HEALTHCARE PROVISION IN THE GAMBIA: THE ROLE OF HEALTH INFORMATICS

(Subtitle: DEVELOPING HEALTH INFORMATICS IN AFRICA: THE GAMBIAN EXPERIENCE)

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LIST OF ABBREVIATIONS

AMIA	-	American Medical Informatics Association
BHS	-	Basic Health Service
BMiS	-	British Medical Informatics Association
CDC	-	Centre for Disease Control
CHCS	-	Community Healthcare System
CHN	-	Community Health Nurse
CPR	-	Computer-based Patient Record
CRD	-	Central River Division
DBA	-	Database Administrator
DBMS	-	Database Management System
DoSH	-	Department of State for Health
DHT	-	Divisional Health Team
EDI	-	Electronic Data Interchange
EHR	-	Electronic Health Record
EPI	-	Expanded Programme on Immunisation
EPR	-	Electronic Patient Record
ERP	-	Economic Recovery Programme
ESU	-	Epidemiology and Statistical Unit
FAIS	-	Financial Administration Information System
GDP	-	Gross Domestic Product
GFPA	-	Gambia Family Planning Association
GHS	-	Gambia Health Service
GNHS	-	Gambia National Health Service
HAS	-	Health Administration System
HIS	-	Health Information System
HIAS	-	Health Information and Administration System
HISA	-	Health Information System Administrator
HMIS	-	Health Management Information System
HospIS	-	Hospital Information System

HW	-	Health Worker
ICD	-	International Classification of Disease
ICT	-	Information and Communication Technology
IMR	-	Infant Mortality Rate
IT	-	Information Technology
LRD	-	Lower River Division
MCH	-	Maternal and Child Health
MMR	-	Maternal Mortality Rate
MRC	-	Medical Research Council
NBDE	-	North Bank Division East
NBDW	-	North Bank Division West
NEA	-	National Environmental Agency
NGO	-	Non-Governmental Organisation
NHA	-	National Health Account
NHL	-	National Health Laboratory
NHS	-	National Health Service
OPD	-	Outpatient Department
PHC	-	Primary Healthcare
PHCS	-	Primary Healthcare System
PHPNP	-	Participatory Health Population and Nutrition Unit
PMR	-	Patient Medical Record
RVH	-	Royal Victoria Hospital
SQL	-	Structured Query Language
TBA	-	Traditional Birth Attendant
UNDP	-	United Nations Development Programme
URD	-	Upper River Division
VHS	-	Village Health Service
VHW	-	Village Health Worker
WD	-	Western Division
WHO	-	World Health Organisation

DEDICATION

This thesis is dedicated to:

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Mrs. Beatrice Cobbina for all the wonderful love and sacrifice she made throughout my life. Mr. Gabriel Lionheart Adekyie Yamuah for his fatherly duties performed.

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DECLARATION

I, Lawrence Kweku Yamuah, grant powers of discretion to the University Librarian to allow this thesis to be copied in whole or in part without reference to me. This permission covers only single copies for study purposes, subject to normal conditions of acknowledgement.

ABSTRACT

While technological advances in computing and telecommunications are revolutionising the way many organisations work, healthcare systems in The Gambia are very much lagging behind. No proper patient records or filing systems are in place. Delivery of effective healthcare depends on availability of routinely collected, good quality health data to provide useful information that is accessible when and where it is needed. Presently, in The Gambia, there is considerable scope for improvement in relation to such data. Electronic patient record system is long overdue.

This research, focuses on the development of a Health Information System (HIS) capable of providing doctors, nurses and other healthcare professionals with quick and easy access to the appropriate information needed to care for their patients.

A systems analysis has been undertaken to identify the full need for patient health data, the range of users and the extent of present paper-based provision. From this analysis, a requirements specification has been produced for a proposed health information and administration system (HIAS) to become operational and also successful in terms of efficiency and effectiveness. The requirements specification has taken the form of a series of precise statements of needs, buttressed with a corresponding justification in each case.

By assessing what information and communication technology (ICT) is required and feasible, affordable and available in The Gambia, based on the extensive fieldwork involving interviews, observational study and questionnaires, a design specification (the logical and physical framework for the proposed HIAS) has also been produced as a precursor to the development of the proposed HIAS prototype. The approach used will aid any implementor to progress from the proposed system to a fully functional one in an efficient and timely manner.

Constraints in the programme of research were such that it was not possible to continue on with a prototype implementation based on this design. Hence it is now for The Gambia government to study and implement the proposed system. Several recommendations have been made in the areas of policies to be implemented, resources needed and training and motivation.

In conclusion, the study has demonstrated the value or role of health informatics in the provision of health care in a developing country. It has contributed in the understanding of the complexities of the problems in The Gambia and developing countries, building this understanding in terms of requirements analysis and design specification and in methodological issues.

CHAPTER 1

INTRODUCTION

1.1 Background

The health of a nation's people is one of the most important contributing factors to its economic success or failure. It is therefore imperative that we should do all we can to secure the highest level of well being especially where disease prevention and/or control are feasible.

Due to pressures on population and economic decline, the doctor to patient ratio in some African countries including The Gambia is continually getting smaller. This reduces the level or efficiency of healthcare in the society. Though a comparatively new area with rapid growth in recent years, the potential for the application of health informatics in healthcare appears to be increasingly recognised by the World Health Organisation (WHO).

In The Gambia, there is a rapid growth in population which is attributed to high birth rate (fertility rate is 6.0) and the high influx of aliens from neighbouring countries. There is a tendency towards urban migration, which results in over population and unemployment in the urban areas. One of the reasons is people's belief that better service can be found in the urban centres.

The country was in 1993-94 ranked 162nd out of the 174 poorest nations. The life expectancy of females is 56 years, while that of males is 54 years. Infant mortality rate (IMR) is 90/1000. Literacy is still a problem in The Gambia and so is proper healthcare. Poor basic facilities and healthcare are encouraging the spread of many diseases including HIV/AIDS, tuberculosis, malaria, acute respiratory infections and diarrhoea.

The government of The Gambia has been struggling with good intentions over the years to adopt the philosophy and strategies for 'Health for All by the Year 2000' (already delayed and impossible). In order to achieve this, we must be committed to ensure that all people (not just some) attain a certain level of health. It must be at a level that enables them to actively participate in the social and economic life of the community in which they live. For this objective to be attained, existing health systems must be directed to achieve equitable reallocation of resources for health, i.e. total coverage, increased accessibility to primary healthcare services and effective referral to secondary and tertiary levels of care.

Preventive health services are, relatively, very difficult to promote, owing to cultural, economic and logistic barriers to reaching both urban and rural homes in Africa. The information requirements of successful community healthcare can be demanding. It may require a knowledge of who in the community requires health services, when the services are needed, and what problems are hindering the quality or acceptability of the services at any point in time. The challenge is often concentrated on the need for convenient and low-cost community health services.

Government and managers need to know if coverage objectives are being achieved, if the population served is responding to services, and if basic support functions for the field operations are functioning smoothly. In particular, it is important to know if logistics and supply operations are adequately supporting field operations, and if particular problems are arising that hamper operations.

This obviously requires accurate and detailed information on possibilities, needs, and consequences of recommended actions. The needed detailed and accurate information is often lacking, inadequate or unreliable. Decision-making based on assumptions and unjustified conclusions often results in the selection of inappropriate policies and programmes, the consequences of which are only discovered after implementation.

It is therefore not surprising that although assistance has been given to The Gambia since 1986 in the form of a consultant reviewing the situation, there is still no properly established or operational health information system (HIS) in place. An HIS department may exist (nicely described on paper) but not (and very far from) fully functional.

In 1994 two consultants went to The Gambia to review and advise on the possible development of an HIS. Again in 1996 a mission to prepare a plan of action for a possible development of HIS was undertaken by the Ministry of Health with the Epidemiological and Statistical Unit (ESU) in conjunction with the WHO (personal communication with the acting Head of ESU in 1999). I was told that some of the conclusions and recommendations were that there were structures ready to provide support for the development of an HIS, but that the system was not functioning for reasons that include:

- Technical weakness of health workers;
- Inadequate resources;
- Inadequate guidance and norms to be followed in the operation of the information system (i.e. indicators for health monitoring and case definition);
- Poor reporting systems particularly of mortality data which are collected routinely at the health facility but not reported;
- Poor staff attitudes towards health information;
- Shortage of staff and lack of proper training of existing staff;
- Inadequacy of computer skills at all levels of the health system;
- Over-dependency of the Divisional Health Teams (DHTs) on an inadequately functioning ESU for analysis of their data.

The supposedly paper based health and/or management information system(s) as they currently seem to exist are not as efficient and effective as they could be due to lack of resources, lack of formalised systems and lack of recognition of their importance. The ESU, for example, which is supposed to coordinate health data collection, reporting, processing and analysis, rarely performs this function. Management data may exist but in different formats and scattered in different departments.

For the past five years or so, the World Bank has been supporting The Gambia's health service through the Department of Participatory Health Population and Nutrition Project (PHPNP). One important area the World Bank wants to see effected is the development and implementation of a health management information system (HMIS), which is one of the reasons it supported the country wide workshop on health indicators in May 2000 which the researcher attended by invitation. As recently as late 1999 and early 2000, the PHPNP was advertising for Technical Assistance for the Design of a Health Information System. In the background information to the Draft Terms of Reference (see Appendix A), some of the issues it mentioned as identified included:

- Lack of government policy on HIS;
- Lack of minimum set of indicators;
- Lack of standard case definitions for some definitions of epidemic potential and of public health importance;
- Lack or inadequacy of knowledge in data recording, analysis, interpretation, reporting and use at all levels;
- Lack or inadequacy of skills in computer use at the central and divisional levels;
- Lack of feedback at all levels;
- Lack or inadequacy of equipment and software;
- Too many data collected;
- Lack of analytical skills of staff at all levels.

One of the important specific outputs they expect from the consultant is advice on the introduction of software to make it possible for the HIS to be computerised at both central and DHT levels.

There is no quick and easy access to the information which doctors, nurses and other health professionals need in order to provide better care for all their patients. To be able to address some of the issues in order to contribute to the improvement of this situation is the challenge this PhD programme and/or project faces.

1.2 The Problem Statement

In The Gambia, there is a Primary Healthcare (PHC) system in place; a programme initiated in 1981. To serve the health needs of the communities or nation, it is important to apply an available technology in an optimal manner, within the limited resources available. However, in The Gambia, there are numerous problems:

- First of all there is no proper system in place to facilitate finding the information needed to use for better delivery of care. No information means there is continued burden on healthcare delivery.
- Patient record management is manually performed and far from perfect;
- Locating case notes of previous visits is a nightmare;
- What is recorded is partially complete;
- No basic structure or policies exists for collecting data and is error prone;
- No centralised computerised or paper based system is in place;
- There are no properly coordinated existing health information systems in The Gambia; neither electronic nor properly established paper based systems;
- Prescription documentation is incomplete;
- Appointment scheduling is not working properly and not computerised;
- Activity reports (by diagnostics, type of activity, personnel etc), is difficult to produce, often much delayed and mostly checked manually.
- NGO and other charitable organisations have different and separate systems that are not directly integrated into The Gambia National Health Service;
- No proper integration of the different health centres facilities;
- Dates of births are unknown for a substantial proportion of the population;
- Besides, there are big problems with names. There are many people with the same first and second names and sometimes having the same names for one or both parents; This makes unique identification of individuals in the country much more difficult;
- No existing Permanent Patient Identification number such as the NHS number in U.K.;
- No existing national enforcement of the registration of births, marriages and deaths;
- There is also lack of ambulance and motor bike for community staff;
- There are times when two or three patients had to be nursed in the same room with inadequate facilities;
- No proper training of staff dealing with records.

In summary, little, if any, information for use in better delivery of care is available.

Given these problems, there is the need to create a system or an environment that can be utilised to develop better care for patients. This needs:

- Good communication system;
- Good control on population;
- Good education and/or training;
- Very sound economy;
- Good Patient Administration System consisting of:
  - Patient categorical data
  - Referral system and
  - Follow ups;
- Good Financial and Administrative systems in healthcare institution;
- Good statistical information for government and managers, NGOs and donor countries for decision making.

In healthcare settings, the first step in the development of an HIS is to identify a clinical, administrative, or research need usually arising from an inadequacy or inefficiency in the delivery of healthcare. The decision to develop an HIS was motivated by a desire to improve the quality of care, to improve access to care, and/or to collect the information needed to document and evaluate the healthcare delivery process itself. It is intended that the HIS will correct defects in the present or old system; such as more accurate and timely record keeping and also allow integrated access to patient record.

1.3 The Research's Aim and Objectives

This research aims at developing a prototype health information system (HIS) in The Gambia that is capable of providing doctors, nurses and other healthcare professionals with quick and easy access to the information to care for patients; also to provide this information when they need it, where they need it, and in the format in which they find most useful.

Specific Objectives include:

1. Reviewing and documenting the existing knowledge, experiences, status and achievements of health informatics to date in both developed and developing countries. And in particular its role in supporting healthcare delivery to meet the challenges such as those encountered in The Gambia with particular emphasis on potential applicability in The Gambia.

2. Investigating and describing or documenting the current situation, the provision and challenges of healthcare delivery in The Gambia within the broader context of The Gambia as a developing African state.

3. Identifying specific areas from the literature review that can be applied to the development of an HIS in The Gambia in cognition to the needs and expectations of The Gambian people.

4. Investigating factors influencing the provision of proper healthcare in the Gambia and identifying those that can be addressed by putting in place a proper HIS.

5. Identifying factors that may influence the introduction or development of a health information system in The Gambia.

6. Developing a prototype health information system using appropriate information technology which is convenient and at a comparatively low cost.

7. Making recommendations to The Gambian government concerning the implementation and sustainability of the health information system to be put in place.

1.4 Rationale and Hypothesis of the Research

The delivery of effective healthcare is dependent upon the availability of routinely collected, and good quality health data. Such data can be considered to comprise the Patient Medical Record (PMR), patient categorical data and data relating to health centre activities. At present, in the context of both urban and rural Africa and particularly in The Gambia, there is considerable scope for improvement in relation to such data. This relates both to the process by which these data are captured and stored, and to the manner in which they are subsequently analysed in order both to improve the management of the individual patient and to monitor the effectiveness of the healthcare delivery overall.

In different healthcare environments and/or hospitals, large numbers of data are collected by different health professionals who work in different settings. Healthcare is provided to patients by different people – physicians, nurses, technicians, pharmacist, radiographers etc. For effective healthcare delivery, communication among the members of the team is essential. Data must be available to the decision makers when and where they are needed; a good system will help by storing, transmitting and displaying those data. It is important to mention here that the patient record is the primary vehicle for communication of clinical information.

Information Technology (IT) can be used as an all embracing technology that affects strategic and operational issues [1]. Developing countries have used it extensively and found a high potential value for it. Apart from having a big influence on society in general and healthcare in particular, IT has become an important tool in the development of almost all sectors of a nation. It is said that, "no country can afford not to join the information revolution, nor can it avoid its impact" [2].

In the United States, the benefits of good healthcare IT are becoming more widely recognised. A report of the U.S. Public Health Service's Data Policy Coordinating Committee [3] identified health as one of the key sectors that can benefit from advanced computer technology and telecommunications. Smaller statewide initiatives in the United States are starting to appear, such as the Delaware Health Information Network (DHIN [4]) effort. Several European countries including the United Kingdom have also accepted these benefits and announced aggressive positions on healthcare information technology, investing large amounts of capital in national healthcare information initiatives.

The purpose of the national strategy in the U.K. is to help their National Health Service (NHS) exploit the full power of clinical IT, ensuring that patients receive the best possible care. The NHS has invested £1 billion over the last few years in order to modernise how the service collects, stores and uses healthcare information (see the NHS information strategy summary [5] and full plan [6]).

Among the information activities that flow within the healthcare system are referrals, proposal guidelines, statistics, reports, coordination, feedback and inquiries. It is reported that a few healthcare providers spend much time on data collection, recording, processing, retrieving and communication activities [7]. It is however true that without adjustments, the software and hardware imported from industrialised countries may not work in less developed countries [7]. The World Health Organisation (WHO) identified the lack of information, or untimely and unreliable information, as one of the major obstacles to healthcare management in developing countries [1].

The Gambia is poor and a developing country but does not need to be left behind. If the technology is good for developed or western countries then it must be good for The Gambia and Africa. Adjustments however need to be made to the software and hardware imported from developing countries if they are to work properly.

The research hypothesis which it proposes to test is that the design and development of a prototype health information system (HIS) for The Gambia, using appropriate information technology, can assist in the collection of high quality health data. The use and enhanced analysis of these data would enable the quality of healthcare delivery across communities to be monitored and evaluated.

This is based on the assumption that good telecommunication links, wireless or satellite and good infrastructure exist.

1.5 Importance of the Study

In The Gambia, there is a wide range of vital clinical information that can be generated for health policy, planning, epidemiological research purposes and to help in the provision of decision support tools. However, such investigations can only be carried out if good quality health data have been collected and are readily available. At present such a good data collection system is not in place. This project is designed to put in place an HIS for good collection, communication and storage of data.

Capturing some relevant health data as part of the health information system, the study would enable a number of further interesting subsequent studies to be undertaken. Given the added value of the consistent high quality of data provided by the HIS, it will be possible to revisit in a more systematic manner a number of epidemiological studies. This could for example enhance the search for some answers to contributing factors of death by diseases and have implications for the management of, and interventions against, diseases and/or mortality due to the diseases.

This health information system will satisfy some of the information needs pertinent to decisions that management can make towards the development and/or design of a complete national health information system.

The implementation of this HIS will help doctors, nurses and others who are currently training to become more accustomed to the use of information technology and in appreciating the role of medical informatics in healthcare, not only in The Gambia but across the African continent in general.

1.6 Thesis Plan

The thesis document is presented in ten chapters. The first chapter has provided an introductory overview of the whole research presenting the background, problem statement, the research's aim and objectives, rationale and hypothesis of the research and the importance of the research.

Chapter two gives a description of the background of the study country including demographic features and an overview of the organisation and management of the health sector in The Gambia and the current situation, the provision and challenges of the healthcare delivery system in the country.

Chapter three reviews the status and achievements of health informatics to date in both developed and developing countries, and in particular its role in supporting healthcare delivery to meet challenges such as those encountered in The Gambia with particular emphasis on potential applicability in The Gambia. It also comments on problems (such as attitudinal ones) faced with HIS and on lessons learnt from the general reviews.

Chapter four is a description of the research methodology and design used in addressing the issues and investigations of the research. It discusses the advantages and the disadvantages of some methods employed and justifies their selection instead of other alternative strategies. It also describes the initial proposition of a conceptual model of the health information system design.

Chapter five describes the field work that was undertaken in order to gather additional data to enhance the design specification as well as provide more information to allow requirements analysis to be completed.

Chapter six describes the analysis of the data captured during the field work the results of which was used for the design specification and requirements analysis taking into consideration the comments made by key people interviewed.

Chapter seven describes the requirement analysis and specification while chapter eight dwells on the final design specification stage.

Chapter nine is a general discussion on all the issues raised in the research and the analytical results of all the questionnaire, interviews and observational studies of the field work.

Chapter ten describes all the major or main conclusions made from the research undertaking as well as recommendations made to The Gambia government and to possible future studies to be conducted.

CHAPTER 2

FACTS ABOUT THE GAMBIA AND ITS HEALTH SECTOR

Before proceeding to consider specific issues of healthcare information, it is appropriate to provide a brief background to the country, The Gambia, its basic features and its healthcare structure. To move towards a health information system (HIS) that is effective in context, there is the need to be aware of particular problems. Hence it is appropriate to provide a general overview of the country, its characteristic features and institutions that highlight issues and problems that need to be addressed or taken into account by any systems designer. It also shows how the features in their various ways affect healthcare in general in the country from both human and other resources points of view. Prior to the research, an informed awareness of the entire health sector is necessary as this will help during health workers' interviews and will also assist in placing details of the current system in perspective. Knowing how the health service is structured and who is who and where is important when deciding how and who to contact during the feasibility study and design stages of the research.

The systematic view of the environment, the population, the economy, health status, education, institutions, and administration of the health delivery structure, is relevant for the specification of requirements of HIS and understanding the complexity of the problems that may impinge on the design of HIS. It is also important to gather information on the possible effect of government policies on the health sector. Without sufficient time devoted to the areas mentioned above, the researcher will not be able to fully understand the significance of some matters discovered during the fact-finding stage of the work and may design the new system with the limitations of the old one. If this should happen, a new system, although appearing nice on paper, may operate no better than a previous system simply because some environmental conditions frustrates its operation. It is therefore important for the researcher, through information gathering, to try and predict and estimate environmental conditions in order to be able to anticipate flexibility of the system to be designed.

Most of the information provided in this chapter has been the result of the feasibility study and information gathering stages of the research investigation as described in chapter 4 (methodology).

2.1 Physical Features and Climate

The Gambia is a small country located on the West Coast of Africa and is bounded on the North, South and East by Senegal, and on the West by the Atlantic Ocean. It is about 480 km long inland, extending from the Atlantic Ocean, and varying between 24 and 42 km wide in different areas. The surface area of the country is 10,689 square km, about 19 percent of which consists of wet land [8, pp7]. Generally, the land is flat, made up of swamps and infertile sandy soils and low lying with the highest point being approximately 50 metres above sea level. It is devoid of any known mineral resources of commercial value.

The climate of the districts is typical of the Sub-Sahel region with a rainy season from July to October and a long dry season from November to June (consisting of a cold season from November to February and a hot, drier season from March to June). "Decades of drought leading to low and uneven rainfal distribution has caused a sharp decline in agricultural production with a corresponding drop in rural income levels over the past three decades. Agriculture is the main source of employment and food supply for the rural population; 86.4% of rural women are subsistence farmers. The decline in production particularly groundnut, the main cash crop, has both social and economic consequences for the country. Specifically, this decline has had serious negative consequences on rural household incomes; thus inhibiting their ability to pay for the cost of social services such as health and education user-fees [8, pp8]".

Apart from Banjul, there are eight busy (not necessarily large) health centres that are covering all parts of the country (Serekunda, Fajikunda, Sibanor, Brikama, Mansakonko, Farafenni, Bansang and Basse). The major urban centres such as Banjul and Serekunda are on the coast, with a few centres such as Farafenni, Bansang and Basse up country.

"There is only one main tarmac road some 480 km long that runs through the south bank of the country. However, the Government is constructing another 48km tarmac road with a bridge on the north bank. All other roads in rural areas are laterite roads. Some of these roads become impassable during the rainy season, thus creating problems of accessibility and distribution of merchandise for the greater part of the country. In addition, outreach clinics for antenatal care and vaccinations for children are cancelled during the rains. Under normal circumstances, patient evacuation by road, particularly for high-risk pregnant women and sick children, is very difficult. This situation worsens during the rainy season"[8, pp9].

2.2 Demographic Profile: The Population and Healthcare

It has an estimated population of just over one million (1,038,145) with a population density of 97 per km^2 and a growth rate of 4.2% (1993 census) [9]. It is one of the most densely populated countries in Africa. The ratio of males to females is almost 1:1. Between 1963 and 1983, the population doubled. If the present growth rate remains unchanged, it is estimated that the present population will double by the year 2015. This rapid growth is attributed largely to high birth rates, a decline in mortality rate and the high influx of aliens from neighbouring countries. The life expectancy of females is 56 years, while that of males is 54 years. Total fertility rate (TFR) is 6.0 with an infant mortality rate (IMR) of 90/1000. Although fertility has declined, on the whole, The Gambia's TFR of 6 children per woman is one of the highest in sub-Saharan Africa. [8, pp8].

"While the United Nations statistics estimated the Maternal Mortality Rate (MMR) of The Gambia as 1,100 per 100,000 in 1990, the Maternal Mortality Study also conducted in 1990 by the then Medical and Health Department estimated it as 1,050 per 100,000 [8, pp20]". Current data on MMR are not available. The MMR of 1,050 per 100,000 is one of the highest in the sub-region. It is important to mention that the MMR remains extremely high, about twice the level of neighbouring Senegal, despite the high levels of access to health services at primary and secondary levels. The questions to be asked are why, what can be done and how. HIS can be one of the answers.

The population consists of a relatively large number of ethnic groups such as the four major ones; Fulani (18.8%), the Wollof (14.6%), the Mandinka (39.5%), the Jola (10.6%), and other smaller ones; the Serere, the Serahule, the Krios, the Manjagos and smaller groups such as the Mansuankas, Balantas and Karoninkas. The majority of Gambians live in the rural areas and earn an income by agriculture, although some semi nomandic groups such as the Fulanis, the Manjagos and Mansuankas are cattle owners or herdsmen.

Most Gambians, about 93 - 96 percent, are Muslims. The Christians form about 4 percent of the population and live mainly in the coastal areas whereas the others (among whom some Manjagos and some of the Jolas form the larger groups) are adherents to traditional African beliefs. The Gambia is culturally, a paternalistic, male dominated society where women have little decision-making power. Women are valued for their fertility and generally it is accepted by both men and women that the socio-economic status of women is inferior to that of men. Traditional beliefs and customs are very strong, especially in the rural areas, and male-child preference leads couples to continue having children in an attempt to fulfil their desire to have sons for inheritance [8, pp 8].

Although about 78% of the total population live in the rural areas there is an increasing tendency towards urban migration. In 1963, only 15% of the population lived in urban settings or growth centres. By contrast, in 1993, about 37% of the population lived in urban areas with annual urban growth rate of 6.2% compared to 3.2% for rural areas [8, pp9]. This tendency towards urban migration results in over population and unemployment in the urban areas. This is a trend, not only in The Gambia, but in almost all African countries. It is worth mentioning here that a principal pillar of health or medical informatics policy is the mobility of the population says F.T. de Dombal [10, p1].

There exists a Primary Healthcare System (PHCS). However, health is significantly influenced by traditional medicine, socio-economic status and cultural habits. Literacy is still a problem in The Gambia and so is proper healthcare. The latest census of 1993 showed that only 28 percent of the women between 15 and 34 years were literate. In the general population adult literacy is reported to be around 39% while high illiteracy rates in the rural areas (80% for men and 94% for women) have been documented [9]. In a situation analysis of children and women in 1998, illiteracy rate was reported females (10 years and above) as 73.1% compared to 45% for males (10 years and above) [8, pp76]. This high illiteracy could have serious implications for health education in particular and healthcare in general.

The official language and medium of instruction is English. The youth constitute the majority of the country's populace with about 48% being under 15 years and 18% being between the ages of 15 and 24 years. The age group of 65 years and above accounts for only 3.2% of the population according to the 1993 census. The Gambia is described as a youthful population with 50.4% of its population under age 18 which gives rise to a high dependency ratio, as almost half of the population has to work to support the other half [8, pp8].

2.3 Governmental Administration

Administratively, the Gambia is divided into five divisions. These are Western Division (WD), Lower River Division (LRD), MacCarthy Island Division (MID), North Bank Division (NBD) and Upper River Division (URD). Each administrative division is headed by a Commissioner. The divisions are divided into districts with each district headed by a chief. A district is further divided into villages and a group of villages constitute a ward. There are two municipalities in the country, the Banjul City Council and the Kanifing Municipal Council.

2.4 Economic Overview

The Gambia engages mainly in subsistence farming with groundnuts as the chief export or main cash crop. Almost 60% of the arable land of the country is used for cultivating groundnuts. The groundnut agricultural industry contributes about 24% of the Gross Domestic Product (GDP) and provides employment for about 52% of the nation's work force. Agriculture is the main activity of the economy, with more than 70% of the population engaged in farming [8, pp10].

Though growing slowly, the industrial sector is relatively small. It accounts for about 8% of the GDP and its activities are limited to light industries such as brewing, manufacture of soap, food processing, cement bagging, plastics and bricks. The sector provides employment for approximately 3% of the labour force.

One area that has developed into an important source of income for the country is tourism. The industry contributes about 10% of the GDP and provides employment for about 2% of the labour force mainly on a seasonal basis. The number of tourist arrivals has increased from 27,000 in 1974/75 to some 100,000 in 1995/96. In 1990/91 the Government collected about D48 million (US$ 5.3 million, using the 1998 exchange rate) in direct and indirect taxes from tourism investment in hotels along the coast. The importance of this information is to consider the impact of the tourist arrivals on the healthcare system in the country and the consideration it needs to be given when thinking about any development in HIS, not to talk about the importation of diseases foreign to the country.

In recent years, the service sector has emerged as an important factor in the country's economic landscape. A major contributor to the national revenue now is the transit and re-export trade. This involves the re-exportation of goods to Senegal and other West African countries. This also involves a lot of movement of people especially heavy duty drivers from all corners of the sub-region.

In the late seventies to mid-eighties, The Gambian economy experienced a major downturn. There was a decline in GDP during this period, with an increase in the government deficit as well as an escalation of foreign debt. To redress these problems, the government embarked on the Economic Recovery Programme (ERP) in the mid-eighties. Following this was a Programme for Sustained Development, which sought to consolidate the gains made under the ERP.

The Gambia is one of the least developed countries in the world with a GDP of US$337. Recent surveys show that the percentage of the population below the poverty line has increased from 33% in 1993 to 69 %. In 1993-94, the estimated per capita income was US$249.6 and the country was ranked 162nd out of the 174 poorest nations. In the National Human Development Report by UNDP in 1997 it is stated that the country is among the least developed, ranking 165 out of 185 with an estimated per capita income of US$ 320 [11].

2.5 Overview of the Health Delivery System

2.5.1 Divisional Administration

Administratively there has been a decentralisation of the health service which is presently administered through six divisional health teams (DHTs). These DHTs operate from six health divisions within the country namely Western Division (WD), Lower River Division (LRD), Central River Division (CRD), Upper River Division (URD), North Bank Division East (NBDE) and North Bank Division West (NBDW). Each divisional health team is responsible for the management and implementation of healthcare activities within its respective division at all levels. These health divisions are in line with the official five government administrative divisions apart from the North Bank Division that is further divided into two health divisions, namely North Bank Division East and North Bank Division West. The North Bank is divided into two health divisions because the Kerewan "Bolong" (river) divides the administrative division and can make supervision difficult for as far as logistics are concerned. Besides, the river is seen to pose additional constraints in terms of access to health services and referrals to health facilities.

2.5.2 Health Structures of the Gambia

The health services of The Gambia are currently organised in a pyramid like system, with three hospitals at the apex functioning as major referral centres (see figure 2.1). Besides the three general hospitals, there are a mental hospital, tuberculosis sanatorium, leprosarium and home for the old and infirm. Below the hospital level is a network of rural health centres, dispensaries and sub-dispensaries.

A health centre is the main health institution in the rural areas and is intended to provide a comprehensive health service in the fields of maternal and child health (MCH), curative outpatient care and environmental health promotion and protection. Its staffing varies somewhat, but as a minimum, it usually consists of a Nurse, Community Health Nurse/Dispenser and a Public Health Officer. A dispensary is also a health institution in the rural areas, but is manned by a Nurse/Dispenser who runs mainly an outpatient care programme in the unit. However, some dispensaries are regularly visited by the mobile MCH team, which periodically operates in their MCH clinic. In addition, an increasing number of the dispensaries are being staffed with Public Health Officers, who visit surrounding settlements to carry out activities related to environmental health work. A sub-dispensary has no resident-trained worker. It is a lock up unit, which is visited only once a week or less frequently by a Nurse/Dispenser or MCH mobile team from the nearest dispensary or health centre; such areas are referred to as trekking stations.

Since 1983, village health workers (VHWs) and traditional birth attendants (TBAs) have been selected in each village with more than 400 inhabitants and usually given 6 weeks training in preventive and curative medicine. These villages are referred to as Primary Healthcare (PHC) villages.

Thus, healthcare in The Gambia is currently delivered through 3 referral hospitals (2 plus 1 quite recently), 7 major health centres, 12 minor health centres, 20 dispensaries, 177 outreach stations (OS) and 396 health posts (see table 2.1) [8, pp50]. The system is designed around a three-tier level system of care, namely primary, secondary and tertiary (see figure 2.1).

