systems functionality: data collection, storage, processing and reporting, and the analysis of identified problems related to data collection, processing and analysis, and reporting. Chapter 6 provides the analysis and discussion of the findings in relation to the study problem and in relation to what is found in the literature to date, the recommendations and generalizations from the study. Chapter 7 provides the analytical conclusion towards the main problem area, the research contribution to knowledge, and possible further work basing on my reflections on the research findings. The appendices contain copies of reviewed documents, tools for data collection, and necessary permissions for the study.

Chapter 2

LITERATURE REVIEW AND THEORETICAL FOCUS

My dissertation is informed by situation analysis of the Health Information Systems in Mozambique and Tanzania with additional influences from a review of the literature as a secondary source of information. In this chapter, I present the theoretical focus relevant to my field research and interpretation in relation to the research approach. This theoretical focus, together with my research findings, make up the foundation for analysis and discussion of the research.

In order to analyze the use and management of information at local levels within the Health Information System (HIS), we need a theoretical focus for approaching it. The theoretical focus aims at developing an understanding and knowledge around issues relating to HIS operating in developing countries. The focus presented in this chapter is drawn from various writers on the existing HIS in developing countries, social-cultural factors shaping the HIS, the role of Information and Communication Technologies (ICT) in health systems in developing countries, and decentralization of information management toward the district level as a way of restructuring the health information system in the broader processes of health sector reform.

2.1 Health information systems in developing countries

Data collection is the first step of the information process within the health information system, so health information systems are often classified according to data collection method. Studies show that there are two basic ways in which to collect data: routinely and periodically (non-routine). Periodic data collection usually means conducting surveys and these can appear to be expensive at first glance. However, they involve one-time costs, and may be less expensive than routine data collection in the long run (Ties 1991). Without external financial and technical assistance, most developing countries cannot afford to rely on periodic data collection methods for generating information (Lippeveld 2000).

Many health information systems in developing countries, for example, Mozambique and Tanzania as my case studies, deal with routine data collection at the health facility level, which are the main sources of data in healthcare information systems. The routine data collection involves the various health programmes: Maternal and Child Health (family planning, antenatal care, deliveries and immunization), Tuberculosis and Drug programmes.

There are people living in remote areas who cannot reach the health facilities due to poor infrastructure and long distances from the community to the health facility. Therefore, there is a need to combine routine data collection with other data sources and data collected on a periodic basis, particularly to obtain more data at the community level. As Lippeveld argues,

No single data source can provide all of the information required for planning and management of health services. A national health information system in support of health services always uses a combination of data collection methods,

depending on the nature and the use of the information for which data need to be collected (Lippeveld 2001, page 17).

2.1.1 Routine health information systems

Routine health information can be defined as “information that is derived at regular intervals of a year or less through mechanisms designed to meet predictable information needs” (RHINO 2001, page 11). Examples of routine health information are information generated from data collected by health workers on various health programmes; Mother and Child Health, communicable diseases, Tuberculosis and Drug programmes. Routine data can also be collected by/from the community.

Data collection can be quite simple, requiring only a pen and a piece of paper. It can also become quite sophisticated, employing several people, an array of pre-printed forms, calculators, computers and all the accessories that come with computers (Ties 1991). “Their main purpose is to record data that will assist care providers in health services delivery to individuals or to communities at large, at the facility itself, or through outreach activities in the community” (Leppeveld 2000, page 95).

While performing their daily health care activities health workers within the health facilities collect data for patients and health facility management. Data collection in health facilities consists of a set of forms, registers, and tally sheets filled in by health workers. Routine health facility data can also be aggregated to generate information on services provided to the population and for diseases surveillance. As such it structures the communication between health professionals and patients and makes the continuous, cooperative work of managing patient’s trajectories possible.

Yet most experts agree that routine health information systems in most countries, industrialized as well as third world countries, are woefully inadequate to provide the necessary information support to individual care and public health activities. In fact, poor use of information for evidence-based decision-making is probably one of the main causes of the current lack of linkages between individual care and public health systems (Lippeveld 2001, page 13).

Rarely is sufficient consideration given to the amount of data that are collected. In a study carried out in Atlantis, in South Africa, it is reported that, “a comprehensive evaluation of the information system showed that the volume of data collected is enormous but that the quantity of useful information produced from it is minimal” (Braa *et al.* 1997, page 115). Sandiford argues that, “Collecting data on diseases for which there is no effective response is obviously of little value” (Sandiford *et al.* 1992, page 1082).

There are several reasons why routine information systems in developing countries do not provide the necessary information support for decision-making. The following reasons are reported in the literature (Allotey and Reidpath 2000; Braa and Nermunkh 2000; Khemrany 2001; Rubona 2001; Wilson *et al.* 2001a).

- Poor quality of data
- Weak analysis of data
- Lack of an information culture
- Lack of trained personnel
- HIS activities seen as a burden due to high workloads especially at the health facility level.

In summary, routine health facility data have a potential role to play in facilitating the improvement of the use and management of information within the HIS. Since the routine health facility data are the main source of information for individual patient and health

facility management, if used and managed effectively, such routine data can provide necessary information for decision-making.

The following section provides a description on the relationship between routine health information systems and the health system in general.

2.1.2 Health Information Systems and management information systems

A Health Information System (HIS) is a functional entity within the framework of a comprehensive health system to improve the health of individuals and the population. As such, it is a *management information system*. Although many definitions of a management information system have been proposed, I propose the one given by Hurtubise (1984): “a system that provides specific information support to the decision-making process at each level of an organization” (Hurtubise 1984 cited Lippeveld 2001, page 15). The HIS structure should allow generation of necessary information for use in decision-making at each level of the health system with a given amount of resources. This involves the processes for collecting, processing and disseminating information in a health system (Shrestha and Bodart 2000).

The HIS structure can be described as a set of interrelating constitutive elements that can be grouped under two broad components: information process and HIS management structure. The information process consists of the following components: data collection, data transmission, data processing, data analysis, and presentation of information for use in patient care and health services management decisions. “In order to make the information process efficient, a HIS management structure is required to ensure that resources are used in such a way that the information produces high-quality information

in a timely fashion” (Lippeveld and Sauerbon 2000, page 17). The HIS management structure consists of the following components: HIS resources including persons (for example, managers, statisticians, epidemiologists, and data collectors); supplies (for example, registers, telephones, computers, report forms, data processing programs and financial resources); and a set of organizational rules (for example, the use of diagnostic and treatment standards, definition of staff responsibilities, supply management procedures, and computer maintenance procedures), to ensure efficient use of health information system resources.

For the HIS structure, the organizational level goes from local levels (health facilities and community) to the national level. Each of these levels has specific functions that require specific decisions to be made, intended ultimately to improve the health status of the population. The information needed for decision-making at each level changes continuously with changing planning and management needs. This, in turn, affects the data collection, data processing and analysis and information presentation.

Based on clearly defined management functions, the information needed for decision-making at each level of the HIS can be defined. The next question is how to obtain this information in the most effective and efficient way (Lippeveld 2001). To answer this question, it is important to understand the HIS structure in relation to the social and cultural aspects of the people around it, which is described in the following section.

2.2 Health Information systems: social and cultural aspects

A health information system can be considered to be a combination of people, equipment and procedures organized to provide health information to health workers and the population it serves. It should have at least the following technical elements: *input* (data),

processing, in which input data are transformed into output, and an *output* (information). It also includes a *storage* element, where data can be stored before and after processing (Ties 1991). However, information systems cannot be understood independently of the people around them; their social relationships, their culture and the work practices that they are engaged in within everyday life. In order to gain a better understanding of information systems development, implementation and use, all work within a particular information system must involve a better understanding of how people work and what kind of organizational practices they are engaged in.

An information system includes the social system, which in turn, has its own subsystems of people, business processes, social structure, and culture. The problems of development, implementation and use of information systems are well known and invariably they concern an interaction of human, organizational and technical factors, which cannot be separated. Therefore, information systems should not be regarded as technical systems with behavioral implications but are better conceptualized as social systems in which technology is only one of the elements (Walsham *et al.* 1988).

2.2.1 Information systems as social systems

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

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

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

2.2.2 Information systems and culture

There are many definitions of culture provided in diverse literatures. I hereby consider a definition by Reeves and Baden, that culture comprises “the distinctive patterns of ideas, beliefs, and norms which characterize the way of life and relations of a society or group within a society” (Reeves and Baden 2000, page 4).

In general terms, culture can also be considered as a set of ideas, and rules, that is, culture comprises systems of shared ideas, systems of concepts and rules and meanings that are expressed in the ways that humans live. Culture refers to “humans’ knowledge, not what they do and make. It is this knowledge, which provides standards for deciding: what is..., what can be..., how one feels about it..., what to do about it...”(Keesing 1981, pages 68-69 cited Hardon *et al.* 2001, page 3).

An information system is an integral part of the wider culture and society in which it is found. This means that ideas, practices, organizational arrangements, roles and statuses in the information system reflect the wider socio-cultural and political-economic context in which they occur and are influenced by that context (Hardon *et al.* 2001).

The RHINO workshop recommends that, one of the lessons of experience and guidelines in the collection and use of routine health information in developing countries is “the shaping of the culture of the organization or health system that intends to benefit from the information system” (RHINO 2001, page 7). The workshop refers to this as a “culture of information” or information culture, which relates to the policy and management environment, particularly the incentives for information use within it, and the experience and attitudes of managers and planners with respect to the role information plays in securing adequate performance in the health sector.

2.2.2.1 Information culture

Despite the rapid growth of requirements for data recording and reporting within the health information system, there is not much evidence that the data are used. Sapirie (2001) argues that,

Extensive emphasis is placed on the importance of correct and complete recording and reporting. Considerable inservice training is provided in the proper completion and submission of the reports, and service units are monitored for timely and complete reports. The result is that considerable reporting takes place, but since little of the information results from or is fed into managerial processes and “action-taking”, the data remain largely unused (Sapirie 2001, page 106).

Changing the health information system requires a carefully managed process resulting in the creation of a new information culture, that is, changing the way information is gathered, processed, and used for decision-making. As Lippeveld (2001) puts it:

Even if a perfectly relevant, well–organized, and technologically sound routine health information system were readily available, it would not be possible to introduce it immediately. The main issue is that information systems are managed and used by people who have certain beliefs, attitudes, and practices, and changing them will take time (Lippeveld 2001, page 24).

Establishment of an information culture has been a challenge in Zambia as a recent case study. Simwanza and Church (2001) found that while the Health Management Information System (HMIS) in Zambia was designed, and health workers were trained in accord with internationally documented practices, a technically sound system, in and of itself, does not mean that data are used as broadly for evidence-based decision-making as hoped, nor does it consistently produce evidence of the quality of data required to support good decisions.

Training health workers in data use has been seen as a way of strengthening the capacity of managers at the district and local levels to use health data for better management and health service delivery. However, in another recent study, Azelmat *et al.* (2001) show that, “Creating an information culture is a long-term behavioral intervention” (Azelmat *et al.* 2001, page 43). From the very beginning, the major objective of the health information system in Morroco was to improve the use of Maternal and Child

Health/Family Planning (MCH/FP) data generated by the system for decision-making at all the levels. For five years, several activities were undertaken to convince the managers of programmes and peripheral health services, and, through them, the service providers, that information can lead to action. To achieve this, training was designed in the form of exercises in MCH/FP data analysis that would help participants identify problems and propose solutions. Although health information system restructuring did transform the system into a more relevant, reliable, and rapid information production tool, it did not lead automatically to better use of the information.

2.3 Information and communication technologies (ICTs) in developing countries

Heeks (1999) defines information and communication technologies as “electronic means of capturing, processing, storing, and communicating information” (Heeks 1999, page 3). These comprise computer hardware, software and networks, radio, television, telephone, books and newspapers.

Given their role in the current transformation of advanced economies, information and communication technologies (ICTs) have the potential to affect health conditions in developing countries both directly and indirectly. ICTs can work directly by improving health care provision and disease prevention. They also work indirectly on the health status of the population through their effects on the broader determinants of health, such as growth, the economic position of households, and the social infrastructure (see, for example, Chandrasekhar and Gosh 2001).

2.3.1 ICT and development

There are opportunities for applying the ICTs in supplying health, educational and agricultural information in developing countries. However, such opportunities are limited by a number of features, which are common to most poor developing countries. These include inadequate basic physical infrastructure such as telephone lines, and lack of required skills among health workers for using ICT tools (see, for example, Chandrasekhar and Gosh 2001; Braa *et al.* 2001).

Introducing ICT in a given situation or organization involves non-technical aspects, that is, working with the community as well. To build sustainable programmes and projects ICT champions would do well to consider standard capacity building guidelines. “Building the capacity of a community or local organization is much more than ensuring it has resources and inputs” (Batchelor 2001). In building local capacity for development Batchelor (2001) suggests that, “It is not a question of applying information – but applying knowledge to development.” We have first to consider the fact that, every community has its own set of values, all may not share them but there have to be some common values. “Commonality is often built around language (audio, written and visual)” (Batchelor 2001).

Some of the most successful developments of local content and capacity building surround local language, because it is relatively easy to develop material in local language. The second aspect surrounds the aims of the community. This involves, “asking the community more open questions like, what are your problems?, which are the most important?, and what do you need to tackle these problems?” (Batchelor 2001). Thus making the community part of a context that will influence the possible strategies.

“Structure and systems, and even resources, flow from the aim and agreed strategy. The development of local capacity will vary depending on the resulting strategy and structure” (Batchelor 2001).

As ICT programmes and projects progress, the identification of required resources, including training and skill upgrading needs, will be a more natural part of the planning process.

In discussing the advent of ICT in developing countries, we also need to consider the major constraints caused by the lack of resources, including high costs of using ICTs. However, in a study done in Mozambique on the use and appropriation of ICT with a focus on the health sector, it was revealed that, “computers and internet are rapidly being spread to the provincial capitals and major districts in Mozambique. A main problem identified is the lack of ICT-skills and education and poorly developed infrastructure and network support” (Braa *et al.* 2001, page 1). The poor ICT infrastructure makes it difficult to introduce computers and electronic communications in most of the districts and a considerable number of districts are without reliable electricity.

ICT strategies may be designed and implemented in ways that could maximize the use of existing resources (money, human resources and technical infrastructure such as telecommunications and electricity), to support development goals, and the necessary skills may be generated over time. This can be done by integrating areas which do not have ICT resources with support from neighboring areas which have ICT resources, and then providing training to the users (see, for example, Batchelor 2001; Braa *et al.* 2001).

2.3.2 ICT and Health Information Systems

Health Information Systems development depends on the level of the general ICT infrastructure in a particular setting.

The expectations that ICTs generate for health improvement in developing countries as described by Chandrasekhar and Ghosh (2001), stem from three sources.

The first is their role as an instrument for continuing education and lifelong learning that will enable doctors in developing countries to be informed about and trained in the use of advances in knowledge. The second is their use as a delivery mechanism to poor and remote locations of a wide variety of services varying from improved public health education to emergency advice, including advice on dealing with and mitigating the consequences of natural disasters. The third source is their potential use as a mechanism to increase the transparency and efficiency of governance which would, in turn, improve the available and delivery of publicly provided health services (Chandrasekhar and Ghosh 2001, page 851).

Computer technology is a crucial question for ICT development in developing countries, and it is an important area for further research. However, to achieve positive results in the use of computer equipment, the health sector has to invest in pre-service and in-service computer training for all health workers. Also the maintenance of the computer; both hardware and software, should be decentralized to the peripheral levels to avoid delays, especially when the maintenance function requires going to the central level. As Lippeveld (2001) puts it,

...introducing computer technology is not necessarily the silver bullet that creates effectiveness and efficiency in health services. On the contrary, lack of appropriately trained staff and hardware and software problems sometimes result in the decay and obsolescence of expensive computer equipment, without any gains in decision making (Lippeveld 2001, page 24).

2.3.3 Computing and routine work

Most computing serves as a resource or tool to support other work: performing complex analysis, preparing documents and sending electronic messages using office automation equipments. To improve the character, quality, and easy use of computing work, we must understand how automated systems actually are integrated into the work they support; how people adapt to computing as a resource, how they deal with the unreliability in hardware, software and operations, which are present in almost every computing environment, even where computing is widely used and considered highly successful (Gasser 1986).

In his study of routine computer use in several organizations, Gasser (1986) argued that, the routine user of computing often faces several low-level problems whereby the nature and severity of such problems vary with the nature of opportunities and contingencies faced in work. That is, the nature of recurrent computing problems that users face depends on how easily they can fit computing (the activity of making changes to computing or changing the structure of work to accommodate for computing misfit, for example, adjusting work schedules and commitments), augment computing (undertaking additional work to make up for misfit, for example, conducting training), or work around computing (intentionally using computing in ways in which it was not designed or avoiding its use and relying on an alternative means of accomplishing work, for example, the use of backup systems, manual or computerized), given the contingencies they face, the resources they control, and the place of their work in the production lattice of computing. Gasser defines the production lattice as “a complex, coordinated structure of intersecting task chains” (Gasser 1986, page 28), whereby, work in organizations can be

seen as a complex structure of organized commitments, which serves to coordinate tasks performed by many people.

The routine information generating process within HIS in developing countries involves interrelating components. Many resources and activities of health workers are taken for granted in this process. Each health worker has a variety of roles to play, each role involving a different line of work. Each of these roles may demand the health worker's attention and activity in the course of the work. Coordination of activities requires commitment from individual health workers. And health workers need to work across and around gaps in existing health systems.

2.4 Decentralization of information management toward the district level

Routine health information systems in most countries are centrally planned and managed. Indicators, data collection instruments, and reporting forms usually have been designed by centrally located epidemiologists, statisticians, and administrators (called data people), with minimal involvement of lower-level line managers and providers of the health services (called action people) (Lippeveld 2001, page 19).

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

In a survey of District Health Management Teams (DHMTs) in Tanzania on the progress of the decentralization process in that country, it was reported that,

...while decentralization has been ongoing for over a decade, at least rhetorically, less than half of DHMTs report that decentralization is underway in their districts and the actual transfer of administrative and fiscal responsibilities is still limited for the majority of districts (Hutchinson 2002, page 1).

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

The importance and needs for appropriate decentralized district-based health information systems addressing the needs of local management and health workers has been widely acknowledged and emphasized by the World Health Organization (WHO). According to the WHO definition,

a district health system based on primary health care is a more or less self-contained segment of the national health system. It comprises first and foremost a well-defined population living within a clearly delineated administrative and geographical area. It includes all the relevant health care activities in the area, whether governmental or otherwise. It therefore consists of a large variety of interrelated elements that contribute to health in homes, schools, workplaces, communities, the health sector and related social and economic sectors. It includes self-care and all health care personnel and facilities, up to and including the hospital at the first referral level... (Tamiro 1991 cited Lippeveld 2001, page 21).

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

In the discussion below, I describe the experiential basis from a large and global project on the design and implementation of health information systems (HIS) in a number of developing countries. This project, which is known by the acronym HISP (Health Information Systems Project), was initiated in 1994 by researchers from Norway, the University of Western Cape and University of Cape Town as an action research HIS project in post-apartheid South Africa (Braa *et al.* 2003).

With its inspiration drawn from the “Scandinavian action research” tradition coupled with the fervor of the South African freedom struggle, the aim of HISP was primarily to empower the new and emerging local health management structures and health workers through improved and locally based information systems (Braa *et al.* 2003, page 6).

The status and inefficiency of most existing HIS in developing countries are linked to the structural weakness of the health system and lack of integration of the overall health system:

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

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

2.4.1 HISP experience in South Africa

In South Africa, HISP started as part of a subcommittee on HIS for the reconstruction and development program in the health sector, in 1994, the focus being on identifying information needs and supporting interim district management teams. Starting in two provinces, Western and Eastern Cape, the efforts resulted in the development of essential data sets (EDS³) and standards for improving health care data and development of the District Health Information Software (DHIS)⁴ application to support the implementation and use of such data sets (Braa and Hedberg 2002). The software is an open source database application, which means that, the source code (programming) and database structure are open to modify by anyone and the software is distributed free, of charge. However, open source software that is distributed for free, requires training and technical support. “In addition, open source software may be somewhat more expensive to support over the long term, since different versions may evolve making it much more complicated to introduce and test upgrades” (Wilson *et al.* 2001b, page 92).

The HISP processes in South Africa are summarized by Braa *et al.* (2003) as follows:

After about 9 months of efforts in developing the minimum dataset, 47 data elements were selected for a real trial, first in the pilot districts, then in the whole of Cape Town. In a parallel process, the first DHIS database software prototype was developed to capture and analyze the data across the health facilities. This led to another iteration to the cycle and a revised version of the dataset implemented in the province by January 1999. Similarly, in the Eastern Cape province a dataset of 27 elements were implemented in all districts from January 1998, and the DHIS by the end of the year. The datasets of the two provinces were partly incompatible, emphasizing the need for providing at the same time both autonomy to the provinces and yet having a common basis for comparison. In 1999 and

³ Essential data sets are basic elements for health data collection, for example, live birth and delivery to woman under 18 years (Braa and Hedberg 2002). They are also referred to as minimum dataset

⁴ For more details on DHIS see Wilson *et al.*, 2001b.

2000 new cycles of consultation on the minimum dataset was carried out, this time in all provinces, leading to a nationally sanctioned standard dataset for the whole country (Braa *et al.* 2003, page 28).

HISP received funding from the Norwegian Agency for Development Co-operation (NORAD) for a 2-3 year pilot project (1996-1998), and the Norwegian University Council (NUFU) for the periods 1999-2001 and 2002-2005, and has received funding through the EQUITY Project of the USAID for the period 2000-2003 to support the national rollout (Braa *et al.* 2003).

At the time of writing, HISP has been designated as the national standard in South Africa, and is in the process of being rolled out in all provinces (Braa *et al.* 2003).

2.4.1.1 Lessons from HISP in South Africa

Implementing a system of this size and scope provides a natural laboratory for testing different approaches and, hopefully, learning about what works and what does not work. I summarize the most significant lessons learned from experiences in the Western Cape and Eastern Cape Provinces of South Africa, as presented by Wilson *et al.* (2001b), and Braa and Hedberg (2002) below.

Through HISP project in South Africa, considerable effort was focused on helping staff use paper and pencil to master analytical skills before the system was computerized. This required development of essential data sets, which health workers can easily understand and analyze on the spot without the need of a computer. Similarly, the use of hand-drawn, catchments area maps and graphs was strongly encouraged as a key step in getting people to understand the populations they serve and to trust the data they collect (Braa and Hedberg 2002; Wilson *et al.* 2001).

The participatory approach which involved all stakeholders or actors in the process of HIS development, aimed at enhancing health services at district level. The input from district and health facility level staff led to new features and functionality in the system. Due to being involved, many district health staffs have a feeling that they own the system.

Several lessons were learned on the software development process. Good linkages and efficient communication between users and a professional software development team were developed. “The good fixed and cellular telephone infrastructure in South Africa has been an asset” (Wilson *et al.* 2001b, page 91) in making communication between users and software professionals easy. Data use was maximized by building links to off-the-shelf software for analysis and reporting, such as Excel pivot tables. “This lets managers use the analysis tools they are most comfortable with and reduces the software development work that would otherwise be required to reproduce this functionality in their application” (Wilson *et al.* 2001b, page 91).

“If database design is internally complex, establish mechanisms to provide users with simpler views of the data for their own ad hoc analysis. Many users expressed frustration at not being able to understand the manner in which data were stored in the system” (Wilson *et al.* 2001b, page 91).

The implementation processes of new software become a vehicle for change, including: standardization, integration, and more widespread dissemination of health data and information (Braa and Hedberg 2002).

The indicator-based approach to determining information needs is an effective way to reduce the number of data elements collected and to ensure that data collected is relevant (Braa and Hedberg 2002).

Improvements in data recording procedures deserve as much attention as reporting and data processing. In the Eastern Cape, focus on this aspect came very late in the process. Problems of time spent recording data, poor data quality and limited use of the data at local level are likely to continue unless more emphasis is placed on this area.

It has been very hard to get people to make timely reports: “they prefer annual reporting. The system is most useful if it can provide fast and up to date indicators of what the problems are and where they are localized” (Wilson *et al.* 2001, page 92).

Currently, the reconstruction processes of the health sector and the DHIS are being adapted in different countries such as Mozambique (since 1998), India (since 2000), Malawi (since 2000), Tanzania (since 2001), Cuba and Mongolia (since 2002) (Braa *et al.* 2003). Thus, Tanzania is still in early stages of adaptation, having a long way to go it can benefit through learning from experiences in South Africa and Mozambique.

While the organizational structures, scale and cultures differ greatly between these countries, there are important problems and concerns that they share. The vertical structure of health programs and their respective information systems make integration and control of information at local administrative levels difficult...(Braa and Hedberg 2002, page 20)

2.4.2 HISP experience in Mozambique

In Mozambique, the processes of HISP adaptation started in 1998, from a meeting between one of HISP initiators with a member of the University of Eduardo Mondlane

(UEM) faculty member at an international conference. This meeting led to the decision to collaborate and in the same year, the HISP initiator visited Mozambique, leading to initial contract with officials from the Ministry of Health (MISAU). Then the NUFU funding from Norway was confirmed in November 1998, and the HISP project in Mozambique started in January 1999.

MISAU asked HISP to be piloted in three pilot districts in the three training provinces for physicians. However, MISAU did not back it up with strong official support. “Within MISAU, there have always existed divided interests around ‘which IT projects to support’. HISP was seen to be in competition to the efforts of a large private company contracted to develop a ‘master plan’ for computerization and networking the entire health sector” (Braa *et al.* 2003, page 31).

The HISP research in Mozambique started with a survey of information technology (IT) diffusion and use with a focus on the health sector in three provinces, Gaza, Inhambane and Niassa. A joint team consisting of a staff from the University of Oslo, staff and students from UEM and MISAU officials carried out the survey. “Results of the survey helped to establish the basis for initiating the action research in the three designated districts” (Braa *et al.* 2003, page 31).

In early 2000, the District Health Information Software (DHIS) prototyping started in Mozambique when the first version of the software was translated into Portuguese. Over the next 18 months, two more versions were translated, causing problems of multiple versions working in different provinces. “However, as from 2002 a full-blown multi-language functionality was enabled through the efforts of the software team in South Africa. This ‘new’ version is currently being implemented in several districts in the three Provinces where the original pilot districts were located” (Braa *et al.* 2003, page 34).

The development of educational capacity has been a key focus of the HISP project team. In addition to research and education, HISP has conducted a number of training workshops and on site sessions in the three provinces. “The first provincial workshop was held in the south in early 2001, in an attempt to make HISP as a provincial project. However, with an absence of total national support, this objective has still to be fully realized” (Braa *et al.* 2003, page 36)

2.4.2.1 Lessons from HISP in Mozambique

In implementing externally developed information system, adaptation to the local organizational structure, routines and tasks have to be carried out. Also factors such as culture, resources, governmental structure, educational level, language and legislation have to be taken into consideration. In most cases, two neighboring developing countries like Mozambique and South Africa, they have more in common in terms of culture, resources, governmental structure, educational level, language and legislation than countries situated far apart. “Nevertheless, when transferring the information system to Mozambique, a sequence of problems occurred during installation, assimilation and adaptation, but also some advantages of getting the system from another developing country were found” (Kaasbøl and Nhamposa 2002, page 515).

The lessons from HISP in Mozambique are discussed bellow. These include, the adaptation process, that is, purchasing, configuring, installing the software and training health workers on computer use.

The origin of the system to be adapted being in a neighboring developing country decreased the resistance against it among the decision makers, and thus the system was adapted including the experiences gained from its development and implementation in South Africa. Purchasing the software posed no problem, since the software is distributed free of charge. However, there were some installation problems that occurred. “The installation problems occurred mainly due to shortages of technical skills, that is, an indication of the general shortages of resources that exists independently of the origin of the computer system to be installed” (Kaasbøl and Nhamposa 2002, page 515).

The HISP team has carried out four mass training sessions, an initial session in 2001 for all three provinces and then training in each of the three provinces. At each of these training sessions, 40 to 60 people were trained the basics of computer use, the HISP approaches and analysis of data using the DHIS. Participants came from different provinces and districts and have a variety of backgrounds.

While the strategy of training many users at a time can be seen as a political brokering approach that aims at introducing the DHIS in the districts, there is no tangible success of the strategy. There were a number of problems with the DHIS training strategies.

- The approach of sending a large group of lecturers to the province for two weeks to training users and then sending participants back to the districts with minimum support of users thereafter, was not cost-effective.
- Many participants had no computer skills at all, and after the course participants returned to districts where there were no computers and could not use the training skills afterwards.

The participatory approach was used through mutual learning processes whereby discussions on ways that the system should be adjusted to fit the health information processes were conducted.

The learning process was initiated with a two weeks training course in computer use with the objective of getting the users and the designers to speak the same language in order to improve the knowledge upon which systems are built, enable people to develop realistic expectations, reducing resistance to change, and increase workplace democracy by giving the members of an organization the right to participate in decisions that are likely to affect their work (Kaasbøl and Nhamposa 2002, page 512).

The DHIS was developed in South Africa using English standards. In order to start using the software in Mozambican context, the software had to be translated from English to Portuguese.

General language competence, computer skills, and medical terminology were required in the translation. The phrases translated from English to Portuguese tended to be longer in the target language. While this would not matter in the translation of prose, field names and button labels on a computer display have limited length, and too long names would clutter up the user interface. Consequently, the buttons had to be located in different positions or the long expressions had to be simplified in order to keep a reasonable layout and distributions of the buttons (Kaasbøl and Nhamposa 2002, page 513).

After testing the first prototype of translated software in three pilot districts, the first problem faced concerned the discrepancies between the meanings of the medical terminology with the ones visualized by the software. This problem was solved through several and long discussions between the medical staff and the researchers.

At the time of writing, only pilot installations have so far been achieved, so the intended changes of organizational routines cannot be observed yet. The adaptation of DHIS from

South Africa to Mozambique required a substantial effort of computer equipments and professionals, which are scarce and costly in developing countries.

2.5 Summary of the literature review

The literature was reviewed in the following areas, in order to develop an understanding and knowledge around issues relating to Health Information Systems (HIS) in developing countries: HIS in developing countries, social-cultural factors shaping the HIS, the role of Information and Communication Technologies (ICT) to health systems in developing countries, and decentralization of information management towards the district level as a way of restructuring the health system.

HIS in developing countries: to understand and define the sources of data within the HIS in developing countries. To understand the tools used for data collection and storage within the HIS. To explore the problems related to data collected within the HIS in developing countries and to understand the relationship between HIS and management information systems.

Social-cultural factors shaping the HIS: to explore the social-cultural aspects of Information Systems (IS) for better development, implementation and use of HIS; IS should be conceptualized as social systems and IS as an integral part of the wider culture and society in which it is found. The shaping of the culture of the health system as a way of developing an information culture, that is, the policy and management environment, particularly the incentives to use information for decision-making, and the experiences and attitudes of managers and planners with respect to the role information plays in improving health performance. And challenges in establishing an information culture.

The role of Information and Communication Technologies (ICTs) to health systems in developing countries: to understand and define ICTs and their role in the current transformation of advanced economies with a focus on the health sector. Exploring the limitations to opportunities offered by ICTs in developing countries such as inadequate basic physical infrastructure availability and lack of skill among health workers for using ICT tools. There is a need for building the capacity of the community or organization when introducing ICT in a given situation or organization by making the community part of the context that will influence possible strategies. There are necessary conditions for positive results in the use of computer technology within the health sector, such as investing in pre-service and in-service computer training for all health workers. However, there is a need for understanding how automated systems are integrated into the work they support; how people adapt to computing as a resource, how people deal with the unreliability in hardware, software and operations.

Decentralization of information management toward the district level as a way of restructuring the HIS: Identifying the extent of decentralization of information management towards the district level; most health public function should be carried out by the District Health Management Teams (DHMTs) in collaboration with, and in active involvement of the community. Exploring the experiential basis from a large and global project on the design and implementation of HIS in various developing countries, known by the acronym HISP (Health Information Systems Project); providing a brief history and aims of the project and then exploring lessons from the project from designing to implementation in two developing countries, South Africa and Mozambique.

2.6 Theoretical focus

The literature review has shown that information systems are social systems, a concept that applies to health information systems. My research assumption, therefore, is based on the concept that, information systems cannot be understood independently of the people around them; how people work and what kind of organizational practices they are engaged in. “This means that ideas, practices, organizational arrangements, roles and statuses in the health system reflect the wider socio-cultural and political-economic context in which they occur and are influenced by that context” (Hardon *et al.* 2001, page 30)

In health information systems, the socio-cultural and political contexts are reflected in work practices that surround health data collection, data storage, data processing and analysis, data presentation and use, and information flows within and across the HIS. Thus, training in data use must be conducted to strengthen the capacity of health workers at the district and local levels to use health data for better management and health service delivery. However, “creating an information culture is a long-term behavioral intervention” (Azelmat *et al.* 2001, page 43), requiring supervision, support and feedback to local level health workers. And routine health information systems management should be decentralized to improve local use of health information. This involves local level managers and health service providers in designing data collection and reporting tools.

Chapter 3

RESEARCH METHODS

The research methods represent the means for achieving the goals of researchers. My research study is informed by informatics and public health fields, and my field research approach is both sociological and managerial, that is, health care information systems are not limited to curative and preventive measures, a managerial component must be present for better planning and quality of care. There are various qualitative research study methods that a researcher can use, depending on the social and technical aspects related to the problem areas under investigation.

In analyzing the research problem areas described in Chapter 1; how are primary healthcare data being collected? What are the tools used to collect and store (record) the collected data? How are primary health care data being kept and managed over time? Where are the collected data sent? Which of the data collected are used? Who uses the data and what do they use it for? How is the patient information shared when, for example, a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, or from one hospital to another, and when she leaves the hospital? A sociological approach had to be included to develop a rich understanding of different stakeholders. I also explored additional theoretical aspects in the course of the problem areas of my field research. Most important among the theoretical aspects are based on the concept that, information systems cannot be understood independently of the people around them; how people work and what kind of organizational practices they are engaged in.

3.1 Qualitative and quantitative methods

Qualitative and quantitative methods both have roles to play in developing theories, models and hypotheses. Most literature distinguishes between qualitative and quantitative methods, while emphasizing that the issue is not whether to use one form or another but rather how these two methods might work together to foster the development of a theory, or a model, or a hypothesis (Strauss and Corbin 1996). However, the selection of a particular method to be used depends on what the researcher wants to find out. “In this sense, your choice of the method should reflect an ‘overall research strategy’” (Mason 1996, page 19).

Qualitative methods are conducted in natural settings and are characterized by the use of data in the form of words rather than numbers, and they can also be visually coded. They are primarily in the form of observations, interviews, and documents review. Qualitative methods are particularly useful in determining *how* and *why* specific outcomes occur, for example, in patterns found from analysis of quantitative data (Anderson and Aydin 1994). In collecting qualitative data, the researcher seeks to capture the richness of people’s experience in people’s own terms. However, the results are often more difficult to analyze, generalize and draw conclusions since the answers contain very rich information and details.

Quantitative methods provide comparisons and statistical aggregation of data. Typically quantitative methods are characterized by the use of closed questions for *yes* or *no* answers or *a set of predefined* answers, which can be quantifiable, comparable and measurable to provide results. However, Silverman (2000) mentions that, “Quantitative research methods can amount to a ‘quick fix,’ involving little or no contact with people or

`field,' and also statistical correlations may be based upon `variables` that, in the context of naturally occurring interaction, are arbitrarily defined” (Silverman 2000, page 7).

The use of questionnaires that focus and restrict responses limits the adjustment of the questions guide to what is perceived as relevant during the fieldwork as it may render the previous results impossible to compare with the new ones. Since interviews can be performed with a varying degree of openness, the researcher will be allowed to undertake further investigation in case unforeseen relevant issues arise during the fieldwork, thus enriching the data being collected.

3.1.1 The choice of methods

Considering the problem areas in this thesis, a qualitative approach was applied during the fieldwork. The qualitative approach provided details through the health workers' own words and descriptions of health facility situations, events, interactions, and observable behaviors. I had direct engagement in the health facilities and was thus able to be an instrument for collecting data and analyzing the data that I was collecting from the settings.

3.2 Sources of information

The information presented in this thesis was collected through a combination of the fieldwork and the literature review. I conducted the literature review prior to, during and after my fieldwork. The fieldwork information is considered as my primary source of information, while the literature review is considered as my secondary source of

information. The literature review and the findings from the fieldwork together make up the foundation for the analysis and discussion in this thesis. In Mozambique, I participated in the fieldwork with the other Masters students: Masters in Information systems and Masters in Public Health, and the Health Information Systems Project (HISP) team members.

3.2.1 Fieldwork methods

For the fieldwork in both Mozambique and Tanzania, I employed qualitative research methods including ethnographic techniques; interviews, observations in the health facilities settings, reviews of documents, and the analysis of information flows and existing computer systems (see findings in Chapter 5) within the health information systems.

I was able to employ an ethnographic approach more fully in Tanzania than in Mozambique, because I know the local language and I am from and in the culture. However, using a combination of ethnographic techniques and being in the group field research gave me a range of coverage concerning my field sites in Mozambique as well. “Qualitative studies generally collect data by using several of these methods to give a wider range of coverage” (Bonoma 1985 cited Anderson and Aydin 1994, page 55).

Ethnographic interviews

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

Semi-structured interviewing was used, whereby each respondent was asked a series of pre-established questions (see the interview questions guide in Appendix B). Elaboration on what was being asked if a question was not understood was followed up with additional questions for further explanation, thus exploring answers and meanings. This provided information in the words of health workers in health facilities and district health offices about their experiences, opinions, feelings, and the procedures used in primary health care data collection, storage, use and information flows.

I found myself deciding *who, when, and how* to interview, as the fieldwork⁵ was progressing mainly according to my assessment of my knowledge and judgment as to how my fieldwork might best be developed further at that particular time during the fieldwork. While selection of interviewees was determined by other powerful people in the fieldwork settings (for example, hospital directors), I tried to retain the possibility to choose candidates for interviews. However, gaining access to interviewees was quite complex, as difficult as gaining access to the setting, which made it necessary for me to negotiate with the health directors in each particular health facility before I could contact the health workers I wanted to interview. An important example was the District Nurse Officer (DNO) in Kibaha district in Tanzania: at the end of my conversation with her, I asked whether she knew of other people dealing with MTUHA within the district with whom I might meet. “Yes, I do”, she replied, “How many people do you want to meet?” One day later, the DNO selected the health workers for the interviews and introduced me to them asking them to help me in my fieldwork.

⁵ Both in Mozambique and in Tanzania

The interviews conducted both in Mozambique and in Tanzania were individual interviews due to time availability of different health workers. While each interview in Tanzania took about 30-40 minutes with the use of the local language, in Mozambique each interview took 50-60 minutes due to translation of the local language. The time spent in each interview included the introduction session, that is, each interview started by introducing the interviewee to the purpose of the interview along with the reassurance about confidentiality and the right of the interviewee to decline to answer any question to which he or she would prefer not to respond.

The interviews both in Mozambique and in Tanzania took place within the health facility surroundings mostly in particular health workers' offices, which I think allowed the interviewees to relax much more than they would in less familiar surroundings, and also it allowed the interviewee to provide answers to the questions asked not only by using verbal expressions but also using physical examples. For example, when asked, "what are the tools used to collect (record) primary health care data?," the interviewees responded to the question by providing me explanations on different register books and forms that they are using, which are in their offices. During each interview I managed to take notes in brief and expand the notes immediately at the end of each day before forgetting the details of responses provided.

Observation

I used observation to gather the impression of the health facilities surroundings through activities carried out: time spent, work space taken as well as processes followed by health workers during routine primary health care data collection, in both Mozambique and Tanzania. This was in the form of participant observation whereby I had personal

contact with health facilities and health workers in order to understand what is going on in depth and detail as well as understanding what health workers said in interviews. Informal talks and discussion, particularly in Tanzania have also played an important role during my observation sessions in the field sites.

I spent approximately 15-20 hours a week doing the observations in different health facilities while documenting what I observed in field notes. My observations involved a wide context of the social and natural environments of health workers, and thus allowed me to see and interpret the health care activities through intensive interaction, for example, by participating in many of the day-to-day activities such as registering children for vaccination, weighing and curative services.

Documents review

The documents reviewed in Tanzania include health performance reports at health facilities and district level, the district plan reports and Health Management Information Systems (MTUHA) guidelines manual and data documentation. I also analyzed the patients' records for varying recording tools and content at the health facilities, district level and regional level.

Documents review in Mozambique was mainly done through the analysis of the patients' records for varying recording tools and content at the health facilities, district and provincial levels. This was done in a group work with other Masters students and HISP team members. I also reviewed the Ministry of Health's strategic plan for the health sector (2001-2005-2010).

I treated the health performance reports and district plan reports as social facts rather than as firm evidences to what they report, that is, I approached them for what they are and what they are used to accomplish. My approach to health performance and district plan reports was based on the fact that what organizations or people plan to do and/or what they report may not necessarily be the same things that they actually do. So I had to compare what is presented in the reports with what I was observing together with the interview responses from the field in order to understand the total context of the real working practices. For example, in Kibaha district health plan for the year 2002, it is indicated that each health facility within the district will be provided with supervision and support from January to December (District Executive Director's Office 2001), but this was not the case during my fieldwork. Among the problems faced by health workers from January to July (the time of the fieldwork) for the year 2002 was lack of support and supervision, as the following health worker said:

"We are supposed to have supervision from the district... I have not seen any one for this year." (Clinical officer A, Tanzania, July 2002)

3.2.2 Literature review

In order to gain an understanding of both the general themes of this thesis and the context of my case studies, I did the literature review prior to, during and after my fieldwork. The literature review is based on the existing Health Information systems (HIS) in developing countries, basing on the concept that, information systems cannot be understood independently of the people around them; how people work and what kind of organizational practices they are engaged in. This means that, work practices that surround health data collection, data storage, data processing and analysis, data presentation and use, and information flows within and across the HIS reflect the wider

socio-cultural and political-economic context in which they occur and are influenced by that context (see Chapter 2).

3.2.3 Fieldwork documentation

Through the description of my sample study (population), I tried to expand and organize the field notes as soon as I could after the fieldwork, which was my preliminary step for identifying key statements from the findings by reviewing my data in the light of my research questions. For example, the data collected were coded into a different set of tools that are being used for primary health care data collection, storage, and flows. From these data, the tools that seem to predominate are forms, register books and tally sheets. The respondents' answers from the interviews were also compared to what I was observing. I also used diagrams and flow charts to show the flow of data within the health information system as a reality from my field notes, as compared to what is described in the documentation of health information systems (see, for example, figures 5.1, 5.2, 5.3, 5.4, 5.5, 5.6, 5.7 and 5.8).

3.2.4 Validity and reliability

As described by Hammersley (1990), I refer to the validity of my research as the extent to which the research accurately represents the social phenomena to which it refers and the degree to which the research methods measure or record what they aim to measure. On the other hand the reliability of my research refers to the degree of consistency with which I assign instances to the same category as the observer in different occasions (Hammersley 1992).

My state of knowledge on the research problem in general, that is, knowing that a problem exists, but knowing little about its characteristics or possible causes, and the context of Mozambique with Portuguese language as a communication medium, means that there is a risk of studying phenomena that are irrelevant and missing important ones. However, the openness of qualitative research methods, helped me in adjusting my fieldwork methods to what was perceived relevant, following an exploratory approach.

Whether or not the generalizations I have made are valid in other developing countries is an important question (see a section on generalizations in Chapter 6). There is a possibility that not all the results found in Mozambique and Tanzania are valid to other developing countries.