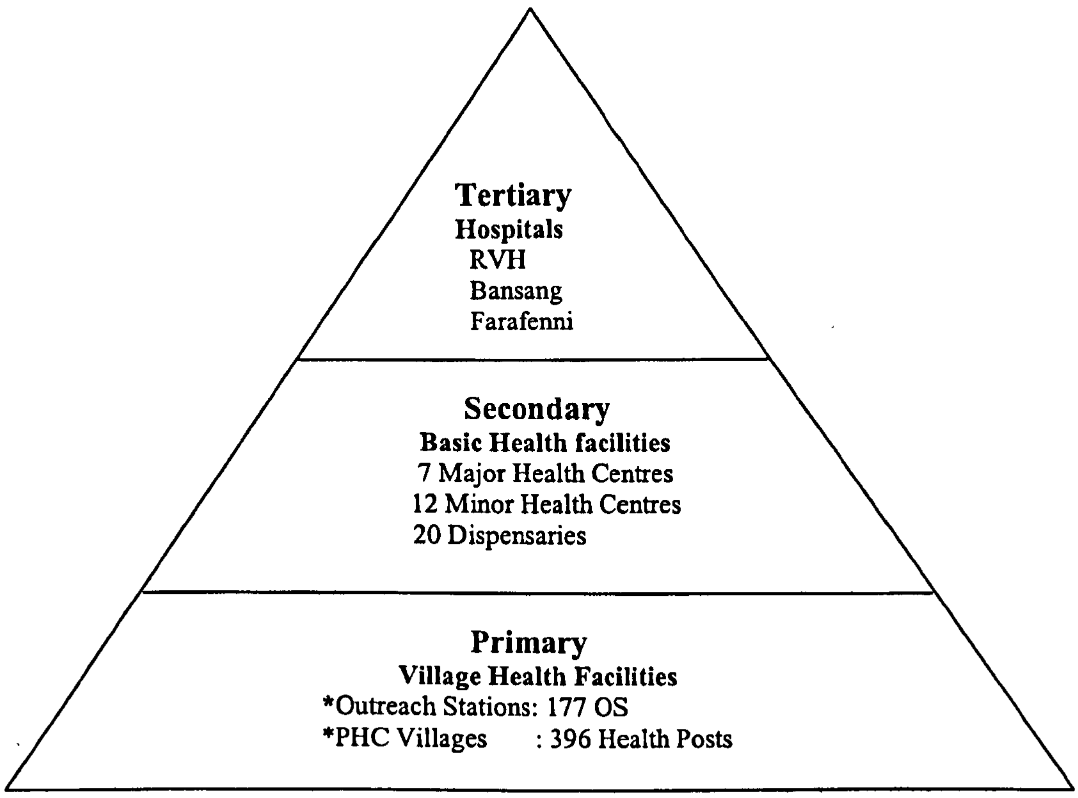

Figure 2.1: 3-Tier system of The Gambia Health Service

2.5.2.1 Primary Level (Village Health Services)

The primary level (or village health services (VHS)) comprises primary healthcare (PHC) villages, key villages and outreach or trekking stations. They are community based and are the first level of healthcare delivery in The Gambia. It forms the lowest level and first point of entry into the Healthcare Delivery System and serves 72% of the designated catchment population.

The primary healthcare (PHC) villages are situated in all settlements with 400 or more inhabitants. Each village is provided with a trained village health worker (VHW) and traditional birth attendant (TBA) who operate from the village health post. The village health worker (VHW) is responsible for maintaining the supply of essential drugs, providing outpatient care, making home visits and conducting outreach education. The traditional birth attendant (TBA) conducts deliveries, makes home visits and identifies and refers at-risk mothers. A key village is one within a group of 4 to 5 PHC villages. Most key villages are served by a community health nurse (CHN) who in turn supervises and trains the VHWs and TBAs in the PHC villages. The outreach or trekking stations are operated periodically in the key villages by staff from nearby secondary health facilities. The CHNs work under the supervision of the outreach staff and divisional health team (DHT).

Facility	**1982**	**1997**
Tertiary		
Hospital	2	2
Secondary		
Major Health Centre	0	7
Minor Health Centre	17	12
Dispensary	15	20
Primary		
MCH & Outreach Stations	81	177
Village Health Post / PHC	30	396

Source: Department of Planning and Information, DoSH

Table 2.1: Number of Government Health Facilities as in 1982 and 1997

NB: It can be seen from the secondary level figures that out of the 17 minor health centres in 1982, five were upgraded to become major health centres hence the 12 minor health centres in 1997. It is worth mentioning that there are now three hospitals because an additional one was ready in Farafenni in late 1999.

2.5.2.2 Secondary Level (Basic Health Services)

The secondary level (or basic health services (BHS)) comprises dispensaries and minor and major health centres. There are 7 major health centres with two located in Western Division (WD) and one within each of the other divisions. There exist 12 minor health centres with 4 located in Western Division and 2 in each of the other divisions. There are 20 dispensaries located in the country with 5 in Central River Division (CRD) 4 in North Bank, 3 in Upper River Division (URD) and 2 in Lower River Division (LRD). Major health centres are staffed by doctors, state registered nurses, state enrolled nurses, public health officers, and other technical staff. The minor health centres have similar staff as major ones but without a doctor and dispensaries are staffed with enrolled midwives, senior health superintendents, and community health nurses. These facilities provide first line referral support for the Village Health Services (VHS).

Health centres and Dispensaries deliver Maternal and Child Healthcare (MCH) and Expanded Programme of Immunisation (EPI) at base and at outreach within their catchment area. In addition, general out patient and obstetric services are provided. Each facility has a four-wheel drive vehicle to be used as an ambulance, for outreach visits and as a general utility.

Among other things, it is expected that these Major Health Centres will function as health districts supervision centres. However, the development of basic health services has constraints in realising its objective of strengthening the VHSs, especially in the areas of management support, supervision, and administration. Each of the services has been developed in isolation and basic health services are still seen as referral centres and not in the light of technical support and supervisory arm to VHSs.

2.5.2.3 Tertiary Level (Hospitals)

The tertiary level services are provided through three hospitals – Royal Victoria Hospital (RVH) located in the capital, Banjul, Bansang Hospital, about 320 km away from Banjul in Central River Division and Farafenni Hospital in North Bank Division. The construction of a new hospital in Bwiam is under way and the contract for the design and supervision of a hospital in Serekunda has been signed. The hospitals are staffed with specialists, doctors, dentists, pharmacists, registered nurses, enrolled nurses, technicians, etc. All three are designed to serve as referral hospitals although RVH is the biggest and serves as the main and ultimate referral point within the country, while Bansang hospital serves as the only hospital providing referral care for the eastern half of the country. The RVH provides the only specialist care such as internal medicine, surgery, pathology, obstetric and gynaecology and psychiatrics in the country. It is a state owned hospital. Cases that cannot be treated at RVH are referred overseas. Farafenni hospital became operational only in 1999. In addition, all three operate outpatient clinics.

Table 2.1 shows and compares the number of government health facilities in 1982 and 1997.

2.5.3 Administration of the Health Delivery System

The day to day administration of the health delivery system falls under the purview of the Department of State for Health (DoSH). Thus, the activities of the government's health programme are at the total responsibility of the Central Government, under the Ministry of Health. The Permanent Secretary who is under the Minister is the policy and the administrative head, and the Directorates of Health Services, Planning and Information and Support Services fall directly under him. The Director of Medical Services, who is the Senior Health Professional in the Ministry of Health, is directly under the Permanent Secretary and with an Assistant Director are responsible for all the technical components of the programme.

Primary and secondary level health services fall under the Directorate of Health Services whilst tertiary level services are headed by a Chief Executive who works under the direction of a Hospital Board. The Director of Health Services is a member of all Hospital Boards. Divisional Health Teams (DHT) are responsible for the day-to-day supervision, administration and management of the primary and secondary level healthcare system.

They constitute six in number to cover each of the six geographical health divisions. Figure 2.2 is an organogram of the administrative structure that portrays the description above.

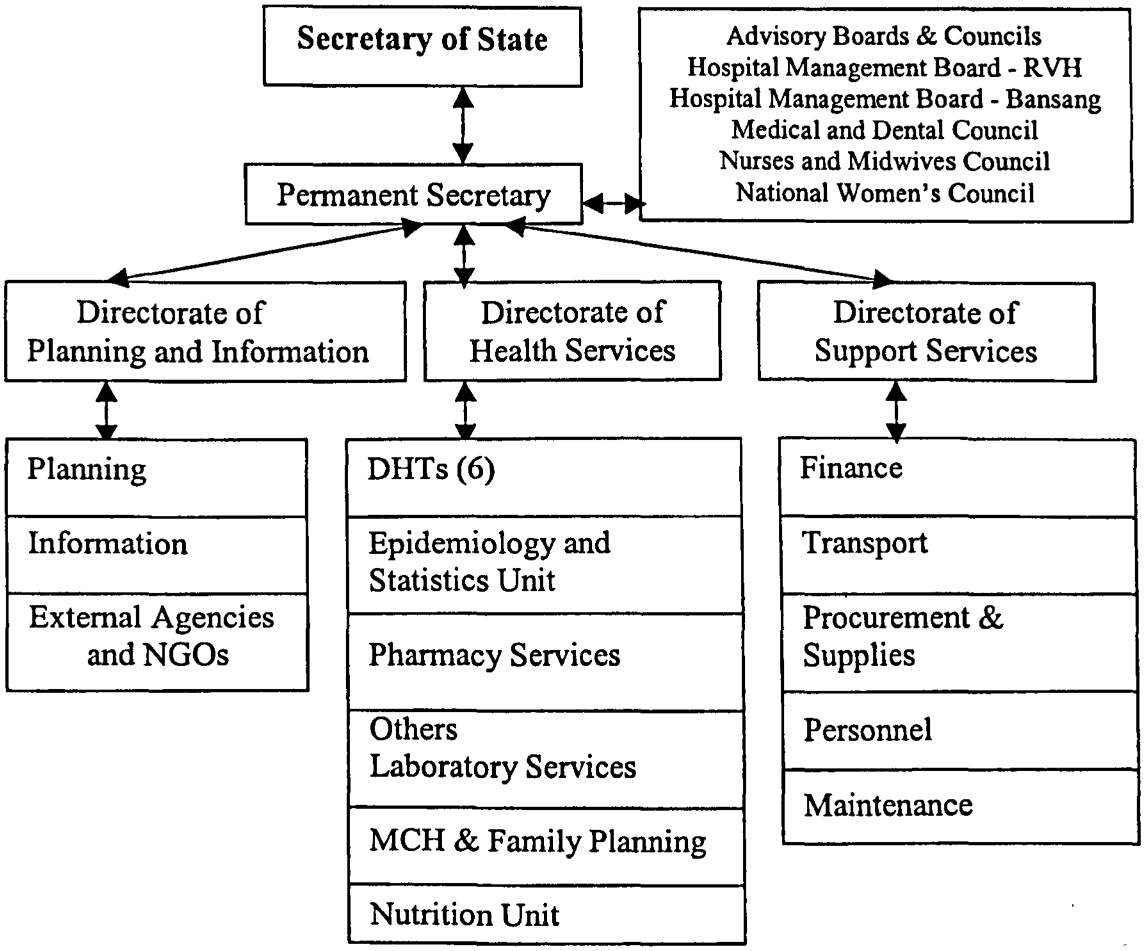

Figure 2.2 : Organogram of the Administrative Structure: Department of State for Health

For the preventive aspects of the programme, there are Medical Officer(s) of health who are responsible for maternal and child health (MCH), the expanded programme on immunisation (EPI), the health inspectorate epidemiology, tuberculosis and leprosy control, health statistics and health education.

2.5.4 Health Policy 1994 – 2000

The national health policy for 1994 – 2000 [12] provides a comprehensive framework for coordinating all health development in the years mentioned above. It ensures among other things that health development is properly planned, comprehensive and integrated. The policy proposes two major drives or efforts towards future health development:

- the consolidation of existing services to ensure optimum functionality in improving quality of care, effectiveness and efficiency; and
- the selective expansion of services to ensure better coverage and access.

The approaches proposed for the consolidation of the existing services are:

- the creation of six divisional health teams with the view to further decentralising health services;
- strengthening/capacity building at the primary level to ensure the functionality of all existing primary healthcare villages;
- strengthening the secondary level to ensure the full operationality of all major health centres and the refurbishment and equipping of minor health centres and dispensaries; and
- strengthening the tertiary level by refurbishing, equipping and ensuring full functionality of the two (then two, but now three) referral hospitals.

The approaches proposed for service expansion include:

- the introduction of primary healthcare services in all villages with a population of 400 or more;
- increasing the number of basic healthcare facilities by upgrading selected trekking stations to dispensaries; and
- upgrading Farafenni Major Health Centre to a referral hospital (achieved late 1999).

The policy identified one of the constraints to service delivery as being the inadequate capacity of maintenance teams and difficulties in establishing guidelines for timely preventive and breakdown maintenance. This has led to the deterioration of the majority of health facilities, staff houses and equipment. Another constraint is the lack of a reliable transport fleet and difficulties in obtaining spare parts and consumables.

The health services policy, recognises that a strong health delivery infrastructure and an adequately resourced and reliable transport system are essential for effective service delivery. In view of this, the policy identified the need to develop a maintenance strategy that will include:

- the development of an inventory system to include the proper inventory of all equipment including furniture and buildings; this will enhance accountability and the proper handling and management of government property;
- the institution of a maintenance scheme;
- the provision of a well equipped maintenance staff that is capable of responding to the requirements of routine maintenance; and
- proper development and utilisation of the maintenance staff given the wide dispersion of health facilities and their needs.

The adoption of a sound policy towards the management of health assets, maximising the resources available for maintenance, capacity building, monitoring the performance of the maintenance system, are crucial to the achievement of the objectives of the health policy. Also crucial are sensitising policy makers, healthcare providers and users and the public on the importance of maintenance. As the health sector grows, the need for a more efficient utilisation of the limited resources available for maintenance becomes more urgent.

2.5.4.1 Maintenance Policy

As a vision, the maintenance policy hopes to improve the efficiency of the health delivery system and quality of healthcare delivery to Gambians through the provision of well maintained, reliable and economical transport, plant and equipment fleet. [13]. It also envisages creating a safe, well-maintained and conducive environment for the workers and users of health and health related facilities.

Naturally, the current expansion of the healthcare delivery system will be accompanied by an increase in the demand for reliable transport and efficient maintenance services. This situation underscores the need to develop capacity to keep pace with the volume and intensity of transport operations and related maintenance activities. The process will involve developing an appropriate structure that will be capable of effectively planning, executing and monitoring the transport maintenance system.

The goal of the plant and equipment maintenance policy is to ensure that safe and reliable plant and equipment are available on a regular basis.

2.5.5 Legislative Framework of Local Government

A policy towards the decentralisation of most of the functions currently carried out by Central Government to Local Authorities has been adopted by the Government of The Gambia. In keeping with this policy, the Local Government Act, of 1999 was enacted to establish and regulate a decentralised local government systems for The Gambia and to make provision for the functions, powers and duties of local authorities and for matters connected therewith. The bill has some implication on some key areas in the health sector.

Under the local government bill, The Gambia is divided into seven local government areas namely Central River Division, Lower River, North Bank, Upper River and Western Divisions as well as the City of Banjul and Kanifing Municipality. A chairperson, to be elected by the eligible citizenry of the area, will be the political head of each local government area. Each area will have a council that will be constituted and have powers and functions vested upon it by the Act.

Under section 52 (1) of the Act, a Council shall, within its area of jurisdiction:
(a) exercise all political and executive powers and functions;
(b) provide services as it deems fit;
(c) promote on a sound basis community development and self help;
(d) have power to perform such functions as are calculated to facilitate or are conducive or incidental to the discharge of any of its functions;
(e) protect the constitution and other laws of The Gambia and promote democratic governance; and

(f) ensure implementation and compliance with Government policy.

The bill proposes that the devolution of functions and authority from Central Government to Councils should be effected gradually over a period not exceeding fifteen years and such devolution should take into account the capacity of the latter to perform the devolved functions. The bill further goes on to state that the devolution must be accompanied by the provision of adequate human, financial and material resources to enable the Council to exercise the powers, functions, services and the responsibilities vested upon it.

2.5.5.1 The Bill and The Implication on Healthcare

The bill again states that subject to national policy guidelines and such regulations as the Secretary of State for the time being responsible for the administration of the Public Health Act may prescribe, every council will be responsible for the promotion and preservation of health within its area of jurisdiction. This includes responsibility for:

(a) major health centres, sub-dispensaries and all primary healthcare services;
(b) maternal and child welfare services;
(c) the supply of pharmaceutical products and vaccines to health services;
(d) the control of diseases;
(e) general hygiene and sanitation;
(f) the registration and enforcement of the registration of births, marriages and deaths;
(g) establishing, acquiring, erecting, maintaining, promoting, assisting or controlling, with the participation of the citizens, ambulance services and mortuaries;
(h) hospitals including such facilities for employees and staff;
(i) establishing a Department of Health Services to which will be transferred the existing Divisional Health Teams; and
(j) planning and implementing any programme or project for the development of infrastructure, improvement of social services, development of human and financial resources and for the general upliftment of the community.

In addition the council will have autonomy over their financial matters subject to the provisions of the Act. The bill provides a list of functions, services and policies for which Central Government will continue to be responsible. Those related to the health sector are the health policy and referral hospital services. These two areas will not be under the jurisdiction of the Councils.

From what has been described above, it seems obvious that the responsibility for the delivery of primary and secondary healthcare will ultimately belong to the Councils. It is envisaged that the Department of State for Health's role in the future will, mainly be the formulation of health and health related, policies and the monitoring of the functions of tertiary level healthcare facilities. Under the local government bill, the role of monitoring and coordinating Government initiatives and policies will be assumed by the Department of State for Local Government. The Department of State for Health will necessarily have to rely on the Area Administrators to draw its attention to any divergence from or non-compliance with Central government policy by any Council. Even where the Department of State for Health has reason to believe that any council is not performing satisfactorily, the former may only seek recourse by referring the matter to the president who will not make any decision without first obtaining the views of the Council involved.

The health policy has brought about the decentralisation of primary and secondary level services with the introduction of six divisional health teams. The teams are located in the Western River Division, North Bank Division East, North Bank Division West, Lower River, Central River and Upper River divisions. These divisions are different from those identified in the Local Government Bill. The Department of State for Health will have to re-organise the health divisions to correspond with local government reform. The health policy recognises that for decentralisation to be effective, control over operational budgets, the accounting system and staff development must be delegated to the Divisional Health Teams. The success of the process hinges to a large extent on the provision of the required resources such as office space, housing, manpower, transportation, adequate furniture and other logistics. The implementation of this policy will pave the way towards the gradual transfer of these functions to Councils.

2.6 Royal Victoria Hospital: An Example of the National System

2.6.1 General

The Royal Victoria Hospital is the biggest referral hospital in The Gambia. It is a state owned hospital. It is a good example of all possible scenarios that happen in all other sectors of the national healthcare system. Cases that cannot be treated at RVH are referred overseas.

The hospital has about 670 beds and provides specialist services in Dentistry, General and Orthopaedic Surgery, Obstetrics and Gynaecology, Paediatrics, Radiology, Pharmacy and Pathology. It has a very busy Out Patient Department (OPD) and a reasonably well-equipped Laboratory. It is on paper to become a teaching hospital in the year 2002. This is one of the hospitals chosen for some aspects of the research work.

2.6.2 Medical Division

There are eight specialised units within the division. These are the Medical; Surgical/Orthopaedic; Ophthalmology; Paediatric; Pathology Laboratory; Obstetrics/Gynaecology; Dental and Radiology. Apart from the Radiographer, each of these units is headed by a Specialist. Medical Officers are allocated to the units every three months. Unit Heads are responsible for the total coverage of their units for twenty hours. In 1985, due to shortage of staff, the medical unit was combined with the Paediatric Unit and covered by one Medical Officer at nights. The same applied to the Surgical which was combined with the Obstetric/Gynaecology Unit under one Medical Officer at night.

2.6.3.1 Psychiatric Unit

The Psychiatric Unit is a unit of the RVH providing care and treatment for the mentally ill throughout The Gambia. The unit has about 100 beds, comprising 33 female beds and 67 male beds. More and more psychiatric patients are being admitted in the unit with insufficient facilities. There is a great need for expansion as the number of psychiatric cases increases. The unit is visited by a medical doctor from the RVH, but does not reside at the camp. There are 2 trained psychiatric nurses, about 26 psychiatric attendants, 9 orderlies, and a night watchman. To ensure that patients are safely and properly cared for, there have been appeals over the years for the review of certain facilities, such as number of staff and food supply.

Some of the problem areas that need more attention are shortage of drugs, irregular supply of meals to the unit, renovation to be carried out including electrical products and shortage of space. There used to be and still are shortages of tranquiliser injections and meals arriving late at the unit from the main RVH kitchen meant that patients got very hungry, restless and irritable and refusing their oral medication. There is a lack of human resources and at the moment no Occupational Therapist is available. There is also a lack of ambulance and motor bike for community staff. To cater for the high influx of patients especially in the male wing, there is the need to expand the unit. There are times when two or three patients had to be nursed in the same room with inadequate facilities.

2.6.3.2 The Sanatorium

The sanatorium is another unit under the RVH that provides care for the rehabilitation and convalescence of patients who are suffering from tuberculosis. It serves the whole country. The unit has 52 beds, comprising 14 female and 38 male beds. There are 4 junior state registered nurses, 1 state enrolled nurse and about 14 attendants of whom 7 are orderlies. The patients there are usually referrals from health centres and polyclinics.

2.6.3.3 Home for the Old and Infirm

The home for the old and infirm unit is also under the RVH management and provides care for the very old and infirm. It is slowly being phased out and is nearer to being closed down. It has a very skeletal staff of about 3 and a watchman for the premises. There is an occasional visit from a medical officer from RVH.

2.6.3.4 Domestic Services Division

In order to ensure better services and more efficient management there are changes that need to be effected. In fact this section had been operating under increasing pressure. The standard and quality of food storage was a big problem until an improvement was made in the maintenance and effective use of the cold room in order to prevent food from becoming contaminated.

A major problem facing the catering and laundry unit is the constant failure of machines especially the boilers for cooking. The acute shortage of spare parts seriously affects the necessary repairs that are needed. Frequent power failures and inconsistency in the flow of electricity is an added problem.

2.6.3.5 Security

Sometimes, the security in the hospital is a big problem for the management. The number of guards needed to maintain proper order and security in the hospital needs to be reviewed. There is a large number of escorts in the hospital. This is not only a major security risk but a health hazard. There is the need to consider a new policy concerning the number of escorts allowed for each patient. The system whereby a doctor decided whether a patient needs an escort or not was not working well. This is because:

1. most patients are admitted outside the Banjul area and are escorted by their relatives. These relatives usually stay with the patients until their discharge because they have nowhere else to stay;
2. customarily, it is believed that relatives should be by the side of the dying and these relatives have a psychological guilt that hunts them if they do not stay with their sick ones;
3. the acute shortage of staff means that total care to be given to the patients at all times is limited and these escorts usually help the nursing staff; and
4. psychologically patients react in a better way when their loved ones are by their side. This is believed to help in their recovery.

However, the risk of cross and droplet infection increases with every added escort in the hospital and the numerous numbers of escorts does not help proper cleaning of the hospital to take place. Some suggest that there is an urgent need for health education programmes to re-orientate peoples thinking about visiting and staying with patients.

2.6.4 Hospital Attendance by Patients

Apart from antenatal patients, babies, pre and school going children, a patient seeking treatment in the hospital pays a consultation fee of D5.00 (US$0.25) for a child and D10.00 (US$0.50) for an adult. This entitles him/her to consultation, investigation and treatment, including admissions in the general wards of the hospital. However, a patient who wishes to have more privacy and comfort can request admission to the "Private Block" where a charge of D750.00 ($37.50) per week is made. The exchange rate is as it was at the end of April, 2002 (US$1 = D20). Most of the patients who opt for private rooms are patients of diabetes, malaria, hypertension, gynaecological problems and orthopaedics. There are ten rooms in the private block and which offers one patient to one private room. There are no other fees payable except for patients:

- referred to the hospital by private practitioners for investigations, e.g X-rays; requiring laboratory tests; they pay a minimal fee towards the cost of material and reagents used for the investigation;
- who seek cosmetic dental care;
- who want eye glasses; and
- private students who are seeking medical examination for overseas studies.

There are two consulting rooms for both Obstetrics and Gynaecology. Specialist clinics are held daily, Monday to Friday, in the Gynaecology outpatients clinic. There are three antenatal and four Gynaecology clinics per week.

Patients are referred either from the general outpatients in the RVH or from both government and non-government health workers throughout the country. A number of patients, with major surgical problems, from countries in the region also find their way to

RVH. The patients are first registered by a clerk and are then sent to different, but appropriate, specialist clinics. The commonest gynaecological complaints are infertility, complications of early pregnancy, menstrual disorders and pelvic inflammatory disease.

Shortage of bed space continues to be a major problem. There are instances when patients even after surgery had to remain on the trolley until alternative arrangements could be made for such emergencies to be admitted. The demand for in-patient accommodation continues to be a serious problem. This is because the demand made on the service is huge coupled with limited bed spaces.

2.6.5 Accident and Emergencies

The accident and emergency unit of the RVH is the recipient of almost 80% of all referrals from the periphery. All acutely ill patients that need emergency attention are basically processed at the accident and emergency (A & E) unit. It is the focal point of contact for all types of crisis and disasters and epidemic outbreaks.

The A&E unit also functions as a catalyst to the congestion at the wards, because, patients are now 1) permanently admitted and treated there and 2) admitted and observed there for 24 – 48 hours. Thus screening of all cases, emergencies or otherwise are conducted at the A & E. The A & E unit is also supervising the surgical outpatient department.

The unit has a call system in place whereby doctors and nurses are on 24 hours duties to attend to and manage referral and emergencies in consultation with the various departments or units of the hospital. The A & E has a pivotal and complementary role in managing surgical emergencies in association with the theatres and the intensive care unit.

2.6.6 Seeking Medical Attention: Choice and/or Referral

When individuals are sick there are various options of their personal choice to seek for medical attention (see figure 2.3). Ideally people from urban areas are normally closer to a hospital and therefore will go to the hospital as their first and probably the only and best option. On the other hand they will go to a major health centre if the major health centre is the closest (there are only three hospitals in the country). People from the semi-urban centres will go to a major or minor health centre as their first depending on which one is available or closest. Those from the rural areas have only the basic health facilities as their first and most times the only choice.

However, desperation or lack of trust on the part of the patient could force them to move heaven and earth to by-pass their first choice and go to the next level of healthcare delivery. On the other hand patients could also be referred to a higher level of healthcare delivery, that is from basic to secondary or tertiary, depending on the seriousness of the condition.

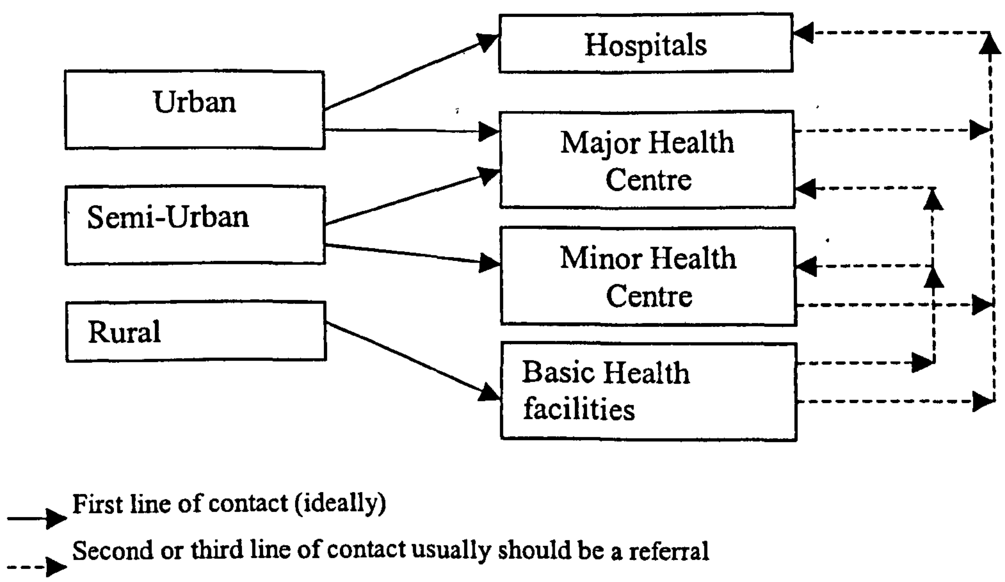

Figure 2.3: Seeking medical attention

2.6.7 Pharmacy

Essential drugs supplies for both in-patients and outpatients are procured through the central procurement unit (C.M.S) of the Ministry of Health. There are reasonably enough drugs and a flat rate of D5 (US$0.50) is charged for indigenous Gambians, while a flat rate of D20 (US$2.00) is charged to foreigners, resident in The Gambia.

Shortages most often occur primarily due to delays in drug delivery by the manufacturer, and in such situations the hospital embarks on local drug purchase to meet the needs of the patients. Very rarely, however, patients may be referred to purchase items which can be categorised as non-essential drugs.

2.6.8 The Medical Records Unit at RVH and Problems

Source: Personal Communication with the Medical Records Officer and Unpublished 1998 Annual Report. [14]

The Medical Records Department has continued to make efforts to improve and expand its services to the patient and the hospital and other healthcare deliveries in general. This is all in regard to the maintenance of patient management of patient care and general statistics. It needs to be emphasised here that medical records are an essential component in the effective management of patient care. They provide the information needed for planning, management, execution and evaluation of care given to the individual, which serves as a tool for communication and also give information to all health personnel and administrator who deals with the patient.

"The potential of the Medical Records Office can only be realised when it is recognised as being much more than just a storage area for patients' files. That is it is seen as an office capable of producing valuable information which can lead to improved patient care, and also provides factual evidence to aid future planning and development." These are words of the Medical Records Officer (MRO) in the 1985 Annual Report [15] and repeated in 1998 [14]. The Medical Records Office is also responsible for arranging medical examinations, hospital appointments, medical reports, medical examinations for appointments, confirmation and study abroad.

The activities of the Medical Records Office include:

a) organisation of patients records, collection of daily, monthly and yearly hospital statistical data and analysis of all patient data and activities in the hospital;
b) clerical services for immediate clinical care of the patient data and activities in the hospital;

c) utilisation of the medical records data for clinical, teaching epidemiological and research;
d) responsibility for the design of medical records patient forms;
e) assisting in medico-legal procedures; and
f) hospital annual report production.

Although working under difficult situations, they strive towards making optimum use of their present facilities and staff. In the words of the MRO [14], the constraints affecting the functioning of the unit can be summarised in five main areas:

1. The unit continues to encounter problems with doctors inserting final diagnosis on the patient case notes. This is necessary for the purpose of accurate coding of patients' diagnosis under the International Classification of Diseases (ICD) system. Information on patients notes is still very scanty, leading to an immense lack of valuable information in the continuity of patient care and for future research and referral purposes in relation to teaching.
2. The poor provision of well-organised arrangements for handling of patient records and case notes between nursing and clerical staff. The people who are affected most when it comes to good or bad admission, clinical registration and discharge procedures are the patients. It is therefore important that notes are complete and available when they are needed for patient treatment or for reference purposes.
3. It is of prime importance that the collection of the data and statistical data analysis be part of the day-to-day clerical activity in order to ensure continuity, accuracy and efficiency of the Medical Records. However, there is no proper recruitment of staff and some of the members of staff of the unit are very poor at carrying out their duties in the areas of punctuality, performance, conduct etc. This is affecting the statistical data collection and the efficiency of the office and patient management. The work load on some of the existing hard working staff is heavy and yet currently there are no remunerative incentives by way of extra duty allowances.
4. Considering the demands made on the unit for data collection, compilation of the data analysis, medical reports, medical examinations etc. it can be said that the unit is

seriously handicapped in terms of equipment. The unit lacks a good typewriter, computer or word processor or printer or photocopier etc.

5. Sometimes there are acute shortages of some basic stationary. For the smooth running of all the numerous hospital activities to continue, there is the need to ensure that the requisite stationary is available at all times.

In her appeal to strengthen and save the medical records office from future collapse the Medical Records Officer appealed for a proper recruitment of staff and modern and efficient information technology to be established

As stated earlier, the Medical Records Office prepares an annual report for the hospital. However, there are unavoidable delays since all computations are done manually in the absence of a computer to help with the data statistical compilation. The 1998 – 1999 annual report has not yet been completed due to lack of facilities."

2.7 Summary

This chapter has described the characteristics of The Gambia in relation to health. Reasons for the need for this informed awareness of the country and its health sector have been put forward. Physical features of the country, its infrastructure, population demographics, economic overview, education and the health of the populace and a general overview of the health delivery system have been presented. Within this overview of the health delivery system, the administration of it, the health structures in place, the 1994-2000 national health policy and the legislative framework of local government and its possible future impact on health have all been presented. The maintenance policy and the Royal Victoria Hospital as a good example of the types of healthcare delivery in the country have been described. The choices available to patients seeking medical attention and/or referrals and the impact of education on health have also been presented. The problems of the medical records office of the RVH (the only comparatively reasonably established medical records office) have also been discussed. This broad review has provided the context within which HIS needs to function if it is to function properly. It has identified possible pitfalls or problems when designing HIS and provided a basic introduction to The Gambia in the context of this programme of research. In doing this, a range of features and problems has been highlighted which will inform the requirement specification that will be discussed later (chapter 7) in the thesis. The next chapter will now be dwelling on the importance of health information systems in relation to healthcare delivery.

CHAPTER 3

HEALTH INFORMATION SYSTEMS

Having provided a general background to the situation in The Gambia, this chapter now focuses on health information systems (HIS), providing definitions and highlighting the importance of such systems in relation to healthcare delivery. The researcher explores what can be done in health with modern technology whilst considering the gap between theory and practice; as well as the needs of those delivering healthcare. The implications of the introduction of the new technology will also be reviewed and the impact this has on healthcare systems and the lessons learned from other sectors. Thus, the importance and impact of information technology and health informatics is considered. A review of health and hospital information systems which looks at a number of general (including monolithic or central, evolutionary, and composable or distributed systems) and country specific systems (the Netherlands, Japan, Switzerland, Nigeria and The Gambia) is also provided. These are reviewed based on their relevance for consideration to the situation in The Gambia as described in chapter 2. The two main communication standards in health, HL-7 and EDIFACT, were also briefly discussed.

The Netherlands hospital information system (set up in 1960) has been described because it was historically one of the first to be established in the world. The Diogene hospital information system in Switzerland has been described because it is considered as one of the most successful. Those two operational European hospital information systems show how earlier choices with respect to scope, architecture and integration work out in practice. The hospital information system in Japan was considered because it gives an example of a system from a country in Asia as compared to Europe (Switzerland and Netherlands). Nigeria's health information system has been described because it gives an example of a typical African country and, apart from South Africa, seems to be where there is a lot going on theoretically and practically about HIS in Africa. Besides it is within the same West African sub-region with The Gambia for the purpose of geographical and other comparisons. Situations in America and United Kingdom have also been referenced in this chapter. In this way, examples of health and hospital information systems in all continents world wide have been reviewed in order to learn from them. The situation in The Gambia as far as health information systems development is concerned has also been described.

The importance of the electronic patient record (EPR), previously more commonly known as computer-based patient record (CPR), as well as the rationale for using computers in health information system development is also presented. Various, relevant problems associated with the introduction and/or development of health and/or hospital information systems are also described again looking at a Western world, an Asian and an African country. This includes problems due to complexity and leadership, budgetary constraints, technophobia, improper way of gathering and using the data, lack of cooperation between service activities and health personnel as well as attitudinal difficulties. Lessons learnt from these reviews are also described in this chapter.

3.1 Information and Communication Technology (ICT) in Health

3.1.1 General Overview

We have constantly been reminded over the last decade that our lives will be changed by the arrival of "New Technology" and the "Silicon Chip". It is true to say that recent advances in computer technology have provided the tools and the environment to study, analyse, and better understand complex systems. This technological development has enabled researchers to collect and analyse large amounts of data to a level that was previously not possible. In the medical and the biological science fields, the impact of this technology is now being felt. It has been widely observed that, in recent years, there has been a dramatic intensification of research in interdisciplinary areas such as health and bioinformatics and computer-assisted medical decision making.

In terms of their prices and utility, personal computers (PCs) are becoming more and more accessible thanks to rapid technological developments. Information technology (IT) has a significant role to play in the fields of science and education and in medicine, for example in clinical investigation and management of all kinds of patients. Computers are becoming more and more important in hospitals and research centres where they help (or ease) the provision of database systems for the surveillance of patients and subsequently in the analysis of the data collected. Information is 'data presented in meaningful form, especially by the processing of raw data.' More and more healthcare personnel are now using PCs for the storage and analysis of data in developing countries.

In healthcare, there have been relatively few *specialty computing* (clinical computing) applications until relatively recently. The unparalleled complexity of the medical world and its data, the legal and social issues (such as privacy), and other factors caused clinical computing to be predominantly the focus of a small number of pioneers. In recent years, however, as both large servers/mainframes and microcomputers have become unprecedentedly cheap and fast with "high fidelity" (accuracy), clinical computing applications have begun to be used more frequently.

The connecting together of millions of computers across the world on the Internet for communication has also paved the way for the rapid transmission of data from PC to PC for virtually the cost of a normal telephone call. This capability for quick data transmission has somehow begun to change immensely the working and everyday lives of many people.

In a keynote address during a five-day conference of the American Medical Informatics Association (AMIA), in Washington DC in November 1999, Peter G.W. Keen said: "The Internet will radically change the face of healthcare" [16]. He mentioned that the healthcare sector would evolve from implementing distributed networks to using intelligent tools, allowing the customer (physician, medical specialist, nurse, but patient as well) to request information. He argued that wireless communication constituted the only way of stimulating the majority of medical specialists to actively use the computer and pointed out that, up till then, easy computer access had formed a serious difficulty for mobile clinicians.

In the United States, the benefits of good healthcare IT are becoming more widely recognised. A report of the U.S. Public Health Service's Data Policy Coordinating

Committee [3] identified health as one of the key sectors that can benefit from advanced computer technology and telecommunications.

Several European countries including the United Kingdom have also accepted these benefits and announced aggressive positions on healthcare information technology, investing large amounts of capital in national healthcare information initiatives. The purpose of the national strategy in the U.K. is to help their National Health Service (NHS) exploit the full power of clinical IT, ensuring that patients receive the best possible care. The NHS has invested £1 billion over the last few years in order to modernise how the service collects, stores and uses healthcare information (see the NHS information strategy summary [5] and full plan [6]). Smaller statewide initiatives in the United States are starting to appear, such as the Delaware Health Information Network (DHIN [4]) effort.

The fact that The Gambia is a small country and poor does not mean it should not exploit the use of the latest healthcare information technology in its attempts to improve the quality of healthcare in the country.

3.1.2 Nature and Role of Health Informatics in Healthcare

The British Medical Informatics Society is a national association for people concerned with health informatics. It points out that: "The terms 'medical informatics' and 'health informatics' have been variously defined, but can be best understood as meaning the understanding, skills and tools that enable the sharing and use of information to deliver healthcare and promote health. 'Health informatics' is now tending to replace the previously commoner term 'medical informatics', reflecting a widespread concern to define an information agenda for health services which recognises the role of citizens as agents in their own care, as well as the major information-handling roles of the non-medical healthcare professions.

Health informatics is thus an essential and pervasive element in all healthcare activity. It is also the name of an academic discipline developed and pursued over the past decades by a world-wide scientific community engaged in advancing and teaching knowledge about the application of information and communication technologies to healthcare - the place where health, information and computer sciences, psychology, epidemiology and engineering intersect. See figure 3.1 for an illustration. The researcher is convinced the intersection should include social science, mathematical and statistical science. It can be seen from the figure that health informatics is a multi-disciplinary subject area and portrays a very complex picture of the health arena.

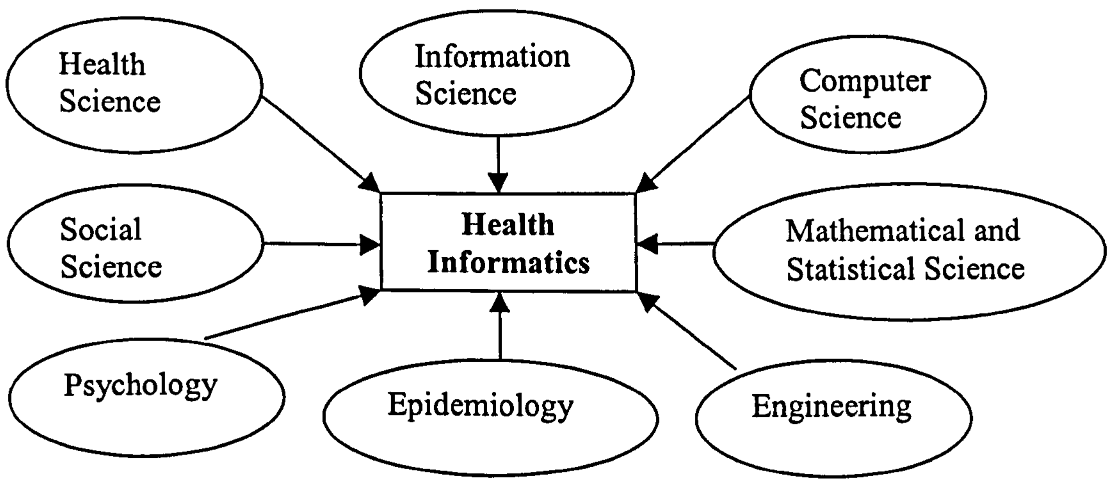

Figure 3.1 Components of Health Informatics

Healthcare (general and medical) informatics refers to every possible involvement of informatics in the healthcare environment (from a life or death decision support system in the emergency department to the pay-roll system that pays the cleaners' wages). Medical informatics, which is specific to the healthcare environment (excluding the general systems and packages), comprises medical information science and medical information technology. Sometimes referred to as clinical information science, medical informatics relates to the sources, types, flow, characteristics, classification, value and processing by the healthcare professional of all types of information.

Healthcare informatics, which refers to the acquisition and management of information, is now generally accepted as a key building block in the development of a modern integrated healthcare system.

Stephen B. Johnson of Columbia University argues that medical informatics research seeks to optimise the use of information in order to improve the quality of healthcare, reduce cost, provide better education for providers and patients, and to conduct medical research more effectively." [17].

Dr. Johnson further points out that medical informatics, in addition to its technological base, needs to provide scientific methods to study information needs, not just to assume a particular technology is the answer, and must show true impact of systems, not just develop applications or assume that things work.

The American Medical Informatics Association (AMIA) adopted as the theme of its 1999 annual conference four concepts or cornerstones for a new information management environment for healthcare [16]. These cornerstones which can serve as a functional "definition" of medical informatics are:

- representing medical knowledge,
- acquiring and presenting clinical information,
- managing change, and
- integrating information.

These are key functions well-suited for medical informatics leadership. They point out that many of the "megachanges" in healthcare that will occur in the next decade will concentrate on the manner and extent to which information is gathered, disseminated, managed, and used throughout the healthcare system.

Several other arguments and definitions of health/medical informatics as given by different experts [16, 17, 18, 19, 20, 21, 22, 23] can be found in Appendix C.

D. Sittig et al., in the classic article "The Clinical Information Architecture as a Member of the Healthcare Team" [22] argue that for clinical computing success in healthcare, there is the need for enough experience in each focus of the "information architect triad" - that is, medicine, management, and IT. Figure 3.2 illustrates the point. They agree the costs associated with the hiring of such a highly qualified individual [a medical informatician] are admittedly high. But believe that without a full-time, on-site person, who is capable of fulfilling the role of the information architect described, the difficulty of the task increases to the point of *becoming nearly impossible*."

This is one area where The Gambia is going to have a problem unless they start training the indigenous people in health informatics to reasonably higher levels to take up the challenges described above.

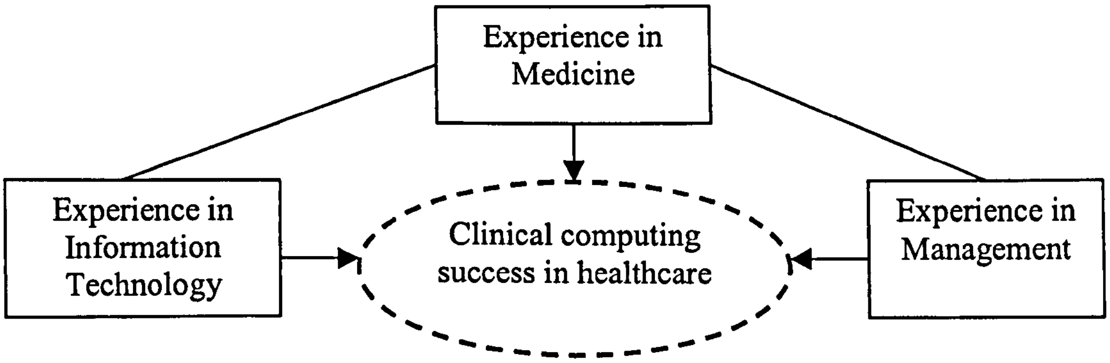

Figure 3.2: Information architect triad – for clinical computing success in healthcare

In a commentary on a New England Journal of Medicine article "The American healthcare system – the movement for improved quality in healthcare" by Thomas Bodenheimer [23], informatician Dr. Gil Kuperman, argued that quality measurement and improvement in data in healthcare information systems does not come easily; that, the information systems must be properly designed, their datasets properly modelled, and they must be properly installed, evaluated, and continuously improved by those who understand medicine and medical information science.

3.2 Health and Hospital Information Systems Reviews

Having defined the nature and role of health informatics, this section will provide a review of health information systems (HIS) and hospital information systems (HospIS) which are sometimes used interchangeably, although HospIS is a specialised form of HIS (a subset of HIS). This review begins by providing definitions and functions of health and hospital information systems as well as examining the evolution of such systems and the way in which this can be organised. This is then followed by a review and critique of a number of specific health and hospital information systems that have been implemented in particular nations.

3.2.1 Definition and Functions of Health Information Systems

In the introductory chapter to a recent (year 2000) book "Design and Implementation of Health Information Systems", Lippeveld and Sauerborn [24, pp2] wrote:
"A "system" is conveniently defined as any collection of components that work together to achieve a common objective. The objective in the case of a health information system then is to improve health services management through optimal information support. We define "information" as a meaningful collection of facts or data.

While consensus on the definition of "system" and "information" is quickly established, defining the term "health information system" is less obvious. At the outset, health information systems were oriented to collect information on diseases ("surveillance") and on health service output. While these functions are certainly important, we prefer to start from the definition of information systems as commonly used in industry. Hurtubise (1984) [25] describes them as systems that provide specific information support to the decision-making process at each level of an organisation. The ultimate objective of health information systems is therefore not "to gain information" but "to improve action". Applied to the health sector, we can now define health information systems as a set of components and procedures organised with the objective of generating information which will improve healthcare management decisions at all levels of the health system.

The widely used term "health management information system" (HMIS) could be misleading, since it may suggest that there are different information systems for different functions, for example management information systems, epidemiological surveillance systems, and administrative information systems. We consider all these as "subsystems" of a unified health information system and therefore prefer the latter term.

In summary, health information systems integrate data collection, processing, reporting, and use of the information necessary for improving health service effectiveness and efficiency through better management at all levels of health services."

3.2.1.1 Why Health Information Systems

In the same introductory chapter to the book "Design and Implementation of Health Information Systems", Lippeveld and Sauerborn [24, pp1] posed the question "Why health information systems". They indicated that good management is a prerequisite for increasing the efficiency of health services. The need to do more with less is especially important because the health sector faces ever increasing demands while receiving stagnant or decreasing resources. They also mentioned that good management is also a prerequisite for increasing the effectiveness of health services and that the challenge for health systems is to optimise the management of service delivery in a way that minimises losses in effectiveness. They mention the fact that a report of a World Health Organisation (WHO) meeting in 1987 clearly linked improved management to health information systems: "Of the major obstacles to effective management, information support is the one most frequently cited."

They pushed the argument further by saying that, for information to influence management in an optimal way, it has to be used by decision-makers at each point of the management spiral and that information is crucial at all management levels of the health services, from periphery to the centre. It is crucial for patient/client management, for health unit management, as well as for health system planning and management. This means that not only policymakers and managers need to make use of information in decision making but also care providers, including doctors, health technicians, and community health workers. They point out that, unless this occurs, the considerable opportunity costs involved in set-up and maintenance of health information systems can be difficult to justify.

Helfenbein et al. In 1987 [26] stated that: "changing the way information is gathered, processed, and used for decision-making implies changing the way an organisation operates". In their 1988 article on health information systems in Papua New Guinea, Newbrander and Thomason [27] pointed out that: "The enhanced development of the health information system has been used as the entry point for the improvement of managerial capabilities in the health system". Similarly, Lippeveld and Sauerborn have hypothesised that the development of rationally structured routine information systems, closely adapted to the information needs of health services at the district, health centre, and community levels, can potentially contribute to the overall improvement of health service management.

3.2.2.1 Definitions and Functions of Hospital Information Systems

A Hospital Information System (HospIS) has been defined by Degoulet and Fieschi as a computer system designed to ease the management of all the hospital's medical and administrative information, and to improve the quality of healthcare [28]. Hospital information systems (HospISs) originated from medical technology research and development and have been found to play an important role in societies with increasing needs for medical care by highly efficient usage of medical resources. A HospIS is an integrating system and could also be called an integrated hospital information processing system (IHospIPS). HospIS is a means to improve healthcare while providing a more rational management of medical activities. It is argued that HospIS will provide a better understanding of the hospital's activities and the health of the population it serves. HospIS is considered by many as part of a larger framework of the health information system. The first HospISs are said to have been developed in the mid-1960s in the United States and in a few European countries such as the Netherlands, Sweden or Switzerland. These systems were designed to support the information requirements of hospitals and of university-affiliated medical centres – the predominant settings for healthcare delivery [29, pp360].

The main objectives of HospISs are to improve the quality of healthcare and control cost. Other objectives include improving communications, reducing waiting times, helping decision-making, reducing the number of days of hospitalisation, reducing administrative overhead and reducing personnel expenses [28].

The functioning of a complex organisation such as a hospital, with its many departments, mainly depends on the availability of data. Data may concern patient care on the one hand and the functioning of the hospital on the other. Therefore a distinction should be made between patient-oriented and hospital-oriented data. Van Bemmel and Musen in their Handbook of Medical Informatics [20, pp343], argue that, "The only way to collect, store, process, communicate, and present large amounts of data in a way that meets the user's requirements is with computers. The user may be a nurse who enters or retrieves patient data, the head of a clinical department who is planning the provision of care for the following week, or a member of the hospital board who uses the system for management support. These requirements can largely be met by a hospital information system (HospIS)."

Particular functions of an HospIS are:

1. support of day-to-day activities,
2. support of the planning and organisation of these day-to-day activities,
3. support of the control and correction of planned activities and their costs, in view of agreements on medical and financial policies, and
4. support of clinical research through use of HospIS database, which is particularly important for university hospitals.

Thus, the function of an HospIS is to support hospital activities on operational, tactical and strategic levels. They argue that the means by which HospISs can meet these requirements are varied and in many ways depend on a variety of technical and organisational factors. They mention that "The goal of an HospIS is to use computers and communication equipment to collect, store, process, retrieve, and communicate patient care and administrative information for all hospital-affiliated activities and to satisfy the functional requirements of all authorised users." To meet the requirements, they argue that an HospIS should at least contain the following:

1. a facility for the storage of data (i.e. a database),
2. facilities to enter data into the database and to retrieve or edit the data (i.e., applications),
3. data communication facilities, and
4. facilities that enable the user to use the system (i.e. terminals or workstations).

Figure 3.3 is a diagrammatic illustration of minimum functional facilities for hospital information systems required of all users.

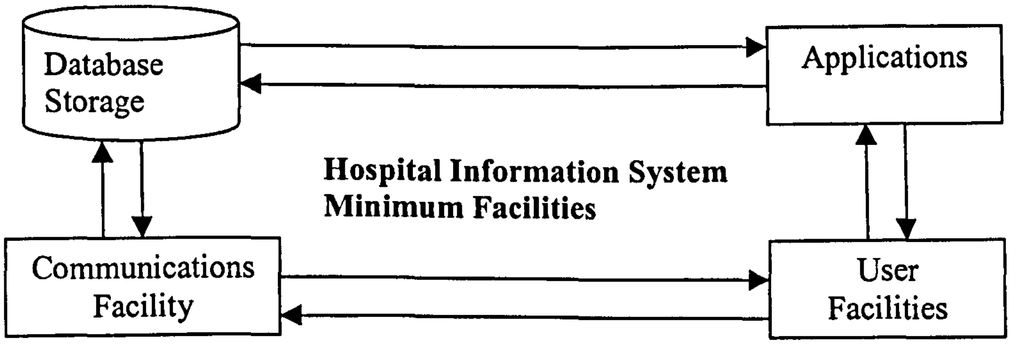

Figure 3.3: Minimum facilities for Hospital Information Systems to meet functional requirements of all authorised users.

Despite these, when a hospital chooses to invest in a new HospIS architecture, there is often a negative component (i.e. users having considerable problems with the current system) and a positive component (e.g., the advantages of the new system manifested). Irrespective of the current situation or the required situation it is important that different aspects such as flexibility, performance, cost-benefit aspects, and user-friendliness are thoroughly considered before making a choice, because the choice of a system often has far-reaching organisational consequences.

3.2.2.2 The Evolution of HospIS Architecture

"Theoretically, the choice of a particular architecture is not related to the functionality offered to the user. However, the choice of a particular architecture does have consequences for the development and maintenance of an HospIS"[20, pp 348-350]. The most common distinction between architectures is: monolithic systems; evolutionary systems; and distributed systems. The choice of architecture affects the choice of hardware and the design of the software for storing, accessing, and transmitting data. Each architecture has advantages and disadvantages. In creating an HospIS, flexibility has priority; the fact that HospIS may be distributed is only one aspect. If all the various types of architectures are put in their own time frames, it becomes obvious that each architecture can only be based on what is technically possible and what is organisationally feasible at the moment of origin .

3.2.2.3 Isolated Applications

In real terms a situation in which all applications are seperately developed and applied cannot be called an architecture. The monolithic architecture was in many cases preceded by a period of time when there were only stand-alone applications. The only advantage of this situation for example that a head of department can buy his or her own system, bypassing any hospital policy, does not outweigh the disadvantages, such as diversification and the impossibility of using the data or functions of other systems. The consequences of these disadvantages are that there is no coherent presentation of patient data to the user, duplication of functions and a data, inconsistency of data, a security that is rarely warranted, and continuity that is seldom guaranteed. This is exactly what is happening in The Gambia with the few people and offices that use computers.

3.2.2.4 Monolithic Systems

A Monolithic HospIS was developed on a holistic approach, that is, on the basis of the idea that, in principle, it is preferable to arrange the systems so that all hospital functions are supported from one overall perspective. In addition to the implementation of all applications into one computer system, the development of software and the choice of standards and of periphery equipment are also determined as much as possible by the perspective. It is important to realise that these systems originated at a time when personal computers and network facilities, taken for granted nowadays, were in the distant future. The advantages of this holistic approach are especially that applications can be optimally integrated. In the early systems the drawbacks observed were a lack of flexibility and the fact that external applications could not, or could hardly be linked to the system because of the closed character of the systems.

"Central systems integrate and communicate information well because they provide users with a single data store and a general method to access information simply and rapidly. On the other hand, large systems are expensive to implement and operate. Large initial investments are necessary, ... to bring the entire system into operation. Central systems are difficult to install because many areas of an organisation are affected simultaneously, and backup is particularly costly because of the expense of purchasing redundant hardware to be used when the primary computer is unavailable. An insidious problem is that, by the time a vendor has developed a comprehensive system that supports all the functions a healthcare organisation might want, technological obsolescence will have crept in. It is not easy to modify a central system to accommodate previously unrecognised or changing needs. Furthermore, central systems often serve poorly those individual users who compete with all users for the computer's resources. The biggest limitation of central systems is their inability to accommodate the diverse needs of individual application areas. There is a tradeoff between the uniformity (and relative simplicity) of a general system and the nonuniformity and greater power of custom-designed systems that solve specific problems [29, pp382]".

3.2.2.5 Evolutionary System

An HospIS that is completely based on the monolithic architecture is likely to run out of control at some point if its functionality and the number of users are constantly increasing. This could well be the most important reason for the appearance of an architecture (evolutionary architecture type I) that circumvented some of the drawbacks mentioned for the monolithic architecture while preserving the overall perspective. Such an architecture became possible when the state of the technology had advanced far enough. The architecture becomes more flexible and easier to extend because of the fact that applications for local processing are linked to the central systems as separate modules.

To arrive at a form of integration of separate applications, the evolutionary system type II is a logical subsequent step. Sometimes, these applications are far along in their development and are functioning well. In most cases, applications that are important at several locations in the hospital are installed on the central system, whereas the applications with mainly local importance are linked to that central system as modules.

"In a modular system, one of a few machines is dedicated to processing within the organisation. Distinct software application modules carry out specific tasks, and a common framework, which is specified initially, defines the interfaces that will allow data to be shared among the modules. Major tasks may be performed by free-standing systems. Thus, a healthcare organisation can tailor the healthcare information needs and financial constraints by "plugging in" appropriate modules as desired.

The modular approach solves many of the problems of central systems. Although individual modules are constrained to function with predefined interfaces, they do not have to conform to the general standards of the overall system, so they can be designed to accommodate the special needs of specific areas. .... Furthermore, modification of modules, although laborious with any approach, is simpler because of the smaller scope of the system. As long as the interfaces are undisturbed, subsystems can be modified or replaced without the remainder of the healthcare information system being disturbed. Modular systems also are more responsive to local users because much processing can be performed locally on departmental machines. The central machine with shared data files can be smaller, because it does not handle all processing. The price for this greater flexibility is increased difficulty in integrating data and allowing communication among modules. In reality, installing a subsystem never is as easy as simply plugging in the connections [29, pp 383-384]".

Generally, data to be used at several locations are consolidated in a data repository, where they are accessible within their context. Evolutionary systems types I and II are in general more alike than different. This looks (sounds) more like a system that was on the minds of the staff at the Epidemiology and Statistical Unit (ESU), but which they have never been able to set up to be operational.

3.2.2.6 Composable (Distributed) Systems

In the ideal situation, an architecture is characterised by optimal flexibility, in which the HospIS can be composed of applications from different HospIS suppliers. These applications may be running on different platforms that communicate with each other and with the database via standards. The following are examples of present communication standards:

- TCP/IP, a communication protocol;
- COBRA, for systems integration;
- SQL, communication with the database;
- HL-7, now the global communication standard in medicine and internal communicator with subsystems; and
- EDIFACT, external communication.

In the framework of a composable (distributed) architecture, the client-server model is the model in which the components of database, application logic, and user interface are partitioned between clients and servers. This means that users can utilise applications that run on another computer (i.e. the application server) via their own workstation; these applications communicate with the database that can be implemented on a separate computer, a database server. It is important to emphasise however, that, even when using the most advanced models, including those based on a so-called middleware concept, successful communication between systems is only possible when there are agreements about the logical concepts, the data definitions, and the division of functions. Equally important is the coordination of the communication standards to be used. This condition is however generally difficult to fulfil. A common reference architecture in combination with standardised interfaces would form the basis for an HospIS generation in which portability (i.e, transferability of software to other platforms) and interoperability (i.e, ability to approach data and functions from other platform) are the keywords.

"The advantage of a distributed system is that individual departments have a great deal of flexibility in choosing hardware and software that optimally suits their needs. Smaller ancillary departments that previously could not justify a major computer acquisition because of insufficient workload now can purchase microcomputers and participate in the computer-based information system. Healthcare providers in nursing units (or even at the bedside), physicians in their offices, and managers in the administrative offices can access and analyse data locally using microcomputers. Some computers may handle resources that are shared by all users – for example, the admission-discharge-transfer (ADT) information, the active medical records, the index to archived medical records, and the mail exchanged electronically between individual users. Several local area networks (LANs) can be linked together by gateway computers. Thus, networks can be used for communication throughout systems serving affiliated outpatient facilities, nursing homes, and outside laboratories.

The distribution of information processing and the responsibility for data among diverse systems makes the tasks of data integration and communication difficult. However, the development of the industry-wide standard network protocols has eased the technical problems of electronic communication.

3.2.2.6.1 Standards for Message Exchange

"Communication between sender and receiver completely depends on the use of messages for which both sides agree on syntax and semantics. In other words, integration between two systems is possible only when both systems support the same message standard. A disadvantage is that until now there have been various standards.

For the healthcare sector as a whole, two standards are available:

1. EDIFACT messages, which are generally used for communication with systems outside the particular organisation, and
2. The HL-7 standard, which is generally used for communication within the particular organisation.

The EDIFACT (Electronic Data Interchange for Administration, Commerce, and Transport) standard, originating from systems for international trade, is a set of agreements on the setting up of messages and on the use of segments and fields. An example of such a message is the laboratory report sent from a hospital to a General Practitioner. The HL-7 (Health Level Seven) standard, which originated in the United States, not only contains a syntax to compose messages but also allows for the definition of the so-called trigger events, on the basis of which messages are sent to the various applications. Examples of trigger events are the admission of a patient, a placement of a laboratory order, or transfer of a patient to another department [20, pp 351]".

3.2.3 Specific Countries' Systems

The Handbook of Medical Informatics described two operational European HospISs to show how earlier choices with respect to scope, architecture, and integration work out in practice [20, pp 352-354]. It points out that both HospISs, the Hiscom HospIS and Diogene HospIS, meet the criterion that is perhaps most important for an HospIS, but that unfortunately, can only be determined after it is in place, namely, that it has proven itself in practice. Japan's HospIS, Nigeria's HIS and the HIS situation in The Gambia are also described.

3.2.3.1 The Netherlands HospIS [20]

"The HospIS of Hiscom (Leiden, the Netherlands) is used by most Dutch University hospitals and a large number of general hospitals and psychiatric hospitals. The Hiscom HospIS is considered to be a complete system with a high level of integration. It is an example of a system that from the beginning has actually gone through the steps in the development of an HospIS architecture, using technology that is functionally relevant to the users of the system" [20, pp352].

The Hiscom HospIS is based on one logically central database in which medical as well as administrative and logistic data are stored. It concerns current as well as historic data. The registration of data supporting the primary process of the hospital was already given priority at the first stage of the development of the system. Thus, the functions of central medical support departments, such as the laboratories, the pharmacy, or the radiology department, were assisted early on. The more than 80 applications render support to a large number of hospital functions, focusing on the patient as well as on the hospital facilities.

To comply with the very strict requirements for availability posed to an operational HospIS – hospital operations never stop – all central equipment of the Hiscom HospIS has been duplicated. In case of an emergency or for maintenance, it is possible to switch over to the standby system immediately, often without the users even realising it. In this way, the realised level of availability is 99.7%.

Examples of open communication between the Hiscom HospIS and the outside world are the developments in the area of EDI (Electronic Data Interchange), which have resulted, for instance, in communication with General Practitioners (GPs), health insurance companies, health services of companies, and suppliers.

3.2.3.2 Diogene HospIS in Switzerland [20]

Developed and still under development in Geneva, Switzerland, the Diogene HospIS can be considered as one of the most successful HospIS and can be regarded as a composable system in its present form. As a project with its basic concept of being a complete HospIS without barriers between administrative and medical applications, Diogene was started in 1971 [20, pp353]. The official start of Diogene I was in 1978 when it actually operated on a mainframe computer and with its home made database management system (DBMS), its main applications, and its star like network became the correct answer to the requirements of a large hospital in the 1970s.