3.2.5 Ethics

Ethical standards were maintained during this research by considering the following:

- Ensuring support from the Ministries of Health in Mozambique and in Tanzania: This mainly included the people within the Health Management Information Systems (HMIS) department (see Appendix C for the Ethical Clearance letters).
- Names of the health workers who participated were not used in reporting the results of the study and confidentiality was maintained all the time.
- Ensuring that informed verbal permission was obtained from all the participants.
- There were no threats of job loss or demotion for those health workers who would have declined to participate in this study.

3.3 Access limits and constraints on research methods

I have already described several constraints related to the research methods, including access to the interviewees in the above sections. I enumerate access limits and constraints below.

I could not use audio or video recording during the interviews and observation sessions in the settings because the health workers were not comfortable with being recorded. Most of the health workers feared to be broadcast on the radio or television. When expanding my interview notes with recorded interview sessions, it would have been easier for me to remember all of the issues that were being addressed by my interviewees during the interview.

As I mentioned above, the use of Portuguese language as a communication medium in Mozambique may have had influence in the lack of details from my fieldwork in Mozambique as compared to Tanzania, where I could speak and understand “Kiswahili,” the local language being used since “kiswahili” is my local language. Due to the language limitations in Mozambique, I had to use my colleagues as translators, especially during the interview sessions. The use of translators resulted into missing out the direct impressions and quotations from the interviewees and thus ending up with what was my translator’s understanding and interpretation from interviewees’ responses.

My presence during participant observation and ethnographic interviews within the health facilities surroundings may have influenced the situation I was observing, as well as responses from the interviewees.

3.4 Study Limitations

In summary, this study had the following limitations:

- i) The language problems in Mozambique made the study difficult for me as a researcher, since I did not have much control on my research design and plans.
- ii) In both Mozambique and Tanzania, the lack of resources, distances to the health facilities, time constraints and means of transport hampered the mode of research, since there are other health facilities that are in very remote areas, which I did not manage to visit.
- iii) In both Mozambique and Tanzania, most health workers were busy with health care delivery services. As a result, interview sessions were to undergo postponement, or were conducted during odd hours, which might have resulted in the interviewee being tired by the time the interview is conducted and thus not providing detailed answers.

Chapter 4

RESEARCH SETTINGS: Where I have been

This chapter contains a description of the research settings (countries, provinces, regions and districts), presenting a situational analysis of each setting in this study. I presented background on the existing health information systems in Mozambique as well as Tanzania, in Chapter one. This situational analysis will provide the reader with an overview of the research settings for which I will present my findings in the next chapter (McCoy and Bamford 1998).

4.1 Situation analysis of Mozambique

In this section, I briefly describe the situation analysis of Mozambique to show the country's historical and existing situation, including an overall description of the provinces, districts, people and communities who make it up. I focus on six aspects of this situation analysis, including the geography of the country, the demography, the socio-economic profile, the history of war, the state of literacy and illiteracy in the country and the health status and problems. These six aspects have impacts on health and health care delivery in the country.

Geography

Mozambique, a Portuguese speaking country, lies on the east coast of Africa. It shares borders with Tanzania in the north, Swaziland and South Africa in the south, Malawi,

Zambia, Zimbabwe and the northern part of South Africa in the west. On the east it has a long coast covered by the Indian Ocean (see figure 4.1). The country has an area of approximately 799,380 squared kilometers including inland bodies of water. The country is administratively divided into eleven provinces and each province has many districts, making a total of one hundred and thirty one districts in the whole country. Distance between districts is enormous, sometimes hundreds of kilometers, and many districts are dispersed in remote corners of the country. For example, the distance from Niassa, in the north, to the capital city of Maputo, in the south is about 3000 kilometers, making communication extremely problematic and difficult for districts to be enrolled in different development initiatives.

Another particular aspect of geography is the long coastline of the country and major rivers emptying to the ocean, which makes it particularly susceptible to floods.

Demography

Mozambique's population (2002 estimates) is approximately 18 million people, being approximately 75% rural and 25% urban (INE 1997). The proportion of children under 15 years old, projected for 2001, is 44.5% of the population, and the degree of dependence is approximately 90%. This means that Mozambique's population is young with a greater trend to consume than to produce, which has implications in certain areas of socio-economic development such as health, education, housing and employment (ISDM 1997 cited Ministry of Health Mozambique 2001).



Figure 4.1: A map of Mozambique showing the geographical view, administrative divisions and the study area.

The history of war

From 1964, Mozambique was engaged in an armed war for independence, which was ultimately achieved in 1975. The health sector faced many difficulties during this period. Noormahomed (1991, page 13) argues that, “The difficulties of this period should not be underestimated. No one knew how many health personnel existed, how many had left, how many rural hospital or health posts had been abandoned. Communication and distribution networks – always very weak – broke down.” This problem was magnified by the long devastating civil war (1976 to 1992) that followed independence. The civil war destroyed the physical and communication infrastructure in the country including roads, telephone lines and health facilities.

The war affected all aspects of development and led to millions of refugees fleeing the countryside in the wake of destruction. As a result of the breakdown of infrastructure, there was practically no communication between remote areas and provincial capitals leading to people being “isolated” in different locations. This isolation has seriously affected socio-economic development processes, effects of which are still being felt.

The state of literacy and illiteracy in the country

Another aspect of the country that affects health and health care delivery is the low level of literacy of the population. The census of 1997 (INE 1997) showed that 60.5% of the Mozambican population is illiterate and about 72.2% live in rural areas which have poor access to education. The general poor level of literacy makes it difficult to develop ICT awareness and computer literacy. Lack of adequate schools and access to teachers and resources makes the problem of illiteracy a deeply systematic and embedded one.

Socio-economic profile

Agriculture is the major economic activity and the main way of subsistence for most of the population in Mozambique. Along the coast fishing also represents an important source of household income. Mozambique frequently suffers from floods, cyclones and droughts that sometime reach disastrous proportions. These disasters have caused the death of people and animals, mass population displacement and other direct negative effects on agricultural production, infrastructure and the national economy (Ministry of Health Mozambique 2001).

The level of poverty is extremely high. More that 70% of the population is living below the poverty line (Ministry of Health Mozambique 2001).

Health status and problems

Communicable diseases, infectious diseases and parasites, namely malaria, diarrhea, respiratory infections, tuberculosis and HIV/AIDS, dominate the epidemiological framework in Mozambique. The country's maternal mortality rate is considered among the highest in the world, from approximately 600 to 1100 per 100,000 live births.

Mozambique is vulnerable to frequent outbreaks of cholera, dysentery, meningitis and bubonic plague. These epidemics are more likely to occur in unstable environments, particularly in urban areas, and are caused by overpopulation in cities and towns by people who migrated searching for security during the 16 years period of war.

The health situation in Mozambique is aggravated by the following factors: the population's low level of education, regional disparities in access and consumption of

health care services, and unfavorable environments to good health, including limited supply of drinking water (Ministry of Health Mozambique 2001).

4.1.1 Province and districts visited

In Mozambique, the study was carried out at the Ministry of Health and in Gaza Province; in Xai – Xai district, Chokwe district, Chibuto district and Bilene district, during the period of April and May 2002.

Gaza province is north of the capital city Maputo and consists of a relatively coastal area and a vast sparsely populated inland bordering South Africa and Zimbabwe. Four out of eight districts were visited, whereby a total of six health facilities were studied. The Gaza provincial headquarters was also visited.

Gaza province was among the first provinces in Mozambique to implement the computerized provincial health information system, which was introduced in 1992 (see a discussion on case studies in Chapter 1). The health information system was among the first and is still among the very few application systems designed to support the particular needs of an organization at the provincial level. Furthermore, Gaza province is currently among the pilot provinces for the implementation of a DHIS, the software of the HISP project in Mozambique (see discussion on DHIS in Mozambique presented in Chapter 2).



Figure 4.2: Location of Health Facilities in Gaza Province

4.2 Situation analysis of Tanzania

In this section, I briefly describe the situation analysis of Tanzania to show the country's historical and existing situation, including an overall description of the regions, districts, people and communities who make it up. I focus on five aspects of this situation analysis, including the geography of the country, the demography, the socio-economic profile, the state of education in the country and the health status and problems. These five aspects have impacts on health and health care delivery in the country.

Geography

The United Republic of Tanzania is the largest of the East African countries (i.e. Kenya, Uganda and Tanzania). It has borders to the following countries: Kenya and Uganda to the north; Rwanda, Burundi and Democratic Republic of Congo to the west; Zambia, Malawi and Mozambique to the south. On the east it has a long coast covered by the Indian Ocean (see figure 4.3). The country includes the islands of Zanzibar and Pemba, and other offshore islands in the Indian Ocean. The country has an area of approximately 945,000 squared kilometers including inland bodies of water. The poor condition of roads is one of the major problems facing the country. Of some 81,900 kilometers (about 50,900 miles) of roads, less than five percent are paved.

The country is administratively divided into twenty-six (26) regions: twenty one (21) on the mainland and five (5) in Zanzibar. Each region has many districts, which make up a total of one hundred and thirty (130) administrative districts; the mainland has one hundred and twenty (120) and Zanzibar has ten (10) administrative districts. The

Demography

The population of Tanzania (2002 estimate) is about 33 million people, giving the country an overall population density of about 33 persons per square kilometer. The proportion of children under 15 years old is about 46% of the population. Yet the population distribution is irregular, with high densities found near fertile soils, and comparatively low density throughout much of the interior of the country. About three-quarters of the people live in rural areas. Kiswahili and English are the official languages of Tanzania, but many people continue to use the language of their ethnic groups.

The state of education in the country

Primary education is compulsory in Tanzania, but not enough schools are available to accommodate all of the children, and only 50 percent of eligible children are enrolled. However, as a result of adult education campaigns, more than 90 percent of people over the age of 15 are literate. In the early 1990s, some 3.5 million elementary pupils and about 167,000 secondary students attended government schools annually. In addition, many children attended private schools, which were mostly run by religious groups. However, since mid-1990, individuals are free to establish and run private schools. Institutions of higher education enroll about 5300 students per year.

Socio-economic profile

Agriculture, forestry, and fishing are the main sources of employment in Tanzania. The economy of Tanzania is primarily agricultural. About 80 percent of the economically active population is engaged in farming, and agricultural products account for about 85

percent of the annual exports. The country is the world's largest producer of sisal and cloves. With per capita income at an estimated \$110 a year, Tanzania is one of the poorest countries in the world. About 50% of the population are living below the poverty line.

Health status and problems

Tanzania faces health problems similar to most of the developing countries. Major health problems in the country can be summarized as follows. The top ten diseases (morbidity) and health problems are malaria, Acute Respiratory Infection (ARI), pneumonia, intestinal worms, eye infections, diarrhea, anemia, skin infections, Sexually Transmitted Diseases (STDs) and Urinary Tract Infections (UTI). Other diseases are asthma, non-infectious gastrointestinal disease and minor surgical conditions. There is also an increasing number of HIV/AIDS patients, which has resulted in the increase of Tuberculosis (TB) patients.

4.2.1 Region and district visited

In Tanzania, the study was conducted at the Ministry of Health and in the Coastal Region, in Kibaha district during the period of June to August 2002.

Kibaha is one of the six districts forming the Coast Region. Other districts include Kisarawe, Mkuranga, Rufiji, Mafia and Bagamoyo. Geographically, Kibaha district is located on the western part of the Coast Region.

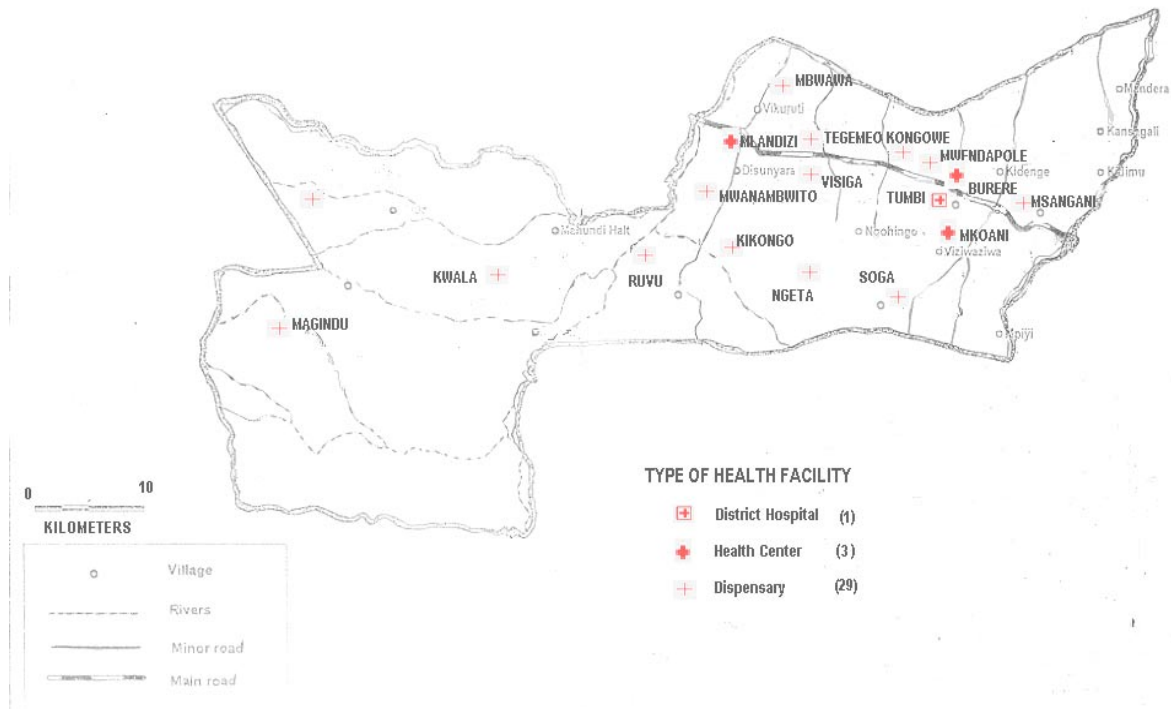


Figure 4.4: Location of Health facilities in Kibaha region

Source: Kibaha district offices in Tanzania, July 2002

The district has 33 health facilities, which include one (1) hospital, three (3) health centers and twenty nine (29) dispensaries of which 28 provide Maternal and Child Health (MCH) services. Nine out of thirty three health facilities were studied. The study was also carried out at the regional offices. The major health problems of the inhabitants of the district include malaria, worm infections, diarrhea, anemia and malnutrition typically affecting the inhabitants of the Coastal area of Tanzania. It is estimated that 55% of the district residents have access to piped water sources. The rest of the residents depend on water from rivers and small seasonal streams and locally dug water wells.

Kibaha district transport infrastructure consists of roads and limited rail transportation. Most of the roads serving rural villages are fairly passable during the dry season and almost impassable during the rainy season. Hence the only reliable means of transportation during the rainy season is by bicycle or by animal-drawn carts. Telecommunications and postal services exist serving urban, sub-urban settlements and villages along the Tanzanian highway. Reliable services are not available in most villages of the district. Transport and communication are severely limiting factors to efficient health service delivery (District Executive Director's Office 2001).

Chapter 5

RESEARCH FINDINGS: What I have seen

In this chapter, I describe my findings from the study, which is a description of the health information systems in Mozambique and Tanzania. This information was gathered through a combination of semi-structured interviews with health workers, observation by the researcher during the fieldwork, and a review of the documents.

I first present the findings in Mozambique and then, I will present the findings in Tanzania and lastly, I will provide a comparison between the findings in Mozambique and the findings in Tanzania. The key findings in both Mozambique and Tanzania include the health information system's functionality: data collection and storage, processing and reporting, and problems related to data collection, processing and analysis, reporting and information flows, and the analysis of existing computer systems within the health information systems in study.

5.1 Findings in Mozambique

Table 5.1 describes the physical overview of my fieldwork period in Mozambique to provide the reader with an impression of where I visited and observed and whom I interviewed and what documents I reviewed. It is from this physical overview that I provide my research findings for my study in Mozambique.

Table 5.1: Physical overview of my fieldwork in Mozambique: visited places, observed areas, interviewees, reviewed documents.

Total number of places visited	Type and number of health facility(s) visited	Total number of interviews conducted	Title and number of interviewed health workers	Type of reviewed documents	Observed areas
10	Two health posts	18	Two District Directors	Ministry of Health: Strategic plan for the health sector (PESS) (2001-2005-2010)	The district hospitals. For example, the interaction between health workers and patients.
	Two health centers		One Medical chief and hospital director.		Health posts. For example, a long queue of patients waiting to be attended by one health worker.
	Four district hospitals including district offices		Eight health workers responsible for Nucleo de Estatística e Planificação (NEP ⁶), which comprise health workers from different health programmes.		The location of the health posts from the main road and the district offices.
	Two governmental health centers		One person responsible for Boletim Epidemiológico Semanal (BES ⁷)		
	Provincial offices		One person responsible for the Tuberculosis and Leprosy (ELAT/ELAL) programmes.		
	National offices (Ministry of Health)		One computer operator		
			One hospital administrator and Chief administrator for the district.		
			One pharmacy agent at the district hospital		
			Two health workers at the provincial pharmacy storage		

⁶ The core planning team responsible for the entire district

⁷ Weekly epidemiological bulletin; the basis of the weekly surveillance system for infectious diseases.

5.1.1 Mozambique's health information system functionality

I discuss Mozambique's health information system functionality in terms of the means of data collection, tools for data collection and storage, data processing, reporting and information flows, data sharing from one health facility to another and when the patient leaves the hospital, data use and the existing computer systems.

Means of data collection

How are primary healthcare data being collected?

The health facilities are the origin of the health care data and statistics being generated in a health system. Health workers collect data routinely on patients attending the health centers by recording the information on a patient's health problem; how long it has been present, how it progressed, and the diagnosis made. Apart from this means of data collection, there are people working in the community who collect information on the services they are providing, for example, Agentes Polivalentes Elementares (APEs⁸). This is also being done through outreach programmes.

Tools for data collection and storage

What are the tools used to collect and store (record) the collected data? How are primary health care data being kept and managed over time?

Data collection at all health centers and health posts consists of a number of forms for different health programmes: Saúde Materno Infantil (SMI⁹); Programa Alargado de

⁸ People trained for a few months to provide first aid in the community, usually in places where there is no health unit.

⁹ Maternal and Child Health

Vacinação (PAV¹⁰); Community health, that is, a number of forms for immunization, family planning, drugs, nutrition, and outpatient statistics. Each of the health programmes has separate data collection and storage forms used at the health facility and district levels (see a list of SIS forms in Appendix A.3). Also the study revealed that data are being collected using tally sheets, register books and some small pieces of paper, for example, traditional midwives known as Activists use small pieces of paper, since they are not being provided with any data collection tool. Health facilities appear to collect data and the data are kept in files at the district level, which comprises records for many years back.

Data processing, reporting and information flows

Where are the collected data sent?

At the health facility level, data on SMI, pharmacy (drugs consumption), stomatology and Sexually Transmitted Diseases (STDs) are aggregated into a monthly report and then sent to the district, while the data on PAV are being sent to the district on a daily basis (without being aggregated) and data on BES are being sent to the district on a weekly basis. Different forms are being used at the health facilities for data collection and then the report is produced in a different reporting form, for example, for SMI there are three different forms for data collection, which are then combined into a single reporting form.

At district level, data from the health facilities are aggregated into single reporting forms and sometimes separated into different reporting forms; a single reporting form received from the health facilities on SMI is being reported into three different reporting forms from the district to the province. The reporting on SMI data from the district to the province is done per health facility, that is, it is not aggregated, while for PAV, drugs consumption, stomatology and STDs, data are aggregated.

¹⁰ The Extended Immunization programme

Each district has a group of health workers that constitutes the NEP, who are in charge of the collection, aggregation, and analysis of all the health data from all the health facilities in the entire district, and its transmission to the province level. The NEP team is composed by the chief of SIS (also the chief of NEP) in the entire district, the person responsible for SMI, and the person responsible for PAV. The chief of the NEP receives all the reports (for all the programmes) from the health facilities and then distributes them to each individual responsible person, for SMI and PAV, respectively. Each person prepares the report on the particular programme and then-together as a team, the NEP, they produce a district report, which has to be checked by the district director before being sent to the province. After checking the report, the district director sends it back to the chief of the NEP, who then sends the report to the province. I summarize the information flows within the district level in figure 5.1

In parallel to information flows within the district, there are also data collection and reporting processes that are being followed by each programme at the district during the preparation of the overall district reports. In figure 5.2 and figure 5.3, I describe the data collection and reporting processes for the Maternal and Child Health (SMI) and the Extended Immunization (PAV) programmes at the district level.