By the mid-1980s it was recognised that the increasing use of the system as well as the new technological possibilities required a new system architecture, with its most important characteristics as follows:

- a relational DBMS,

- a multi-computer system,
- an efficient network, and
- portable applications to decrease dependence on the hardware supplier.

An initial decentralisation of functionality occurred from the central mainframe computer, where most of the functionality remained, toward a number of satellite computers. The communication between satellite computers (UNIX machines) and the central system was based on an Ethernet network using a de facto standard TCP/IP. Communication with the outside world was performed by an electronic mailbox.

The Diogene is one of the healthcare information systems that was developed by Jean-Raoul Scherrer and his colleagues at the Canton Hospital at the University of Geneva beginning in 1971. Built originally with a centralised architecture, it has migrated successfully to a distributed platform. In contrast ...... Diogene was originally designed to perform administrative and clinical functions – its earliest applications were personnel management, invoicing, patient admitting, and general accounting, later followed by ancillary departmental and clinical information modules. Today, Diogene supports almost all administrative and clinical functions, including a full physician order entry that has been operational for more than a decade. A unique feature of the system is its user interface: Diogene primarily prints its reports instead of making them available on clinical workstations. Physicians write orders by telephoning a special operator who types the order while the physician dictates. The physician then views the typing on the computer screen and gives verbal consent [30, 31].

3.2.3.3 Japan's HospIS

The authors, Huruki et al. [32] indicate in their paper that hospital information systems have been developed in Japan since the 1960s [33]. Japanese society needs a variety of medical and health-care services and hospital information systems (HospIS) are obviously required to play important roles in supporting not only medical care in hospitals but also health and welfare services in the community [34]. On the other hand, the technology that supports hospital information systems is evolving into a decentralising architecture and integrated functionality [35]. Under these circumstances, the authors considered it important to make inquiries for assessing the status of HospIS in Japan and to evaluate the effects quantitatively. They used two questionnaire surveys to assess the status of HospISs in Japan for shaping policies for future developments.

The first questionnaire was sent at the end of 1995 by mail to each manager of 2,394 member hospitals of the Japan Hospital Association; answers were collected early in 1996. The second questionnaire was sent to 444 hospital managers in late 1996 and answers were collected at the beginning of 1997. The main purpose of the second survey was to complement the first one; of 444, they chose 307 hospital managers from the ones who had answered the first questionnaire and 137 others because of their active reporting on their HIS. In these questionnaires, subsystems of HospISs were divided into four groups: dedicated management systems, order-entry systems for outpatients and for in-patients, reference systems and other applications. These four categories, in turn, included further subsystems such as patient billing, management of medical records, management of X-ray films, laboratory tests, physiological test, X-ray tests, blood transfusions, food control, pharmacy, nursing, surgical operations, rehabilitation, nuclear medicine, personnel, accounting and purchasing. Other further subsystem examples include, prescriptions, injections, appointments for reconsultation, drugs, materials, medical treatment, and disease registration.

The paper pointed out some of the main effects of the subsystems. Dedicated management systems greatly reduced office work and resulted in easier management of materials and articles. Order-entry systems for outpatients greatly shortened patients' waiting time, and improved management. Order-entry systems for in-patient and reference systems improved the efficacy of the medical treatment.

Over half the responders wanted to solve the following problems: utilisation of the data for statistical purposes, a more comprehensive system, combined usage with PC application software, cost reduction, and easier operation. Regarding expectations of the new subsystems, there is a high demand for the development of automatic payment, waiting time display for patients, patient enquiry for medical records, insurance accounting using magnetic tapes (media), prescription verification for the drug interactions and side effects, and graphical display of clinical data.

The paper reports that dedicated management systems are the most popular HospISs in Japan; especially office-management systems for patient billing which are used in 95% of Japanese hospitals. During the last ten years, marked progress has been made regarding the development of hospital information systems aimed at more effectiveness, says the paper. For example, many kinds of orders are entered at outpatient examination rooms or wards, transmitted to the offices for patient billing, laboratories, pharmacies, food departments, etc. through the order-entry system. In this way, the authors argue that communication is faster and more correct than using traditional paper slips. The transfer of orders before the patient's transfer allows reduction in waiting time for consultation, blood sampling, payments, and preparation of drugs. Entering and billing of paper slips and creation of work sheets are done automatically, thus greatly improving the efficiency in the departments, where these orders are received. Additionally, workers can retrieve data by network terminals at many different locations. This renders medical consultation and treatment more efficient. The order-entry system is used in at least 20% of the hospitals in Japan.

The percentage of hospital managers planning to introduce a HospIS ranges from 20 to 30%; the same holds for subsystems. This shows that HospISs are well accepted in Japan and are being extended.

The authors argue that the cost of a HospIS is a major problem not only in Japan, but also in other countries. Future requirements for HospISs, they say, are automatic payment, waiting time display for patients, retrieval of patient records, use of magnetic media for insurance claiming, checking drug interactions and side effects, and graphical display of clinical data. In these systems, drug surveillance systems are directly related to patient safety. They argue that new technologies have been developed for these systems [36, 37] and therefore efforts to adopt these technologies are needed. They also argue that changes in the social customs and laws affecting the disclosure of information and protection of privacy are necessary to be able to respond to other requirements.

3.2.3.4 Nigeria's HIS

In their paper entitled "A national health management information system", Akinde et al. [38] pointed out that, in Nigeria, especially since the 1980s, information technology has made a substantial impact on the society. The paper reviewed an existing Health Information System (HIS) in a typical specialist hospital (the Obafemi Awolowo University Teaching Hospital Complex), at Ile-Ife. It highlighted the attributes, problems and limitations of that HIS and discussed options for funding and strategies to support the HIS on a national scale.

They mentioned that the explosion of information in aspects of human endeavour in Nigeria is beginning to pose serious problems and were thus calling for computerisation. It was pointed out that when the HIS was installed in the Obafemi Awolowo University Teaching Hospital Complex (OAUTHC) in 1989, there were mixed feelings, fears and reactions. Some felt that the computer system was going to perform automatic diagnosis, while others were apprehensive that the new technology was going to take over their jobs or that the *system may be damaged and thereby cost them their jobs*. It was not until 1991 that most of the fears subsided. This was the time the system had reportedly proved to be reliable, efficient and useful. The paper also reviewed the software problems encountered at OAUTHC and discussed the efforts of the OAUTHC management to ensure stability and continued viability and gave some recommendations.

Overall, issues and strategies of funding and support for HIS as well as problems and limitations of HIS were discussed. Recommendations for other developing countries to follow in their attempt to introduce HIS, was given by the authors in the paper. Some of the recommendations pointed out that:

- all participants, users, computer scientists, administrators etc. must be continuously involved with both the development and implementation of the system and also contribute to the decision-making process, whilst management implements the decision;
- on the national level, an integrated information system (built around appropriate networks of computers) should be developed for a National Health Information System (NHIS). It is assumed that such a system will be centrally managed by an appropriate government agency;
- identifying new application(s) for the NHIS network(s) and highlighting the benefits that can accrue should be carried out for government as well as the private sector;
- devising means of promoting greater awareness of the general public was important as well as providing the opportunity for the public to interact directly with the NHIS Network(s) project and thus better appreciate its capability;
- because telephone systems in Nigeria are presently poor and far behind the latest technology, provision needs to be made for telecommunications systems to link the appropriate network(s) of computers for the proposed NHIS network(s). The telecommunications system must be reliable and stable. Inter state links may be through microwave links that are more reliable and less likely to be affected by new constructions; and
- Government should see the computer and NHIS project as valuable resources and thereby take appropriate steps to make provision for their continuous serviceability and availability.

3.2.3.5 The Gambia's HIS situation

After reviewing general and specific examples of systems in a number of countries the question obviously is, what is the HIS situation in The Gambia like?

Although assistance has been given to The Gambia since 1986 in the form of consultants reviewing the situation, there is still no properly established or operational health information system (HIS) in place. An HIS department may exist (nicely described on paper) but not (and very far from) fully functional.

Between 1986 and 1996 the Ministry of Health was working very closely with two NGOs: the World Evangelical for Christ (WEC) and Save the Children, USA in the area of health information systems. Most NGOs and other research organisations, such as Gambia Family Planning Association (GFPA), Gambia Food and Nutrition Association (GAFNA), Ahmadiya Mission and the British Medical Research Council (MRC), have their own systems independent of the supposedly national HIS.

In the June 1996 report of the mission to prepare a plan of action for HIS development [39], it was stated that: "In the past five years there have been at least five consultancies in the area of health information systems and none of their recommendations have been implemented even though there is recognition that there are problems and weaknesses in the present system. Comments on the reports of some of these reviews are given in the section on Field Findings. This mission, the sixth, is part of the government's response to the WHO HIS strategy for strengthening the generation, management and use of health information."

Before 1987 data collected from health facilities were processed manually at the Epidemiology and Statistics Unit (ESU). Due to the expansion of the health services the amount of data generated could no longer be handled manually. In 1987 following an agreement between the British Medical Research Council and the Government, the 1986 and 1987 data were computerised using the MRC facilities. In 1988 the MRC BBC Torch computers were transferred to ESU and the Overseas Development Agency (ODA) provided a statistician under a technical assistance agreement to set database system for handling service statistics for use at the health facilities and primary healthcare level.

In 1989 the then Ministry of Health Social Welfare and Women's Affairs (MOHSW & WA) signed an agreement with CERPOD Mali, Bamako to provide HIS software. In 1990 this software was installed in ESU and members of ESU were trained in its use. Before the installation of the software the data collection forms were reviewed and new forms introduced in 1990. The CERPOD software started with the new forms. Very few problems were encountered from 1990 – 1992 because of ODA support. Since this ODA stopped in 1992, ESU started encountering problems.

The software which was installed by CERPOD had the following limitations:

- It excludes the disease surveillance component of the HIS;
- It has no in-built validation facility;
- It details an over-dependence on support personnel in Bamako, Mali for solutions of software problems.

An additional constraint is that not all the staff of ESU are conversant with CERPOD software.

The ESU computer room is reported to leak during the rainy season and is not dust proof. There are inadequate filing facilities for the data records received from the divisions and health facilities.

The team for the mission mentioned above reviewed some documents and wrote their findings which together with other reviews made by this researcher will be presented in chapter six (6) as part of the results and findings obtained from the fieldwork. However, some of the conclusions and recommendations from their report which were personally communicated to the researcher and read much later during the fieldwork is found in the next three paragraphs below. Some of these conclusions and recommendations also appeared in a draft set of terms of reference for Technical Assistance for the design of Health Information Systems that is also mentioned below.

In 1994 two consultants went to The Gambia to review and advise on the possible development of an HIS. Again in 1996 a mission to prepare a plan of action for a possible development of HIS was undertaken by the Ministry of Health with the Epidemiological and Statistical Unit (ESU) in conjunction with the WHO (personal communication with the acting Head of ESU in 1999). The researcher was told that some of the conclusions and recommendations were that there were structures ready to provide support for the development of an HIS, but that the system was not functioning for reasons that include:

- Technical weakness of health workers;
- Inadequate resources;
- Inadequate guidance and norms to be followed in the operation of the information system (i.e. indicators for health monitoring and case definition);
- Poor reporting systems particularly of mortality data which are collected routinely at the health facility but not reported;
- Poor staff attitudes towards health information;
- Shortage of staff and lack of proper training of existing staff;
- Inadequacy of computer skills at all levels of the health system;
- Over-dependency of the Divisional Health Teams (DHTs) on an inadequately functioning ESU for analysis of their data.

The supposedly paper based health and/or management information system(s) as they currently seem to exist are not as efficient and effective as they could be due to lack of resources, lack of formalised systems and lack of recognition of their importance. The ESU, for example, which is supposed to coordinate health data collection, reporting, processing and analysis, rarely performs this function. Management data may exist but in different formats and scattered in different departments.

For the past five years or so, the World Bank has been supporting The Gambia's health service through the Department of Participatory Health Population and Nutrition Project (PHPNP). One important area the World Bank wants to see effected is the development and implementation of a health management information system (HMIS), which is one of the reasons it supported the country wide workshop on health indicators in May 2000 which the researcher attended by invitation. As recently as late 1999 and early 2000, the PHPNP was advertising for Technical Assistance for the Design of a Health Information System. In the background information to the Draft Terms of Reference (see Appendix A), some of the issues it mentioned as identified included:

- Lack of government policy on HIS;
- Lack of minimum set of indicators;

- Lack of standard case definitions for some definitions of epidemic potential and of public health importance;
- Lack or inadequacy of knowledge in data recording, analysis, interpretation, reporting and use at all levels;
- Lack or inadequacy of skills in computer use at the central and divisional levels;
- Lack of feedback at all levels;
- Lack or inadequacy of equipment and software;
- Too many data collected;
- Lack of analytical skills of staff at all levels.

One of the important specific outputs they expect from the consultant is advice on the introduction of software to make it possible for the HIS to be computerised at both central and DHT levels.

The proposed final draft of the above mentioned terms of reference was communicated to the researcher on 28th of March 2001, see Appendix B. Part of the background information reads: "In order to strengthen the Department of State for Health's (DoSH's) programme management, as well as its planning and monitoring and evaluation capacities, the foundation for a comprehensive Health Management Information System (HMIS) is to be developed. The core of the system will include: the ***Health Information System*** (HIS, including Health Indicators Database, Reference Databases and Disease Control Database), ***the Finance and Accounting Information System*** (FMIS), the ***Human Resources Information System*** (HRIS) and the ***Drugs Information System*** (procurement and inventory management). To accomplish this, two consultants are to be appointed, at first to develop a guiding Master plan, organisational structure and system architecture, and then a second to begin to implement that plan.

At present, a draft health policy has been prepared and is under review. This draft policy includes general recommendations for the HMIS policy and strategies, and for the implementation of these strategies within the DoSH.

A set of key indicators for disease surveillance, for monitoring health conditions across the country, and for supervising and evaluating healthcare delivery has been developed. These will be in use when the consultancy begins.

There exist currently a number of vertical programmes, and related agencies or units, which have information and reporting requirements that are not integrated with the central HIS. This multiplicity of parallel systems has resulted in duplication of reporting and incompatible databases, which make information sharing difficult if not impossible.

In the absence of a Master Plan for an HMIS and a coherent organisational structure, there is little or no coordination among the programmes and managers of the various units, leading to duplication of effort and expenditure, unplanned software and hardware purchases and no provision for maintaining and troubleshooting equipment.

Without a Master Plan, there has been inadequate staffing, and no significant training in information management, computing and information use."

A health indicators workshop in May 2000 was attended by the researcher. The final indicators are yet to be established although ad hoc piloting have been going on since the initial compilation after the workshop.

The final draft of the health policy framework (Changing for Good: Health Policy Framework) mentioned above was completed in September 2001 [40]. In the preamble to the section on health information, the policy mentions that: "The current weaknesses in the Health Information System (HIS) include the limited capacity at all levels to collect, analyse and use information effectively. There is an inadequate surveillance system and an out-dated health database. This policy will ensure that HIS provide an effective framework to facilitate planning, budgeting, and monitoring and evaluation of the healthcare delivery system.

The Department of State for Health does not have a strong research base to generate data for management. Also, the findings of some researches conducted in The Gambia are not easily accessible, let alone used in health management.

There is a need to establish a Health Research Unit that will promote, coordinate and evaluate all research activities in the country, and to ensure they are relevant and safe."

The policy states the five year strategic goal of the health information as: "Timely availability of relevant information for the effective planning, implementation, monitoring and evaluation of health services."

As can be deduced from above, in The Gambia, there is presently first of all no proper system in place to facilitate finding the information needed to use for better delivery of care. No information means there is a continueing burden on healthcare delivery.
No basic structure or policies exists for collecting data, what is available is error prone and no properly centralised computerised or paper based system is in place in the country.

There are no properly coordinated existing health information systems in The Gambia; neither electronic nor properly established paper based systems. NGOs and other charitable organisations have different and separate systems that are not directly integrated into The Gambia National Health Service and no proper integration of the different health centres' facilities. There is actually nothing one can even call a National Computer Network in the country.

There is no existing national enforcement of the registration of births, marriages and deaths and no proper training of staff dealing with records.
In summary, little, if any, information for use in better delivery of care is available.

Given these problems, there is the need to create a system and an environment that can be utilised to develop better care for patients. This needs:

- Good communication systems;

- Good education and/or training;
- Good Patient Administration Systems consisting of: Patient categorical data, Referral system and, Follow ups;
- Good Financial and Administrative systems in healthcare institutions;
- Good statistical information for government and managers, NGOs and donor countries for decision making.

There is no properly established national Health Information Systems' policy in place although a draft policy has been produced quite recently in April 2002 which is yet to be finalised and approved by all concerned.

The telephone systems in The Gambia used to be one of the best in the sub-region but are presently deteriorating without any signs of being saved from total collapse. Without much money poured into its sustainability the telecommunications system will in the not too distant future be counted as one of those that are far behind the latest technology. If there should be a proper implementation of the proposed National Health Information System then provision should be made for a telecommunications system to link the appropriate network(s) of computers and this system must be reliable and stable and less likely to be affected by new constructions. This is one area where the economic strength of the country, priorities and the government's willingness to carry health policies through can be tested.

Currently, there are only two main channels of Internet provision in the country. The major one is by Gambia Telecommunications (GAMTEL) which is a parastatal, partly owned by Government. It provides Internet services to mainly urban and major semi-urban areas and serves as the national backbone to the International Internet connections. Government agencies, Non-governmental organisations (NGOs), educational institutions commercial companies and certain individuals subscribe through this GAMTEL Internet system. The other Internet service provider is QUANTUM NET, which is a private commercial company which attracts mainly private companies and individuals. Although QUANTUM NET is comparatively more expensive, some organisations subscribe to both Internet providers as a back-up because there are occasional breakdowns in GAMTEL's Internet system. In general, there are comparatively very few institutions, commercial companies and individuals that can afford to subscribe to the Internet service because of the cost involved.

Typical examples of arguments raised in substantiating the impact of computers in healthcare are described below under subheadings 3.2.4.1 (electronic patient record or computer-based patient record) and 3.2.4.2 (rationale for using computers in health information systems).

3.2.4 Using Computers in Health Information Systems

3.2.4.1 Electronic Patient Record (Computer-based Patient Record)

The electronic patient record is an important component of all health information systems. Now commonly known as Electronic Patient Record (EPR), a Computer-Based Patient Record (CPR) ideally contains all data on the patient's history, physical examinations, diagnostic tests and therapeutic interventions done to support patient care. The realisation of a CPR is one of the most difficult and challenging endeavours in medical informatics according to the Handbook of Medical Informatics by J.H. van Bemmel and M.A. Musen [20, pp 449]. The benefits of CPR are increasingly becoming obvious to clinicians. The data in CPRs are used mainly for direct patient care, quality assessment of care, management and planning support, and research and education.

In general, information systems in healthcare are used on four levels:

- on the personal level, that is, the physician, the nurse and the patient;
- the clinical department, the outpatient clinic, or the primary care practice level;
- the healthcare institution level (the hospital or an organisation of healthcare providers); and
- the regional level (country, state, or province).

See figure 3.4 for an illustration.

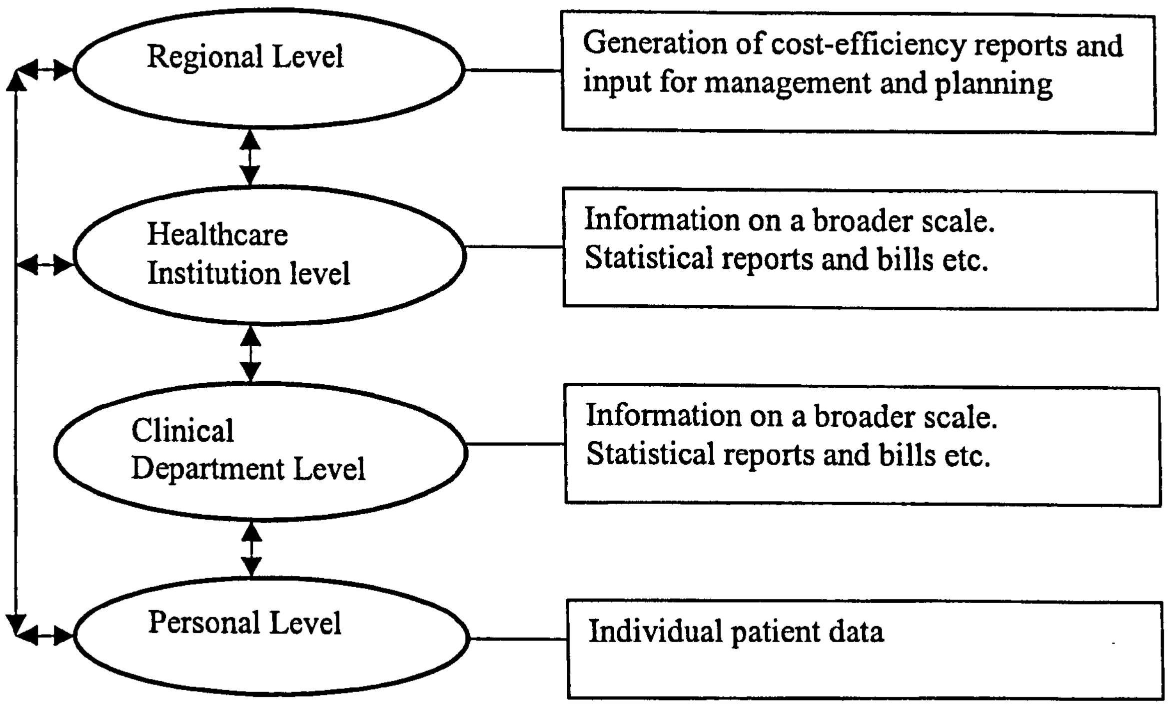

Figure 3.4: Four levels of use of information systems in healthcare

Patient data are exchanged between providers on the same level (e.g between different clinicians) and between the different levels (e.g., data flowing from clinicians to the national authorities). Users may benefit from CPR data on all four levels. Patient care centres on the use of individual patient data. At the hospital or departmental level, one is interested in information on a broader scale. Statistical reports and bills can be generated automatically on the basis of data contained in the patient record. At a higher level the benefit of CPR-coded data enables the generation of cost-efficiency reports, and the data can serve as input for management and planning. Examples of reports are the number of admissions and outpatients per department or speciality, disease profiles of in- and outpatients, the average cost per diagnostic category or per type of intervention, or overview generated as a function of resources and utilisation of tests. Researchers too may benefit from the CPR by electronically retrieving information about patients according to specified criteria. The information that had been retrieved can then be processed using statistical programs.

There is a rapid increase in the use of information systems by General Practitioners (GPs) in primary care in some countries, especially in United Kingdom and The Netherlands. CPRs are being incorporated in these information systems and are rapidly replacing existing paper-based records.

It is also mentioned that education nowadays prepares clinicians in the use of computer-based information systems and CPRs. The training emphasises that proper use of systems and CPRs reduces administrative workload and enables the production of referral letters, and the tracking of certain categories of patients.

Apart from the use of data in CPRs for direct patient care goals, CPR data can be used in applications for decision support and for the assessment of the quality of care. It is argued that pressure from law-enforcing bodies, third party payers, hospitals, clinicians and patients themselves may lead to this use of automated review of CPRs.

Since CPR data are now becoming available for different purposes, it is very important to protect the data in order to guard the patients' privacy and to protect the professional interests of healthcare professionals. Many employers, insurance companies, etc. are interested in patient data and therefore the data should be extremely well protected in CPR systems. Even though privacy laws exist in different European countries to control healthcare data, it will be difficult to totally prevent the improper use of data stored in CPRs. If it is difficult in Europe which, is developed, it is going to be much more difficult in The Gambia, an African country which, is one of the poorest in the world. Despite this, attempts should however be made to put the best available and affordable security system in place.

3.2.4.2 Rationale for using Computers in Health Information Systems

In 1991 Wilson and Smith [41] suggested that: "The creative use of microcomputer technology is one of the most promising means of improving the quality, timeliness, clarity, presentation, and use of relevant information for primary healthcare (PHC) management."

In 2000 Wilson [42] states that: "At the same time it is important to ensure that computerisation does not dominate the health information system improvement process. The majority of information users in developing countries have no access to computer technology, and the development and improvement of manual systems for the collection and analysis of the data should be the primary focus. Computerisation should only be undertaken when it supports the overall objectives of improving health surveillance and service performance."

In highlighting some of the case studies in the text to attest the potential for this computer technology in the developing country setting, Wilson [42] advanced reasons for using microcomputers in a health information system as including the following:

- Improving programme efficiency by processing and analysing large amounts of data quickly. Because manual health information systems are by nature paper-heavy, managers are often buried under mountains of data – much of which they are unable to navigate or effectively analyse and use for improved decision making. This often results in the phenomenon referred to as "information anxiety".
- Producing a wide variety of outputs and feedback reports targeted for many levels of the health system from a single data set or by combining data sets.
- Reducing the duplication of work which is typically seen in the many hierarchical data collection systems. In such systems, each level of the hierarchy prepares similar analysis of the same data received from below. With the effective decentralisation of computers and communications technology, data can be entered once, close to the periphery, and transmitted to higher levels on diskette or via a modem. For example, each level can receive disaggregated data about the performance of individual health facilities. In traditional manual health information systems, this level of detail is often lost as each level in the hierarchy works with the aggregated data from the level below.
- Improving the quality of the data collection through automatic validation during data entry and automatic preparation of immediate feedback reports on errors for individual health facilities.

- Improving analysis and information presentation to facilitate data interpretation and use for decision-making.
- Managing the data for monitoring the attainment of health programme targets and objectives.
- Developing decision support tools for planning increased service coverage and logistics (e.g. target cost from the future group).
- Modelling and simulation to facilitate planning by analysing projected outcomes for given inputs and conditions.
- Integrating services statistics data with already computerised data on demography, health structure, and/or financial management.
- Decentralising data analysis and use to reduce the data entry bottleneck at the central level and provide management information to district managers in a more timely manner. For this to work effectively, it is crucial to maintain compatibility of data at all levels, so that it can be aggregated for national planning and management.
- Training health personnel through computer-based interactive tutorials for self-instruction and continuing education.
- Accessing the Internet to search for information about new products and approaches to service delivery, and exchanging information with other healthcare workers around the globe.
- Improving data dissemination by providing online public access to data through the Internet World Wide Web pages.

In addition to some of the direct reasons for using computer technology in primary healthcare work, a number of indirect benefits have been identified. From their experience in Haiti, Auxila and Rhode in 1988 [43] noted that the process of computerising in and of itself can in fact serve as an opportunity to review and improve dysfunctional manual systems and procedures. This runs counter to the conventional wisdom in the information systems field that suggests that there is little point in computerising poorly functioning systems. Similarly, Sandiford, Annett & Cibulskis in 1992 [44] noted: "The introduction of microcomputers provides the opportunity for a complete rethinking of information needs and a change of staff attitudes towards the utility of data". Another benefit is that the attraction of learning to use the technology can act as an important incentive to boost staff moral. However, this benefit comes with a caveat, as Sandiford, Annette & Cibulskis in1992 warned: "Unfortunately it would seem that the presence of a microcomputer in an office often correlates more closely with the status of the employee within that organisation than with their ability to make fruitful use of the machine." In other instances, public sector employees, once trained and armed with very marketable computer skills, then abandon their jobs for much better paying private sector opportunities [44].

3.2.5 Problems Associated with Health Information Systems

Whilst from the above, it is clear that much has been achieved in relation to the provision of health and hospital information systems, a number of difficulties have arisen. Some of the general problems are discussed here. These include problems due to complexity and leadership; budgetary constraints, lack of cooperation and technophobia and attitudinal factors. Again examples have been chosen form the Western world, one from Asia and one from Africa.

3.2.5.1 Healthcare IT Failures due to Complexity and Leadership

Dr. Scot Silverstein points out in his write-up on Healthcare IT Failures [45] that:
As healthcare information technology becomes increasingly more complex, and as it supports increasingly complex medical science and practices, the number of ways that failures and mishaps can occur from errors in judgment, inadequate knowledge, mismanagement, and related factors increases markedly. He, however, believes that the depth of understanding of any subject comes from the Hegelian dialectic of thesis and antithesis. If you do not consider the negative sides of a domain, you are not developing a deep understanding and real picture of the area.

These familiar stories of healthcare IT failure and organisational discord reflect, as their root cause, basic *poor leadership* and significant inadequacies in organisational thinking, structures and support of healthcare information technology. Such technology is vital to healthcare quality improvement and *prevention of errors*. But, this technology is often not treated as such by healthcare leadership, right up to the "C" level (CEO, COO, CIO thus, Chief Executive Officer, Chief Operational Officer, Chief Information Officer respectively) and boards of directors. Usually, there are spectacular examples all-around of the wrong people making the wrong decisions for healthcare at an exceptionally wrong time.

Medical professionals are being held to increasingly stringent standards of quality and accountability at the same time they are becoming highly dependent on healthcare IT in taking care of patients. Those who are responsible for healthcare IT, including senior healthcare management, have not been held to the same standards of quality and accountability as the medical professionals dependent on this critical IT. This needs to change.

Issues such as air filtration, maintenance, and contaminant circulation from the power supply fans of each machine, heat generation from the cathode ray tubes (CRTs), dirt accumulating on the mouse and keyboard, and other ergonomic and medical issues are usually not considered.

3.2.5.2 Problems due to Budget Constraints, Lack of Cooperation and Technophobia

An example of a good discussion of problems in the field of health informatics is seen in a paper by M. Yamamoto et al. [46]. The paper argues that the population of Japan in the 21st century is expected to be distributed heavily on the side of higher ages and in view of the aged society, improved hygienic, medical, and welfare services must be provided in every community. Thus, as Japanese society becomes highly information-oriented and heavily loaded with an aged population, medical, hygienic, and welfare activities also require innovative information-related systems.

The authors argued that the introduction and utilisation of community medical information systems may well be regarded as an indispensable component (or subsystem) of the community healthcare system (CHCS).

The paper advances the argument that, with increasing demands for the introduction of medical information systems as progress towards the information society advances, it is true that diversified problems have been emerging in the various communities when introducing or operating medical information systems. The first problem is that of the budget for implementation and operation of the medical information system. Many persons engaged in medical occupations returned such answers as 'information equipment is expensive', 'economic burdens must not be imposed on doctors and other staff', 'we have no budget dedicated to the systematisation of medical information' and 'we get no financial support from government'.

The second problem is the attitude of medical personnel concerning the systematisation of the medical information. As the proportion of older doctors increases, low consciousness of the role and necessity of various medical information systems in the CHCS, poor purpose-oriented attitude, and a conservative attitude of being content with the present situation are found in many doctors. The difference in attitudes towards the advanced systems and poor communication among medical personnel are the main factors impeding the organisation of cooperation to implement an information network. This implies that it will be critically important to change the ways of thinking and the attitudes of those engaged in medical services to induce them to make a commitment to the task of medical information networking.

Third, the attitudes of medical personnel towards necessary information, the acquisition and management of various items of information and utilisation of the information must be studied. Problems such as 'we do not know how to collect, enter and store that kind of information', 'what kind of information is truly needed', 'how should the accuracy and reliability of information be improved?', 'what kind of information is helpful to medical personnel?', 'how should a shared database be made?' and 'can the resident's privacy be protected?' have not been met by clear answers and counter measures.

The fourth problem they discussed was that of technophobia, namely prejudice against computers and advanced medical instruments must be addressed. Interactive, multifunctional terminals need more complicated operation. Medical professionals of the older generation need terminals, which allow information to be entered or retrieved through easier operation. At the same time it will be necessary to provide opportunities for training in the operation of the terminals, and to help conquer the technophobia relating to computers and keyboards.

The fifth is the compatibility of data and software among hardware of different specifications. A CHCS can be implemented more economically and effectively by means of the shared utilisation of the database in community medical information systems, joint development of software, etc. Therefore, joint development of an economical terminal, and standardisation and improvements in compatibility, will have to be studied. Factors hindering the implementation and operation of community medical information systems may also be found in the lack of cooperation between the municipality and the medical association, and the lack of manpower needed to promote systematisation in the medical association.