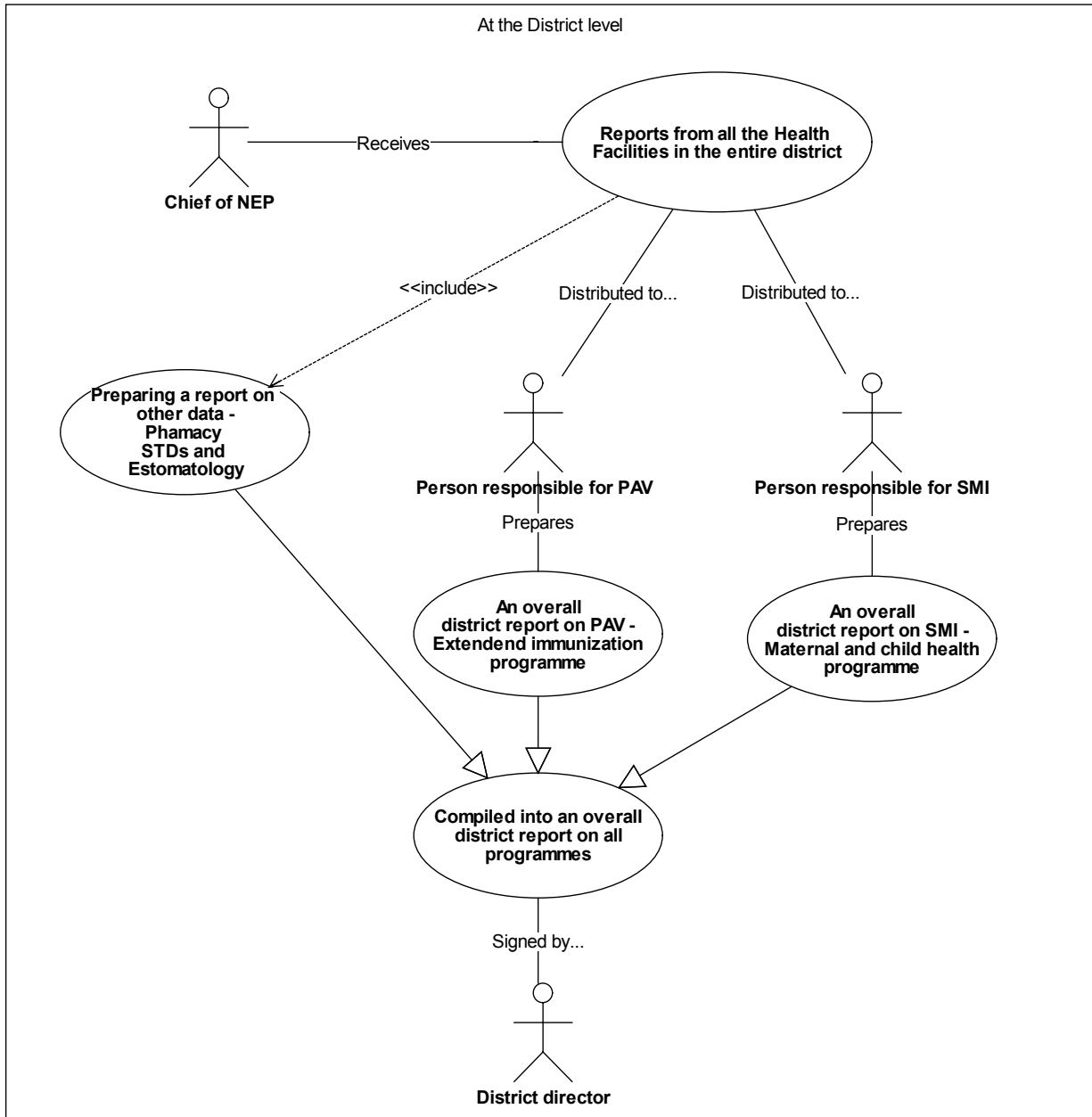


Figure 5.1: Information flows within the district level of the health administrative hierarchy in Mozambique.

Source: Fieldwork at District level in Gaza province, Mozambique, April 2002.

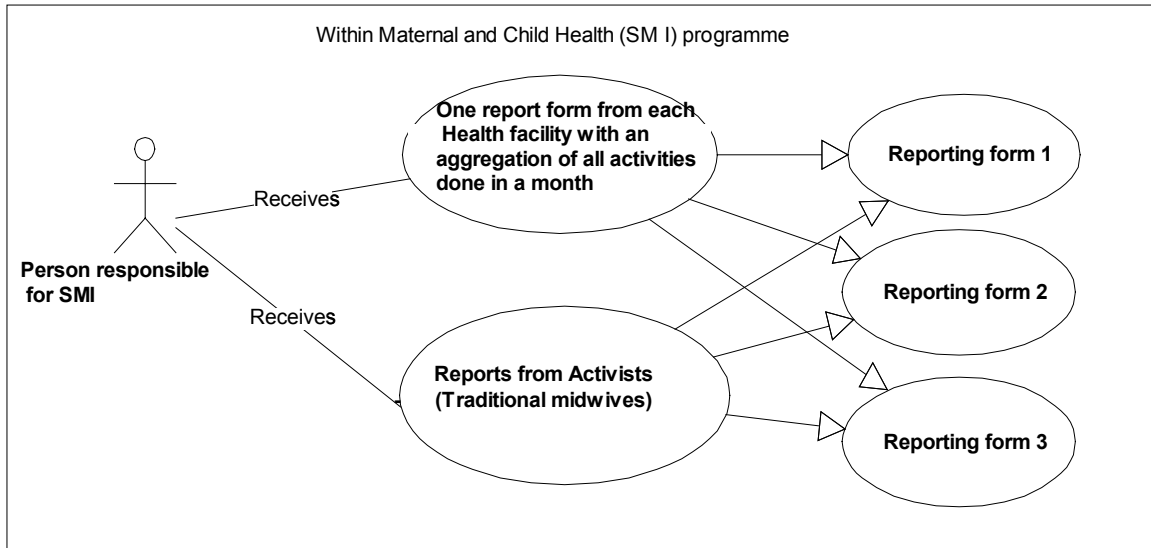


Figure 5.2: Preparation of the district report on SMI programme within the district level of the health administrative hierarchy in Mozambique

Source: Fieldwork at District level in Gaza province, Mozambique, April 2002

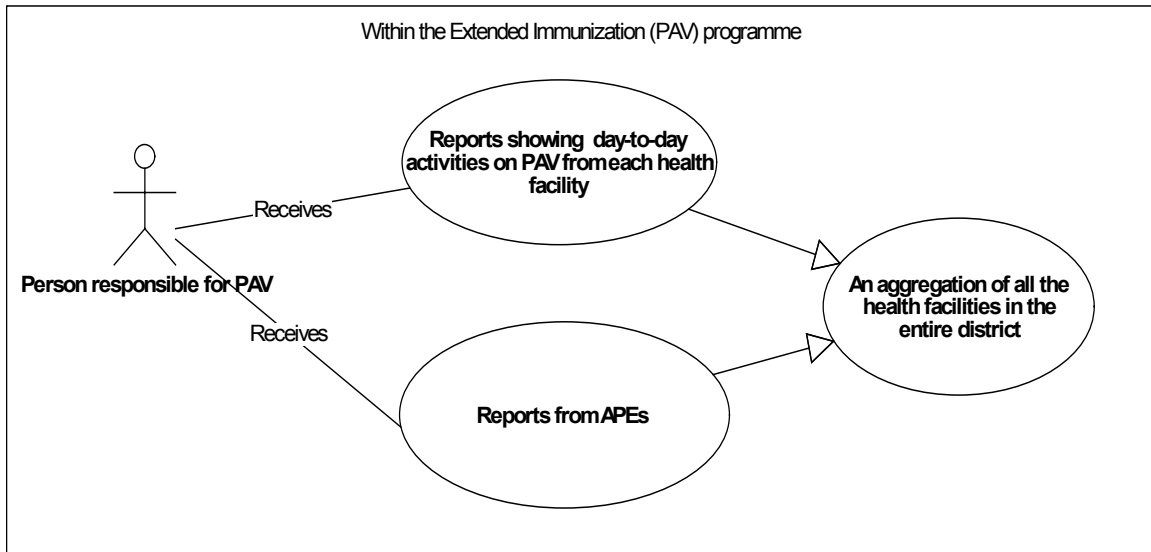


Figure 5.3: Preparation of the district report on PAV programme within the district level of the health administrative hierarchy in Mozambique.

Source: Fieldwork at District level in Gaza province, Mozambique, April 2002

At provincial level, reports from the districts are aggregated to produce the overall provincial report. The person responsible for SIS (also the head of provincial statistics) receives all the reports (for all the programmes) from the districts, and enters the data in the SIS computer database (SISDB). After entering the data into the SIS computer database, the paper forms were distributed to the province staff responsible for different programmes, for example, to each individual responsible person for SMI and PAV. Each responsible person prepares the report on the particular programme, while the person responsible for SIS also prepares an overall report for all programmes. The head of provincial statistics coordinates the reports by making a comparison between the individual analyses and what was produced using the computer. After the coordination, the reports were sent to the national level by fax or were carried in person in paper form and on diskettes. I summarize the flows of information within the provincial level in figure 5.4

In addition to the monthly reports, both the district and the provincial level produce three months, six months, nine months and annual reports describing the overall health status of the district and the province during these specific time periods, and comparing each report with corresponding periods of the previous year. The province is responsible for sending monthly reports to the Ministry of Health, based on further aggregation of the health data from the provincial districts.

I summarize the overall information flows within SIS in Mozambique in figure 5.5

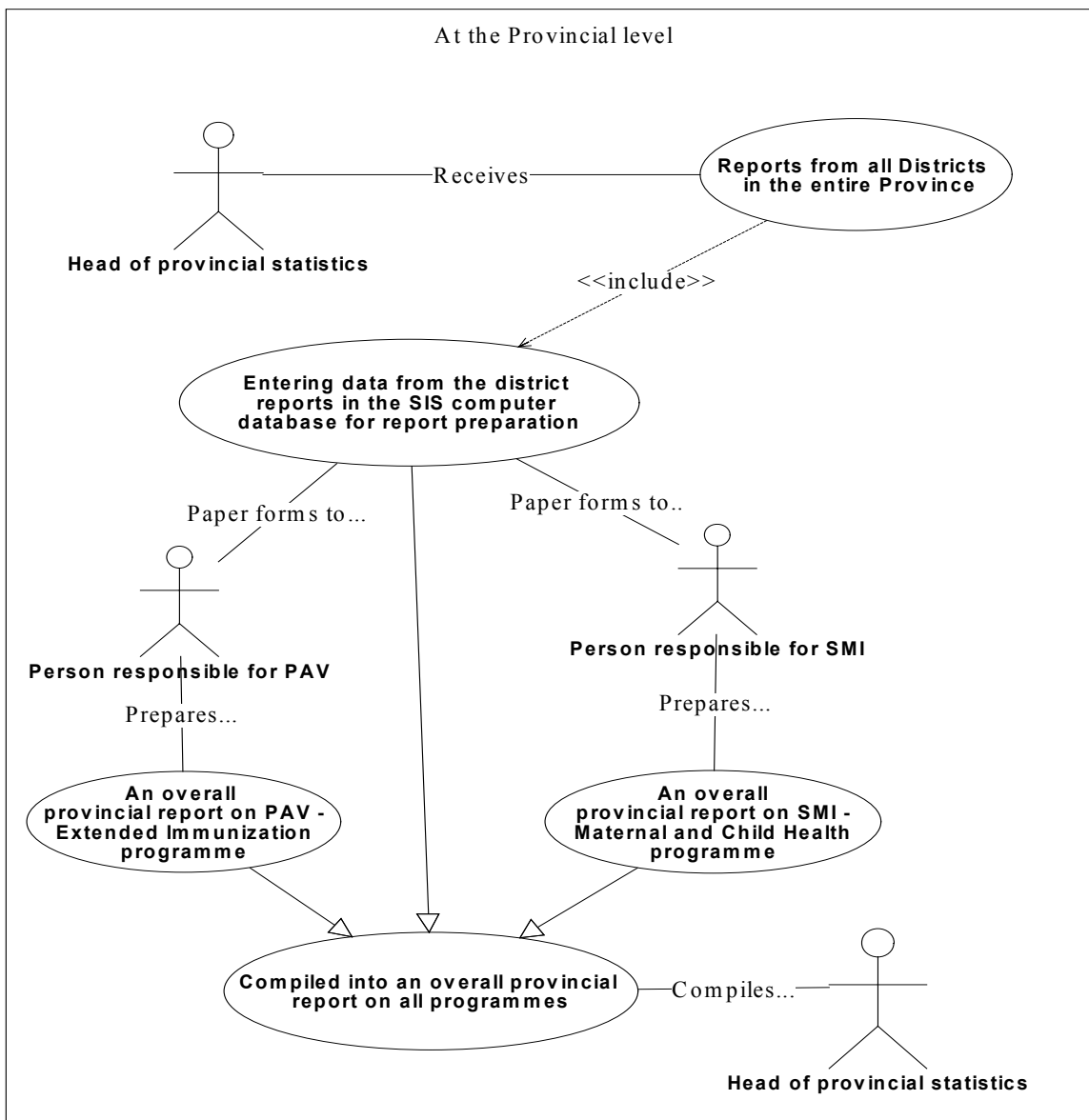


Figure 5.4: Information flows within the provincial level of the health administrative hierarchy in Mozambique

Source: Fieldwork at Provincial level in Gaza province, Mozambique, April 2002.

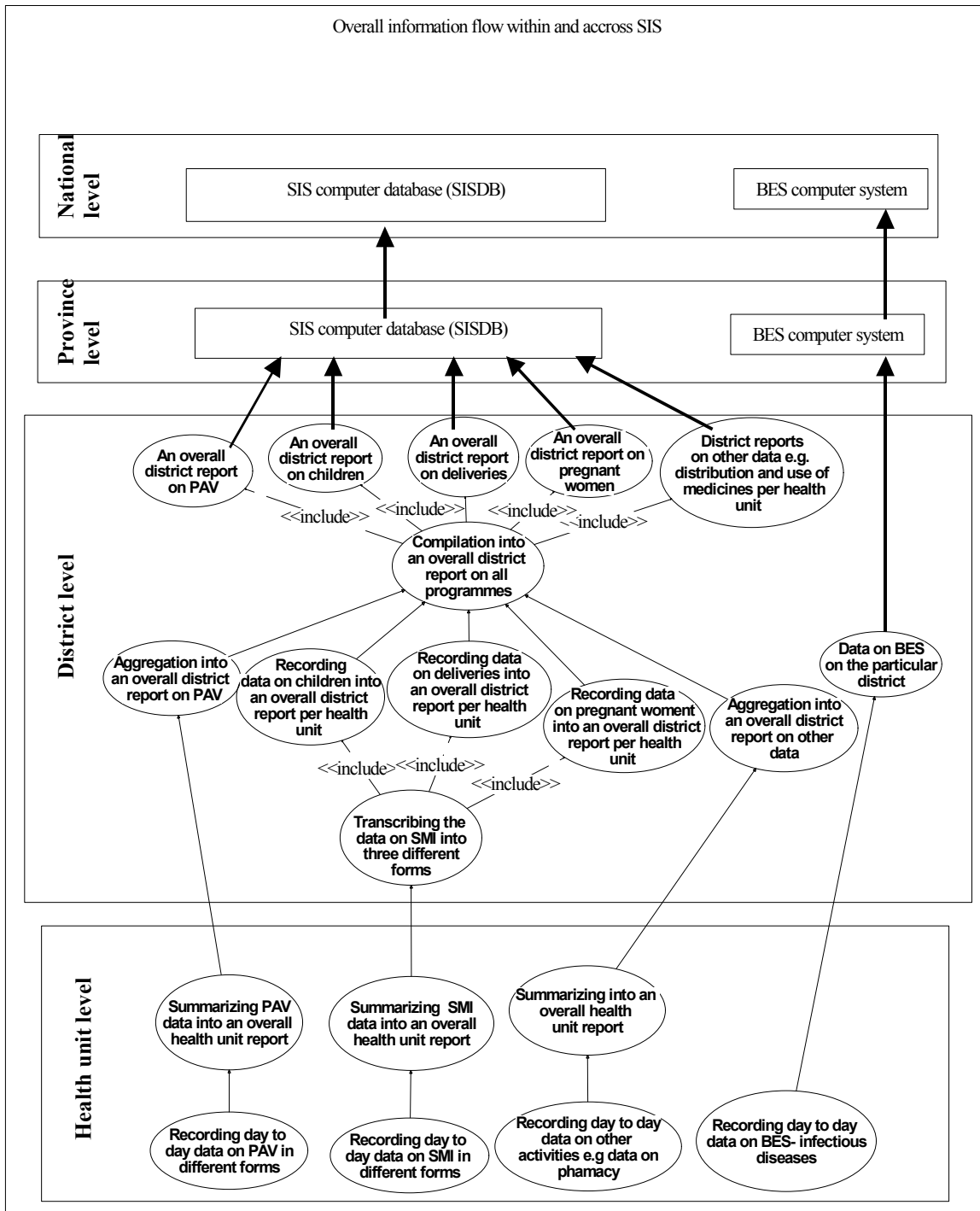


Figure 5.5: Information flows within SIS in Mozambique

Source: Fieldwork in Mozambique, April to May 2002

Sharing of data from one health facility to another and when the patient leaves the hospital

How is the patient information shared when, for example, a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, or from one hospital to another, and when she leaves the hospital?

When a patient is being referred from one health center to the hospital, the patient's progress information is written on a paper. The patient takes the paper to the referral hospital, and then he or she has to bring a feedback report from the referral hospital to the health facility that referred him or her. The patients' documents are stored in files at the health facility for future use as a particular patient's health history. Some of the documents go with the patients, for example, a discharge form indicating the patient's further follow-ups.

Data use

Which of the data collected are used? Who uses the data and what are they used for?

The health facilities are the origin of the health care data and statistics being generated in a health system, but in most of the health facilities I visited there was no evidence of data use for improving health care services. When asked what was the purpose for data collection, a health worker responded as follows:

"We are collecting data for the purpose of reporting to higher levels as an indication of work done, as well as being provided with health care service requirements such as medicines, injections and vaccinations." (NEP member, Mozambique, May 2002)

There was no evidence of data use in planning of district activities, nor in systematic monitoring and evaluation of health care activities.

5.1.2 Existing computer systems within SIS in Mozambique

In Mozambique, there are three main computer systems in use: SIS computer database (SISDB), BES and a Spreadsheet, being used at the provincial and national levels. The computer systems are being used for analyzing health data, aggregating data into monthly and quarterly (three months) reports, as well as for data storage.

i) SIS computer database (SISDB)

SISDB is a computerized part of the Health Information System (SIS) being used at the Province and National levels. The structure of SISDB is built on the paper forms used for reporting from the district. At the province the system is used for analyzing monthly health data and aggregating data into quarterly (three months) reports, as well as for data storage. The data are entered into SISDB from the reporting forms from the district. At the national level (Ministry of Health) data are imported from floppy disks coming from the provinces. The SISDB at the national level stores data on all provinces.

The provincial version of SISDB has the ability to create reports and analyze data on a monthly basis while the national version has the ability to create reports on a quarterly basis. The SISDB software was developed and deployed in Mozambique in 1992 – 1994 by a British engineer who is now in England. Thus, changes cannot be made to cope with the changes in the Health Information System requirements.

ii) BES

BES is a computerized health information system part of SIS used at national and provincial level, whereas the districts and health facilities use paper forms. The purpose of the BES system is to record and analyze epidemiological information about infectious

diseases. It keeps weekly reports to allow quick reactions to changes in conditions and cases indicating risks of spread of infectious diseases.

iii) Spreadsheets

A large group of spreadsheets are in use, in Microsoft Excel or Lotus format storing information on infrastructure, hospitals and to analyze data from other systems (SISDB and BES), at the province and national levels.

iv) District Health Information Software (DHIS)

The District Health Information Software (DHIS) of the Health Information Systems Project (HISP) is still under implementation (see description on HISP experience in Mozambique in Chapter 2).

Analysis of problems identified in the existing computer systems, mainly on SISDB, BES and Spreadsheets.

Basing on this study's findings related to existing computer systems within SIS in Mozambique, I describe the problems identified as systems fragmentation leading into inconsistency between systems, changes in the data collection forms not reflected in the system and poorly trained personnel.

Systems fragmentation

The existing computer systems are fragmented; there is very little integration between the systems. An example of the fragmentation is that the BES reports the number of incidents of malaria and deaths and in the Spreadsheets, the hospitals report the number of patients with malaria and number of deaths. Due to the nature of the systems, this information is not compared at all. Systems fragmentation leads to inconsistencies between systems. For

example, the list of health facilities is being stored in SISDB and Spreadsheets, but these lists are not similar and none of them are complete. There are missing health facilities and none-existing health facilities (**Source:** Analysis of SISDB and Spreadsheets during the fieldwork at the Provincial offices and the Ministry of Health in Mozambique, April 2002).

Changes in the data collection forms not reflected in the system

After SISDB was created and deployed in 1994 and the developer went home to Europe there was no one left who could change the software. But the data collection forms have changed. For example, in the form A04 (see description on the types of SIS forms in Annex B), diphtheria, tetanus and pertussis (DTP¹¹) doses 1, 2 and 3 have been extended to also cater for hepatitis (HEP) 1, 2 and 3. This change has not been reflected in SISDB. And the users of SISDB seem to have coped with it by entering the DTP data together with HEP. By considering that DTP is usually given together with HEP, combining data on DTP with data on HEP seems to be a reasonable idea, but the problem is that it is impossible to know when the district started giving DTP and HEP, because SISDB does not separate them. The only way to find this out this is to visit each district and ask the particular health workers responsible for data collection on DTP and HEP (**Source:** Analysis of SISDB during the fieldwork at the Provincial offices and the Ministry of Health in Mozambique, April 2002).

Poorly trained personnel

The personnel responsible for operating the computer systems are poorly trained in analyzing data and using computers, the poor quality of much of the data within the systems is proof of that. For example, the responsible person at the provincial level could

¹¹ DTP stands for a combined vaccine against diphtheria, tetanus and pertussis and is given in three doses on the second, third and fourth month after birth. The second and third doses are follow-ups of the first dose.

not use the SISDB functionality for finding districts which did not report (**Source:** Fieldwork at Provincial offices in Gaza province, Mozambique, April 2002).

5.1.3 Analysis of problems identified within SIS in Mozambique

I discuss the problems identified within SIS in Mozambique in terms of gaps in data collection, poor (minimal) analysis of data, poor data quality resulting from lack of personnel and lack of skills, timeliness resulting in incompleteness of reports, poor feedback and lack of feedback, minimal use of information, and lack of recourse.

Gaps in data collection

There are a number of problems related to data collection in terms of gaps in the data collection forms. Sometimes, the forms for data collection are not received on time from the higher levels. This results in the development of local forms to aid in data collection, thus leading to duplication.

Sometimes the data collection tools do not meet either the report requirements or health facilities day-to-day functioning requirements. The problem of the data collection tools not meeting the needs of the reporting requirements was described by health workers in cases where a new service or medicine is introduced in a particular health facility. For example, when the new vaccination programme starts the health workers have to write the collected data at the backside of the form in case there is a space, otherwise they have to develop their own forms for recording data on that particular new programme. During the fieldwork, in April 2002, vaccination programme on vitamin A was just started and the data collection forms had no space for recording data on vitamin A (**Source:** Fieldwork in Xai-Xai district in Mozambique, April 2002).

Poor (minimal) analysis of data

There is minimal analysis of data at the district levels, and where data are analyzed, the information is not interpreted for local use; for example, most health facilities had a number of graphs on the walls but the responsible health workers could not explain the meaning of those graphs. However, most of the graphs were for comparing data collected for two years with details of an increase in the number of attended patients without comparing the data to expected targets that the particular health facility should strive to achieve (see photo 5.1).

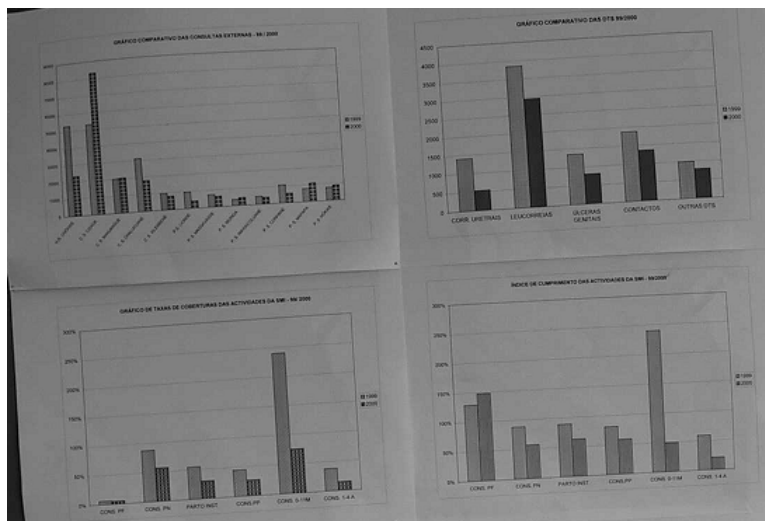


Photo 5.1: Graphs on the walls at the health post in Mozambique

Source: Health post in Gaza province, Mozambique, April 2002

Generally the health workers do not have tools to use for data analysis and they appeared not to be trained in data analysis. Another example of poor analysis of data is from one of the districts visited, where the annual report that was written by the secretary, someone who is not aware of the meaning of health data, was found to have many mistakes, for

instance, an incorrect number for the target population for the district. When the research team together with the NEP team analyzed this case, a member of the NEP team said,

“No one had analyzed the report after it was typed and we sent it to the district as it was because we were on the deadline.” (NEP member, Mozambique, May 2002)

This report passed through the district offices to provincial offices but no one commented about the incorrect number for the target population for the district, which was used in the report. This finding raises the question of whether the information was used for planning. If it was used, then the wrong information was used.

When data are aggregated at the district level for all programmes, the health facility level details are lost, thus limiting the ability to control the quality of data since it becomes difficult to detect the source of errors. For example, for the Extended Immunization Programme (PAV) in Chibuto district for the year 2001, the target population used for the BCG immunization and DPT1 was found to be different, whereas it should be the same (see table 5.2), thus, making it difficult to detect which health facility reported based on an incorrect number for the target population.

Table 5.2: Aggregated data for PAV in Chibuto district 2001, in Mozambique

Vaccine	Target population (“Group Alvo”)	Achievements (“Realizado”)	Coverage (“Cobertura”)
BCG	1424	4805	337%
DPT1	1388	4835	348%

Source: NEP Chibuto district in Mozambique, May 2002

Also, the coverage is greater than 100%, which is impossible in one year, without an explanation to why it was that much.

Poor data quality

Health workers at the health facilities attend many patients but report less or incorrect values for the number of patients attended, because they take care of patients during the day and in the afternoons they try to remember what they have been doing during the whole day for reporting purposes. So, what is filled in the form is sometimes what the health worker thinks was done during the day. During the course of my fieldwork in one of the districts, when I asked the person responsible for the SMI programme about her daily responsibilities, she told me:

“ In the morning, when I arrive at the hospital, I attend women coming for antenatal checkup and family planning cases. After working with the patients, I go to my office to fill the forms about what I have been doing, for example, how many patients I attended, how many birth control pills and condoms were distributed.”(Person responsible for SMI, Mozambique, April 2002)

Poor data quality also results from lack of personnel and lack of skills.

Lack of personnel

Lack of personnel influences the problem of poor quality of data because one person performs many activities and it is important to have all these activities done, rather than filling endless forms. During the course of my fieldwork one health worker expressed how much workload she has by saying:

“On average, I attend 200 patients a day. Sometimes I have to take others’ [other health workers, for example the person responsible for PAV] responsibilities in case they are absent and also I have to do statistics on the health services I have been providing.”(Person responsible for SMI, Mozambique, April 2002)



Photo 5.2: A queue of patients waiting to be attended by two health workers at the health post in Mozambique

Source: Health post in Gaza province, Mozambique, April 2002

Lack of skills

The educational level of health workers in the district varies from medical doctors to “servants”. Apart from the medical doctor, the educational level of people managing the health facilities is mostly limited to elementary (i.e. seven years of education completed) or primary school. The lack of medical skills among the health workers results in poor quality of data, since the health workers fill in the forms without any idea of what the data elements specified in the forms mean. The following statements from one of the district directors express the lack of skilled personnel:

“There are 11 health facilities in this district, only 6 health posts have trained health workers and the other 5 are run by not trained people (servants).”

“... I do not trust the data from the health posts because of the skills level of people who are running the health posts.” (District Director, Mozambique, April 2002)

Timeliness

For each level of information flows, that is, from the health facility to the district, from the district to the province and from the province to the national level, there is a deadline for sending reports from one level to another. What happens is that not all health facilities send their reports on time, thus resulting in incompleteness of reports. For example, the district reports are incomplete because they are based on reports from some but not all the health facilities within the entire district. The following were the statements from two health workers responsible for report preparation:

“... it is mandatory to send data related to BES each week but sometimes the health posts are not sending the data on time.” (District Director, Mozambique, April 2002)

“...there are some problems of delays in reporting. Some districts delay for one to two months, sometimes even for six months but not more.”

“... there is a deadline for sending the report to the Ministry of Health, but sometimes I have to wait without following the deadline for the people from the district to bring their reports.” (Head of Provincial statistics, Mozambique, April 2002)

Late reporting resulting in incompleteness of reports

Not all the health facilities are reporting to the district. However, at the provincial level, delays in reports from the district do not limit the provincial report preparation and the reporting from the province to the national level (Ministry of Health). This was expressed by the head of the provincial statistics office in the following statement:

“... when the district delays in sending the report..., we prepare a report without including that particular district..., we just indicate that there is no data on that district. The Ministry does not do anything about it.” (Head of Provincial statistics, Mozambique, April 2002)

Poor feedback and lack of feedback

Data are collected daily, weekly and monthly at the district level and reports are sent to the upper levels. But the feedback on the reports virtually does not exist, unless there are mistakes or gaps in data filled in the reports. There is no evidence of written feedback from either the district or the province levels, which means that there is lack of information flow down the hierarchy of reporting. The only flow down is a request for information.

“ Very limited feedback is received from the Ministry of Health. I have never seen any such feedback; maybe my boss receives them. Sometimes the Ministry of Health returns to us the reports we send when there are some errors and problems.” (Head of Provincial statistics, Mozambique, April 2002)

Lack of feedback from higher levels to low levels does not motivate health workers on collecting high quality data.

Minimal use of data/information

The minimal use of data collected or information produced in decision-making is a problem that I found resulting from someone making decisions based on his or her idea or experience. For instance, the supply of medicines from the district to the health post should be based on information coming from the health post regarding the use of medicines. But this is not always the case. A pharmacist at the district level told me:

“Sometimes I do not believe what he is asking in the paper, I know what are the needs of the health center he is coming from, so that I give him what I think he needs,” (Pharmacy agent at the district, Mozambique, April 2002)

Lack of resources or disproportional distribution of resources

The health system at local levels is dealing with lack of personnel and material resources. There are some health facilities that are run by one person; if he/she is not able to

determine the diagnosis, the patient has to be transferred to other health facilities. It is inconvenient for the patients who have to walk long distances while sick and it can also be dangerous. The lack of resources strains the health system performance in several ways. For example, the following health worker was not organized because of the lack of folders in which to keep the reporting forms from the health facilities.

“We do not have folders, that is why my room seems to be not organized and I am shifting these records of the last year to put them somewhere else and use this folder for the records of this year.” (Chief of NEP at the district, Mozambique, April 2002)

I found the lack of the means of communication such as telephone lines to be a problem for communication between the district offices and the health posts within the district.

“...there are 10 health posts in this district but only one health post has a telephone in the village, whereby we call through that telephone and then someone takes the message to the health post.” (District director, Mozambique, April 2002)

There were no vehicles available at one of the health posts I visited and the following is what the health worker at that particular health post said:

“... we do not have a car for transport, ... in case of emergency we use the cars from the community, for example, taking a patient to the rural hospital or we use local transport [called ‘chapa’].” (Basic nurse at the health post, Mozambique, April 2002)

5.2 Findings in Tanzania

Table 5.3 provides a physical overview of my fieldwork period in Tanzania, as the main study area, to provide the reader with an impression of where I visited and observed, whom I managed to interview and what documents I reviewed. It is from this physical overview that I provide my research findings for my main study in Tanzania.

Table 5.3: Physical overview of my fieldwork in Tanzania: visited places, observed areas, interviewees, reviewed documents.

Total number of places visited	Type and number of health facility(s) visited	Total number of interviews conducted	Title and number of interviewed health workers	Type of reviewed documents	Observed areas
11	Two governmental dispensaries	22	One District Medical Officer (DMO)	Kibaha district health plan regarding the utilization of health basket grant for the year 2002	The district hospitals MCH section. For example, the interaction between MCH nurses and pregnant women, children and the tally sheets.
	Two parastatal dispensaries		One District Nurse Officer (DNO)	Kibaha district health performance report for the year 2001	The Clinical officers working environment and processes. For example, the interaction between the clinical officer and the patient and the register book.
	One private dispensary		One District Educational Officer (DEO)	Kibaha district council: Health cascade communication 2002	The location of the health facilities from the main road. For example, one health facility I visited is located 3 kilometers from the main road and it is very difficult for a car to pass through the available road to the health facility.
	Two governmental health centers		One regional health secretary	The Health Management Information System: MTUHA version 2.0. Book 1: Guidelines manual.	
	One district hospital		Two HMIS workers at the Ministry of Health	The Health Management Information System: MTUHA version 2.0. Data documentation.	
	District offices		Five clinical officers		
	Provincial offices		Two clinical assistants		
	National offices (Ministry of Health)		Eight Maternal and Child Health (MCH) nurses		
			One hospital health secretary		

5.2.1 Tanzania's health information system functionality

I discuss Tanzania's health information system functionality in terms of the means of data collection, tools for data collection and storage, data processing, reporting and information flows, data sharing from one health facility to another and when the patient leaves the hospital, data use and the existing computer systems.

Means of data collection

How are primary healthcare data being collected?

The health facilities are the origin of the health care data and statistics being generated in a health system. Health workers collect data routinely on patients attending the health centers as outpatients, inpatients or for Maternal and Child Health (MCH), that is, immunization, family planning, weighing, and antenatal services (see photo 5.3, 5.4 and 5.5). Apart from these means of data collection, data are collected through Community outreach programmes, that is, working with the community through Village Health Workers (VHW¹²), Traditional Birth Attendants (TBA¹³) and Community Based Distributors (CBD¹⁴) for contraceptives) and school visits, that is, in school health programmes and/or immunization programmes.

¹² People in the community responsible for reporting all activities going on in the community, such as, all newborn deaths occurring in their respective areas.

¹³ People in the community responsible for deliveries in the community and reporting to the health facility on neonatal tetanus cases, registered children, children weighing and children behind their immunization schedule.

¹⁴ People in the community responsible for distributing contraceptives to the community members and reporting to the health facility.



Photo 5.3: MCH nurse giving a child vitamin A in Tanzania, in the immunization section.



Photo 5.4: A mother weighing her child in Tanzania, in the weighing section

Source: Health center in Kibaha district, Tanzania, July 2002

Tools for data collection and storage

What are the tools used to collect and store (record) the collected data? How are primary health care data being kept and managed over time?

Data collection at all health facilities consists of a number of register books (a total of 12 register books as described in table 5.4) for Community Health, Outpatients, MCH (for example, family planning, antenatal care, deliveries), Diarrhea cases, Dental, and tally sheets (for children vaccination, diagnoses, house visits, neonatal tetanus). For hospitals, there are department sheets or registers, for example, for laboratory data. Each of the health programmes has a separate data collection register book. The register book is a collection of forms for collecting data on different health activities concerning a particular programme.

Each year each health facility receives a set of register books in which there is a *health facility data book*. The health facility data book contains summaries that are transcribed from the other register books. The individual information from other registers and forms is summarized (usually over time) and recorded in the health facility data book throughout the year. The health facility data book is therefore the storage tool for the health facility.

Table 5.4: MTUHA register books and tally forms for data collection and reporting at the health facilities in Tanzania

Register book/Tally form number	Register book/Tally form title and functionality
1	Guidelines manual (user manual) - A reference book for health workers, explaining how to collect and compile data.
2	Health facility data book - Contains summaries that are transcribed from the other register books. - Contains all the vital information about the running of the health facility for the year.
3	Community outreaches - Used to collect information from the community.
4	Ledger book - Used for monitoring the flow of drugs and other medical supplies, for example,

	what is received from donors and what is used.
5	Outpatient Department (OPD) register book - Used to collect information on outpatients
6	Antenatal register - Used for monitoring pregnant women.
7	Child register - Used for recording information about the children attending the health facility.
8	Family planning book - Used for recording all the family planning clients as well as the quantity of contraceptives supplied to clients.
9	Diarrhea Treatment Corner (DTC) register - Used for recording all patients referred to the DTC from OPD and MCH clinics.
10	Report book - Includes all forms that are used to prepare health facility reports.
11	Dental register - Used for dental clinics.
12	Laboratory register - Used for recording all the work done in the laboratory.
F201	Child tally form - Used to record children's attendance and to record the weight of the children who come for measles immunization.
F202	Immunization and vitamin A tally form - Used to record data on immunization and vitamin A supplementation for children
F203	General tally form - Used to prepare summaries from all registers.
F204	Neonatal tally form - Used for monitoring neonatal tetanus disease.

Source: Fieldwork at Kibaha district offices in Tanzania, July 2002; Ministry of Health Tanzania 1993

Each year each district receives a District Processing File (DPF). The DPF contains tables whereby information from the individual reports from the health facilities are transcribed into these tables, and the district totals are compiled. Copies of the District reports and computer

tabulations received from the Regional Medical Officer (RMO)'s office are also kept in the DPF. The DPF is therefore the analysis and storage tool for the district.

Individual health facility files are also being created at the District Medical Officer (DMO) office, and once the information from the health facility reports are transcribed into the DPF, the reports are placed in the relevant health facility file. Also in the health facility file are reports from the supervision visits, evaluation, record reviews, and any other information about the health facility (Source: Fieldwork at Kibaha district offices in Tanzania, July 2002).

At the RMO office, most of the information from the district reports is stored into a computer software package (MTUHADB) designed for the MTUHA. Then the district reports are filed by district after entry into the computer (see photo 5.5). The same computer software package is available at the national level for storing information from the regions' reports (Source: Fieldwork at Coastal region offices in Tanzania, July 2002).



Photo 5.5: District reports stored in files at the regional level in Tanzania, indicating many years back.

Source: Coastal regional health offices in Tanzania, July 2002

Data processing, reporting and information flows

Where are the collected data sent?

At the health facility, data from the different register books are compiled in the *health facility data book*. The data recording in the health facility book is done over a period of time (on daily basis or monthly basis) depending on the particular programme, for example, data from the community register book is recorded immediately when the health worker comes from the community where he or she takes the community register book with him or her. The same data recorded in the health facility book is recorded in a *reporting book* where quarterly totals are summarized (that is, a three month report) and then summarized annually. This reporting book comprises a number of forms that have to be filled in duplicate for reporting one copy to the district level and keeping one copy at the health facility. Most of the health facilities prepare the reports as teamwork. I describe the overall report preparation at the health facility in figure 5.5

There are data that have to be reported only once a year, for example, data on equipment inventory, which must be reported at the beginning of each year. Also, there are data that have to be reported only from governmental health facilities, for example, in the renovation/maintenance report. Quarterly and annual reports have to be reported by all health facilities. The description on the reports from the health facilities is summarized in table 5.5.

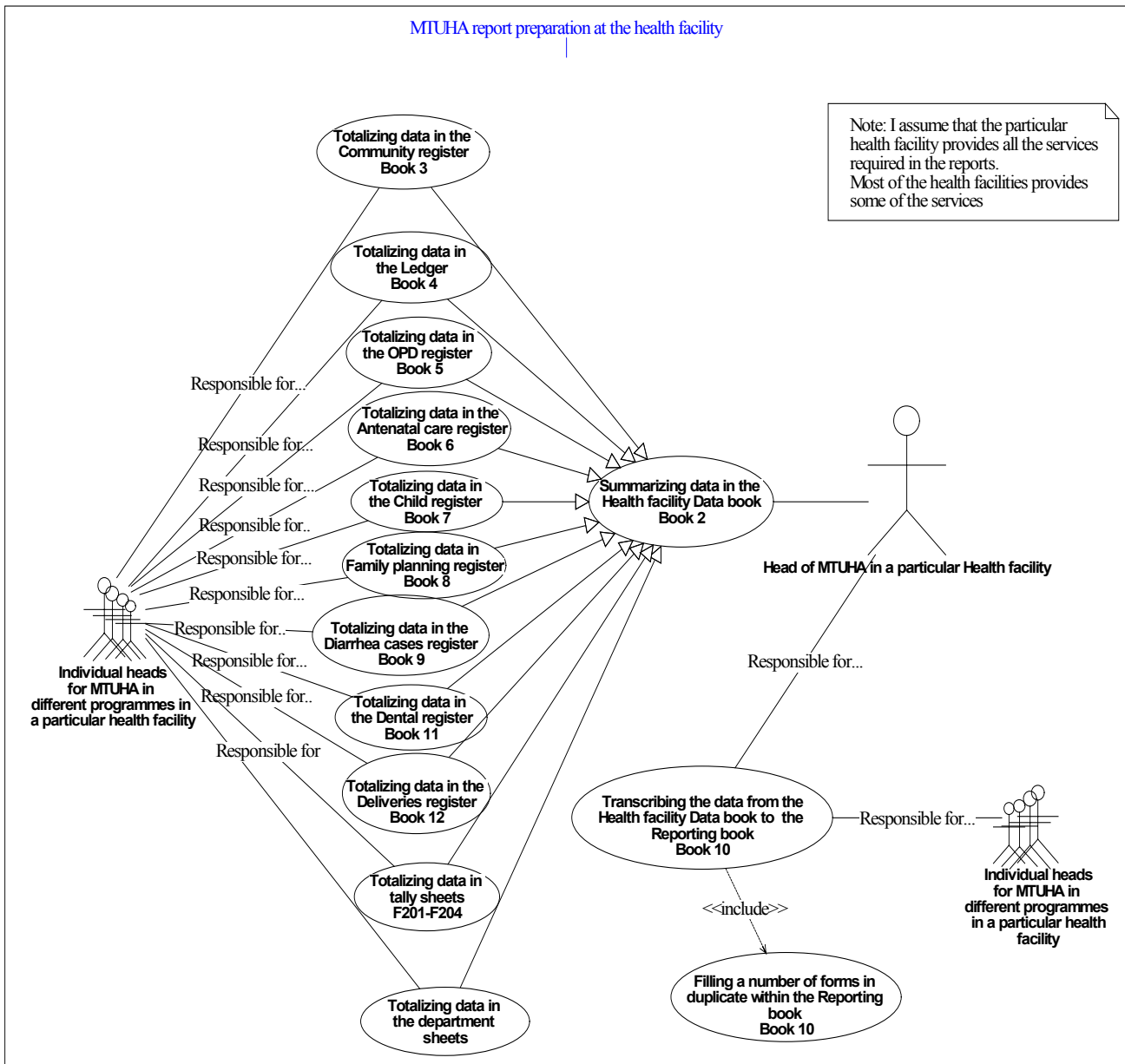


Figure 5.6: Information flows within the health facility level of the health administrative hierarchy in Tanzania.

Source: Fieldwork in health facilities in Kibaha district Tanzania, June to August 2002; Ministry of Health Tanzania 1993

Table 5.5: The description on the reports from the health facilities in Tanzania

Form code	Report description	Who has to report	Reporting period and when to prepare and submit
F001	Staff listing <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the Health Facility (HF) and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	Annual. Prepared and reported in January
F002	Equipment inventory <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. (If the department wishes to keep a copy, then the form is completed in triplicate) 	Reported by all HF (government, private, NGOs and parastatal organizations)	Annual. Prepared and reported in January
F003	Physical structure inventory <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by Government HF only (public health sector)	Annual. Prepared and reported in December
F004	1 st Quarter report <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	Quarterly. Prepared and reported at the end of March
	2 nd Quarter report <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	Quarterly. Prepared and reported at the end of June
	3 rd Quarter report <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	Quarterly. Prepared and reported at the end of September
	4 th Quarter report <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	Quarterly. Prepared and reported at the end of December
F005	Annual report <ul style="list-style-type: none"> Completed in duplicate, one copy is kept at the HF and one is 	Reported by all HF (government, private, NGOs and parastatal	Annual. Prepared and reported at the end of

	sent to the DMO office.	organizations)	December
F006	Renovation/Maintenance <ul style="list-style-type: none"> ▪ Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by Government HF only (public health sector)	Annual. Prepared and reported at the end of December
F008	Equipment breakdown <ul style="list-style-type: none"> ▪ Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by Government HF only (public health sector)	As needed. When and if there is a breakdown of any essential equipment.
F009	Notifiable disease <ul style="list-style-type: none"> ▪ Completed in duplicate, one copy is kept at the HF and one is sent to the DMO office. 	Reported by all HF (government, private, NGOs and parastatal organizations)	As needed. Immediately when a notifiable disease is suspected by the HF

Source: Fieldwork at Kibaha district offices in Tanzania, July 2002; Ministry of Health Tanzania 1993

At the district level, reports from the health facilities are aggregated into an overall district report and sent to the Regional Medical Officer (RMO)'s office together with a copy of each health facility's annual report. One copy of the district quarterly report is also sent directly to the Primary Health Care (PHC) secretariat.