In conclusion, the authors mentioned that no medical information system can work in an environment without a medical care system. Similarly, it may be said that no community medical information system can develop in an environment where no community healthcare system exists. At the transition of society towards a highly information-driven society, implementation of medical information systems should also be regarded as an endless process of building a system, similar to the case of CHCS. The history of the medical information systems is not a history of mere technology and equipment says the authors; it is a history of organising and coordinating the four pillars (philosophy, humanware, software, and hardware) which constitute medical information systems. The authors end by saying that, in the course of developing medical information systems which are capable of making a real contribution to community healthcare, further efforts and cooperation among doctors, the medical association, and people concerned in local healthcare activities are called for.

3.2.5.3 Attitudinal Problems towards HIS

Examples of attitudinal or behavioural problems towards HIS are seen in an article by Lakay et al [47]. A heritage system, says the paper, is one that has been in use for a lengthy period of time or has exceeded its expected life span, but continues to be used for various reasons despite the problems it may be causing. Such a heritage system endures either because the application is so complex and so extensively used that it would be disastrous to replace it, or because there are no financial resources to do so. Groote Schuur Hospital, Cape Town, South Africa has a HIS that is more than 25 years old. The paper reports the results of a survey on users' attitude and sense of involvement in the system. An attempt was made to determine whether users felt the need for change and whether a sense of involvement was related to this need. Thus, the study investigated whether there is a relation between both attitude and sense of involvement and length of service at the hospital. User involvement was defined by Barki et al. as the extent a person believes that a system possesses the two characteristics, importance and personal relevance [48], while attitude was defined by Fishbein et al. as, the level of feeling for or against something [49].

The paper argues that, with the increasing financial constraints placed on hospitals, the likelihood of heritage systems in hospitals is increasing. It points out symptoms that show that the life span of an information system is ending. These include:

- recognition by users that information needs are not being met;
- increasing running costs;
- increasing hardware breakdowns and unreliability;
- increasing cost of modification;
- size of accumulated database or overload;
- changes in the organisation;
- changes in the environment; and
- changes in technology, and negative user attitude and sense of involvement with the system.

From 82 questionnaires distributed, 43 persons responded, and of these 65% felt that the hospital needed a new system. The authors thought the 65% figure seemed a low percentage for a 25-year-old system. The paper reported that those who supported a new system had a marginally significantly lower attitude score regarding the current system ($p<0.04$). Those who felt that the current system should be improved had a significantly lower ($p < = 0.01$) sense of involvement with the system. There was a significant difference in attitude to the HIS between staff who felt the system supported their work and those who did not ($p <0.015$). Years of employment showed no correlation with either attitude scores ($r + -0.14$, ns) or with involvement scores ($r = 0.15$). It is possible that users became more involved in the system but their attitude towards the system declined argued the paper. The attitude of those involved in the development of the system was similar to those who were not. Training was not related to attitude or to sense of involvement.

The paper concluded by saying that, unless users have experience with or have observed new systems, a negative attitude to the old system may not necessarily develop; none of their users had that experience. The implication was, therefore, that pressure for a new system must come from health informaticians themselves.

3.2.5.4 What is Wrong with Current Health Information Systems?

This question was posed and discussed by Lippeveld and Sauerborn in the introductory chapter to the book "Design and Implementation of Health Information Systems", [24, pp3]. They referenced that: "Unfortunately, health information systems in most countries are inadequate in providing the needed management support (Lippeveld, Foltz & Mahouri, 1992) [50]". They argued that most healthcare providers in developing countries equate information systems with filling endless registers with names and addresses of patients, compiling information on diseases (e.g. sex and age of patients) every week or every month, and sending out reports without adequate feedback. Furthermore, the data received are often not helpful for management decision making because they are incomplete, inaccurate, untimely, obsolete, and unrelated to priority tasks and functions of local health personnel. In other words, information systems tend to be "data driven" instead of "action-driven" (Sandiford, Annett & Cibulskis, 1992) [44, pp3].

They went on further to reference that: "A large part of the data collected passes to the national level without being analysed and used, and frequently ends up on the dusty shelves of an office in the Ministry of Health (Becht, 1986 [51]; Frere, 1987 [52]; Ho 1985 [53]; de Kadt, 1989 [54])." That is a familiar situation in The Gambia. Current health information systems, they argue, are therefore widely seen as management obstacles rather than as tools. The reasons can be summarised in five points:

- Irrelevance of the information gathered;
- Poor quality of data;
- Duplication and waste among parallel health information systems;
- Lack of timely reporting and feedback; and
- Poor use of information.

They pointed out that the chaotic status and efficiency of most existing information systems in developing countries are linked to the structural weakness of the system and lack of integration in the overall health system. This they said can be explained by the fact that historically, as in most developed countries, information systems were not intentionally planned to provide management support to the health services in an integrated way. Foltz in 1993 explained: "They differ from country to country depending upon historical accident and the interest of policy makers, administrators and researchers" [55].

3.3 Lessons Learnt

Some lessons have been learnt from the review of Health Information Systems above. The lessons considered important to learn from the recommendations and arguments put forward by most authors in the papers reviewed have been compiled. They were used as relevant "think tank" guidelines as the research progressed. Most of these have been outlined below and figuratively summarised in figure 3.4:

One of the lessons learnt was that, it is important to use technology that is functionally relevant to the users of the system and this needs a high level of integration. That it is possible to have a system that will render support to a large number of hospital functions, focusing on the patient as well as on the hospital facilities.

Hospital information systems (HospIS) are obviously required to play important roles in supporting not only medical care in hospitals but also health and welfare services in the community.

Many of the "megachanges" in healthcare that will occur in the next decade will concentrate on the manner and extent to which information is gathered, disseminated, managed, and used throughout the healthcare system. The pre-eminent role of information will dramatically affect the delivery and administration of healthcare and will have a profound influence on the content and techniques for training, continuing education, and research designed to support and improve the healthcare system. The development of a new robust information management paradigm will be required, and four major cornerstones form the core of this new paradigm. They are: *representing medical knowledge, acquiring and presenting clinical information, managing change, and integrating information*. These are key functions well-suited for medical informatics leadership.

The only way to effectively collect, store, process, communicate, and present large amounts of data in a way that meets users requirements is with computers. This may be the entry or retrieval of patient data or planning the provision of care for the following week, or hospital board using the system for management support. These requirements can largely be met by a hospital information system (HospIS). Despite these, when a hospital chooses to invest in a new HIS architecture, there is often a negative component (i.e. users having considerable problems with the current system) and a positive component (e.g., the advantages of the new system manifested). However, the choice of a particular architecture does have consequences for the development and maintenance of an HIS".

All central equipment of an HIS has to be duplicated if we are to comply with the very strict requirements for availability posed to an operational HIS – to ensure that hospital operations never stop. This way, in case of an emergency or for maintenance, it is possible to switch over to the standby system immediately, often without the users even realising it. In this way, there can be a realised level of 99.7% availability of the system.

Dedicated management systems can greatly reduce office work and result in easier management of materials and articles. Order-entry systems for outpatients can greatly shorten patients' waiting time, and improve management. Order-entry systems for in-patient and reference systems can improve the efficacy of the medical treatment.

The development of hospital information systems should aim at more effectiveness, for example, entering many kinds of orders at outpatient examination rooms or wards, transmitting them to the offices for patient billing, laboratories, pharmacies, food departments, etc. through the order-entry system. In this way, communication is faster and more correct than using traditional paper slips. The transfer of orders before the patient's transfer allows reduction in waiting time for consultation, blood sampling, payments, and preparation of drugs. The drug surveillance systems can then be directly related also to patient safety. Additionally, workers can retrieve data by network terminals at many different locations. This renders medical consultation and treatment more efficient.

It is important that all participants, users, computer scientists, administrators etc. must be continuously involved with both the development and implementation of the system and also contribute to the decision-making process, whilst management implements the decision.

On the national level, an integrated information system (built around appropriate networks of computers) should be developed for a National Health Information System (NHIS) and such a system should presumably be centrally managed by an appropriate government agency.

In countries such as Nigeria, The Gambia and most African countries where telephone systems are presently poor and far behind the latest technology, provision needs to be made for telecommunications systems to link the appropriate network(s) of computers for any proposed NHIS network(s). The telecommunications system must be reliable and stable. It is suggested that an inter state link may be through microwave links that are more reliable and less likely to be affected by new constructions; and that governments should see the computer and NHIS project as valuable resources and thereby take appropriate steps to make provision for their continuous serviceability and availability.

One of the problems with HospIS appears to be the choice of management tools especially in a distributed environment and not necessarily the choice of optimal communication standards or of the operating system and the DBMS.

Many persons engaged in medical occupations argue that "information equipment is expensive, does not have any budget dedicated to the systematisation of medical information and does not get financial support from government".

The costs associated with the hiring of a highly qualified individual [a health informatician] are admittedly high. However, without a full-time, on-site person, who is capable of fulfilling the role of the information architect, the difficulty of the task increases to the point of *becoming nearly impossible."*

The difference in attitudes towards the advanced systems and poor communication among medical personnel are the main factors impeding the organisation of cooperation to implement an information network. This implies that it will be critically important to change the ways of thinking and the attitudes of those engaged in medical services to induce them to make a commitment to the task of medical information networking.

Medical professionals of the older generation need terminals, which allow information to be entered or retrieved through easier operation. At the same time it will be necessary to provide opportunities for training in the operation of the terminals, and to help conquer the technophobia relating to computers and keyboards.

Factors hindering the implementation and operation of community medical information systems may also be found in the lack of cooperation between the municipality and the medical association, and the lack of manpower needed to promote systematisation in the medical association.

Unfortunately, health information systems in most countries are inadequate in providing the needed management support. Furthermore, the data received are often not helpful for management decision making because they are incomplete, inaccurate, untimely, obsolete, and unrelated to priority tasks and functions of local health personnel. A large part of the data collected passes to the national level without being analysed and used, and frequently ends up on the dusty shelves of an office in the Ministry of Health. Current health information systems are therefore widely seen as management obstacles rather than as tools. The reasons can be summarised in five points:

- Irrelevance of the information gathered;
- Poor quality of data;
- Duplication and waste among parallel health information systems;
- Lack of timely reporting and feedback; and
- Poor use of information.

The chaotic status and efficiency of most existing information systems in developing countries are linked to the structural weakness of the system and lack of integration in the overall health system.

In the course of developing medical information systems which are capable of making a real contribution to community healthcare, further efforts and cooperation among doctors, the medical association, and people concerned in local healthcare activities are called for.

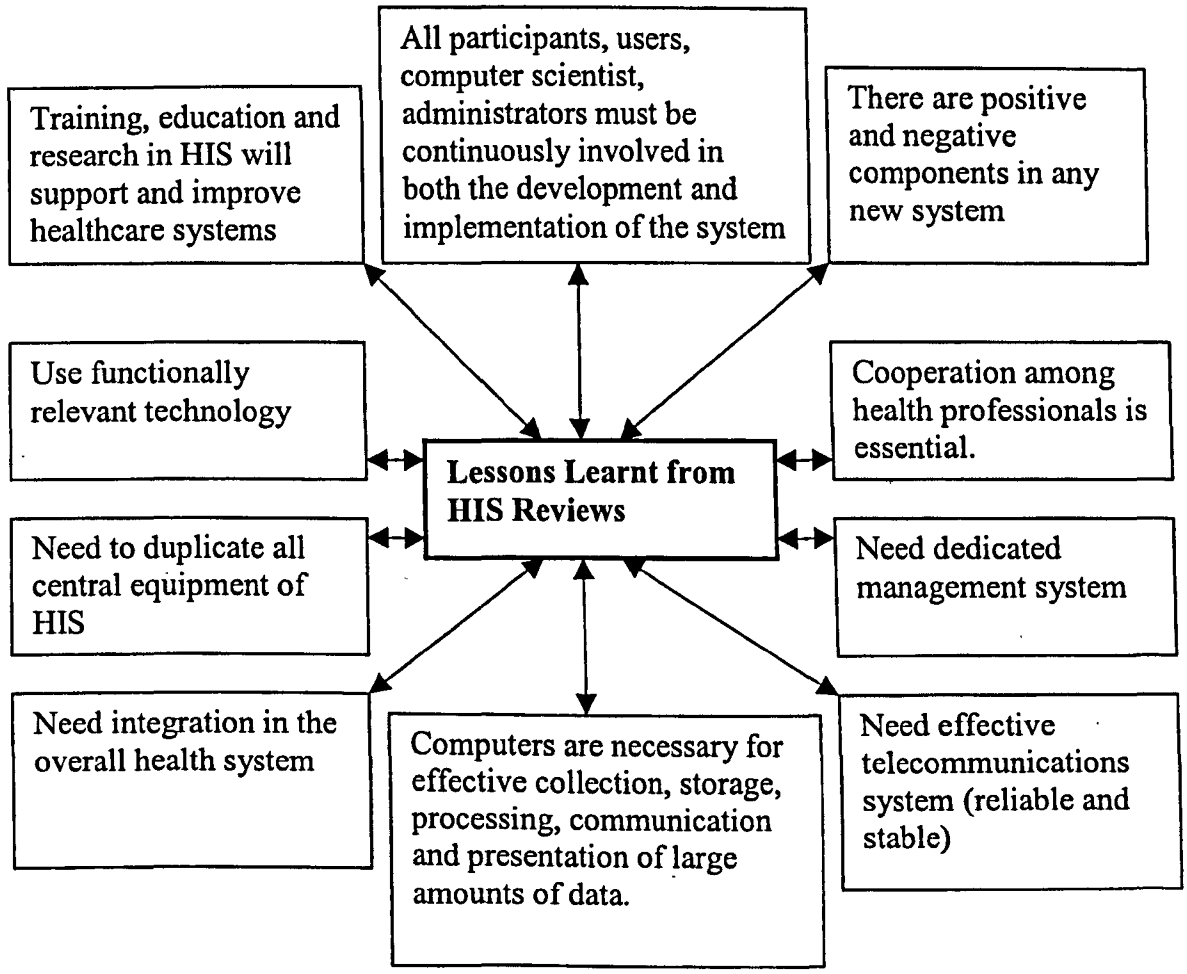

Figure 3.5: Summary of Lessons Learnt from HIS Reviews

Unless users have experience with or have observed new systems, a negative attitude to the old system may not necessarily develop; so in situations where none or most of the users do not have that experience the pressure for a new system must come from health informaticians themselves. The lessons learnt have been summarised in figure 3.5 above.

3.4 Reconciling Facts of The Gambia and Health Information Systems Review

With the knowledge of expandable systems, future designs of The Gambian system should bear in mind the fast growing trend of the population due to the high fertility rate and growing influx of immigrants from neighbouring countries and also the increase in tourism. The design of the HIS should be one that is easily expandable to meet the changing parameters. It should also consider the rural to urban shift and the fact that a larger percentage of the population are the youth. It is worth reminding ourselves here that a principal pillar of health or medical informatics policy is the mobility of the population says F.T. de Dombal [10, p1].

When building or designing an effective, appropriate and affordable system, the economy of the country needs to be considered in terms of its budgetary allocation for the entire health sector and specific budget for the development of HIS in this case if any. Presently, in The Gambia, there is no specific budgetary allocation from the government for the development of an HIS although the government has good intentions for it. Part of the World Bank loan for the Participatory Health Population and Nutrition Project (PHPNP) is to be channelled towards activities of the HIS development, but what is on paper is not always translated into reality. Being a poor country, there are other health issues that are deemed by strategic people as being much more important on the priority list than HIS development some will say. It therefore takes a much stronger team and determination to push such things through the powers that be.

Policies should be a guiding principle for any kind of development to be undertaken. The designer or researcher should therefore pay particular attention to the possible impact these policies could have on the development now and in the near future and to build the system with enough room for changes to meet predictable or unpredictable changes in policies if possible.

For sustainability of any system developed, it will be important to know the availability of the human resource capacity and easily trainable indigenous people based on their educational level or literacy rate of the country. The illiteracy rate in The Gambia is comparatively high. This high illiteracy could have serious implications for health education in particular and healthcare in general.

Apart from sustainability, making a decision on which system (whether monolithic i.e. central, evolutionary or distributed as described in sections 3.2.2.3 - 6) is finally chosen will depend on several factors including affordability, appropriateness and availability of human resource capacity. Considering the poverty level of The Gambia one might be tempted to settle in the initial stages for a central or monolithic system, but it is important to look at the future and also the disadvantages of putting such a system in place before making a final decision.

The geographical or physical features of the country and the administrative structures of the health sector are important for considering the choice of hardware (that can withstand the terrain and weather) and the type of network linkages, distances and complexities to be dealt with.

The problems of the countries telecommunication systems if any are worth knowing. There is the need for a reliable and stable telecommunications system to link the appropriate network(s) of computers if there should be a proper implementation of any National Health Information System. Such a system should be less likely to be affected by new constructions.

3.5 Summary

In this chapter a general review of the literature on health information systems and in particular the importance of such systems in relation to healthcare delivery has been presented. A background introduction to information technology and its role in medical/health informatics has been given. Various definitions and importance of health or medical informatics especially in healthcare settings as given by several experts or authors in the field have been presented. Also presented have been various reviews of health and hospital information systems; general (including monolithic or central, evolutionary and composable or distributed) and that of different specified countries including The Netherlands, Switzerland, Japan and Nigeria. The two main communication standards in health, HL-7 and EDIFACT were also briefly mentioned. The situation concerning The Gambia's HIS was discussed. The use of computers in health information systems has been presented and included a description of the importance of the electronic patient record previously more commonly known as the computer-based patient record and a rationale for using computers in health information systems was presented. Various relevant problems associated with the introduction and/or developing of health information systems have also been described, again looking at a Western world, an Asian and an African country. A summary of the lessons learnt from these general and country based reviews of the problems associated with the use of computers in information systems has been presented.

Having undertaken this review, the next chapter will describe the methodology applied in this research investigation and the stages it underwent.

CHAPTER 4

METHODOLOGY

The previous chapter presented a general review of the literature on health and hospital information systems, the importance of such systems in relation to healthcare delivery as well as constraints and problems associated with its development. Having done that, this chapter discusses the methodology that has been adopted in undertaking this research. A methodology is a kind of guide, a manual for an application development project and a technique is a particular method for carrying out specific tasks; says Degoulet and Fieschi [28, pp 19]. The research investigation was planned in four main time frame stages which, follow typical systems life-cycle or investigational approaches. Stages 1 and 2 were the feasibility study and information gathering stages. Stage 1 included the identification of the research needs and some preliminary information gathering, while stage 2 concentrated on the systems analysis stage of the research which, included more information gathering activities. Stage 3 was the field work and data entry stage, while stage 4 was the data analysis, results reporting and interpretation as well as requirement analysis and design implementation phase. In tackling some of the problems, the researcher used some systems analysis approaches during the investigations especially during the fact-finding stage.

4.1 Stage 1

4.1.1 Identifying Research Needs and Information Gathering

In healthcare settings, the first step in the development of a health information system (HIS) is to identify a clinical, administrative, or research need usually arising from an inadequacy or inefficiency in the delivery of healthcare.

During this stage of the research, the current health structure in the Gambia was reviewed. This was done in order to gain insight into the access to care and quality of care existing, as well as collecting information needed to document the healthcare delivery process itself and any defects in the present or old system. The outcome of this review and information gathered, have been described in chapter 2.

In addition, relevant existing global health information systems were reviewed. Some relevant papers have been reviewed in relation to the build up of arguments for the choice of methodology and ideologies or rationale behind the work already done in other countries. This has been described in chapter 3. At some point, stages one and two were running side by side (concurrently).

4.2 Stage 2

4.2.1 Undertaking an Analysis of the Health System

Stage two of the research was the undertaking of a systems analysis. The systems analysis was undertaken in order to identify issues relating to patient health data. This included addressing the following questions:

- What is the need for patient health data in The Gambia?
- Who needs/uses such data in The Gambia?
- What data currently exist in The Gambia and in what formats?

This was based on the premise that patient health data represent the results of monitoring status and activity. As such they should be used to analyse and assess the state of the health centre and its activities in relation to the delivery of effective healthcare both to the individual patient and to its population of patients as a whole. In other words, what are the problems regarding patient health data that need solution?

Daniels and Yeates argue that: "Systems analysis is essentially about identifying and defining business problems which are worth solving within the resources likely to be available. Without systems analysis there is a real danger of designing and implementing systems which do not meet the user's needs – simply because the user's needs were not adequately identified and defined [56, pp53]."

4.2.2 Steps in Systems Analysis

Methodologically, there are several approaches to steps taken during systems analysis and different authors have described different steps. The research described in this thesis has approached the systems thinking by drawing from a combination of the different approaches but the major focus presented here is the waterfall model approach as described by Degoulet and Fieschi in their book "Introduction to clinical informatics" [28, pp19-22] excerpts of which have been described below.

4.2.2.1 The Waterfall Model

Most methods used for managing computer projects divide development into phases or steps separated by control points. A step may not be started until the previous step has been validated at a control point. The *waterfall model,* which dates back to the early 1960s, is the best known. Figure 4.1 illustrates the phases in the model.

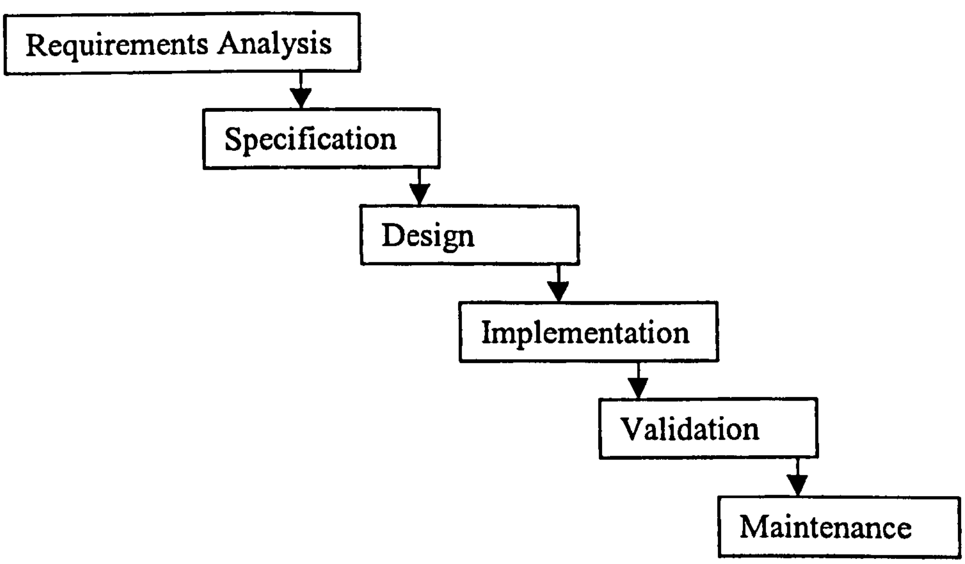

Figure 4.1: The Waterfall Model (Source: Degoulet and Fieschi [28])

What happens at the different phases or steps in the Waterfall model has been described by the authors as below:

1. *Requirement analysis* defines the objectives of a computer system and specifies user requirements. The problem is defined: the WHY of the computer system.
2. The *specification* phase defines user requirements in terms of the functionality of the computing system as seen from the outside: the WHAT of the system.
3. The *design* phase provides a precise model of the system and a detailed description of its implementation. It defines the HOW of the system. It is often divided into two steps, the architectural design step and the detailed design step leading to a formalism that will enable program coding.
4. The *implementation* or *development* phase concerns the writing of the program code.
5. The *validation* phase concerns the installation and testing of the system in a real usage situation.
6. *Maintenance* concerns the updating and successive improvements that must be performed on the system.

An adapted version of the waterfall model showing some control points is presented below in figure 4.2.

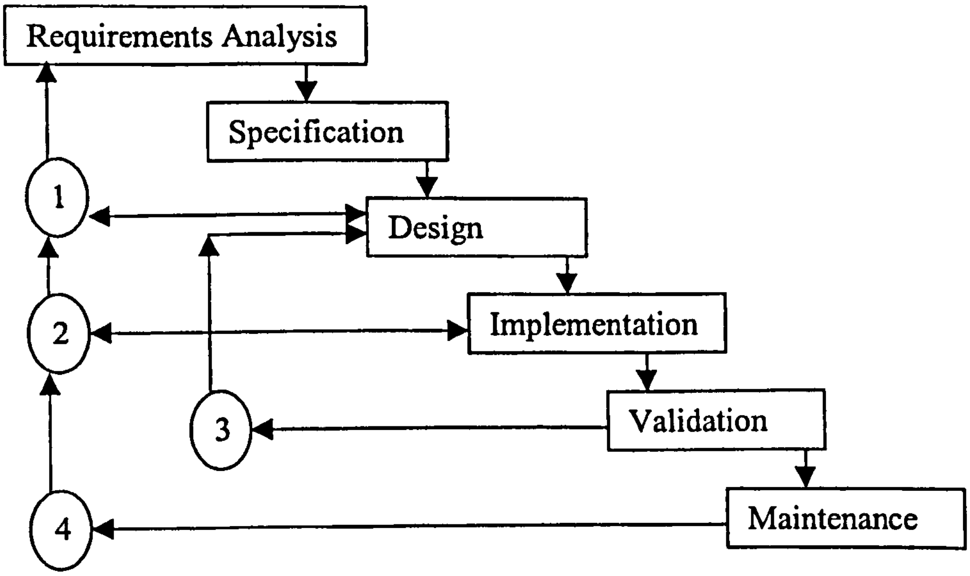

Figure 4.2: The Waterfall Model showing some control points

Key to control points:

1) After a feedback, are the users happy with the requirements and specification as proposed? If not, there is the need to revisit the requirements analysis phase.
2) Has the implementation met the requirements and design specifications? If not, there is the need to revisit the requirements specification and/or the design specification phase.
3) Are the users and/or designer satisfied with the testing and validation of the system? If not, there is the need to go back to the design stage.
4) Good maintenance may lead to updates in the master plan and successive improvements that must be performed on the system or even to a new detailed study as mentioned in the waterfall method.

The waterfall corresponds rather well to the intuitive vision of the development of a computerised system. It is important to specify a system first in general terms, then in more detail, before starting development. The control points, executed between each step, validate the work that has been accomplished.

4.2.3 Methodology as Described by Daniels and Yeates [56]

4.2.3.1 Systems Life-Cycle

Systems investigation falls within the early stages of systems work and is part of what is commonly termed the system life-cycle. This is subdivided into the following stages:

1. Analysis
2. Design,
3. Implementation,
4. Maintenance and review.

Each one of these stages may be subdivided and have a number of tangible products. The stages of the system life-cycle form the basic problem-solving methodology of systems analysis. First, the problem is analysed, then a solution is designed; next the solution is put into practice and finally a review is undertaken to see how well the solution in reality solves the original problem as defined. Systems investigation may be undertaken as part of a feasibility or preliminary study. The preliminary study is generally undertaken to get some idea of whether it would be worthwhile investing additional resources in more detailed studies. On the other hand, systems investigation may be undertaken as part of a detailed study, the outcome of which will determine what, when and how information will be produced by a new system. It is vitally important that this work is thoroughly done - and done to the satisfaction of management, the end-user and the computer services department.

An important point to note is that the systems analyst needs a formal, disciplined approach to analysis and design which will enable users to play their full part in the systems development process and ensure that new systems are developed in a cost-effective way. To produce well-structured systems designs, the analyst needs to define accurately the outputs from the system, its inputs, the data structures and the processing. To help him to do this, information is gathered from a variety of sources in several different ways. Further, the analyst checks back with many different people in different circumstances to ensure that what he is doing is right. The output from this process is a systems specification which the user is expected to evaluate and approve. In most cases however, users have neither the time nor the ability to comprehend the details and the implications of the proposed system.

According to the authors, the system design process begins with a functional specification of what the new system is to achieve and ends with a detailed system specification from which programs can be prepared. The design process is an iterative activity. As each of the design elements is considered, a re-examination has to be made of the design decisions taken so far and an assessment made of the relationship between these previous design decisions and the element being considered. This repetitive activity continues until every aspect of the proposed system has been considered and the final and complete design has been reached. This is complemented by the illustrated waterfall model diagram (figure 4.1) that has been adapted as in figure 4.2 to depict some of the areas of iteration in a design process. The basic steps in the overall design process are:

1. The definition of the system's goals.
2. The preparation of a conceptual model or logical system design.
3. The development of a physical system design.

4. The preparation of the system specification.

Thus, in summary, the development of a new system passes through various stages until a working system is produced.

4.2.3.2 Initial Preliminary Feasibility Study of The Gambia Health Sector

Having reviewed or discussed the theories behind the systems methodologies this section describes some of the practical applications of the method employed in achieving some of the goals of this research. This section describes the preliminary feasibility study that was conducted in order to gather useful information to aid the researcher in the development process.

During this period, various relevant healthcare service reports and health related policies proposed by government or committees and consultants were reviewed. These reports included the RVH reports (1985, 1997 & 1998), Participatory Health Population and Nutrition Project's (PHPNP) Project Operations Manual of October 1998. Also, Situation Analysis of Children and Women, The Gambia, September 1998, Health Policy 1994 – 2000: Improving quality and access, 1994, Maintenance Policy, Ministry of Health and Social Welfare, National Human Development Report, 1997. The review of the documents provided useful information that were used in the early stages and/or later stages of the research investigations.

Personal communications took place with some healthcare administrators, the head of Epidemiological and Statistical Unit and the Director of Participatory Health Population and Nutrition Programme (PHPNP). This was to enhance further, the possibility of having a complete overview of the entire Gambian healthcare service and its delivery.

Preliminary interviews with some members of the District Health Teams were conducted to determine what data might be needed, and more generally what the users requirements could be. Six interviews with a pre-designed questionnaire were conducted in May, 2000 with these healthcare administrators to discover some of the aspects of the current situation, including the problems being faced in the health service.

Some of the important areas that the personal communications and preliminary interviews dwelt on were:

- presentation of clinical patient information;
- documentation of physician orders and instructions;
- access to other information and medical knowledge (remote or near);
- communication to remote sites;
- review and utilisation of resources; and
- education.

Having collected and analysed some preliminary requirements data, it was then possible to progress to a further step which was the proposition of initial conceptual model of a health information system for The Gambia (see sections 4.2.5.1 and 4.2.5.2). The proposed initial conceptual model of the system was based on a perceived expected flow of data and/or reporting information within the main stream of The Gambian National Health Service. This was then followed by an initial design specification.

The write-up below describes in detail the research plan; the initial proposed system for the collection and dissemination of personal health data in its conceptual model form, a description of what is needed, constraints and what needs to be done including the field work.

4.2.4 Proposing a System: The How of the Study

A hospital information system (HospIS) may be defined as a computer system designed to ease the management of all the hospital's medical and administrative information, and to improve the quality of healthcare [24, pp 91]. The authors argue that to successfully implement an HospIS, several conditions must be met. Some of the most important are:

- a thorough knowledge of the underlying information system of the hospital;

- a detailed analysis of the sociology of the hospital's structure and good communication, internally between the various hospital's players and externally with its environment;
- a well-adapted hardware and software strategy; and
- a good estimation of the resources necessary for its deployment and maintenance.

These points were taken on board while addressing the Gambian situation. To obtain a good knowledge of the underlying information system of the hospitals and the sociology of the hospitals' players, interviews conducted during the fieldwork ensured that the key players who could provide these information were included. These included Chief Executives of the three hospitals, Principal Nursing Officers of the three hospitals, Medical Records Officer(s) and technicians in order to get a good balance of the situation.

4.2.4.1 Deciding on Choice of a Hospital Information System

Some of the conditions to be met for a successful implementation of a HospIS have been mentioned. With these conditions in mind, it will be true to say that making a decision on the choice of any hospital information system to be proposed depends on several factors and existing problems that may prevent the implementation of a particular proposed system. Some of these factors are:

- availability and/or affordable hard- and software architecture of the system
- availability of trained personnel;
- financial availability;
- resources;.
- electricity availability;
- telephone or satellite communication availability (Infrastructure).