The preparation of an overall district report involves a group of health workers who have to work together. The processing is done through the use of a *District Processing File* (DPF). When data are received from the health facilities it is first sorted for whether it is from the hospital or the health center or a dispensary indicating each health facility's code and recorded in the DPF. The DPF has the working forms that are used to transform data from the health facilities into district aggregates and indicators. The DPF is divided into six categories.

- i) Basic information, that is information on how to use the DPF
- ii) Staffing, equipment and physical structure.
- iii) Notifiable diseases
- iv) Quarterly reports

- v) Annual report
- vi) Feedback from computer outputs

The data on notifiable diseases are reported to the regional level through a telephone call. I summarize the report preparation within the district level in figure 5.7

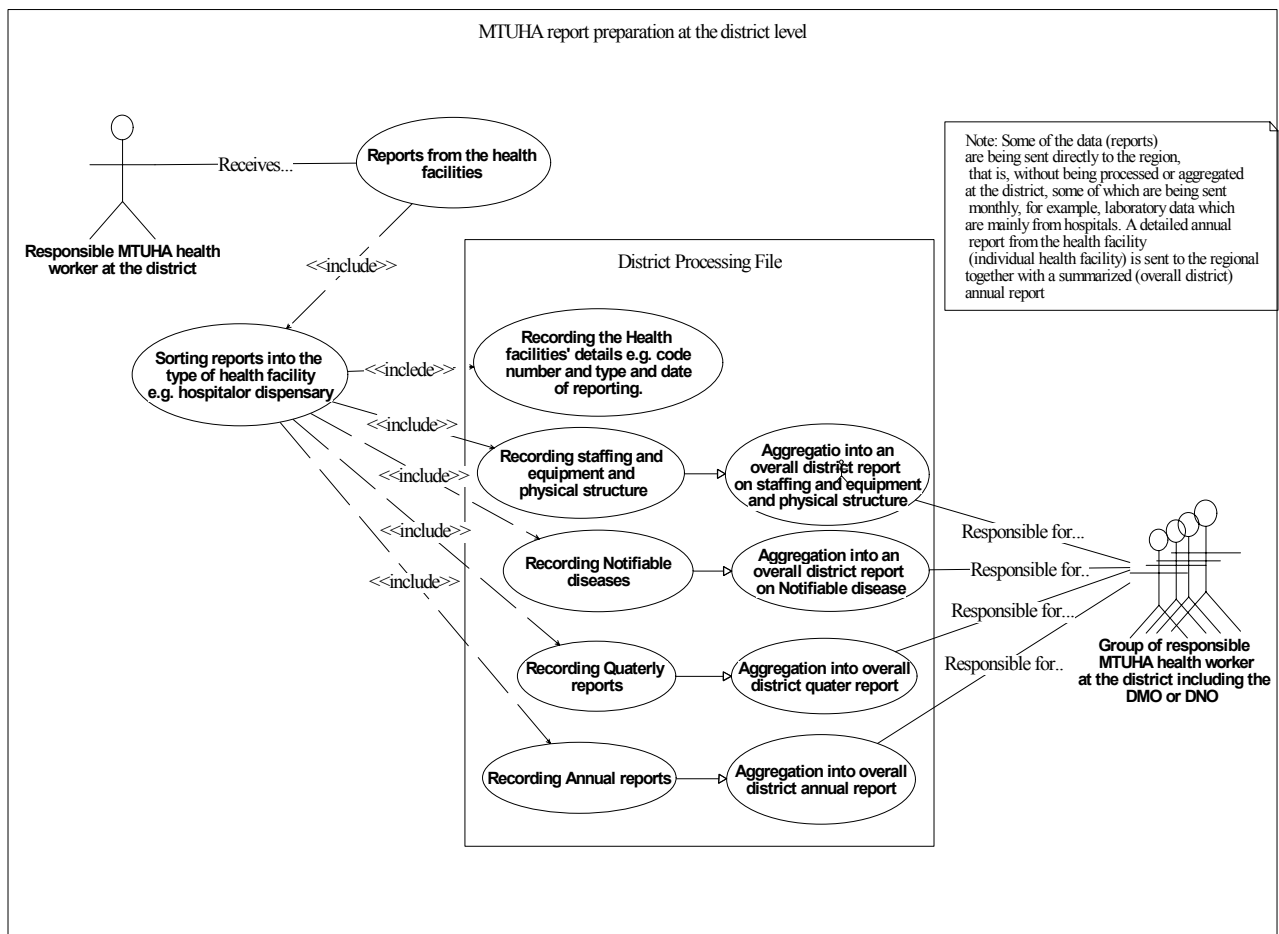


Figure 5.7: The flow of data collected from the health facilities within the district level of the health administrative hierarchy in Tanzania.

Source: Fieldwork at Kibaha district offices in Tanzania, July 2002; Ministry of Health Tanzania 1993

Some of the data (reports) are sent directly to the region, that is, without being processed or aggregated at the district. Some of these are being sent monthly, for example, laboratory data which are mainly from hospitals. A detailed annual report from the health facility (individual health facility) is sent to the regional office together with a summarized (overall district) annual report (**Source:** Fieldwork at Kibaha district offices in Tanzania, July 2002; Ministry of Health Tanzania 1993).

At the regional level, data processing is done using a computer software package, but not all the data are entered into the computer. The reports are sent to the national level on a floppy disk. The data on notifiable diseases are reported to the national level through a telephone call. The district reports, a copy of each health facility's annual report, are the sources of information that the regional offices have about each district from MTUHA.

I summarize the overall information flows within MTUHA in Tanzania in figure 5.8

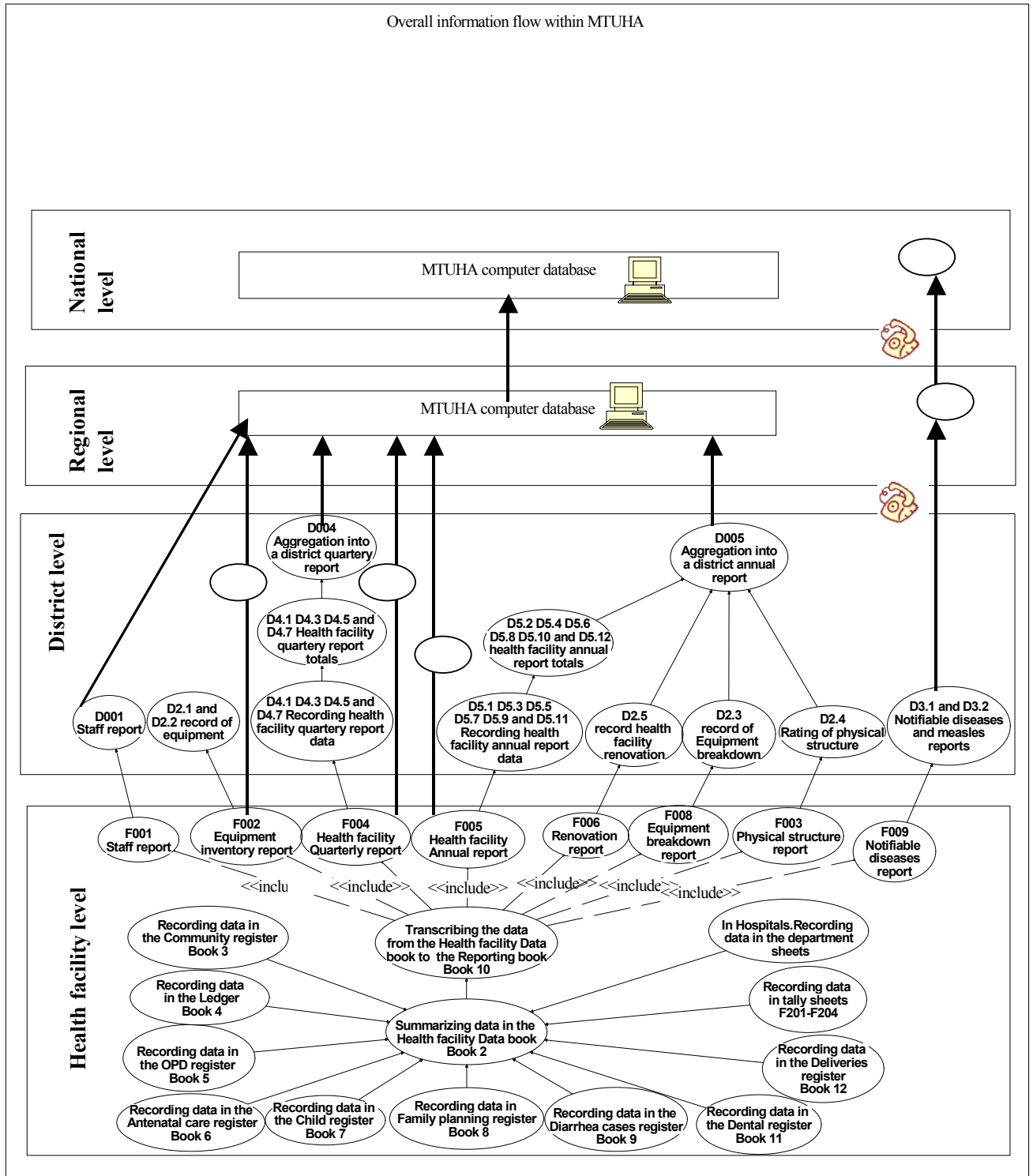


Figure 5.8: Information flows within HMIS (MTUHA) in Tanzania.

Source: Fieldwork in Tanzania, June to August 2002)

Sharing of data from one health facility to another and when the patient leaves the hospital

How is the patient information shared when, for example, a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, or from one hospital to another, and when she leaves the hospital?

The dispensaries serve as the first point of entry of the patient into the health system. A card is made out for the patient, which is then supposed to serve as the patient's health history. When a patient is referred to another hospital he or she takes a letter with him or her and a card that indicates the risks of his or her illness/sickness and the diagnosis made. When a patient is discharged he or she takes a discharge note with him or her that documents further follow-ups requirements and the patient's full record is kept in the patient's admission file. Each patient provides a notebook for recording all his or her visits to the hospital. These notebooks are not maintained by the dispensaries, but are maintained by the patients. Often these notebooks are misplaced and the patient's history has to be reconstructed again.

Data use

Which of the data collected are used? Who uses the data and what are they used for?

Health facilities are the origin of health care data and statistics being generated in a health system, but most of the health personnel at facility level never use the data themselves to improve the services they are providing. This is because they collect data for the purpose of reporting to higher levels as an indication of work done, as well as being provided with health care service requirements such as medicines, injections and vaccinations, as the following statements illustrate.

“We use the reports we are generating in the following ways: to know how many and what medicines are being used, to know the services that are being provided,

to know the use of equipments and what equipments are required, ... to know how many patients are given the services.” (MCH nurse A, Tanzania, June 2002)

“...the reports are being used for ordering medicines...”(MCH nurse B, Tanzania, June 2002)

The higher levels use the data collected at the health facilities for planning purposes, for example, budget-making. At the national level the planning is done based on the data aggregated at the regional level. When asked about what data the Ministry of Health (MoH) is using for planning, one of the MTUHA health workers at the MoH told me:

“We are dealing with data at the regional level. Since we receive it in aggregation form, we can’t trace a specific health facility. What we can at least trace is a District.” (MTUHA health worker, Ministry of Health Tanzania, August 2002)

5.2.2 Existing computer systems within MTUHA

In Tanzania, I managed to observe one computer database in use (MTUHADB), that is, the computer software package designed for MTUHA. This same computer database is available at the regional level, as well as at the national level (Ministry of Health). At the regional and national levels, data analysis is done by using the computer database. However, during my fieldwork at the regional level, the health worker responsible for using the computer database expressed the following problems:

“We had an old system that is installed in a computer that is not working, we have diskettes but they can’t be transferred to the new system [the database in use] since the old system and the new system are not compatible.”

“...the new system [the database in use] is not user friendly compared to the old one.”

“...we were not trained on how to use the new system. We prefer to use manual data rather than the system.”

“...the terminologies used in the forms are not the same as those used in the database.”

“...the system does not complete the required calculations, for example for calculation of indicators.” (MTUHA health worker, Coastal region offices Tanzania, July 2002)

5.2.3 Analysis of problems identified within MTUHA

I discuss the problems identified within the MTUHA in Tanzania in terms of gaps in data collection, poor (minimal) analysis of data, poor data quality resulting from lack of personnel, lack of supervision and lack of skills, timeliness resulting in incompleteness of reports, poor feedback and lack of feedback, minimal use of information, and lack of recourses or disproportional distribution of resources.

Gaps in data collection

There are a number of problems related to data collection in terms of gaps in the data collection forms. Sometimes the data collection register books do not meet either the report requirements or health facilities day-to-day functioning requirements. This can be described by the fact that reports on laboratory data have to be prepared and sent to the district while reporting registers do not have a space for the laboratory quarter report.

“ The MTUHA register books do not have a space for the laboratory quarterly report, so we have to design the reporting forms ourselves to be able to report to the District Laboratory Technician.” (Clinical officer A, Tanzania, July 2002)

There are health facilities that provide more services than the data elements described in MTUHA forms, for example, a table for registering medicines indicates only those which are being provided in Drug Kits (that is, for health centers and dispensaries), but the hospitals receive more medicines than those described in MTUHA forms. These problems result in the development of local forms to aid in data collection. One of the health workers said:

“MTUHA registration books have few rows and columns, compared to the services we are providing. So, I have to write in a paper following the format in the book to indicate all that has to be reported,” (Hospital health secretary, Tanzania, June 2002)

Sometimes the register books for data collection are not received on time from the higher levels. For example, when I was doing my research in July, that is the time they received the register books for the year 2002, most of the health facilities I visited were either using the previous year’s register book or using their local structured forms, trying to make them look like the register book they usually use. The following statements by health workers expressed this.

“At this time we have no MTUHA books, so we are using our hand made forms, ... and MTUHA’s old forms.” (MCH nurse C, Tanzania, June 2002)

“Now we do not have tally sheets, so we make [them] ourselves...” (MCH nurse D, Tanzania, June 2002)

Poor (minimal) analysis of data

There is no evidence of data analysis at the facility and district levels. This may be because of the lack of tools to use for data analysis. Generally the health workers do not have tools to use for data analysis and they appeared not to be trained in data analysis. Health workers have a feeling that analyzing data manually is a difficult task and that it takes a lot of time, as one of the health workers responsible for report preparation at the district level told me:

“It is very difficult to analyze data manually, ...” (District educational officer, Tanzania, July 2002)

When data are aggregated at the district level for all programmes, the health facility level details are lost, thus limiting the ability to control the quality of data, since it becomes difficult to detect the source of errors.

“We are dealing with data at the regional level. Since we receive it in aggregation form, we can’t trace a specific health facility. What we can at least trace is a District.” (MTUHA health worker, Ministry of Health Tanzania, August 2002)

Poor data quality

Health workers at the health facilities report incorrect values on the total number of patients attended, which results in poor data quality. For example, data quality can be considered poor because people are collecting data to show the work done, as well as the use of resources, such as medicines, without considering the purposes of data collection for health management.

“In our report [the report for MCH section], we also include the data for outpatients but most of the time we get incorrect numbers because those responsible for the data in the Outpatient Department (OPD) just submit what they feel will impress the hospital secretary who requests the data.” (MCH nurse A, Tanzania, June 2002)

Poor data quality also results from lack of personnel, lack of motivation and supervision from higher levels and lack of skills.

Lack of personnel

For the health facilities attending more patients than their service area, it becomes difficult for one health worker to compile the report, since the same health worker attends many patients.

“We have a lot of work, since we are few health workers compared to the patients attending the hospital.” (MCH nurse A, Tanzania, June 2002)

Lack of motivation and supervision

The counting of the totals from the register books and tally sheets has to be done in a quiet place and with no interruption in order to come up with correct numbers. In order to

do that, those health workers responsible for compiling the reports have to work overtime and without supervision. This doesn't motivate the health workers in making sure that they have good quality of data.

"It is a hard work for one person to compile a routine report. It takes time and sometimes we have to work overtime without payment." (MCH nurse F, Tanzania, June 2002)

"...usually a person from the district offices passes in each doctor's office each quarter to take the OPD attendance totals, ... for this year I have not seen anyone coming to take the totals." (Clinical officer B, Tanzania, June 2002)

"We are supposed to have supervision from the district... I have not seen anyone for this year." (Clinical officer A, Tanzania, July 2002)

District records on health facility supervision visits for 2001 also indicated lack of supervision on most of the health facilities (see Appendix A.2).

Lack of skills

Most of the health workers responsible for data collection and reporting are not trained on how to use the MTUHA system. Sometimes it happens that the training is being given to those not responsible. One of the health workers responsible for preparing the health facility's reports said:

"Seminars involve those who are not dealing with MTUHA system reports, thus [they are] not able to express the shortcomings of the system," (Hospital health secretary, Tanzania, June 2002)

Sometimes changes are being made in the system without training the health workers on how to cope with those changes. The health workers expressed the lack of training on new system changes.

"No training has been provided on how to use MTUHA system for a long time although some changes have been made to the system." (Clinical assistant A, Tanzania, June 2002)

“No seminars on the changes of MTUHA..., we only use our personal efforts to know and get used to the changes.” (Clinical officer A, Tanzania, June 2002)

Lack of training was a problem even more in non-governmental health facilities than in governmental health facilities.

“No seminars on how to use the system (MTUHA), especially for us non-governmental health facilities, though we are insisted on using the system” (Clinical officer C, Tanzania, June 2002)

Due to lack of training, most of the health workers do not understand the purpose of collecting data, as it is expressed in the following statement from the district offices:

“Most health workers do not understand the purpose of health data collection, resulting into poor reporting.” (District Medical Officer, Tanzania, July 2002)

Timeliness

For each level of information flows, that is, from the health facility to the district, from the district to the region and from the region to the national level, there is a deadline for sending reports from one level to another. What happens is that not all health facilities send their reports on time, thus resulting in incompleteness of reports. For example, the district reports are incomplete because they are based on reports from some but not all of the health facilities within the entire district (see Appendix A.1 Record of health facility reporting in Kibaha district for 2001). The problems related to timeliness can be described in terms of late reporting and incompleteness.

Late reporting and incompleteness

Not all health facilities are reporting in time. An example of this is from the district where I conducted the research, whereby out of 33 health facilities only 20 health facilities reported for the year 2001, and most of them submitted their first quarter report in May and June (see Appendix A.1 Record of health facility reporting in Kibaha district for 2001).

Poor feedback and lack of feedback

There is not an indication of feedback from higher levels to local levels. I came to understand this even though the health workers at the Ministry of Health say that they provide an overall annual report with a summary of all the regions in Tanzania.

“We provide annual feedback to the regional offices and district offices as well as do annual publications.” (MTUHA health worker, Ministry of Health Tanzania, August 2002)

In contrast to what was said at the Ministry of Health, at the health facility level, health workers talk of the feedback they get only in terms of reports they send coming back for corrections.

“...sometimes the reports are returned for corrections.” (MCH nurse A, Tanzania, June 2002)

Minimal use of information

No evidence was found for use of information at health facility level rather than health workers using the data they are collecting to know how many and what medicines are being used, the services that they are providing, the use of equipments and what more equipments are required. This is what most of the health workers were explaining concerning how they use the data they are collecting.

Lack of resources or disproportional distribution of resources

The health system at local levels is challenged by lack of personnel and material resources. For example, the following health worker was not organized because of the lack of folders to keep in the reporting forms from the health facilities.

“We don’t have a specified amount of money for buying working tools, for example, folders for keeping forms for infectious diseases, that is why you see that

things are not well arranged on my table.” (Clinical officer D, Tanzania, July 2002)

There are other health facilities that receive the whole set of register books (11 in total) while they are not providing some of the services in particular register books. This results in wastage of resources:

“We are being provided with ledger books while we are not using them because we do not have reports on them.” (Clinical officer C, Tanzania, July 2002)

Other health facilities are located outside the community, that is, very far from the community they are supposed to serve and there is no reliable transport. Due to this, patients have to go to the other health facilities, usually very far dispensaries from the one responsible for the area where they live, as long as they have easy access to transport.

“We don’t receive many patients since most of them are going to Kongowe dispensary and Mlandizi health center due to access to transport.” (Clinical officer D, Tanzania, July 2002)

5.3 Comparison between the findings in Mozambique and the findings in Tanzania

This section provides a comparison between the research findings in Mozambique and the research findings in Tanzania: Similarities and differences between the Health Information Systems (HIS) functionalities in Mozambique’s HIS and Tanzania’s HIS. The comparison is done through a description of the findings categories: Levels of the Health Information System (HIS) administrative hierarchy, means of data collection, tools for data collection and storage, data processing, analysis, reporting, and information flows, data use, problems, reporting from the health facility to the district, to the province, to the national level, and the administrative hierarchy of the HIS and the reporting system. These are described in table 5.7.

Table 5.6: Comparison between the findings in Mozambique and the findings in Tanzania

Finding category	
	Similarities
Levels of the Health Information System (HIS) administrative hierarchy	Both countries have four levels of the HIS administrative hierarchy, that is, health facility, district, province/regional, and national (Ministry of Health) levels.
Means of data collection	Both countries use routine data collection as the main means of data collection, whereby the health facility level is the origin of health care data, including data collected directly from the community.
Tools for data collection and storage	<p>In both countries data collection is done using forms, tally sheets and register books.</p> <p>Data are stored in folders at the health facility and district levels.</p> <p>Data at the province/regional level are stored in both a computer system and in folders.</p>
Data processing, analysis, reporting, and information flows.	<p>Data are processed and analyzed manually at the health facility and district levels.</p> <p>Data are processed and analyzed using a computer system at the province/regional and national levels.</p> <p>At the district level, reports from the health facilities are being aggregated into an overall district report.</p> <p>Report preparation at the district level is done by a group of people working as a team.</p> <p>The reports on infectious diseases are being reported on a weekly bases.</p>
Data use	In both countries, there is no evidence of data use for local decision-making.

<p>Problems</p>	<p>There are gaps in data collection tools, that is, data collection tools do not meet the needs of health facilities nor the needs of reporting requirements.</p> <p>Poor quality of data; the main reason being lack of personnel, that is, one health worker performing several tasks and lack of data collection skills among health workers.</p> <p>Poor analysis of data at local levels¹⁵; the main reason being lack of tools to use for analysis and poorly trained health workers.</p> <p>The health facilities do not have enough health workers compared to the number of patients to be attended, resulting in one health worker attending an average of 100 patients a day, at the same time preparing the report on what was done during that particular day.</p> <p>The health workers do not have enough skills required for health managerial activities.</p> <p>The data collection tools are not arriving at the health facilities in time, resulting in delays in data collection and reporting.</p> <p>Data at the district level is incomplete due to the fact that they are based on reports from some but not all the health facilities within the entire district. As a result, data at the province/regional and national levels are incomplete.</p> <p>Poor feedback and supervision from higher levels to lower levels, resulting into unmotivated health workers at local levels.</p> <p>There are lacks of resources; both human and material resources, for example, lack of transport, lack of data storage tools at the health facilities (such as folders).</p>
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¹⁵ By local levels, I refer to health facility and district levels.

	Differences	
	Mozambique	Tanzania
Reporting from the health facility to the district, to the province, to the national level.	The reporting is being done monthly throughout all the HIS administrative hierarchy, including cumulative quarterly reports from the province to the national level.	The reporting is being done quarterly throughout the HIS administrative hierarchy, whereby the reports are not cumulative.
	All the reports from the health facilities are being aggregated at the district level before being sent to the provincial level.	The reports at the regional level include the health facility's annual report, that is, each health facility's report is sent to the regional level without being aggregated at the district level.
		One copy of the district quarterly report is also sent directly to the Primary Health Care (PHC) Secretariat
Health Information System (HIS) administrative hierarchy and the reporting system.	The HIS administrative hierarchy and the reporting system do not include private health care facilities.	The HIS administrative hierarchy and the reporting system include private health care facilities.

Source: Fieldwork in Mozambique, April and May 2002 and Tanzania, June to August 2002

Chapter 6

ANALYSIS AND DISCUSSION

This chapter provides the analysis and discussion of the research findings presented in the previous chapter. It is in this chapter where I provide the answers toward the research questions and toward the main problem area as presented in the introduction chapter, that is, “how can use and management of information be improved at local levels of the Health Information Systems (HIS)?” By local levels of the HIS I refer to the health facility and district levels. The general discussion reviews the key findings of the case studies to understand their significance in relation to the literature reviewed where applicable. In the case of this discussion I provide recommendations on how to improve the use and management of information at local levels within the HIS.

The research methodology applied in this research is a sociological and managerial approach, through the use of qualitative research methods including ethnographic techniques including interviews, observations in the health facilities settings, and reviews of documents (conference reports, the district plan report and analysis of patients records for varying recording tools and contents). The openness of qualitative research methods, mainly interviews and observations, helped me in adjusting my interview questions and observation guide to what was perceived relevant, following an exploratory approach. A combination and comparison between what people said, what I observed and what is written in the documents (reviewed documents) is used as evidence for understanding the larger cultures and social contexts in which the particular society in study belongs.

My discussion is to a large extent based on the social systems perspective as presented by Walsham *et al.* (1988) that, “information systems should be conceptualized as social systems in which technology is only one of the elements,” a perspective that is highly suitable for HIS in developing countries where there are problems such as the current state of knowledge, availability of suitable equipment and infrastructure, lack of financial resources, shortages of technically competent personnel and constraints imposed by the socio-cultural and political contexts.

Through the empirical findings and the literature review, I have analyzed the HIS functionality in terms of data collection, data storage, data processing and analysis, data presentation and use, and information flows, and use of information within and across the HIS administrative structure in Tanzania and Mozambique, that is, health facility, district, region/province and national levels.

Studies show that there are two basic means in which to collect data: routinely and periodically (non-routine) (Ties 1991). This research is based on routine data collection, which was found to be the main means of data collection in Mozambique and Tanzania, involving various health programmes such as Maternal and Child Health (MCH), tuberculosis and drug programmes as well as data from the community.

This research revealed that local levels of the HIS require greater attention in order to become effective in using and managing health information for the improvement of health care activities. This is because the functioning of HIS comprises human and non-human factors, which are deeply embedded in socio-cultural and political contexts. These socio-cultural and political contexts are reflected in work practices that surround

data collection, data storage, data processing and analysis, data presentation and use, and information flows, particularly at local levels within the HIS.

6.1 Work practices at local levels within the HIS

Data collection is the first step of the information generating process within the HIS (Lippeveld 2000). Data collection can be quite simple, requiring only a pen and a piece of paper. It can also become quite sophisticated, employing several people, a set of pre-printed forms, calculators, and computers (Ties 1991). In Mozambique and Tanzania, routine data collection consists of a set of forms, registers, and tally sheets filled in by health workers at local levels within the HIS. While performing their daily activities, health workers at local levels collect health data by filling in the data collection tools, aggregating data into reports and reporting to higher levels of the HIS. The health information system therefore, is embedded in social work practices surrounding health workers at local levels.

The quality, use and management of data collected through routine data collection depend on the *layout*, *simplicity* and *relevance* of **data collection tools** (Lippeveld 2000). By the *layout* of data collection tools, I refer to the arrangement of data elements in a logical manner and the printing quality of data collection tools, for example, the space provided to fill in data, that is, is there a space for filling in data on every service being provided and is the space enough to fill in data? By *simplicity* of data collection tools, I refer to the clarity and helpfulness of the instructions for filling in the data collection tool and the time and effort required by health workers to fill in the data collection tools, that is, how much time and effort is required by health workers to fill in the data collection tool? By *relevance* of data collection tool, I refer to the usefulness of data collected in a

particular data collection tool for management of health care activities at the data collection level (Lippeveld 2000). From the field studies in Mozambique and Tanzania, it was revealed that the data collection tools neither meet the requirements of the health units' health care service delivery nor the reporting requirements due to unavailability of spaces to fill in data for either some of the services being delivered by particular health units or some of the services that the health units are required to report.

Data processing and analysis should generate high-quality information for decision-making at all levels of the HIS. By data processing and analysis, I refer to the manipulation of raw data in order to transform them into useful information that can be used for decision-making (Shrestha and Bodart 2000). Data processing involves checking for inaccuracies or inconsistencies that must be corrected, for example, missing or duplicate records, improbable values for a variable, and inconsistency with other known information (Shrestha and Bodart 2000). During the studies I discovered that there are some errors in data that are not checked (see table 5.2), for instance, the coverage of more than 300% is an improbable value in a year and, the number of children vaccinated for DTP1 being greater than the number of children vaccinated for BCG in the same year is an inconsistency error. Another example from the field research is the case where an incorrect number for the target population for the district was used in preparing the district report due to typing mistakes, which indicates that neither data review nor checking for accuracy and inconsistency was conducted. After processing data can be rearranged to form a summary set of variables conducive to analysis. This results in a set of tabulations and/or statistical analyses, which present information in the form that is clearest and most useful for health workers. Rearranging data would point to certain types of errors when improbable information is generated through preliminary data processing.

Data sharing, reporting and information flows

A health information system should ensure that data reporting and information flows do not only support decisions that have to be made at higher levels but also day-to day management of health care services at the health facility level. Streamlining data transmission should address the two main flows of information within the health services system: within the individual health care system and from health unit to system management levels (Lippeveld 2001). This study identified the two main information flows within the health care service delivery systems in Mozambique and Tanzania, whereby within the individual health care system special attention is on data-sharing from one health facility to another, that is, the referral system. For example, when a pregnant woman defined as a risk case is sent from the facility to the hospital to deliver, data-sharing is done through a letter and a card that indicates the risks of her illness/sickness and the diagnosis made.

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

Data presentation and use of information

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

However, most of the graphs that were made in health units during this field studies had poor presentation of information since they compared data collected for two years with details of an increase in the number of attended patients without comparing these data to expected targets that the particular health facility should strive to achieve (see for example, photo 5.1). In addition, health workers at the local levels considered the use of collected data as mainly a way of showing the higher levels the work done for more provision of resources such as medicines and injections. It is important to measure the workload and efforts done by a particular health unit for provision of resources. However, collecting and using data for the purpose of showing work done fall short of the kind of information needed to achieve the broader public health goals.

6.1.1 Problems facing work practices at local levels within the HIS

There are several problems facing the work practices within the HIS such as, poor quality of data, weak analysis of data, lack of an information culture and lack of trained personnel (see for example, Allotey and Reidpath 2000; Braa and Nermunkh 2000;

Khemrany 2001; Rubona 2001; Wilson *et al.* 2001a). This research identified similar problems, which are grouped into the following categories:

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

Lack of clear understanding of the purpose of data collection

There is a lack of training in information awareness and handling among health workers. There is also a lack of expertise in health information management and use particularly at local levels. These have great effects on the HIS in terms of analysis, use and management of information at local levels. The findings from this research revealed that health workers are not trained on how to use the data collection and reporting tools even when the changes are made to the health information system. For example, when the structure of data collection and reporting forms is changed to include more reporting requirements. Health workers collect data for disease reporting and use of resources and partially address the management objectives at the health facility. Quality of care is crucially involved with continuity, far more than just the number of services provided. For example, the collected data can be used for monitoring conditions that need follow-up over long periods such as antenatal care, immunization and tuberculosis, that is, to see which patients have been provided with the services as expected and which need follow-up or tracing in the community.

Information flows reflecting the requirements of higher levels, without addressing the local level's information needs

The findings described in figure 5.5 and 5.8 illustrate a number of problems related to information flows within the HIS, particularly the vertical data flows, from local levels to higher levels that result in poor integration of information at the district level. There is a continuous aggregation of data that takes place as the data move up the hierarchy, which masks the health facility data, making it difficult to analyze and use the data for local management activities, for example, detecting health care problems from a particular health facility. The reporting is one-way with limited supervision and feedback from the top authorities.

Centralization of routine health information systems management is among the factors that influence low use and poor quality of information at local levels within the HIS. Indicators, data collection instruments, and reporting forms usually are designed by centrally located epidemiologists, statisticians, and administrators with minimal involvement of local level managers and health service providers. Lippeveld pointed out that,

the main result of this centralization is that information use is weakest at the district level, where the main public health interventions are planned, implemented, and monitored, and at the health unit level, where individual health decisions are made (Lippeveld 2001, p.20).

Health workers at local levels do not take part in defining appropriate solutions to common health problems in the community that they face in their daily work practices and lives. This in turn does not promote ownership and control of essential health system functions. Therefore, health workers at local levels are not motivated to produce high

quality data, because most of the data they collect is irrelevant to their own information needs.

Decentralization of health information systems management towards the district level is an effective strategy to improve local use and quality of health information. However, to achieve positive results in decentralized health information systems management, most administrative functions should be carried out by the District Health Management Teams (DHMTs) in collaboration with and with active involvement of the community. These administrative functions often include control over personnel, supplies and equipment: hiring of staff, purchasing and ordering of resources, planning and defining the data collection tools, delivery of health care services, and control over allocation of resources for different health programmes.

Poor and inadequate resources and infrastructure for health care activities

There is a shortage of both human and financial resources, while the demand for healthcare services is increasing at the health facilities. The field research showed that the health units are understaffed resulting in high workloads, poorly qualified and trained health workers staff health facilities, and the health facilities are lacking the most essential HIS supplies such as forms and registers.

Opportunities for applying the ICTs in supplying health, educational and agricultural information in developing countries are limited by a number of features, which include inadequate basic physical infrastructure such as telephone lines, and lack of required skills among health workers for using ICT tools (see, for example, Chandrasekhar and Gosh 2001; Braa *et al.* 2001b). The field research revealed the lack of infrastructure, for example, telephone lines, to be a problem for communication between the district offices

and the health units within the district. Poor roads and lack of funds, for example, for cars and petrol, restrain the transport possibilities of the community and health workers, for instance, in cases of reports submission and to transport referred patients from one hospital to another.

While computer technology (computing) generally serves as a resource or tool to support other work such as performing complex analysis, preparing documents and sending electronic messages using office automation equipment (Gasser 1986), this research identified several problems related to computerized parts of the health information systems in Mozambique and Tanzania. Both computer databases (SISDB and MTUHADB) are being operated by poorly trained health workers who can not use all the available data manipulation functions, and have no skills on how to make changes in the databases to reflect the changes in the HIS. As a result of dealing with the unreliability in software and operations (Gasser 1986), the responsible health workers prefer to use either manual data processing or other applications such as spreadsheets.

This study shows that poor and inadequate resources and infrastructure result in unreliability of information in terms of timeliness and correctness of reports.

6.2 Recommendations

In the light of key findings, analysis and discussion from the research, the following ideas and recommendations are crucial to enable the use and management of health information at local levels within the health information system. Individual countries need to establish appropriate mechanisms for overcoming the problems facing work practices at local levels. Developing countries need to learn from each other about existing HIS

functionalities, and experiences in the improvement of the use and management of health information.

6.2.1 Overcoming the problems

To overcome the problems facing work practices at local levels the following must be done.

- Local learning and discussion of essential HIS needs, and the role of routine data collection in meeting those needs.
- Establishing an information culture in HIS and health care organizations.
- Investing in health data collection, use and management of health information at local levels within the HIS.

In addition, developing countries can learn from each other's experience.

Local learning and discussion of essential HIS needs, and the role of routine data collection in meeting those needs

Health workers at local levels should be able to learn and practice their profession with due regard to the socio-cultural, organizational and political context of their work. Local learning and discussion of essential HIS needs involve training health workers in data collection, analysis, use and management of information by discussing with health workers how to keep data collection tools as simple as possible and performing simple processing and analysis of data. For example, one way of ensuring data quality at the health facility level is to look at the data by running one's eyes across each line looking for missing data values and inconsistencies. At the district level health workers may ensure data quality by checking for completeness of the reports from the health facilities

before reporting to higher levels, that is, by checking if all health facilities have submitted all the reports with all the data they should report on.

Establishing an information culture in HIS and health care organizations

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

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

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

Investing in health data collection, use and management of health information at local levels within the HIS

The improvement in the use and management of health information at local levels within the HIS needs to be made by considering the constraints of infrastructure and scarce resources (physical and human), which cannot be ignored.

The Ministry of Health (MoH) and donor assistance need to invest in health data collection, use and management of health information to support local decision-makers. Investing in HIS involves supervision and support for the acquisition and development of basic resources and infrastructure. This in turn will involve providing sufficient and appropriate physical and human resources for HIS management and ensuring that the available resources are used in such a way that high-quality information is produced in a timely manner.

Developing countries learning from each other's experience

In restructuring the existing routine health information systems to reflect the needs of decision-makers and managers at all levels of the health system, specifically at local levels, developing countries can learn from each other about existing HIS functionalities, and experiences in the improvement of the use and management of health information. However, special considerations should be given to the social system perspective by considering HIS as an integral part of the wider culture and society of the country in which it is found.

For example, while the population and culture differ between Mozambique and Tanzania, there are important problems and concerns that they share. In addition to sharing problems and concerns the two countries can also learn from each other's experience.

Tanzania can learn from Mozambique on monthly data reporting to reduce the report preparation workload and enable easier and earlier detection of mistakes, that is, it is very difficult to prepare a three month report rather than a one month report and detecting mistakes in a three month report is more difficult than detecting mistakes in a one month report.

Parallel with monthly data reporting, the lessons from the HISP experience in Mozambique as well as in South Africa can be applied as a guide to HISP adaptation in Tanzania. For example, from HISP experience in South Africa, Tanzania can learn the following.

- Making considerable efforts focusing on helping staff use paper and pencil to master analytical skills before the system is computerized, requiring development of essential data sets, which health workers could easily understand and analyze on the spot without the need of a computer.
- Encouraging the use of hand-drawn, catchments area maps and graphs as a key step in getting people to understand the populations they serve and to trust the data they collect.
- And the participatory approach which involves all stakeholders or actors in the process of HIS development, aiming at enhancing health services at the district level.

From HISP experience in Mozambique, Tanzania can also learn to avoid discrepancies between the meanings of the medical terminology with the ones visualized by the software through several and long discussions between the medical staff and the HISP implementation team.

Mozambique can learn from Tanzania through including private health units in the reporting of health care data. Excluding the private health care facilities means missing data on some or the majority of the patients who are attending the private health units.

6.3 Generalizations

There are three recommendations from this research that can be applied by health managers within the Health Information Systems (HIS) in Mozambique, Tanzania and developing countries in general to improve the use and management of information at local levels within the HIS.

- i) Facilitate local learning and discussion of essential HIS needs, and the role of routine data collection in meeting those needs.
- ii) Establish an information culture in HIS and health care organizations.
- iii) Invest in health data collection, use and management of health information at local levels within the HIS.

The application of the above recommendations is not limited to HIS in Mozambique and Tanzania or developing countries only, but can be applied by health planners and health managers in other developed countries to improve the use and management of health information at local levels of the HIS, thereby improving the health care services. The

recommendations are independent of the organization structure, staff skills and technology since all information systems, computerized or not computerized are embedded in the socio-cultural contexts of the organization in which they are a part. The improvement in the health care services requires some changes to be made, the changes in the information systems will have to be backed up by organizational or structural change, in developing countries as well as developed countries.

Chapter 7

CONCLUSION

In this chapter I present the analytical conclusion towards the main problem area as the essence of the discussion and analysis. Then I will present this research's contributions to existing knowledge. And lastly, I will discuss possible areas of further work basing on my reflections on the research findings.

The main problem can be stated as:

How can use and management of information be improved at local levels of the Health Information Systems (HIS)?

In general, I found poor use and management of health information at local levels within the HIS. Poor data processing, analysis and presentation, lack of an information culture, lack of staff, lack of trained personnel and poor and inadequate resources and infrastructure for health care activities are the causes of poor use and management of health information at local levels within the HIS.

Computers have a role to play in improving the health system's work practices, but they are not a universal solution and, clearly, they offer no ready-made solutions. A computer is a machine for handling symbols; what symbols, who prepares them, how are they prepared and what kind of outputs are needed from the computer are questions which have to be answered before the implementation of a computerized information system. More important than computerization, is a review of several variables underlying the HIS

working environments. For example, do the HIS have adequate human resources in terms of qualities and quantities for the present health care activities? Does the expertise and environment match with the available human resources to influence better HIS goals? Are there effective supervision, support and feedback strategies for local level health workers who are the main data collectors?

All efforts must be made to improve the quality of data collected at the data collection level. To ensure that the HIS is well understood by health workers, training should be conducted. To enable accurate data collection and reporting, registers, forms and tally sheets should be relevant and easy to understand; to accomplish this, data collectors must be involved in designing data collection tools. Supervision, support and feedback must be provided to local level health workers. Feedback may take many forms but it is best done in writing combined with discussion about what is written. And, HIS workers need to be able to learn from others how to effectively integrate the applications into their working practices.

The health information systems do not need to be computer intensive to ensure the use and management of health information at local levels. The use and management of health information at local levels can be improved with consideration of the general work behaviour of individual actors and the role of different sections and departments within the HIS.

7.1 Research contributions to knowledge

Through the analysis of the research findings and the literature review, this study provides a wider understanding of the work practices of health workers, problems facing

work practices at local levels within the health information system (HIS) and the causes of identified problems. Other writers pointed out that, HIS activities are seen as a burden due to high workloads in filling the data collection forms (see, for example, Allotey and Reidpath 2000; Braa and Nermunkh 2000; Khemrany 2001; Rubona 2001; Wilson *et al.* 2001a). In addition to what is pointed out by other writers, this study discovered that, there is also lack of personnel for health care delivery services at local levels, that is, the number of patients to be attended is not proportional to the number of health workers in a particular health facility.

In conducting the literature review, I did not find comparison between findings in two different settings. Therefore, this study provides an example of countries can learn from each other's experiences through cross-case comparative analysis.

This research provides recommendations on how to improve the use and management of health information, with a focus at local levels of the HIS. This provides health planners and health managers with knowledge on how to plan and manage health care activities for effective health care delivery services at district and sub-district levels.

Carrying out a research study in the health sector in developing countries, with a focus on local levels, has explored the necessary conditions for ICT capacity development in local settings. This is because the health sector extends to the most peripheral areas of the community where the majority of the population experience poor living environments such as poor health services, poor educational services, and poor economic situations. While other studies indicate the importance of computerization in ICT capacity building within the health sector (see for example, Braa *et al.* 2001), this study showed that, ICT capacity building surrounds the human and social aspects of the community in study, that

is, asking the community what are their problems, which problems are the most important, and what people in the society need to tackle these problems, thus, making the community integral to the analysis of the context for ICT projects. The community can suggest appropriate locations, appropriate technology and working environments, which will provide possibilities for access and affordability of ICTs in the community.

Methodological contribution

Qualitative research methods including ethnographic techniques such as interviews, observations in the health facilities settings, and reviews of documents are social in character. When using them in settings where there is no commonality of language between the researcher and the setting in study, there is a possibility of missing out the important findings of the research. Adjustment of the research plan is required according to what is perceived as relevant during the study. To accomplish this, the interview questions and observation guide must be adjusted to what the researcher perceives relevant during the study. With commonality of language in Tanzania, I managed to conduct informal talks and discussion with health workers during the observation session. In Mozambique all the discussions had to take part during the interview sessions, which resulted in more additional questions for further explanations from the interviewees, thus the interviews took more time than the planned time.

7.2 Further work

Further research is required to develop underlying methodologies and judge the usefulness and success of approaches used in developing countries to restructure the existing routine HIS.