4.2.4.2 Architectures to Consider

In terms of meeting the condition of a well-adapted hardware and software strategy, it will be important to have a good knowledge of the different available architectures, their strengths and weaknesses. In the design of any computerised system, there are three main types of architecture to consider. These are centralised system, distributed system and network of network system. To propose or make a choice for what will be appropriate for The Gambia, it is important to know these strengths and weaknesses of each of the architectures in addition to other constraints such as financial and human resources. For this reason, brief descriptions of these strengths and weaknesses have been provided below:

In a **Centralised System**, the central computer supplies all the services; communication between workstations, data storage, calculations etc. The model requires that all software runs on the same computer. It groups all useful information on a single computer and facilitates the installation of backup and access procedures to guarantee the security of the information.

The major disadvantage is the architecture's lack of flexibility, which does not allow simple evolution and makes the institution dependent on a single computer manufacturer.

Distributed Systems: use specialised local servers to store certain types of information (e.g. patient identities, medical data, laboratory results, images) and manage communications or calculations. The main advantage is in its approach, which is to build a computing system in successive stages of the hardware and/or software components, which may use equipment from different manufacturers.

The disadvantage is that it increases the complexity of the information system and may cause compatibility problems between various hardware and software components as well as security problems. Each computer may become a Trojan horse for entry into the network (e.g., computer virus introduction).

Network of Networks is a system that ties together the local area network of an institution. This changes the concept of the institution itself says Tapscott in 1993 [57]. Access to the data on the network becomes ubiquitous; at the office via the workstation, at home via personal microcomputers or network computers (teleconsulting and/or teleworking), or

Hertzian network using a personal assistant equipped with the necessary communication tools.

Working in groups (using groupware) is enhanced by exchanging messages (e.g. e-mail, group discussions), remote connections, and videoconferencing. Several institutions can share resources around a common objective, creating a virtual institution. The Internet, initially used by universities and research centres, can virtually connect all world private and public networks.

Relying on the TCP/IP protocol, it offers multiple services such as access to multimedia servers through navigation tools or browsers, electronic mail, and distant connection or transfer of data or program files. At the end of 1994, nearly 25,000 networks and 2.5 million computers were connected to the Internet, while traffic increased nearly 10% per month, says Laquey in 1995 [58]. At the end of 1998, it was estimated that 150 million end users all over the world were connected. This success and the wide availability and low cost of Internet tools have incited institutions to use the same approach and build local Internet based networks now called Intranet.

4.2.4.3 Analysis of the Interacting Elements

As in section 4.2.4, we remind ourselves of the three other conditions that must be met if we were to be able to successfully implement a HospIS. These were:

- a thorough knowledge of the underlying information system of the hospital;
- a detailed analysis of the sociology of the hospital's structure and good communication, internally between the various hospital's players and externally with its environment; and
- a good estimation of the resources necessary for its deployment and maintenance.

Therefore, for both the present and the future, there is the need for an in-depth analysis of all the interacting elements that gather, process and supply the information necessary to the hospitals' or health centres' activities (see figure 4.3 for the main types of analysis that are usually performed).

The analysis of the information system needs to be carried out in several different ways:

- **Analysis by Objectives**; i.e what is the information system environment? What are the hospital's, health centres', or Ministry of Health's goals?
- **Structural Analysis**; i.e. what is its structure and organisation?
- **Functional analysis**: i.e. what functions does it offer?
- **Behavioural Analysis**: i.e. what are the possible effects of a computer system on the hospitals'/health centres'/health service's organisation, and how will the relationships between the players be modified?

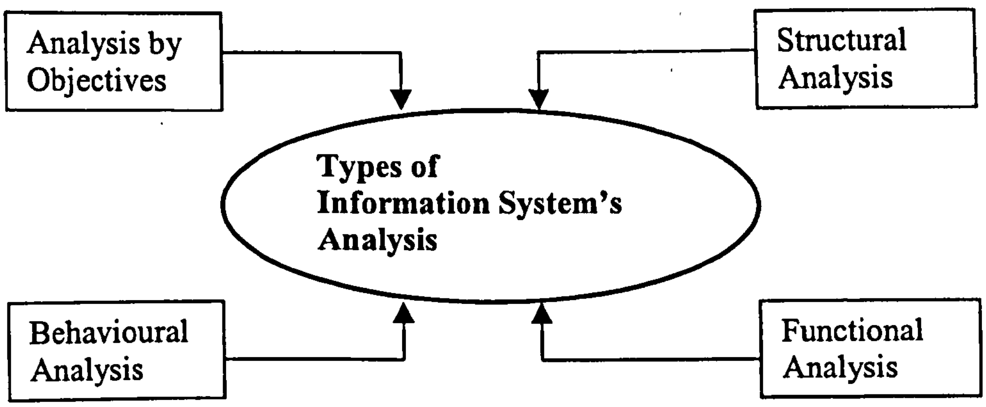

Figure 4.3: Different ways of analysing the information system

4.2.4.4 Analysis by Objectives: The Information System's Environment

No matter how complex the health information system may seem to be, it is important not to underestimate the communication needs of the various subsystems (e.g. general practitioners or insurance companies).

The diversity of the players involved either directly or indirectly in the information system include:

- Patients;
- Healthcare personnel (physicians, nurses, paramedics, pharmacists and biologists);
- Administrative personnel; and
-

- Also players outside the hospitals such as organisations from government, industry, NGOs, donors and the media.

During the field work stage (stage 3, section 4.3) of the research work, the semi-structured questionnaire interviews of key managers in the health sector was used to try to address some of these issues mentioned above. The personnel were asked questions such as how many people are employed in your organisation?, what is the chain of command?, how often and how timely do you send or receive reports internally or externally? and what are the constraints etc? They were also asked for reasons usually given for the delays in sending or receiving information and what they think can be done to improve the situation. The researcher also asked the respondents if they thought the DHT's, ministry or the government rely heavily on the information provided when decisions or policies are being made. Also how often if at all do they make recommendations to the government based on the information received from the various health sectors.

This way the researcher aimed to address what the information system environment was, what the hospitals', the health centres' or the Ministry of Health's goals were.

4.2.4.5 Structural Analysis

Another way of carrying out the analysis for the development of an information system is by structural analysis, in other words, what, is the structure and the organisation of the system like? Thus, this must include a detailed analysis of the organisation, material and human resources, including the following:

- **Administrative** (management, financial services, personnel);
- **Information management** (archives, data processing, statistics, communications);
- **Logistics** (kitchens, laundry, transport, maintenance, etc);
- **Health-care units** (outpatient consultations, emergencies, medical services, surgical services, re-education, etc);
- **Pharmacy**;

- **Technical-medical units** (biochemistry, haematology, blood bank, bacteriology, virology, immunology, cytology, pathology, radiology, endoscopy etc.).

The semi-structured interviews and general questionnaires for the fieldwork were used to gather information about the areas such as administration, information management, logistics, healthcare units, the pharmacy and the technical-medical units of the health sector. For example, in the area of information management, respondents were asked in the fieldwork general questionnaire survey: "What in your opinion do you think should be done to improve the organisation, storage and request procedures of the medical records? In some areas, answers were not easy to obtain in which case the researcher relied on the action research (observational study) approach to gather the information; including such things as how emergencies are handled, how personnel are treated at work, and how easily available are resources that are needed.

During the analysis of information system need, every structure be it medical or medico-technical, becomes a resource available to the other structures or to the outside, performing medical acts, producing information, or consuming other resources.

4.2.4.6 Functional Analysis

This helps to define the various functions of a system (medical diagnostic or therapeutic activities, managing resources etc.). Thus, it defines the **WHAT of the information system**. The existence of the necessary structure is a prerequisite for effective performance of a function (the **HOW**).

In the development of health information systems it is important that the approach chosen does not lead to the development of redundant or even incoherent applications (e.g. different functions for managing requests for examinations, and applications for managing healthcare units or ancillary departments). Equally, precautions should be taken when developing computer applications, such that the approach does not lead to redundant functions and sometimes to contradictions that hinder optimal patient care (e.g. isolating the medical records from the nursing records).

One of the approaches of HIS differentiates the patient information subsystem (anything that concerns the patient and that may be stored in the patient's record) from the other subsystems. This method emphasises on the notion of the unique patient record, which acts as the basis for administrative, medical or nursing information, and for decision making. It also has the advantage of centering the analysis on the hospital's main objective, which is improving the health of its patients and optimising their care. It is the root of hospital information systems built around patient records.

The researcher found this approach of the functional analysis more appropriate to be applied in The Gambian situation since this research aims at developing a prototype health information system (HIS) in The Gambia that is capable of providing doctors, nurses and other healthcare professionals with quick and easy access to the information to care for patients; also to provide this information when they need it, where they need it, and in the format in which they find most useful.

With this approach of the functional analysis in mind, the fieldwork questionnaire was partly designed to enable the researcher to capture information such as:

- Is there the need for all health workers to receive formal training in data recording, data analysis, data interpretation, data reporting and use of data?
- Have you received training of any kind since joining the health service and what kind?
- Should the development of HIS in The Gambia be one of the top priorities?
- Does the current health system need improvement?
- Do all health facilities need a new health information system?
- What are the five most important things you would like to see the government address in the health sector if it was possible?
- Would it be useful for everyone to have a national health service number and health record?

- What do you think should be done to improve patient care in particular and healthcare delivery in general?

4.2.4.7 The Notion of a Model

"The notion of a *model* appears in nearly all phases of software development. A model is an idealised vision of reality, an *abstraction* that masks certain details to bring forth others. We can define mathematical models, physical models, and biological models, to name a few. A computer model is a model designed to facilitate the process of developing information systems and software [28, pp23]."

The authors discuss further by giving more definitions as presented below:
"To define the *structural properties* of a model is to describe its "anatomy", how the model is organised, what it is made from. To define the *behavioural properties* of a model is to define its "physiology", what it does or how it reacts in response to external stimuli. Computer models are concerned with the structural and behavioural properties of data, information, and knowledge.

Normally, *data items* are the elementary facts that are recorded concerning the phenomena of the outside world and may be considered as given such as a patient's temperature of 37.5°C. Information may be defined as the increase in knowledge that may be deduced from a set of data, from the raw material that facts represent.

Knowledge is the result of successive additions of information to the initial data, information that itself is considered as data for the inferences of higher levels. The distinction between data, information and knowledge is obviously relative."

4.2.5 Initial Conceptual Model of The Gambia's Health Information System

Preparing a conceptual model or a logical system design requires that the analyst determines how the system will achieve its goals. To achieve this in The Gambian situation, several steps were taken including having personal communications, reviews of reports and preliminary interviews with key health sector personnel.

After the personal communications, review of reports and the preliminary interviews, an initial conceptual model of the intended health information system for The Gambia is proposed (see figure 4.5) based on a perceived expected flow of information (see figure 4.4) within the main stream of The Gambian National Health Service.

4.2.5.1 Expected Flow of Health Data and Reported Information in The Gambia

Concerning the flow of information, it was perceived that, at the basic primary healthcare level, Traditional Birth Attendants (TBAs)/Village Heath Workers (VHWs)/Community Health Nurses (CHNs) after seeing patients will send information to the key primary healthcare villages. These data can then be forwarded to the Divisional Health Teams (DHTs) where the data will be processed and reports generated and sent to the Epidemiology and Statistics Unit (ESU) which is empowered by the Ministry of Health to collate data and information on most health issues.

It was also perceived that the basic primary healthcare team (comprising TBAs, VHWs, and CHNs) could also send the information to dispensaries, minor health centres or major health centres closer to their area of operation for forwarding to the DHTs. They may also send the data directly to the DHTs (especially if the health worker is geographically stationed in the same town as the DHT); this is shown in figure 4.2 as a dotted arrow. The primary healthcare villages are situated in all settlements with 400 or more inhabitants. Each village is provided with a trained VHW and TBA who operate from the village health post. A key village is one within a group of 4 to 5 PHC villages.

The DHTs are the administrative units of the six (6) different geographical health divisions in the country. They are the management sectors of the secondary level of care and manage or run all the minor health centres, major health centres, dispensaries, outreach stations and health posts within their geographical region.

The DHTs are ideally expected to furnish the Ministry of Health with monthly reports of what is happening at their division concerning numbers of patients, diseases, resources etc. but these are usually delayed for several months. They are also ideally expected to have their divisional statistical analysis to enable them to use the information for the management of their division. Lack of trained personnel, computers and other resources such as simple stationary, make this task very difficult.

The ESU also expect to receive data from the three main government hospitals, main laboratories, the census or population office, personnel department, health transport departments, pharmacy department, health finance department and the cost and recovery program activities.

4.2.5.2 The Initial Proposed Health Information System: Its Organisation

It was initially proposed that the health information system will have a centralised country wide patient database at the Department of State for Health (DoSH) where there will be a main computer server with appropriate software and interfaces. The site will be the ESU. Handheld computers will be used by the various health workers (TBAs/VHWs/CHNs) to input data from the rural areas where they attend to the patients. At the end of each day or on a weekly basis, they will send these data via modem or satellite communication to the dispensaries, minor or major health centres or directly to the DHTs (especially when the health worker is geographical stationed in the same town as the DHT. This is shown in figures 4.4 and 4.5 as dotted arrows or lines).

The initial proposition of having a centralised approach to the system is based on the ease of management. This is because of the lack of funds, lack of highly trained skilled personnel as well as lack of adequate infrastructure such as inconsistent flow of electricity and problems with telephone systems to deal with the distributed approach.

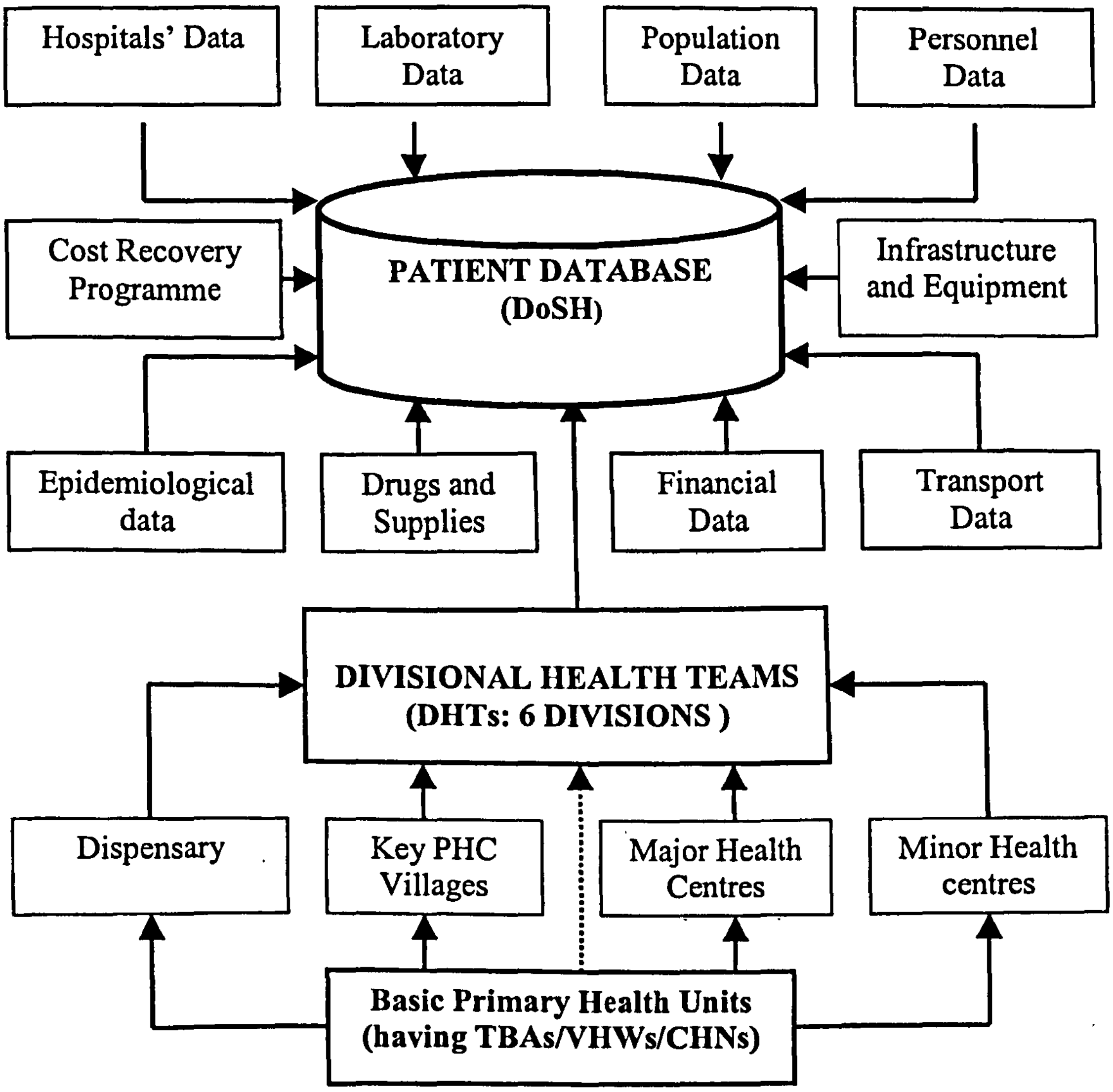

Figure 4.4: Expected flows of data and reporting information

The DHTs should have computers with modems to be able to receive the data, and do some statistical analysis for their divisional management and reporting. They will then send their weekly, monthly or emergency report and/or data to the main server at the ESU, which should be holding the central databases.

The three main hospitals, although semi-autonomous (including the Royal Victoria Hospital with their own Board of Directors) should also be feeding the ESU database, if the national database, located at the ESU, is to be complete. Because of their relative complexity, it is proposed that the hospitals have their own data collection sub-systems with local area networks to deal with the relatively large amount of routine daily collection of data. On a weekly or monthly basis, however, they will send data to the central database at ESU.

Since the pharmacy department is the main unit with official authority to receive and distribute government drugs to the hospitals and health centres, it is important that data on drug administration are added to the central databases. For the majority of patients, recovery depends on quick access to prescribed drugs. It is proposed therefore that the sending of these data should be done on daily basis because of the importance attached to the availability of drugs at all times to avoid any catastrophic delays due to shortages.

Data from the National Health Laboratory and the Nutritional Unit should also be sent to the central database on a daily basis to enable analysis to be carried out and quicker reviews performed of possible shortages of important biological reagents and those of higher priority in a particular season.

It is proposed that a Financial Administration Information System (FAIS) is established in each of the three hospitals and in the six DHTs to monitor the financial activities of the hospital, dispensaries, minor and major health centres. They should then send data to the central database for the purposes of planning, policy and decision making.

Epidemiology data for disease outbreaks and data from surveys of national interest should also be sent to the central database. The Census or Population Office should occasionally send demographic data of interest to the health and healthcare to the central database.

Transport data including the numbers of ambulances, motor bikes for field work, their road worthiness and usage should also be sent to the central database on a monthly basis. Data on the states of infrastructure and equipment should be sent at six-monthly or yearly intervals as this constitutes important information to be considered for patient safety and reliability of services.

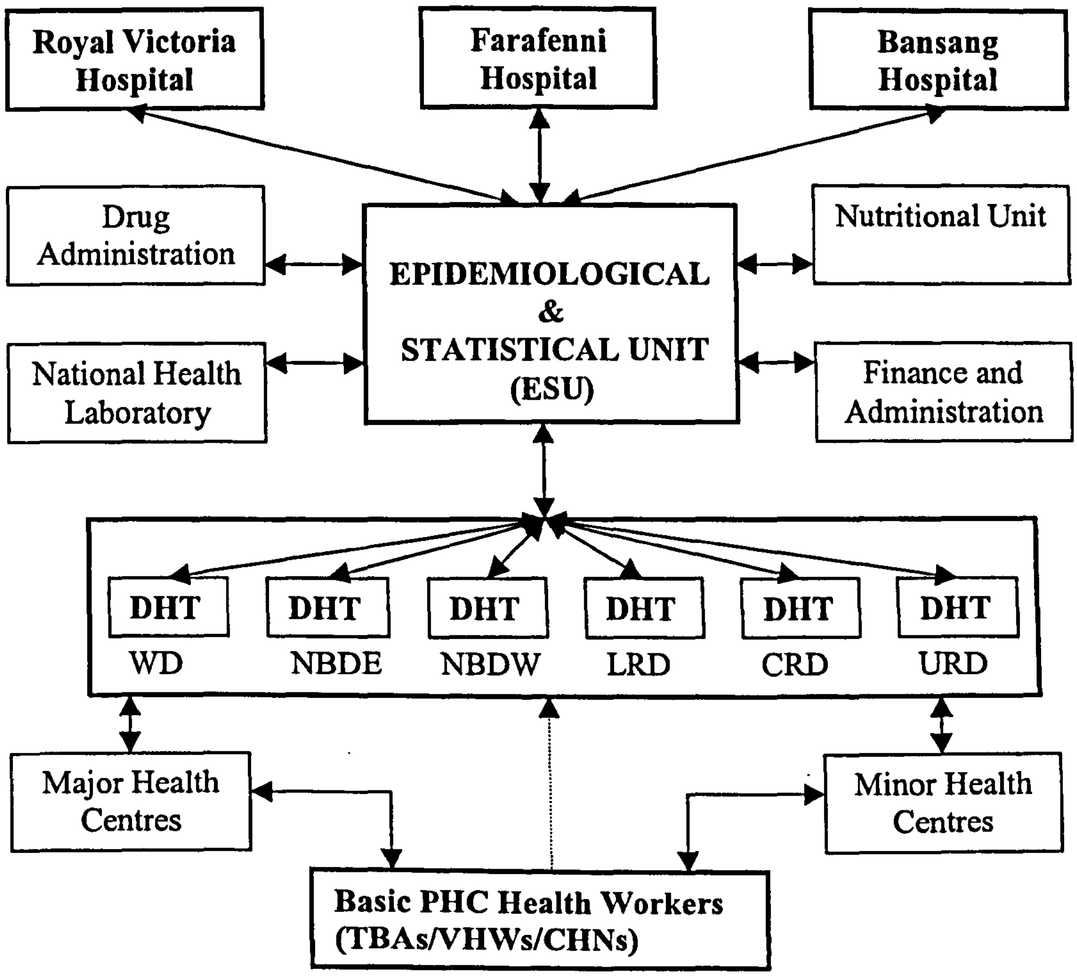

Figure 4.5: Organisation of the initial proposed Health Information System

4.2.6 Initial Design Specification and Constraints for the Conceptual Model

4.2.6.1 Hardware and Software

It is proposed that there should initially be a main or central server physically situated at the ESU. This should be connected to computers at all six DHTs and the three hospitals in the country with a 24-hour open line for data transfer. Subject to financial availability there should be another server to act as a backup in the event of breakdown. This will ensure a continuous operation. In a country like The Gambia where a continuous flow of electricity cannot be predicted or guaranteed, there should be a stand-by generator and an uninterrupted power supply (UPS) unit in place. A stabiliser to take care of the fluctuations in the power supply should also be in place.

Every DHT should have at least two computers for the input and analysis of data collected. One computer should be dedicated for data entry while the other serves as a backup and used for routine management work. They should also have UPSs and standby generators that should be available when needed and not necessarily in a 24-hour operation.

Each team of health workers who go to the rural areas to deliver healthcare should be provided with a handheld computer with an appropriate interface for data collection. Each of the minor and major health centres should also have at least a computer, a UPS and a stabiliser.

Each of the three hospitals should set up a medical records office (at the moment it is only RVH that has a reasonably established medical records office though this is not functioning efficiently). The others are not fully operational. Each medical records office should have at least two computers; one dedicated for data entry and the other serving as a backup. Like the other areas there should be a power stabiliser and UPSs.

Each computer at the DHTs, minor and major health centres, and the hospitals should be installed with a modem.

A TCP/IP protocol should be used. It offers multiple services such as access to multimedia servers through navigation tools or browsers, electronic mail, and distant connection or transfer of data or program files.

4.2.6.2 Database Management System for the Conceptual Model

Computerising a medical record will in practice be very difficult without the use of a database management system (DBMS). A database is created to record facts or events concerning individuals or objects, to provide that data request, and to create new knowledge based on accumulated data (inferences) [24, pp27]. In 1995 Date defined a

DBMS as a set of programs that allows the user to interact with the database [59]. However, making a choice of a DBMS that is most appropriate is not a simple task and needs the following considerations to be taken into account:

- The temporal dimension of the medical data (i.e. the different visits of a single patient);
- The selection of an appropriate model;
- The choice of an appropriate hardware and software infrastructure;
- Accounting for human and environmental factors (i.e., analysing the needs, choosing a man-machine interface, and training personnel concerned);
- The complexity of the medical objects (e.g. plain language text or multimedia data); and
- The need to integrate medical data and knowledge to create decision support systems (e.g. alarms, expert systems).

Relational Database Management Software should be installed with the central server. Microsoft Access (MS Access) with an SQL query language is initially recommended. The computers at all centres and hospitals mentioned should also be installed with Access which should be used for data entry. EpiInfo software should also be provided on the computers before a complete transition is made to using Access as the data entry package.

4.2.6.4 The Database for the Conceptual Model

It is proposed that there should be two components of the central database. One is the Clinical Patient Database which should have patients' categorical clinical data as they visit the hospital or health centres for medical attention with disease.

The second should be a managerial and logistical database which should be in the form of a Central Registry database for everybody (patient or not) in the country including immigrants. This will be useful for research and educational purposes, policy making, preventive public health issues for the government and should include relevant demographics of individuals with regular updates.

The managerial and logistic database can draw on the data from the clinical database which could provide information about diseases, types and number of cases, hospital attendance, and could contribute to the decision-making information needed on Personnel, resources and consumables such as drugs.

A notebook should be provided for each health centre to record each birth or death, the name, sex and address of child or patient, the names of the parents, and the health card number if any. Data to be collected should include the presenting symptoms, distance and time taken to travel, if available, and the date (season) of the event, management and any obtainable information concerning post mortem. Physicians' orders and instructions (if any) will be documented. Parents' and/or patients' education and social status may be collected where possible. In effect the data items to be collected will fall into four categories:

- Demographic (age, sex, residence);
- Season of presentation;
- Presenting symptoms; and
- Diagnosis and management.

The data will then be transcribed from the notebooks onto standardised reporting forms. These forms will then be processed and analysed. This will provide the basis of some of the health indicators (parameters) that are used nationally and which should be included in the piloting when the health information system is introduced.

Some of the advantages offered by databases and database management systems are that: redundancy of stored data is reduced; inconsistency of data is eliminated; stored data can be shared; data can be more secured; and data independence is provided.

4.2.6.5 Data Dictionary and Database Administrator

For a successful use of a database management system, it is essential to have a data dictionary and a database administrator (DBA) or in this case an HIS administrator (HISA).

The data dictionary contains descriptions of all entities and their relationships. The data dictionary is crucial to the DBA or HISA in maintaining the overall system.

The HISA should be responsible for all operational data. His/her main responsibilities should be:

- Maintaining the information content of the database;
- Maintaining the storage structure and access strategy;
- Defining the authourisation checks and validation procedures;
- Liaising with users about data;
- Defining the strategy for backup and recovery; and
- Monitoring performance.

4.2.6.6 Security

The problem of file security arises once a system requires a file. Since the information recorded on a file is vital to the efficient working of the total system, it is very important that this information is not corrupted in any way or destroyed.

There should be physical security to ensure that that there is no damage to the files while they are awaiting processing. This responsibility should rest on the HIS administrator. Part of their functions should be to ensure that suitable house keeping facilities exist for the files and this should include fire protection for all master copies. This person will be responsible for keeping all magnetic media free from dust, in a suitable atmosphere without excess temperature or humidity and away from stray magnetic fields. They should also make sure that correct files are issued to the operating staff and that proper records are kept on the movement of all files.

Operationally, there is the need to put in place security controls and procedures to protect the data against accidental or intentional disclosure to unauthorised persons, or unauthorised modification or destruction of data. Users must be positively identified by the system before they are given access to the data.

4.2.7 Re-examination of Design Process

The design process is an iterative activity as described in section 4.2.2.1 under the waterfall model with an adapted illustration in figure 4.2 as well as section 4.2.3.1 under the systems life-cycle heading. Therefore, as each of the design elements is considered, a re-examination has to be made of the design decision taken so far and an assessment made of the relationship between these previous design decisions and the element being considered. This repetitive activity continues until every aspect of the proposed system has been considered and the final and complete design has been reached. All these iterative steps and each cycle seek to improve on the previous steps especially on the conceptual model and the design specification of the system.

Therefore, there was the need for some fieldwork for the collection of more data and information. The fieldwork was undertaken in order to enable this final and complete design stage to be reached. A brief description of the fieldwork can be found below, in terms of the methods adopted while chapter 5 gives a detailed description of the activities.

4.3 Stage 3: Fieldwork and Data Entry

The fieldwork which was primarily a fact finding stage, started in May 2001 and continued until April, 2002 with the main aim of gathering necessary additional data to enable the system's (design) specification to be completed. This field work involved among other things, interviews with key individuals, administration of questionnaires to determine acceptability, further review of documents and reports, action research in the form of observation to help clarify current practices in the health sector and the collection of data relating to existing government clinical records. This was not only to provide and verify facts, it was also to help provide an opportunity to meet and overcome user resistance.

The fact finding begun with a complete and thorough review of all the information that already existed about the area of HIS development which was being investigated. This included all existing materials that describe what happens now – or what is thought to happen now.

The various techniques the researcher used during fact finding exercise included:

- interviewing
- questionnaires
- observation
- record sampling.

More than one technique was found to be needed to be employed to establish the facts.

Huruki et al [32] considered it important to make inquiries for assessing the status of hospital information systems (HospIS) in Japan and to evaluate the effects quantitatively. They used two questionnaire surveys to assess the status of HospISs in Japan for shaping policies for future developments.

According to Leedy's paper in 1974 [60], a survey research is the type that observes a particular idea by means of an interview or questionnaire. Wiersma in 1991 [61] pointed out that, normally a survey research deals with studies that look at how people feel, perceive and behave (i.e. people's perceptions and feelings about things and behaviour towards it) and that the objective is to determine how these parameters or variables are related. Dane in 1988 [62] argued that the researcher's task is to collect data relating to the variables and based on the data gathered and on the responses presented at the time the question was asked, examine the patterns of the relationship between these variables.

They argue that one of the advantages of survey research is being able to generalise its results to represent the views of the population, since it involves a reasonably large number of respondents making them representative of the population. Needless to say this research investigation aims to gather data and/or information that can be generalised for the entire healthcare sector nationwide.

In order to ensure that in surveys the population sampled is a true representation of the larger population, the same questions must be asked of all respondents. The problem is that wording a questionnaire properly to achieve its objective is a difficult task. For this reason, it is argued that there is the need to take pains to pilot all questions in order to ensure as much as possible that all questions mean the same to all respondents. Although it is difficult to find answers to why questions (as opposed to the ease of providing answers to what?, when? where? and how? questions), Bell, in 1999 [63] argued that, relatively, it can be a cheap and quick way of obtaining information if a survey is well structured and piloted.

4.3.1 Justification for Interviews

Interviewing is probably the most productive fact-finding activity for an analyst. Not only do interviews provide the facts, they enable the analyst to verify facts and they provide an opportunity to meet and overcome user resistance. Success will however depend on the interviewer's ability to work round, or avoid, resistance that may develop on the part of those staff whose work habits will be altered by any changes that may be recommended. Although, the interview does not stand alone as a means of fact-finding, but is used in conjunction with observation and examination, the interview is usually the only means of finding out something about that part of the job which cannot be seen, that which goes on inside the operator's head. It is true that many people are enthusiastic about their job but may regard a visit by a systems analyst (or interviewer or researcher) as a suggestion that their work is not well done, and take this impression to heart. There is therefore the need to be tactful, impartial and, more positively have the skill in influencing others to accept advice or things that they would prefer to ignore.

Resistance to change will often produce a somewhat frigid climate for the interview and some extra care may be needed to produce a thaw. Interviewing is a process of obtaining information – without upsetting the other party – by means of conversation; this entails being a good listener, being adept at keeping the ball of conversation rolling and being able to keep the subject on the right lines. The interview should not run too long and waste time; on the other hand, it would be fatal to cut it short and thus hurt feelings. These advisory reminders mentioned above were taken on board during the actual field work interviews.