- Serious consideration should be given to the socio-cultural, organizational and political dimensions of the processes being studied in addition to the more technical aspects of HIS. For example, *how will the support from the Ministry of Health have an influence in developing consistent policy and realization of a commitment of health workers to HIS change towards improving the health care delivery system?*

This study explored the information flows within the health care referral system, that is, data-sharing from one health facility to another (primary health care levels to hospital levels). Further research is required to find *the importance of information flows in the health care referral system between primary health care levels and hospital levels.*

Another area of further work is to explore and analyze the role of the community in improving health care services delivery. That is, since the majority of routine health data are collected at the first level of the health system, where there is direct contact with the community, *what roles can the community play in improving the health information generating process within the HIS?*

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APPENDICES

Appendix A: Reviewed documents from the fieldwork

A.1 Record of health facility reporting in Kibaha district, 2001

TABLE D1.2: RECORD OF HF REPORTING Year 2001 Page _____

HF Code	Staff List F001	Equip Inv F002	Phy Str Inv F003	Quarter 1 F004	Quarter 2 F004	Quarter 3 F004	Quarter 4 F004	Ann Rep F005	Ren/Main F006
025	20 JUN		20 JUN	20 JUN	31 JUL 01	29 Oct 2001			
031									
016	3 MAY	3 MAY	3 MAY	3 MAY	9 AUG 01	24 Oct 2001			
006	24 APR	24 APR	24 APR		9 AUG 01	29 Oct 2001			
035	24 APR	24 APR	24 APR	29 MAY 01	31 JUL 2001				
008				28 JUL 01	28 JUL 01	10 Oct 2001			
028	18 MAY	18 MAY	18 MAY	18 MAY 01	16 JUL 01	3 rd Oct 01			
022						24 Oct 2001			
041					20 JUL 01	29 Oct 2001			
004	24 APR	24 APR	24 APR	24 APR 01		29 Oct 2001			
038				25 JUN 01	31 JUL 01	29 Oct 2001			
026			20 JUN 01	20 JUN 01	18 JUL	29 Oct 2001			
015									
001	15 JUL 01	15 JUL 01	15 JUL 01	15 JUL 01		13 Oct 2001			
020					19 JUL 01	19 Oct 2001			
007	24 APR	24 APR	24 APR	26 JUL 01	26 JUL 01	5 Oct 2001			
005	4 MAY	4 MAY	4 MAY	4 MAY	31 JUL 01	24 Oct 01			
036									
039	4 MAY	4 MAY	4 MAY	30 JUL 01	30 JUL 01				
012									
023	30 APR	30 APR	30 APR	30 APR	2 JUL 01	22 Oct 01			
009		5 MAY	5 MAY	5 MAY	31 JUL 01	29 Oct 2001			
003	29 JUN	29 JUN	29 JUN	29 JUN		6 Oct 01			
002	9 APR	9 APR	9 APR	7 MAY	19 JUL 01				
017	24 APR	24 APR	24 APR	20 JUN	6 JUL 01	2 Oct 01			
040	25 APR	25 APR	25 APR	25 APR	11 JUL 01	15 Oct 2001			
010	8 MAY	8 MAY	8 MAY	8 MAY	2 AUG 01	15 Oct 2001			
034									
024	4 APR	4 APR	4 APR	17 MAY		10 Oct 2001			
014	24 APR	24 APR	24 APR	20 JUN					

Source: District processing file at Kibaha district offices, Tanzania, 2001

A.2 Record of health facility supervision visits in Kibaha district, 2001

TABLE D1.4: RECORD OF HF SUPERVISION VISITS

HF Code	Visit 1	Visit 2	Visit 3	Visit 4	Visit 5
038					
026					
015					
001					
020		29 JUNE			
007	19 JAN	19 FEB	8 MAR	20 APR	
005	19 JAN	20 FEB	20 MAR	9 APR	28 JUN
036					
039	9 JAN	13 MAR			
012					
023	14 FEB	19 APR	2 MAY	25 JUN	
009	25 JAN	21 FEB	23 MAR	6 APR	12 MAY
003	6 JUN 01				
002	15 JAN	5 FEB	5 MAR	13 JUN	22 JUN
017	13 MAR				
040	28 FEB	26 MAR			
010	20 FEB	14 MAR	5 APR	15 MAY	
034					
024					
014	31 JAN				
025					
031					
016	25 JAN	21 FEB	6 MAR	5 MAY	
006	17 JAN	19 FEB	8 MAR	2 APR	21 JUN
035					
008					
028	6 APR				
022					
041	18 FEB				
004	24 MAR	23 APR			

Source: District processing file at Kibaha district offices, Tanzania, 2001

A.3 SIS data collection and reporting forms (Source: SIS in Mozambique, 2002)

Item	Código	Designação	Nível de preenchimento	Periodicidade
LIVROS DE REGISTOS				
1	SIS-C01	LIVRO DE REGISTO DE CONSULTAS EXTERNAS	Unidade sanitária	Diária
2	SIS-D01	LIVRO DE REGISTO DE INTERNAMENTOS	Unidade sanitária	Diária
3	SIS-D02	LIVRO DE REGISTO DE INTERNAMENTOS CIRURÚGICOS	Unidade sanitária c/ inter. cirúrgico	Diária
4	SIS-B01	LIVRO DE REGISTO DE MATERNIDADE	Unidade sanitária	Diária
5	SIS-E01	LIVRO DE REGISTOS DO LABORATÓRIO - NÍVEIS I/II E TRANSF.SANGUE ????	Unidade sanitária c/ laboratório	Diária
6	SIS-F01	LIVRO DE REGISTOS DO SERVIÇO DE RADIOLOGIA - NÍVEL II	Unidade sanitária c/ radiologia	Diária
7	SIS-G02	LIVRO DE REGISTO DE ESTOMATOLOGIA - NÍVEIS I E II	Unidade sanitária c/ estomatologia	Diária
IMPRESSOS				
8	SIS-A01	REGISTO DIÁRIO DO PAV (BCG, PÓLIO, DPT, SARAMPO)	Unidade sanitária ou brigada móvel	Diária
9	SIS-A02	REGISTO DIÁRIO DO PAV (Vacina Anti-Tetânica)	Unidade sanitária e brigada móvel	Diária
10	SIS-A03	RESUMO MENSAL DO PAV PARA UNIDADES SANITÁRIAS	Unidade sanitária	Mensal
11	SIS-A04	RESUMO MENSAL DO PAV PARA DISTRITOS	Distrito	Mensal
12	SIS-A05	RESUMO ANUAL DISTRITAL DE RECURSOS - PAV	Distrito, Província	Anual
13	SIS-A06	RESUMO TRIMESTRAL/SEMESTRAL/ ANUAL PROVINCIAL DE ACTIVIDADES DE VACINAÇÃO - BCG/VAS	Provincial	Trim/Sem/Anual
14	SIS-A07	RESUMO TRIMESTRAL/SEMESTRAL/ANUAL PROVINCIAL DE ACTIVIDADES DE VACINAÇÃO - DPT	Provincial	Trim/Sem/Anual
15	SIS-A08	RESUMO TRIMESTRAL/SEMESTRAL/ANUAL PROVINCIAL DE ACTIVIDADES DE VACINAÇÃO - PÓLIO	Provincial	Trim/Sem/Anual
16	SIS-A09	RESUMO TRIMESTRAL/SEMESTRAL/ANUAL PROVINCIAL DE ACTIVIDADES DE VACINAÇÃO - VAT (Mulheres Grávidas e Mulheres de 15-49 Anos)	Provincial	Trim/Sem/Anual
17	SIS-A10	RESUMO TRIMESTRAL/SEMESTRAL/ANUAL PROVINCIAL DE ACTIVIDADES DE VACINAÇÃO - VAT (Crianças das Escolas e Trabalhadores)	Provincial	Trim/Sem/Anual
18	SIS-A11	CONTROLO DO MOVIMENTO MENSAL DAS VACINAS	Unidade Sanitária	Mensal
19	SIS-A12	CADEOLA DE FRIO - FICHA DE CONTROLO DA TEMPERATURA	Unidade sanitária	Diária
20	SIS-B02	REGISTO DIÁRIO DE CONSULTAS PRÉ-NATAIS / PÓST-PARTO/PF	Unidade sanitária e brigada móvel	Diária
21	SIS-B03	REGISTO DE CONSULTAS DE CRIANÇAS 0-4 ANOS/VIGIL. NUTRICIONAL 0-35 MESES	Unidade sanitária e brigada móvel	Diária
22	SIS-B04	RESUMO MENSAL DE SMI/VIGIL. NUTRICIONAL PARA UNIDADES SANITÁRIAS	Unidade sanitária	Mensal
23	SIS-B05	CONTROLE DE STOCKS DE MÉTODOS ANTICONCEPTIVOS	Unidade sanitária	Mensal

Item	Código	Designação	Nível de preenchimento	Periodicidade
24	SIS-B06	RESUMO MENSAL DISTRITAL - SMI, CONSULTAS 0-4 / VIGILÂNCIA NUTRICIONAL	Distrito	Mensal
25	SIS-B07	RESUMO MENSAL DISTRITAL DAS MATERNIDADES E PARTEIRAS TRADICIONAIS	Distrito	Mensal
26	SIS-B08	RESUMO MENSAL DISTRITAL - SMI CONSULTAS PRÉ-NATAIS / PÓST-PARTO / PF	Distrito	Mensal
27	SIS-B09	RESUMO TRIM/SEMES/ANUAL PROVINCIAL DE SMI - CONS. 0-4 / VIGIL. NUTRICIONAL	Provincial	Trim/Sem/Anual
28	SIS-B10	RESUMO TRIM/SEMES/ANUAL PROVINCIAL DE SMI - CONSULTAS PRÉ-NATAIS / PÓST-PARTO/PF	Provincial	Trim/Sem/Anual
29	SIS-B11	RESUMO TRIM/SEMES/ANUAL PROVINCIAL DAS MATERNIDADES E PARTEIRAS TRADICIONAIS - I PARTE	Provincial	Trim/Sem/Anual
30	SIS-B12	RESUMO TRIM/SEMES/ANUAL PROVINCIAL DAS MATERNIDADES E PARTEIRAS TRADICIONAIS - II PARTE	Provincial	Trim/Sem/Anual
31	SIS-C02	FICHA DE CONTAGEM DE NOVOS CASOS DE DOENÇAS DE DECLARAÇÃO OBRIGATÓRIA (Semanal)	Unidade sanitária	Semanal
32	SIS-C03	BOLETIM EPIDEMIOLÓGICO SEMANAL - Unidades Sanitárias / Distritos	Unidade sanitária, distrito, provincia	Semanal
33	SIS-C04	RESUMO MENSAL DE CONSULTAS EXTERNAS E DO STOCK DE MEDICAMENTOS KIT "A" - Centros de Saúde	Centro de Saúde	Mensal
34	SIS-C05	RESUMO MENSAL DE CONSULTAS EXTERNAS E STOCK DE MEDICAMENTOS KIT "B" - Postos de Saúde	Posto de Saúde	Mensal
35	SIS-C06	RESUMO TRIMESTRAL PROVINCIAL DE CONSULTAS EXTRNAS	Provincial	Trim/Sem/Anual
36	SIS-C07	RESUMO MENSAL DA DISTRIBUIÇÃO DOS KITS PARA O NÍVEL PROVINCIAL E DISTRITAL	Distrito e Provincial	Mensal
37	SIS-D03	RESUMO MENSAL DE INTERNAMENTOS PARA CENTROS E POSTOS DE SAÚDE	Unidade Sanitária	Mensal
38	SIS-D04	RESUMO DE INTERNAMENTOS PARA HOSPITAIS DISTRITAIS, RURAIS, GERAIS	Hosp. Rural e/ou Geral + Provincia	Mens./Trim/Sem./Anual
39	IS-D05	RESUMO SEMESTRAL/ANUAL PROVINCIAL DE INTERNAM. PARA CENTROS E POSTOS DE SAÚDE	Provincial	Semest/Anual
40	SIS-E02	RESUMO MENSAL DO SERVIÇO DE LABORATÓRIO PARA UNIDADES SANITÁRIAS DE NÍVEL PRIMÁRIO E SECUNDÁRIO	Unidade sanitária c/ Laboratório	Mensal
41	SIS-F01	RESUMO MENSAL DO SERVIÇO DE RADIOLOGIA PARA NÍVEL II	Unidade sanitária com Radiologia	Mensal
42	SIS-G02	RESUMO MENSAL DO SERVIÇO DE ESTOMATOLOGIA DE NÍVEL PRIMÁRIO E SECUNDÁRIO	Unidade sanitária c/ Estomatologia	Mensal
43	SIS-G04	RESUMO TRIMESTRAL PROVINCIAL - SERVIÇO DE ESTOMATOLOGIA	Provincial	Trimestr./Semest./Anual
44	SIS-I01	RESUMO TRIMESTRAL DA ELAL PARA UNIDADES SANITÁRIAS	Unidade sanitária	Trimestral
45	SIS-I02	RESUMO TRIMESTRAL DA ELAL PARA DISTRITOS	Distrito	Trimestral
46	SIS-J01	RESUMO ANUAL DISTRITAL DE RECURSOS - REDE SANITÁRIA E CAMAS DE NÍVEL PRIMÁRIO E SECUNDÁRIO	Distrito/Provincia	Anual
47	SIS-J02	RESUMO ANUAL DA REDE SANITÁRIA E CAMAS	Provincial	Anual
48	SIS-K01	RESUMO ANUAL DISTRITAL DE RECURSOS - PESSOAL DE NÍVEL PRIMÁRIO E SECUNDÁRIO	Distrito/Provincia	Anual
49	SIS-K02	RESUMO ANUAL PROVINCIAL DE RECURSOS - PESSOAL DE NÍVEL PRIMÁRIO (Rural e Urbano), SECUNDÁRIO, DIRECÇÃO PROV. E INSTITUIÇÕES DE FORMAÇÃO	Provincial	Anual

Item	Código	Designação	Nível de preenchimento	Periodicidade
FICHA DE ARQUIVO DO NEP PROVINCIAL:				
50	SIS-NEP-01	RESUMO MENSAL PROVINCIAL DE ACTIVIDADES DO PAV - BCG e VAS	NEP	Mensal
51	SIS-NEP-02	RESUMO MENSAL PROVINCIAL DE ACTIVIDADES DO PAV - VAT (Crianças das Escolas / Trabalhadores)	NEP	Mensal
52	SIS-NEP-03	RESUMO MENSAL PROVINCIAL DE ACTIVIDADES DO PAV - VAT (Mulheres Grávidas / Mulheres de 15-49)	NEP	Mensal
53	SIS-NEP-04	RESUMO MENSAL PROVINCIAL DO PAV - DPT	NEP	Mensal
54	SIS-NEP-05	RESUMO MENSAL PROVINCIAL DE ACTIVIDADES DO PAV - PÓLIO	NEP	Mensal
55	SIS-NEP-06	RESUMO MENSAL PROVINCIAL - SMI - CONSULTAS PRÉ-NATAIS, POST-PARTO E PF	NEP	Mensal
56	SIS-NEP-07	RESUMO MENSAL PROVINCIAL SMI - CONSULTAS 0-4 ANOS /VIGILÂNC. NUTRICIONAL	NEP	Mensal
57	SIS-NEP-08	RESUMO MENSAL PROVINCIAL - SMI - MATERNIDADES E PARTEIRAS TRADICIONAIS (I PARTE)	NEP	Mensal
58	SIS-NEP-09	RESUMO MENSAL PROVINCIAL - SMI - MATERNIDADES E PARTEIRAS TRADICIONAIS (II PARTE)	NEP	Mensal
59	SIS-NEP-10	RESUMO MENSAL PROVINCIAL DE CONSULTAS EXTERNAS	NEP	Mensal
60	SIS-NEP-11	RESUMO MENSAL PROVINCIAL DO SERVIÇO DE ESTOMATOLOGIA	NEP	Mensal

Appendix B: Interviews and Observations questions guide

The following Interview and observation questions guide list do not provide an extensive list of questions asked during the course of all interviews or observations. The questions list is thematically arranged, and do not reflect the sequence of the questions asked during each interview. Additional questions were often added according to the situation at hand.

I present the interviews and observations questions guide in three languages: English, Portuguese and Kiswahili. The questions guide in Portuguese and Kiswahili are revised and translated versions of the original one, which was in English. The translation into Portuguese and Kiswahili had to be done because my settings required the use of local language, that is, Portuguese in Mozambique and Kiswahili in Tanzania.

B.1 English version

- i) In what ways are health data being collected?
- ii) What tools are used to collect and store (record) the collected data?
- iii) How are health data being kept over time?
- iv) What procedures are used to prepare reports?
- v) Where is the collected data sent?
- vi) Which of the data collected are used?
- vii) Who uses the data and what do they use it for?
- viii) How is the patient data/information shared when a patient is sent from the facility to the hospital?
- ix) What data is the patient given when leaving the hospital after being admitted?
- x) What are the problems related to data collection, reports preparation and information flows from the health facilities to higher levels?

B.2 Portuguese version

- i) Quais são as práticas quotidianas de recolha de dados de saúde?
- ii) Que ferramentas são utilizadas na colheita e armazenamento de dados?
- iii) Como é que os dados são arquivados?
- iv) Quais são os procedimentos usados para produzir relatórios?
- v) Para onde é que são enviados os dados colectados?
- vi) Dos dados colhidis, quais é que são usados?
- vii) Quem usa os dados colectados e par que fins?
- viii) Como é que os dados/informação do paciente é partilhada quando o paciente é transferido de um hospital par o outro?

- ix) Que dados são dados ao doente aos abandonar o hospital?
- x) Quais os problemas relacionados coma colecta, elaboração de relatórios e fluxos das unidades sanitárias para os níveis superiores?

B.3 Kiswahili version

- i) Taarifa za afya zinakusanywa kwa kutumia utaratibu gani?
- ii) Vifaa/Zana gani zinatumika katika kukusanya na kutunza taarifa za afya?
- iii) Taarifa za afya zinatunzwaje kulingana na nyakati mbalimbali?
- iv) Utaratibu gani unatumika kuandaa ripoti za afya?
- v) Taarifa za afya hupelekwa wapi?
- vi) Taarifa zipi kati ya zile zinazokusanywa hutumika?
- vii) Nani hutumia taarifa hizo na kwa ajili gani?
- viii) Taarifa zipi za mgonjwa hupelekwa kutoka hospitali moja kwenda nyingine?
- ix) Ni taarifa zipi mgonjwa hupewa anapokwenda nyumbani baada ya kulazwa hospitalini?
- x) Matatizo gani yanatokea katika ukusanyaji wa taarifa za afya, uandaaji wa ripoti za taarifa za afya na uwasilishaji wake katika ngazi za juu?

Appendix C: Ethical clearance (letters of agreement)

C.1 Letter of introduction to the Ministry of Health Tanzania from the University of Oslo



**UNIVERSITY
OF OSLO**

Department of Informatics

P.O. box 1080, Blindern
0316 Oslo
Norway

Gaustadalléen 23

Phone: +47 22 85 24 10
Fax: +47 22 85 24 01

Our ref:
Your ref:

Oslo, 11 June, 2002

**FACULTY OF MATHEMATICS
AND NATURAL SCIENCES**

Letter of Introduction for Faraja Mukama and Juma Lungo


We kindly request the Ministry of Health, Tanzania, to permit Faraja Mukama and Juma Lungo to study the Health Information Systems in Tanzania.

Faraja Mukama and Juma Lungo are Masters students in Information Systems at the Department of Informatics, University of Oslo. As part of their Masters, Faraja Mukama and Juma Lungo, will do a research project on "The Health and Management Information Systems in Tanzania". This research will focus on studying how data is being collected, analysed, used and reported at the various levels of the health system including the Health Facility, District, Regional and National levels. The two students will need to visit the various levels of the health services, observe and study how information is handled and interview staff. They will also need to interact closely with the Health Information Department at MoH and get access to relevant documentation.

This research is part of a larger international Health Information Systems Programme (HISP), which has the Ministries of Health in South Africa, Mozambique, Malawi and Cuba as key partners. In South Africa HISP has developed a free software database application for district based health management, which is in use in all districts and hospitals in South Africa and being adapted and implemented in the other countries mentioned above. As part of their research and under the guidance of the Ministry of Health, the two students will adapt this software to the health and data structure in Tanzania and assess to what extent the experience from South Africa and other countries, and the HISP software may be useful in Tanzania. Our aim is that this research will be of value for the Ministry of Health in Tanzania.

The research by Faraja Mukama and Juma Lungo will be supervised by staff from the University of Oslo, myself included, and Daudi Simba, Muhimbili University College of Health Sciences, UDSM.

Best regards


Jørn Braa

Ass. Professor

C.2 Letter of permission from the Ministry of Health Tanzania

JAMHURI YA MUUNGANO WA TANZANIA
WIZARA YA AFYA



Anwani ya Simu: "AFYA",
DAR ES SALAAM
Simu: 2120261 -7
Fax: (255) -22 - 2139951/110986/138283
Unapojibu tafadhari taja:

S.L.P. 9083,
DAR ES SALAAM

Kumb. Na. BC 209/395/01/229

13 Juni 2002

Kwa Yeyote Anayehusika:

Yah: **Barua ya Utambulisho kwa Faraja Mkama**

Mhusika aliyetajwa hapo juu ni mwanafunzi wa Kitanzania katika Chuo Kikuu cha Oslo kilichopo nchini Norway. Ni mwanafunzi anayesomea shahada ya juu katika fani ya Mifumo ya Taarifa (Information Systems). Mwanafunzi huyu amechagua kufanya utafiti kuhusu MTUHA katika Tanzania kama sehemu ya kukidhi matakwa ya kozi. Hivyo Wizara ya Afya inaomba umpokee na umpe msaada utakaohitajika ili afanye vizuri katika masomo yake na tunatarajia utafiti atakaoufanya utasaidia kuboresha MTUHA hapa nchini.


Maximillian Mapunda
Kny Katibu Mkuu