Possible reasons for which employees resist change and therefore not cooperating include:

1) Fear of losing one's job, of wage reduction, of inability to learn a new job, of loss of prestige, of loss of interest in one's job;
2) Suspicion of management's motives in making the change;
3) Resentment against personal attack, or a feeling that any change is a personal criticism of the way a job was being done;
4) Social upset caused by breaking up a working group;
5) Ignorance, or fear of the unknown.

Considering these possible reasons steps were taken to overcome this background reasons for resistance. Some of the steps taken were as follows:

1) Keeping the people in the picture well in advance and give the full reasons for the research and selling the benefits.
2) Giving them an opportunity to participate by making suggestions.
3) Creating a favourable atmosphere; giving the people time to get accustomed to the idea and assuring them there is no threat to their job security.

In terms of research, the interview (both structured and semi-structured) can be viewed to be more personal than questionnaires are. Apart from working directly with the interviewee, the interviewer has an added advantage or chance to ask follow-up questions that may not have been thought of before the interview started. William Trochim [64] argued that, generally interviews are easier for the respondent to deal with, especially if what is being sought are opinions about specific problems or situations. When the population of targeted interviewees is comparatively small, one of the best and effective methods to use for gathering information about peoples' views, are semi-structured interviews. With this method one can vary the type, the number and the order in which questions are structured or appear depending on who is going to be interviewed.

4.3.2 Justification for Questionnaires

Although the data it yields could be argued to be subject to errors, a questionnaire can be regarded as a scientific tool for the measurement and collection of particular types of data. Like any other tool, the questionnaire needs to be specially designed according to particular specifications and with specific aims in mind.

This method may not be simple and care must be taken over the form design but is very important and useful method especially in the kind of situations including:

- Where staff are located over a widely spread geographical area (such as in this study doing country wide survey);
- When a relatively large number of staff are required to furnish data;
- For verification of data found by other methods; and
- When 100% coverage is not essential or practical (as in the case of this study).

A covering letter may be necessary to explain the purposes of the questionnaire in order to avoid misunderstanding and to help gain cooperation which the study provided.

The advantage of the questionnaire method (especially mail questionnaire) is not only in its ability to reach a larger number of geographically distributed institutions and people, but as argued by Dane, 1988 [62] that it is the least time-consuming and most effective data collection procedure. Bennette in the same year 1988 [65], substantiated Dane's argument by stating that, the technique that is mostly used by researchers in the social and behavioural sciences is undoubtedly the mail questionnaire. He argued that when looking for the type of information that is broad, exploratory and also involving large numbers of people, the questionnaire is a very useful, cheaper and a relatively easy technique.

Investigating into attitudinal or behavioural problems towards HIS in Groote Schuur Hospital, Cape Town, South Africa, the investigators Lakay et al. [47] chose questionnaires to achieve their objective.

4.3.3 Justification for Observation (Action Research)

Action research involves watching an operation for a period to see for oneself exactly what happens, which makes it one of the effective ways of gathering different kinds of descriptive information. In practice, much depends upon powers of concentration. The analyst may undertake planned or conscious observations when s/he decides to use this technique for part of the study. The observation technique is particularly good for tracing bottlenecks and checking facts that have already been noted.

Although the interpretations of the researcher during action research can be subjective, it has a practical advantage of engaging the institution or organisation in the research method. It also makes the researcher's own biases while undertaking the research reasonably overt. It is also true to say however, that, in action research, there is a lack of control of individual variables. Another disadvantage is the acknowledgement that the very presence of the researcher can easily affect the situation being researched into.

Saunders et al.[66], however, argue that, direct observation is effective in situations where the researcher wishes to study specific areas of human behaviour. Needless to say that in this particular research, one of the aims was to investigate the impact working conditions, work loads, ease of access to work place and tools, colleagues, filling system, telephones etc. affect their behaviour.

In their book "Soft Systems Methodology in Action" [67, pp16], Checkland and Scholes point out that: "Action research requires involvement in a problem situation and a readiness to use *the experience itself* as a research object about which lessons can be learned by conscious reflection. In order to make this possible it is absolutely essential to declare in advance an intellectual framework which will be used in attempts to make sense of both the situation and the researcher's involvement in it. It is with reference to the declared framework that 'lessons' can be defined. The action researcher thus has two hopes: that the framework will yield insights concerning the perceived problems which will lead to practical help in the situation; and that experiences of using the framework will enable it to be gradually improved."

4.3.4 Justification for Fact-recording

"The only tangible product of the analyst's working during the investigation stage of systems work is the documentation produced by him. A professional approach to systems work requires a systems team to use standard documentation" [56, pp30]. High quality standard documentation offers the following advantages:

1. *Aid to completeness* Incomplete forms speak for themselves; good standard forms ensure that all the right data are collected, recorded and cross-referenced.
2. *Aid to analysis* Appropriate types of charts and tables enable the essential features of a system to be highlighted.
3. *Aid to communication* Standard forms help all team members to communicate with each other in an unambiguous way. They facilitate the modification of systems designed in the past and ensure that systems currently being designed may be easily modified in the future. They facilitate communication between analysts, programmers, operators and users.
4. *Aid to Training* New entrants can become effective in a shorter time through common installation standard documentation. Transfers of staff from team to team are facilitated.
5. *Aid to management* Until the system is actually up and running the only tangible product of the analyst's work is the documentation. Standard documentation enables the project manager and the analyst to agree on what is to be produced by what dates. A project can be subdivided into many minor stages by reference to the documentation to be produced.
6. *Aid to security* The documentation of a system may be likened to an architect's drawings of a building; if the building is damaged or destroyed the drawings enable repair or reconstruction to be carried out as quickly as possible. Likewise the documentation of a computer system is indispensable for efficient remedial action in the event of a system fault or failure.

Thus, they argue, standard documentation is much more than a means of communication between analyst and programmer – important though that is. The discipline of conforming to standard documents is a sign of professionalism and also ensures that vagueness and incomplete ideas are dispelled."

4.4 Stage 4

4.4.1 Data Analysis, Results and Interpretation

The full details of the analysis of the qualitative as well as quantitative data collected during the fieldwork are described in chapter 6. The software used for the data entry and the relevant data management procedures are discussed. The results obtained and interpretation of it are also described in this chapter. Frequencies of the parameters were generated. Parameters of greater interest were cross tabulated to look for correlations between parameters that would enable relevant deductions to be made.

4.4.2 Requirements Analysis, Design Specification and Prototype Implementation

Once this analysis has been carried out in order to identify need, a requirements specification will be produced. By reviewing what information technology is feasible, affordable and available in the particular context, a design specification should then be produced.

A prototype implementation will then be developed, focusing upon a specific clinical context in a rural, urban or semi-urban community in Africa.

4.4.3 Evaluation

The system will then be evaluated. Having been implemented, this prototype will be tested to the stage of attempting to show "proof of concept". Evaluation is defined as "measuring or describing something, usually with a question in mind." Unlike cars, trains or bridges, it is difficult to confidently predict the performance of information systems, especially health information systems, the purpose of which is to improve clinical performance and patient outcomes. It is difficult to predict, for example, how an information system will influence the complex human and organisational behaviours and therefore need to be measured hypothetically. Evaluation has been argued to be important for both the certification of clinical information systems and for medico-legal reasons. Van Bemmel and Musen put it that "clinicians would be unwise to use any system unless it has been shown to be safe and effective and that another reason for evaluating clinical information systems is that it is our only method for advancing the science of medical informatics."[20, pp 463]. Unless we perform evaluation studies, it is argued that we cannot hope to improve our theories about what works and why.

Evaluation is an integral part of the system building and is iterative as well and involves reflecting back on what it was the system was intended to do. The evaluation will use the example of the stakeholder matrix analysis described in Carson et al. [68]. This uses a range of necessary criteria such as; is the system physically usable, does it work and is it capable of performing the task it was built for, is it readily acceptable by the users, is it safe and is it reliable such that it will not crash easily. The relevant stakeholders are the range of people whose needs were taken care of during the design.

What constitutes the second stage, which is beyond the scope of this project, includes evaluation based on:
a) needs assessment, which will describe information problems amenable to support;
b) informal assessment, which will deal with function and potential value of the system; c) assessment of the impact of the system on users' actions, patient outcomes and the organisation.

4.7 Summary

In this chapter, the methodology applied in this research investigation has been described. It discusses the four stages the entire research went through, together with implementation and evaluation. This, included the description of stage 1, where the current health structure in The Gambia was reviewed (the outcome described in chapter 2) together with a review of relevant existing global health information systems (outcome described in chapter 3). Stage 2 described the system analysis that was undertaken in order to identify issues relating to patient health data and included the review of various relevant healthcare service reports and health related policies by government, committees and consultants (also described in chapter 2). Stage 2 also described the proposition of an initial conceptual model of a Gambian health information system based on The Gambian National Health Service. This was followed by a description of a proposed conceptual model and its design specification, and the decisions on choice of architecture based on various analysis. Stage 3 described the fieldwork that was undertaken including reasons for the choice of research methods used during this phase of the research investigation (full details of the actual work described in chapter 5). Stage 4 considered the data analysis, results and interpretation stage of the research, full details of which are described in chapter 6. How and when of a prototype implementation and evaluation was also mentioned.

Having considered issues relating to methodology, the next chapter will describe the actual work that was carried out during the fieldwork period and mentioning the various areas and activities that took place.

CHAPTER 5

FIELD WORK

Having in the previous chapter outlined the methodology adopted in the project, this chapter now focuses on the fieldwork that was conducted. This fieldwork started in May 2001 with the main purpose of gathering necessary additional data to enable the system's (design) specification to be completed. This field work involved, among other things, interviews with key individuals, administration of questionnaires to determine acceptability, action research in the form of observation to help clarify current practices in the health sector and the collection of data relating to existing government clinical records. This was not only to provide and verify facts; it was also to help provide an opportunity to meet and overcome user resistance.

5.1 Ground Work Activities

5.1.1 Letters of Authorisation

Letters for authorisation / permission to carry out the fieldwork aspect of the research were written to the relevant health authourities (see Appendix D for copies of letters). Obtaining permission from the government authorities to conduct any health research is mandatory. Besides, it would be impossible to obtain any kind of cooperation from health workers of any kind without them first seeing your letter of approval from the health ministry; most importantly the Permanent Secretary of Health or Deputy Permanent Secretary or the Director of Medical Services. Even after receiving the approval, problems arise if any of the others are not properly informed verbally or in writing. Dealing with such bureaucracy can take some time to resolve before the actual survey can start.

5.1.2 Seminars and Workshops

A major seminar was given by the author at the Medical Research Council in June 2001 to explain the research programme and the survey. Other smaller ones were given to various

District Health Teams or divisions as a means of informing the healthcare professionals about the research programme. To ensure a good countrywide coverage of the seminars, questionnaire administration, observational study, and interviews there was the need to visit all six Divisional Health Teams and some selected health centres and their trekking stations.

A major workshop was organised with the Ministry of Health in November 2001. Participants included Heads of Divisional Health Teams, Programme and Unit Heads, and various categories of health professionals. The main objective of the workshop was to discuss the areas of my survey and the issues concerning the problems with the introduction of Health Management Information System in the country. In this way the issues concerning resistance to, or fear of, change and interviews as discussed in chapter 4 were dealt with.

Among the important discussion items raised at the workshop was that of the full national health indicators (parameters) that The Gambian Health Authorities want to be included in the health information systems to be put in place. This issue was also discussed with some of the senior health officials during a number of the interviews. This was to ensure that the minimum, but essential, data set relevant to the HIS and government was identified.

5.1.3 Hiring of Field Worker and Data Entry Clerks

A field worker was hired in September 2001 to help in data collection for a period of four months, this period subsequently being extended by one more month. Two data entry clerks were hired in December 2001 to assist in data entry for two months which was equivalent to hiring one data entry clerk for a four month period as originally planned. This change in timing was due to the unforeseeable delay in the funding and the survey itself. One of the data entry clerks had her contract extended by another month up to the end of February in order to complete the entry of some of the remaining data collected.

5.2 Interviews

The interviews were geared towards gathering information concerning possible organisational changes in the health sector, materials or financial availability and human resources or manpower and time-scales for projected changes and the possible impact on the health service in general.

Pre-designed semi-structured questionnaire-based interviews were conducted from May 2001 till April 2002 with most healthcare administrators to discover some of the aspects of the current situation, including the problems currently being faced in the health service. It was intended that there should be a total of approximately 25 interviews. About 50 plus interviews were eventually conducted, 25 more than the targeted number.
It is worth re-mentioning here that previously six interviews with a pre-designed questionnaire were conducted in May, 2000 with some healthcare administrators to discover some of the aspects of the situation at that time, including the problems being faced in the health service.

Prior to each interview, a visit was made to the office of the prospective interviewee and an appointment date agreed upon. This visit was followed up with a telephone call one or more days before the interview date to confirm the appointment. Occasionally interviews had to be postponed due to the unavailability of the interviewee or other circumstances beyond their control; usually due to a more pressing appointment with a higher authority. In most cases verbal communication and the subsequent visit were enough, but others would ask politely for an official letter prior to the interview.

Those interviewed included the Permanent Secretary of the Department of State for Health (DoSH), the Deputy Director of Health Services, some Programme Managers, the Chief Executive, the Principal Nursing Officer, and Medical Records Officer of the Royal Victoria Hospital. All six Heads of Divisional Health Teams, the Chief Executive and In-Charge of the Medical Records Office of Bansang Hospital, the Chief Executive of Farafenni (APRC) Hospital, the Principal Nursing Officer and In-charge of Accident and

Emergency of the APRC Hospital were also interviewed. Others interviewed included the National Health Laboratory Manager and the Manager of the Participatory Health Population and Nutrition Programme (PHPNP), together with three Proprietors/Managing Directors of private hospitals. A complete list of all those interviewed can be found in Appendix E. A sample of the general questions in the semi-structured interviews can be found in Appendix F.

Where acceptable to the respondents, the interviews were recorded with an audio cassette recorder for subsequent transcription.

5.3 General Questionnaire Design and Administration

A general questionnaire was designed to meet a number of purposes. These included ascertaining the acceptability of the proposed changes that were due to be put in place as a result of the introduction of proper health information systems.

The questionnaire was also aimed at gathering information from health professionals on the ground about constraints, especially resources (or lack of them) that hinder a better collection and dissemination of information needed for enhanced delivery of healthcare to patients and for decision making.

The initial questionnaire was piloted with twelve people with the main aim of having the opportunity to fine tune the individual questions before taking it into the field. What was being sought in this piloting was whether people were likely to have problems completing the questionnaire and any other important feedback. For example, did they see any ambiguity in a question? Although efforts were made to design the questions to eliminate ambiguous questions as far as possible, responders can think differently. Saunders, 2000 [56] argues that piloting questionnaires prior to administration enables the researcher to have an assessment of the validity of the questions and reliability of the data collected. In Dillman's paper in 1978 [69] it is stated that the main purpose of a pilot study is to elicit feedback from the prospective respondents on the content of the questionnaire.

The questionnaire had a covering letter that explained the purposes of the questionnaire and the research investigation in order to avoid misunderstanding and to help gain cooperation. The covering letter also appealed for their patience and time to be invested in the filling of the questionnaire and for a quicker return rate. There was provision of two contact addresses and telephone numbers to call if they encountered any problems while completing the questionnaire or had any questions about the survey. The letter finally thanked them in advance for their time and comments.

400 questionnaires (300 earlier and 100 later when return rate was encouraging) were distributed countrywide. This was done through the heads of the DHTs, Officers-in-charge of the health centres visited, and the field worker when fieldwork trips were made by the researcher and field worker. The DHTs and Officers were asked to distribute these to all categories of health workers randomly. The target was to be able to send these to at least 200 people in the health sector in order to gain a good balance of different levels and categories of health professionals country wide. This would represent a reasonable number (between 10 – 20%) of the workforce of the health ministry that will allow a reasonable amount of information to be collected. The estimated workforce in the health sector was 1500 – 2200 but this includes orderlies, cleaners, watchmen, cooks and other relatively non-health professional staff. The exact figures were very difficult to obtain. A copy of the general survey questionnaire can be found in Appendix G.

The questionnaires were sent personally because the internal postal system in the country does not operate efficiently especially mails to semi-urban areas. Thus, the delivery of the questionnaires through the post not guaranteed or relied upon through the postal system. Similarly, respondents were told not to post the questionnaires but that they will be collected. Because of the distances (relatively long) involved, we allowed ourselves two weeks to go back for collection bearing in mind that might also be enough time for respondents to have completed them. This way, chances of getting more completed questionnaires were higher. Some people ask to be given more time because they are usually busy at work during the day and complain being too tired after work.

It was anticipated that more than 60% of the respondents would return the forms. A total of 358 questionnaires were answered and returned by the end of the survey. This represented approximately 89.5% of respondents returning the forms, higher than the anticipated 60% return rate.

The sample was reasonably representative as can be seen in Appendix G1 showing the different categories of health professionals who responded to the questionnaires.

5.4 Action Research (Observational Study)

Action research in the form of observations to be made in Out-patient, In-patient and Accident and Emergency settings was undertaken to help clarify current practices within the different units of the health sector. This, for instance, allowed the observation of how the referral system worked; the nature of information that accompanied a referred patient and how it was treated.

Also being observed were the number of steps the data collected from patients went through before they reached a records office or wherever they may be kept; and the process of retrieving a patient's paper based file when they came back for the next appointment. This was done in order to help in the review of the process with a view to cutting down the number of steps needed.

Areas observed included:

- Working conditions (light, heat, noise, interruptions);
- Layout (ease of access, proximity to different departments, filing systems, telephones, furniture layout, adequacy of furniture);
- Workload (light, heavy, variable, constraints); and
- Pace and method of working (are there peaks and troughs of activity, does everyone follow the same method?).

The observations were carried out by both the researcher and his fieldworker.

5.5 Data Collection of Existing Government Clinical Records

Data have been collected retrospectively through the government's clinical recording system for some proven diagnoses of episodes of malaria and other diseases of importance and their outcomes. This was intended to help give an indication as to whether the data items collected were in conformity with those of developed countries and whether essential data items needed for better care had been collected, missed or ignored. Apart from checking on whether standard nomenclature and coding systems had been applied to the data from most of the centres, it was also designed to help to determine whether or not there was standardisation of the process of collection of data between the hospitals and/or different health centres.

5.6 Unique Patient Identifier

The issue of unique identification was on the mind of every senior health official. At the workshop conducted in November, 2001 this featured on the agenda and was widely discussed. The discussion centred on its importance and the steps needed to be taken to find the best way of solving that problem. A general consensus was not reached, but various suggestions were very helpful in the future production of algorithms to provide a country-wide unique identification that might serve not only health, but immigration and other social or economic purposes.

The difficulty of patient identification varies in proportion to the scope of the information system. In The Gambia the traditional use of patients' names and dates of birth or age is highly error prone because as mentioned earlier people do not know their exact dates of birth or ages. Besides, there are many similar names of patients and even those of their relatives because there are fewer names in The Gambia. For this reason the chances of having multiple mismatches is very high and this will make queries with just these items highly impractical. However, in the absence of this national unique patient identifier the only alternative is for the hospitals and other health facilities to continue this traditional usage of names and approximated dates of birth.

Some private hospitals try to use a master patient index which is equivalent to a medical record number. However once the patient moves to a different district or hospital, the use or importance of this index is lost because there is very little chance of knowing where the index belongs especially with illiterate folks.

We cannot shy away from the fact that national indexes such as the United Kingdom's National Health Service (UK NHS) make it easier to locate patient information. Locating patient information is facilitated because the NHS number does permit unique identification with a single data item. It is proposed that the system to be put in place in The Gambia, takes advantage of such a unique identifier by treating it as the most important identifying attribute of the patient. Health facilities with government backing should thereafter insist on every patient getting it and using it at all times during visits.

With such a unique identifier any health facility, regardless of its geographical location in the country, would be able to identify the patient and his/her other attributes without much difficulty. A description of a proposed algorithm to generate such identifier can be found in chapter 8 (as part of the design specification). When such unique identification is not available or does not exist (as is in the case of The Gambia), identifying patients (during follow-ups in particular) by using other available attributes take, comparatively, a much longer time and is sometimes error prone.

Apart from date of birth and first and last names other demographic data could have been used such as social security number, postal code, area code and telephone number but only a small percentage of the population have these. Non-demographic data such as ethnic group, native language or nationality and passport number (only a low percentage have one) could also be considered together with physical attributes such as hair or eye colour, disability or scars etc. but these may be too difficult to deal with.

Two other debatable options that were put up for consideration now or in the future were the use of finger prints and/or photos. Most of the arguments against these were that it will culturally and according to some communities' beliefs not be acceptable. In that part of the world some people tend to believe that if someone wants to kill you spiritually, it is very easy to do it through your photos and therefore shy away from parting with their photos. From a social and legal perspective, they have the misconception that signing a document or putting their finger print on anything means agreeing to anything that happens or is done to you by the people to whom you gave your consent. Logistically these two options may need more storage space and sophistication of the software as well as human to take photos.

Despite problems with name similarities, unknown birth dates (by patients themselves) or inadequate registration information on births, marriages or deaths, the government should bear the responsibility of ensuring that every health facility henceforth collects and records this information, if the proposed HIS is to be effective.

At the same time, the computerised facility for data processing should create unique identifiers from a combination of name and other data such as height, date of first attendance as an out-patient or in-patient.

The creation of a unique identifier should be standardised. The system should be interrogated when one such identifier is created to ensure that it does not already exist.

5.7 Telecommunication Status

More extensive and more recent information about the current status and architecture of the telecommunication system in The Gambia needed to be obtained from the relevant sources. This was pursued with vigour, although it proved to be difficult getting the right people at the right time to provide the needed information. It often involved seeing one person who referred you to another, who further referred you to someone else, all in the name of the "appropriate person" who could help with the type of information requested.

In this time and age, most business and industrial ventures place much emphasis on their ability to communicate rapidly and effectively and over long distances. The healthcare sector is no exception and, in actual fact, the demands of this sector could be much greater than for many other businesses and industries.

If a computerised health information system is to be in place, it is important to know whether the infrastructure is capable of supporting the communication links that are needed between the various sectors of a health centre or between health centres at different locations in different communities within the country.

The Director of the Internet Business Service of the Gambia Telecommunications (GAMTEL) eventually granted an interview. The interview sought to ascertain the infrastructure in place, present condition, and possible development in the nearest future that could have an impact on the implementation of an HIS. It was interesting to find out during the interview at the telecommunications headquarters that the organisation is planning to spearhead the introduction of telemedicine in the country.

In his 1992 PhD thesis Tse Chen [70] said, "Telecommunication, networking and interconnected computer systems are important to healthcare because they provide the promise of improved efficiency and productivity through the sharing of work and data. Thus technology provides the capability to use and share information in new ways both within the hospital and outside the hospital".

The quality of communication between healthcare providers strongly influences the quality of care [20, pp67]. In order to be able to deliver a healthcare service efficiently and effectively, the hospital or nation and its information system require the exchange of large quantities of data between the different departments as well as outside organisations. The Internet has had a great impact on the method of communicating data and information and perhaps can be said to be the most well known example of a communications network. Early examples of its application include the e-mail and telenet but its most widely used application now is the World Wide Web. It is worth mentioning again that, in a keynote address during a five-day conference of the American Medical Informatics Association (AMIA), in Washington DC in November 1999, Peter G.W. Keen said: "The Internet will radically change the face of healthcare [16]".

5.7.1 The Gambia ICT Situation

To develop a national/nationwide online/real-time system, it becomes necessary to look at the existing infrastructure and environment to determine what may be feasible. From the interviews and documents read from different sources including the Gamtel website, the researcher was able to gather some information to describe the ICT situation in The Gambia.

A health communication link between The Gambia and the USA called HealthNet Gambia, originating from Cambridge, Massechussetts currently exists. The link was initially by satellite, but is currently operated by telephone polling. There are 30 points connected to a node. Although the numbers are reducing very fast and the system is slowly fading away there are still about a 100 subscribers.

GAMTEL was established as a state-owned limited company in 1984 to regulate and operate telecommunications services for The Gambia. It operates 11 urban branches and 12 provincial stations (shown in figure 5.1), and provides the following services:

- Telephone networks including GSM cellular networks
- Paging
- Internet Gateway
- Public Pay Phones

Under the UNDP's Internet Initiative Project for Africa, a design of an Internet backbone infrastructure was launched in 1996 and completed in August 1998. The Internet Backbone and gateway project was implemented as a joint UNDP/Gamtel project to provide full Internet access in the country. This provided dial-up and direct Internet services using leased lines of 64 and 128k. The project was buttressed by The Gambia's DOS for

Communication and Information in 1999. One of its policy objectives was to assist in the development of a national information infrastructure and its connectivity to the Global Information Infrastructure.

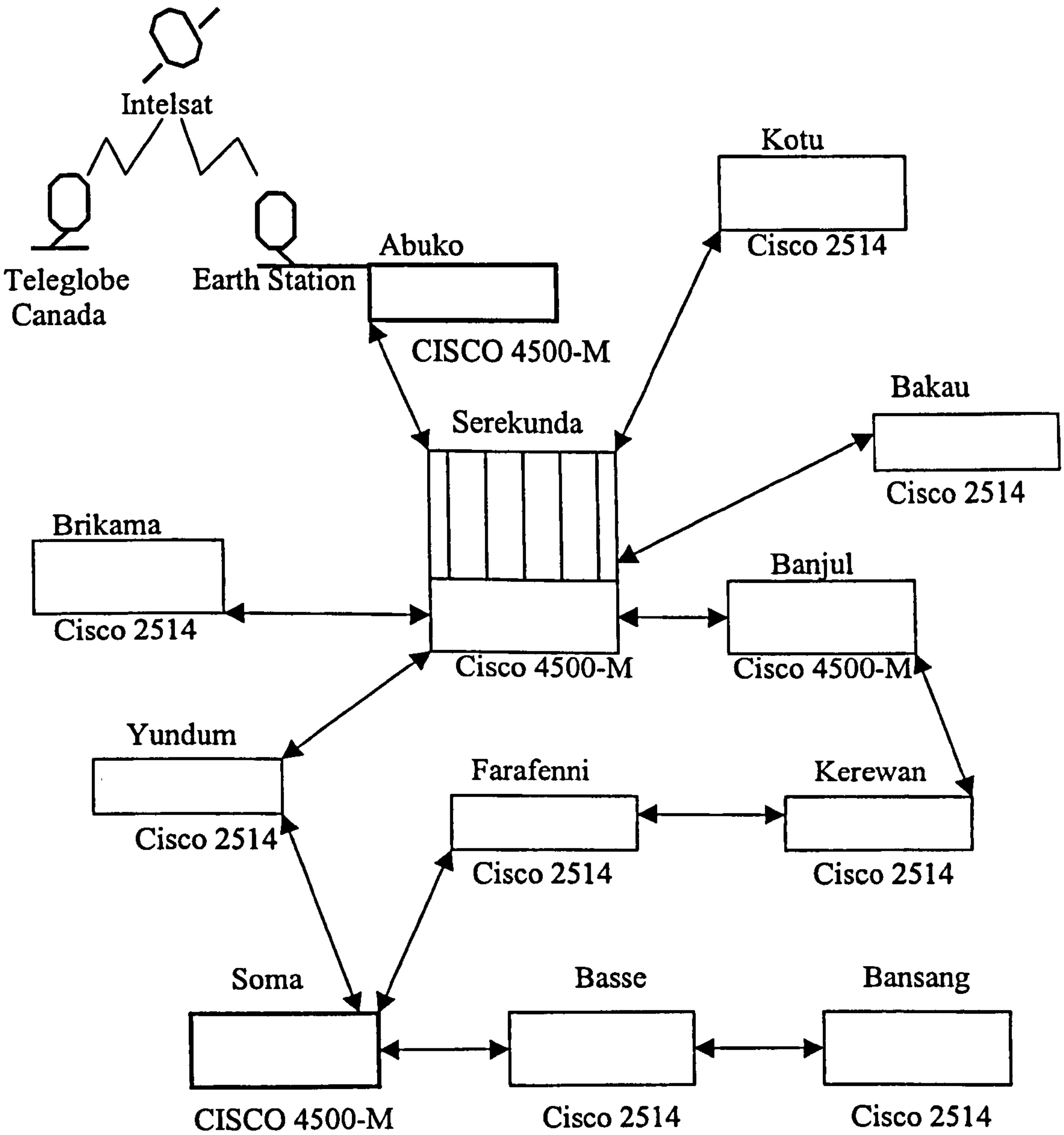

Figure 5.1: Gamtel Internet Backbone

The gateway is a complete satellite system from Gamtel's earth satellite station in Abuko to TeleGlobe in Canada. Figure 5.1 depicts the Gamtel Internet backbone with the routers at the 12 provincial stations.

5.8 Data Entry and Management

All data were entered using EpiInfo software after generating a questionnaire and check files which allowed individual forms to be entered as individual records. The forms were double entered by the two different data entry clerks after which a verification and validation program was run. If errors occurred during entry the process of validation was repeated until the two files were exact copies of the other. This eliminated mistakes during data entry.

All the essential steps of data management were observed. This included ensuring proper reception of forms, initial manual counting, checking and recording of forms, numbering of forms, proper filing and storage as well as ensuring day to day back up of data entered. These steps were observed by following the recommendation by Yamuah's paper [71] that no study should be started without the involvement of a data manager.

The information from the qualitative aspects of the survey were entered in Microsoft Word.

5.9 Delays Encountered of Field Work

There was a significant delay in the time scheduled for the survey to end. This was due mainly to cultural and bureaucratic procedures involved in obtaining authorisation to carry out studies within the governmental sectors and unforeseen postponement of interviews and visit to certain divisional health teams. A major delay was caused by the fact that the money for the entire fieldwork activity was not received until July-August 2001, instead of May 2001.

All the fieldwork activities described in this chapter can be illustrated in a summary diagram as found in figure 5.2 below.

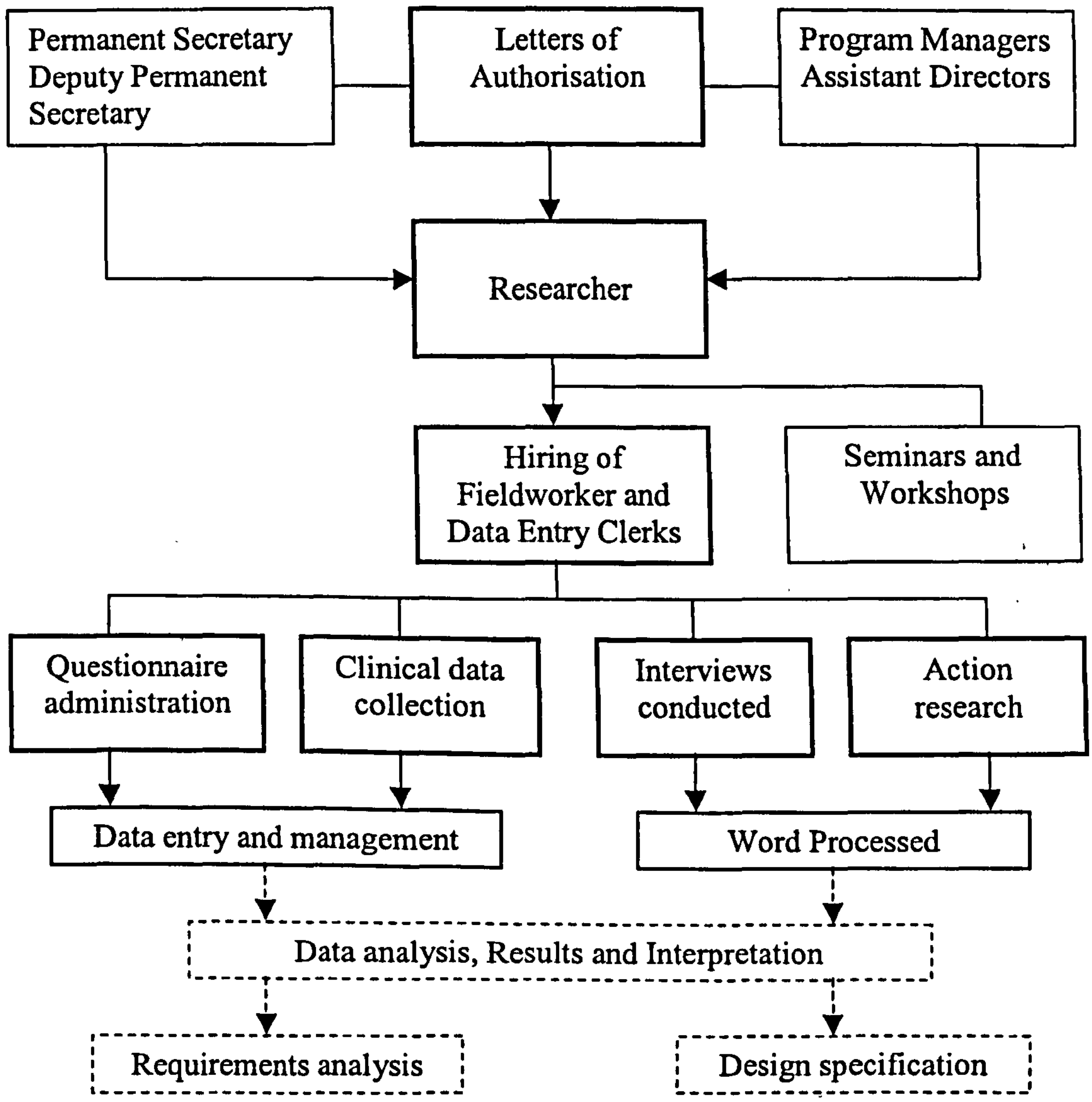

Figure 5.2: Summary of main fieldwork activities

The broken arrows and lines indicate that they were not exactly part of the fieldwork activities but the end results of the fieldwork leads to that.

5.10 Summary

In this chapter details of what was actually done during phase 3 of the research investigation, which is the fieldwork that took place between May 2001 and April 2002, has been described. It detailed the various ground work that was needed before starting, which included letters of authorisation, seminars and workshops and hiring of fieldworker and data entry clerks. It also detailed the conduct of the interviews, the design and administration of the general questionnaire, action research (observational study) and the data collection of existing government clinical records. The issue concerning unique patient identifier was discussed as well as the telecommunication status and its importance. The process of data entry and management, as well as delays encountered during the fieldwork, were also described. The next chapter describes in detail the data analysis and results of the fieldwork and the interpretation of the results.

CHAPTER 6

DATA ANALYSIS, RESULTS AND INTERPRETATION

Having conducted the fieldwork, the next stage of the research investigation was to analyse the data and present the results and their interpretation. This chapter describes that. It discusses the analysis made on the general questionnaire, the relevant results obtained and the interpretations given to those results. These include:

- frequencies of training received and experience in IT;
- frequencies of routine work undertaken by health workers;
- opinions on amount of health data collected, opinions on training needs;
- opinions on HIS situations in the country;
- institutional comparison of some important factors;
- influence of training on the use of computers;
- influence of training on day to day use of computers;
- influence of training on processing/analysis of data;
- influence of training on method used for producing reports;
- influence of training on views of electronic health records;
- influence of training on views of national health service number; and
- impact of ever receiving training on health workers views of certain factors.

It also presents the deductions made from these results and interpretations.

The important issues picked from interviews given to the key strategic and tactical people (unit managers, directors, permanent secretary etc.) are also presented.

It also describes the findings of the action research (observational study), which mainly describes the observations made at the different departments of the hospitals and health centres and how they operate.

6.1 Data and their Analysis

6.1.1 Data Collection

There were different areas from where data and questionnaires were collected. These were major and minor health centres, hospitals, laboratories, health ministry offices, divisional health teams (DHTs) and any sector where health workers had been approached and questionnaire forms distributed.

All questionnaires were received in the MRC Fajara's Computer Centre which accommodated the data entry clerks and the researcher who was also the data manager. The questionnaire forms were received directly from the fieldworker or from drivers who had collected the forms from the health centres or other locations. The data entry clerks checked through all forms for incomplete and inconsistent data and rectified obvious problems after consultation with the data manager. Forms with difficult problems (although very few instances) were sent back to the respective respondents (if they could be identified and located) for rectification. Usually there was not much success in seeing the respondents or getting the forms back again.

It was ensured that at least all six major health centres and all six divisional health teams as well as all three hospitals in the country were covered in the distribution of the questionnaires. The use of 3-digit codes put on the questionnaire forms as they came in reinforced the uniqueness of the form identification as well as the reception and recording process.

In some areas, the researcher and/or fieldworker needed to travel long distances to collect the forms and sometimes took a whole day or two to find respondents. As delays became unavoidable, it became necessary to increase the number of months the fieldworker and data entry clerks were employed for. This was very important in ensuring that all potentially completed forms could be collected as well as entered and cleaned on time for analysis.

6.1.2 Data Entry, Processing and Data Management

EpiInfo version 6.04b software developed by the Centre for Disease Control (CDC) Atlanta, was used for the data processing and management activities. EpiInfo 2000 had been newly released, but was not on all machines. Beside there were a few complaints from some users not completely used to it, so a decision was made to stick to the most current version at the time of entry which was the 6.04b version.

The hardware designated to be used by the data entry clerks at the MRC computer centre at the period of entry was two Dell IBM compatible PCs each of which had more than 1,000 MB disk space. This allowed the use of all other software not only for database management systems for data management, data entry, validation and verification, but for other usage as well. A network shared HP laserjet IIIP and one Lexmark laser Optra lx printers were available for all printing jobs that were needed including validation, weekly listings for field worker and researcher and report writings. The statistical package within the EpiInfo version 6.04b was what was used for the analysis of the data.

The computer needs of the data entry clerks were assessed before the commencement of the data entry process. This proved to be very important. To achieve good quality data, it was essential that each member of the study team was knowledgeable and efficient. Delays in initiating any stage of data management may result in data problems that can be difficult to correct subsequently.

Two data entry clerks, who have had previous experience in computer data entry, were employed by the researcher for this field study. Entering of data was done on a daily basis as soon as the forms were received at the computer centre. Before data were entered, the completed forms received were sorted and stored in folders by the data entry clerks according to the dates they were received. Before entry, each questionnaire was serially numbered as it was received. The purpose of this was to make future referencing and retrieval of forms while validating them an easy process. The data entry clerks each had a computer assigned to them.

The data entry process was such that the first data entry clerk entered a group of forms and passed on the forms to the second data entry clerk for second entry. There was an option for a menu driven entry if the data entry clerks chose to use it. The researcher served as a back up data entry clerk whenever a data entry clerk was unwell or absent for whatever reason. Occasionally, when the need arose, the data manager (researcher) entered data to avoid delays in the data entry process.

Check files were written to detect inconsistencies within each file, particularly to prevent duplication of unique identifiers and to prevent values outside the feasible values from being entered. It was observed that most of the discrepancies of results and/or forms were detected during the time of data entry. The check files ensured that unique respondent's questionnaire form numbers 001 - 400 were assigned and that they could not be entered more than once. This respondent's questionnaire form number given on receipt of the form was the main identifier and was used in all subsequent files created for analysis purposes.

Manually, it was a time consuming procedure to check the forms received from respondents for wrong entries if any. Check files comprehensively programmed within the entry procedure ensured that all data could be entered as soon as they were received from the field worker with the very minimum checking through for important fields. This was a useful way of using the computer to reduce the amount of manual checking.

Check files in place during data entry ensured that the computer disallowed out of range data usually with a beep alerting the entry clerk of a wrong entry. Double entry and its validation and verification also helped in eliminating some errors, especially transcription and range errors. Errors due to wrong recording by respondents or wrong entry could be checked and corrected immediately or within a few days after contacting the respondent if possible. There were reasonably few data entry errors half of which were because respondents' hand writing could not be easily read by the data entry clerks. Most of these errors were rectified by the data management team and just a few needed to be rectified by contacting the respondents (if they had identified themselves) for clarification.

These checks helped to eliminate as much as possible what is known as the "data cleaning" stage which is usually what is done at a later time when it is impossible to verify most factors. At that stage the "cleaning" may result in the removal of unexplainable information and data sets that may not fit into a trend.

Epi Info software was used in the validation of the data. All files created in the study were double entered. A listing of the discrepancies between the data-entry clerks was produced and corrections made by the clerks. The validation process was continued until the files were identical. The files were then backed-up by each data entry clerk. At the data entry stage, queries detected or any uncertainties were forwarded to the researcher for clarification. These ranged from poor handwriting to missing values.

The data manager (same person as the researcher) was responsible for the collection and distribution of data entry clerks' and field worker's logistic needs. This responsibility, which enhanced a closer relationship between the staff and the data manager, became an important aspect of the data management phase of the study by helping substantially in improving the quality of the data.

Monthly meetings for the fieldworker and data entry clerks were organised by the researcher to discuss in detail the progress and problems encountered in the survey if any. Weekly summary reports of the problems encountered during data entry and form collection by fieldworker as well as problems such as difficulty in reading respondents' hand writing. In this way, the data management system and/or the researcher sought and maintained a high quality of data.

The analysis programme of the EpiInfo software (version 6.04b) was mostly used for analysing the quantitative aspect of the survey. Frequencies of the parameters were generated. Parameters of greater interest were cross tabulated to look for correlations between parameters enabling relevant deductions to be made. The results of most of the quantitative analysis made are found in the rest of the document below.

6.2 Results and Interpretation

A total of 400 health workers (HWs) countrywide were approached by the researcher and field worker and encouraged to participate in the general questionnaire survey for the development of the health information system study. Out of these, 358 (89.5%) participated fully by sending in their filled in questionnaires. A 60% return rate was what was anticipated and therefore 89.5% return was much more than could have been imagined. The 10.5% non-returned forms cannot be put down to refusal alone but other factors such as lost questionnaire forms. It must be mentioned here that Haruki et al. [32] considered it important to make inquiries for assessing the status of hospital information system (HospIS) in Japan and to evaluate the effects quantitatively. They used two questionnaire surveys to assess the status of HospISs in Japan for shaping policies for future developments. Also Lakay et al. [47] used questionnaires when investigating attitudinal problems towards HIS in South Africa.

Not everybody filled in the age column but for those who did, the age groups were as follows: under 25 years 45 (13.4%), 25-35 years 163 (48.5%), 36-45 years 85 (25.3%) and 46 years and over 43 (12.8%) making the total number of respondents for this age group question 336. This indicates that there are a greater number of health workers in the 25 to 35 age group.

In response to the question "In which health sector or unit do you work?" 356 of the 358 respondents answered. From this 233 (65.4%) were from government or public sector, 12 (3.4%) from private clinics and 111 (31.2%) from Non Governmental Organisation (NGO) or Parastatal.

In response to the question "How long have you worked in the health sector?" 328 of the 358 respondents answered. 105 (32.0%) 0-5yrs, 78 (23.8%) 6-10yrs, 55 (16.8%) 11-15yrs, 60 (18.3%) 16-20yrs, 18 (5.5%) 21-25yrs, 10 (3.0%) 26-30yrs, 1 (0.3%) 31 – 35yrs, 1 (0.3%) 36 and above years.

6.2.1 Frequencies of Training Received and Experience in IT

Table 6.1 below shows the frequencies of the number of respondents ever trained in various fields concerning data processing and the level of experience with computing or information technology.

PARAMETER	Total number responding	Number and % of HW	
		YES	NO
Have you ever been trained in the use of standard case definitions?	344	146 (42.4%)	198 (57.6%)
Have you ever received any formal training in data recording?	350	178 (50.9%)	172 (49.1%)
Have you ever received any formal training in data analysis?	350	135 (38.6%)	215 (61.4%)
Have you ever received any formal training in data interpretation?	351	124 (35.3%)	227 (64.7%)
Have you ever received any formal training in data reporting ad use of data?	173	87 (50.3%)	86 (49.7%)
Have you ever used a computer?	345	191 (55.4%)	154 (44.6%)
Have you ever received any formal training in any computer skills?	346	139 (40.2%)	207 (59.8%)
Did you receive a certificate?	247	78 (31.6%)	169 (68.4%)
Do you use a computer in your day to day work?	303	118 (38.9%)	185 (61.1%)
Do you personally own a computer, apart from the one at your organisation?	320	46 (14.4%)	274 (85.6%)
Have you received training of any kind since joining the health service?	339	185 (54.6%)	154 (45.4%)
Have you heard of HIS before this questionnaire was sent to you?	344	172 (50.0%)	172 (50.0%)

Table 6.1 Training received and experience in Information Technology (computing)

It can be seen from table 6.1 above that the percentage of health workers receiving formal training of any kind concerning data is inadequate (35.3% to 54.6%). As we move from the comparatively easier task of data recording and reporting the percentage trained dwindles from 50.9% to a low figure of 35.3% in data interpretation, which is comparatively more difficult and should have received more training.

With regards to computer usage we can see 55.4% having ever used a computer to 38.9% using computer in their day to day work to a comparatively poor 14.4% having a computer of their own to use. Out of 135 health workers who have ever received training in any computer skills, 48 (35.6%) had less than one month, 29 (21.5%) 1-3 months, 12 (8.9%) 3-6 months, 16 (11.9%) 6-12 months, 15 (11.1%) more than 1 year, 14 (10.4%) other, varies and 1 (0.7%) unknown training.

It is interesting to mention here that 47.0% of health workers have an email address, 40.9% use email daily while 31.6% use it weekly (making a total of 72.5% using email weekly). Also 43.8% have access to the Internet, 41.9% having daily usage while 30.7 % have weekly usage (making a total of 72.6% accessing the Internet weekly). This signifies that if the technology is made available to the health workers with the appropriate training, the interest is there to use it.

On the question of "How would you like to grade your own ability with computers" the responses out of 300 respondents were: 46 (15.3%) Novice, 117 (39.0%) Complete beginner, 72 (24.0%) Intermediate, 34 (11.3%) Competent, 31 (10.3) Advanced.

6.2.2 Frequencies of Routine Work Undertaken by Health Workers

Table 6.2 below shows the frequencies of the numbers of respondents involved in routine data collection, processing or reporting and dealing with medical records.

It can be seen from table 6.2 below that a reasonably large percentage of health workers as part of their routine work collect data (66.7%), send data within or outside their unit (63.5%) and produce report to be used within or outside their unit (64.3%). However, when it comes to receiving reports from outside their unit, only 45.2% do indicating that the feedback mechanism is not matching that of reporting.

PARAMETER	Total number responding	Number and %tage of YES	Number and %tage of NO
Do you collect health data as part of your routine work?	351	234 (66.7%)	117 (33.3%)
Do you send data of any kind within or outside your unit?	342	217 (63.5%)	125 (36.5%)
Do you process/analyse data?	325	131 (40.3%)	194 (59.7%)
Do you produce report of any kind to be used within or outside your unit?	328	211 (64.3%)	117 (35.7%)
Do you receive reports from outside your unit?	321	145 (45.2%)	176 (54.8%)
Have you ever made a request of any kind to the medical records office?	344	140 (40.7%)	204 (59.3%)
Was your request attended to?	180	102 (56.7%)	78 (43.3%)
Were you satisfied with the response to the request?	173	55 (31.8%)	118 (68.2%)
Do you interact with the medical records office?	313	108 (34.5%)	205 (65.5%)

Table 6.2 Routine work undertaken by health workers

It is worth mentioning here that the level of manually producing the reports and sending is comparatively too high and needs addressing in future; see table 6.3 below.

PARAMETER	Manual	Computer (electronic)	Both
By what method do you send data within or outside your unit?	183 (78.9%)	44 (19.0%)	5 (2.2%)
By what method do you produce reports to be used within or outside your unit?	131 (55.7%)	60 (25.5%)	44 (18.7%)

Table 6.3 Means of sending and producing data and report.

In terms of the format in which these reports are sent out 101 (43.5%) said descriptive writing, 36 (15.5%) said in statistical tables, 4 (1.7%) graphs, and 91 (39.2%) a combination of all.

Although 40.7% of health workers claim they make requests to the medical records office and although 56.7% of people who make requests claim their requests are attended to, only

31.8% were satisfied with the response to their requests suggesting that there is a problem with the medical records office. This confirms the cry for help by the Medical Records Officer during the interviews that the researcher had with her.

Interestingly, asked if they are able to cope with the amount of data collected or generated during their routine work, 223 (79.4%) said YES, 58 (20.6%) said NO, the total respondents to that question being 281.

Although "What is your gender" was an optional question, a good number (344 out of the total 358 respondents) answered the question. Out of this 233 (67.7%) were male compared to 111 (32.3%) of females.

Similarly, "What educational qualification have you obtained (coded)" was an optional question, but 312 people responded to it with the level of educational qualifications as follows: 222 (71.2%) Certificate, 47 (15.1%) Diploma, 17 (5.4%) B.Sc., 21 (6.7%) M.Sc., and 5 (1.6%) PhD.

During the piloting of the questionnaires, it was brought to the attention of the researcher that people were more comfortable giving their age group than their exact age and that not everybody likes being asked the age question. "What is your age group?" was then made an optional question. Surprisingly a total response of 336 out of the 358 was obtained with the age group results as follows: 45 (13.4%) under 25 years, 163 (48.5%) 25-35 years, 85 (25.3%) 36-45 years, and 43 (12.8%) 46 years and over.

6.2.3 Opinions on Amount of Health Data Collected

Table 6.4 shows the numbers and percentages of health workers' opinions on the amount of health data collected. It shows that when it comes to, "There are too many data being collected, Some of the data collected are not necessary", a total of 25.4% agree, 25.4% are not sure and 40.4% disagree. On the issue of, "There are too few data being collected", a total of 18.5% agree, 29.6% are not sure and 51.9% disagree. However, when it comes to, "Some important data to be collected are not being collected", a total of 40.4% agree, 34.2% are not sure and this time only 25.4% disagree.

PARAMETER	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Total
There are too many data being collected. Some of the data collected are not necessary?	36 (11.0%)	47 (14.4%)	83 (25.4%)	118 (36.1%)	43 (13.1%)	327
There are too few data being collected.	31 (10.4%)	24 (8.1%)	88 (29.6%)	103 (34.7%)	51 (17.2)	297
Some important data to be collected are not being collected	55 (17.9%)	69 (22.5%)	105 (34.2%)	56 (18.2%)	22 (7.2%)	307

Table 6.4 Health workers opinions on amount of data collected

The above results indicate that the problem is not with quantity (too few or too many) data, but with the type and quality of data collected.

6.2.4 Opinions on Training Needs

Table 6.5 shows the numbers and percentages of health workers' opinions on training needs for the handling of data. It can be seen from the table that the level of strong agreement with the different training needs ranges from 64.8% to 77.4% with a mean percentage (regardless of type of training) strongly agreeing of 70.7%. Those just agreeing range from 21.2% to 31.1% with a mean of 25.6%. This shows that there is a staggering 96.3% of health workers agreeing in total that there is a need for training of one kind or another in the handling of data in the health service. This compares with only 1.0% in disagreement, while 2.9% are not sure whether they agree or not.

PARAMETER	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Total
There is the need to train health workers in the use of standard case definitions?	250 (72.5%)	79 (23.0%)	12 (3.5%)	2 (0.6%)	1 (0.3%)	344
There is the need for health workers to receive a formal training in data recording?	270 (77.4%)	74 (21.2%)	4 (1.1%)	1 (0.3%)	None	349
There is the need for health workers to receive a formal training in data analysis?	239 (68.1%)	93 (26.5%)	14 (4.0%)	4 (1.1%)	1 (0.3%)	351
There is the need for health workers to receive a formal training in data interpretation?	228 (64.8%)	109 (31.1%)	10 (2.8%)	5 (1.4%)	None	352
There is the need for health workers to receive a formal training in data reporting and use of data?	247 (70.6%)	92 (26.3%)	10 (2.9%)	1 (0.3%)	None	350
Mean % regardless of type of training	(70.7%)	(25.6%)	(2.9%)	(0.7%)	(0.3%)	

Table 6.5 Numbers and percentages of health workers opinions on training needs

6.2.5 Opinions on HIS Situations in The Gambia

Table 6.6 shows the numbers and percentages of health workers' opinions on the issues of HIS in The Gambia. The total percentage agreement on the issues was very high. Thus, "Development of HIS in The Gambia should be one of the top priorities", 87.8%, "The current health system needs improvement", 98.0%, "All health facilities need a new health information system", 89.9%. On the issue of "Electronic (computerised) patient records in health facilities is long overdue", 78.9%, "Electronic (computerised) health record is needed for everybody in the country", 70.3% and "It will be useful for everybody to have a National Health Service number", 84.3%. These results show that health information systems will be well accepted in The Gambia; (way ahead of Japan's 20 – 30% of hospital managers planning to introduce HospIS in Japan [32]).

PARAMETER	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Total
Development of HIS in The Gambia should be one of the top priorities.	190 (55.2%)	112 (32.6%)	36 (10.5%)	4 (1.2%)	2 (0.6%)	344
The current health system needs improvement.	271 (77.2%)	73 (20.8%)	5 (1.4%)	2 (0.6%)	None	351
All health facilities need a new health information system.	182 (52.6%)	129 (37.3%)	29 (8.4%)	5 (1.4%)	1 (0.3%)	346
Electronic (computerised) patient record in health facilities is long overdue.	155 (46.0%)	111 (32.9%)	55 (16.3%)	10 (3.0%)	6 (1.8%)	337
Electronic (computerised) health record is needed for everybody in the country.	115 (33.4%)	127 (36.9%)	61 (17.7%)	25 (7.3%)	16 (4.7%)	344
It will be useful for everybody to have a National Health Service number.	147 (42.7%)	143 (41.6%)	49 (14.2%)	4 (1.2%)	1 (0.3%)	344

Table 6.6 Numbers and percentages of health workers' on HIS situation in The Gambia

The corresponding percentages in disagreement on these issues were very low; 1.8%, 0.6%, 1.7%, 4.8%, 12.0% and 1.5% respectively. This indicates a big cry for change and/or improvement in the HIS situation in The Gambia to be addressed.

6.2.6 Institutional comparison of some important factors: Opinions of health workers

Table 6.7 shows the institutional comparison of some important factors and opinions of health workers in The Gambia. Areas that stand out are: "ever used a computer", "producing reports manually", and "ever trained in the use of standard case definitions?" with p-values of 0.000, 0.0000164 and 0.006177 respectively. It shows that there is a comparatively low percentage of government health workers (42.5%) who have ever used computers, as compared to 81.7% of health workers in the NGOs or parastatals. It was not too surprising therefore to note that only 31.4% of health workers in the NGOs/parastatls produce reports manually, while a high percentage 65.0% of health workers from government produce reports manually. NS means not significant statistically.

PARAMETER	Government sector	Private sector	NGOs / Parastatal	p value
% receiving any formal training in data reporting and use of data.	46.5%	60.0%	54.3%	NS
% ever used a computer	42.5%	58.3%	81.7%	0.0000000
% ever received formal training in any computer skills	29.3%	25.0%	64.8%	NS
% who are novices with computer ability	68.5%	70.0%	29.0%	NS
% producing reports manually	65.0%	85.7%	31.4%	0.0000164
% ever heard of health information system	55.4%	27.7%	41.1%	NS
% agreeing all health facilities need a new health information system.	92.3%	83.3%	85.3%	NS
% agreeing electronic patient record in health facilities is long overdue.	79.5%	54.5%	79.8%	NS
% agreeing electronic health record is needed for everybody in the country.	67.9%	75.0%	74.3%	NS
% agreeing, it is useful for everybody to have a National Health Service Number.	84.6%	91.6%	82.6%	NS
% of females	33.8%	72.7%	25.7%	NS
% ever trained in the use of standard case definitions?	48.4%	18.2%	32.7%	0.006177

Table 6.7 Institutional comparison of some important factors and opinions: numbers and percentages of health workers

It was interesting to find out that, institutionally, there were no significant differences between them on issues of "all health facilities need a new health information system" and "it is useful for everybody to have a National Health Service Number". However, all institutions had very high percentages of agreement on the issues making for a very strong nation-wide consensus on the issues.

There is a highly significant difference between the institution where the health worker worked and whether s/he has ever been trained in the use of any kind of standard case definitions, (p value < 0.006177). 48.4% of government health workers have ever been trained, compared to 18.2% of those from the private sector and 32.7% from parastatals / NGOs

There is a significant difference between the institution where the health worker worked and his/her level of education, although the Chi square value is reported as not valid, (p value < 0.00135)

Institution	Certificate	Diploma	B.Sc.	M.Sc.	PhD
Government	74.3%	17.3%	4.4%	4.0%	0.0%
Private	71.4%	0.0%	0.0%	2.9%	0.0%
Parastatals / NGOs	64.4%	11.9%	7.9%	10.9	5.0%

Table 6.8 Percentage level of health workers education in different health institutions

6.2.7 Influence of Training on Use of Computers

Table 6.9 shows the influence training could have on whether health workers use computers or not. It can be seen from the table that having received formal training of any kind in data handling or computer skills has a great impact on whether the health worker ever uses a computer or not (with highly significant p values from 0.0000 – 0.0002). For example, 94.2% of those who have ever received a formal training in computer skills have ever used computers (compared to 30.2% who have not received formal training in computer skills who have ever used computers). Those who have are 37.36 times more likely to use computers than those who have not received any formal training in computer skills. Similar arguments can be built for all the other factors in the table above, highlighting the message that receiving formal training in data handling and/or computer skills will greatly influence the use of computers by health workers. This is important in a world where, despite great leaps in computer technology, people are still technophobia and sceptical about the introduction of computers which is seen as coming to replace their jobs sooner or later.

PARAMETER	Response to parameter	% Ever used computers	Likelihood (No. of times)	p value
Receiving any formal training in data recording?	YES NO	68.6% 42.3%	2.99 times	0.00000102
Receiving any formal training in data analysis?	YES NO	71.8% 45.2%	3.08 times	0.00000165
Receiving any formal training in data interpretation?	YES NO	77.7% 43.4%	4.53 times	0.00000000
Receiving any formal training in data reporting and use of data?	YES NO	79.8% 56.6%	Chi square not valid	0.0020613* Not reliable
Ever received formal training in any computer skills?	YES NO	94.2% 30.2%	37.36 times	0.00000000
Do you use computer in your day to day work?	YES NO	87.9% 41.0%	10.48 times	0.00000000
Ever received any training since joining the health sector?	YES NO	64.6% 44.3%	2.30 times	0.00023359

Table 6.9 Influence of training on percentages of health workers ever using computers

85.7% of those who are intermediate or higher in their ability with computers agree that all health facilities need new health information system while 90.0% of those who were novices or complete beginners in their ability with computers agree that all health facilities need new health information systems.

6.2.8 Influence of Training on Day to Day Use of Computers

Table 6.10 shows the influence training could have on whether health workers use computers in their day to day work or not. Using similar arguments to those adopted in section 6.2.7 above, having received formal training of any kind has an impact on whether health workers use computers in their day to day work or not. For example, 65.7% of health workers who have ever received formal training in computer skills use computers in their day to day work as compared to 16.9% of those who do not have any formal training in computer skills. Those who have are 9.42 times more likely to use computers in their day to day work than those who do not.

PARAMETER	Response to parameter	% Using computers day to day	Likelihood (No. of times)	p value
Receiving any formal training in data recording?	YES NO	49.4% 27.1%	2.62 times	0.00008194
Receiving any formal training in data analysis?	YES NO	51.7% 31.1%	2.37 times	0.00038158
Receiving any formal training in data interpretation?	YES NO	56.2% 29.9%	3.01 times	0.00000871
Receiving any formal training in data reporting and use of data?	YES NO	62.0% 38.5%	2.61 times	0.00315178
Ever received formal training in any computer skills?	YES NO	65.7% 16.9%	9.42 times	0.00000000
Ever received any training since joining the health sector?	YES NO	47.5% 26.65%	2.50 times	0.00027911

Table 6.10 Influence of training on percentages of health workers using computers in their day to day work

6.2.9 Influence of Training on Processing / Analysis of Data

Table 6.11 shows the influence training could have on whether health workers process/analyse data or not. It can be seen again that receiving training of any kind influences whether a health worker does process or analyse results or not. Again, a good example is the fact that 61.7% of those receiving any formal training in data reporting and use of data are 3.55 times more likely to process / analyse data than the 31.3% of those who have not received that kind of training. The significant differences are very high (very low p-values).

PARAMETER	Response to parameter	% processing / analysing data	Likelihood (No. of times)	p value
Receiving any formal training in data recording?	YES NO	65.6% 32.5%	2.77 times	0.00001422
Receiving any formal training in data analysis?	YES NO	59.3% 28.6%	3.65 times	0.00000005
Receiving any formal training in data interpretation?	YES NO	59.8% 30.0%	3.48 times	0.00000021
Receiving any formal training in data reporting and use of data?	YES NO	61.7% 31.3%	3.55 times	0.00010608
Ever received formal training in any computer skills?	YES NO	52.3% 32.8%	2.25 times	0.00053236
Ever received any training since joining the health sector?	YES NO	47.2% 30.9%	2.00 times	0.00362191

Table 6.11 Influence of training on percentages of health workers processing / analysing data

6.2.10 Influence of Training on Method Used for Producing Reports

PARAMETER	Response to parameter	Manual reporting	Use computer	Both	p value
Receiving any formal training in data recording?	YES NO	43.2% 70.7%	31.0% 19.2%	25.8% 10.1%	0.00001148
Receiving any formal training in data analysis?	YES NO	39.8% 68.3%	34.3% 18.7%	25.9% 13.0%	0.00007943
Receiving any formal training in data interpretation?	YES NO	40.4% 67.2%	34.3% 16.4%	25.3% 13.4%	0.00025443
Receiving any formal training in data reporting & use of data?	YES NO	34.2% 61.4%	39.5% 20.4%	26.3% 18.2%	0.01395642
Ever received formal training in any computer skills?	YES NO	23.5% **81.8%**	47.1% **7.9%**	29.4% 10.3%	0.00000000
Ever received any training since joining the health sector?	YES NO	45.5%	31.3%	23.2%	0.00065922
Ever used a computer?	YES NO	37.0% **84.2%**	37.0% **7.9%**	26.0% 7.9%	0.00023359
Do you use computer in your day to day work?	YES NO	12.9% **84.2%**	53.8% **6.1%**	33.3% 9.7%	0.00000000

Table 6.12 Influence of training on percentages of health workers' method of producing reports

Table 6.12 shows the influence training could have on what method health workers use when producing reports. It is evident from the table that having received training of any kind has an impact on the method used by the health worker to produce reports; manually, use computers, or both. Higher numbers or percentages of health workers who have not received training of any kind produce reports manually than those who have. For example, 81.8% of those who have not received formal training in computer skills produce reports manually as compared to 23.5% of those who have. The significant differences are very high (very low p-values).

Having established the impact of training on the use of the computers and their day to day use by the health workers, it is not surprising to see a very high percentage (84.2%) of health workers who do not use computers in their day to day work producing reports manually. The same is true for "ever used a computer", 84.2% produce reports manually this being highly significant too.

It is worth mentioning here that 96.7% of those who produce reports manually agree that there is the need for the HWs to receive formal training in data analysis. Similarly, 86.4% of those who produce reports using computers agree, while 93.2% of those who produce report using both manual and computers agree as above.

6.2.11 Influence of Training on Views of Electronic Health Records

Table 6.13 shows the influence training could possibly have on the views of health workers concerning the need for electronic patient records to be put in place.

It has become apparent that having received formal training of any kind has little influence on the views of health workers on issues in the health service as can be seen in the percentages agreeing that there is the need for electronic health records. Apart from formal training in data recording with a border line of significance (p-value 0.0481; approximately 0.05), all others are not significant. This indicates the independence of the health workers views on electronic health records from having received of formal training of any kind.

The message here is a loud cry or need for electronic health records; 62.6 – 80.5% of health workers country wide.

PARAMETER	Response to parameter	% agreeing need for electronic health records	p value
Receiving any formal training in data recording?	YES NO	74.7% 64.8%	0.0481
Receiving any formal training in data analysis?	YES NO	72.0% 68.1%	0.4012
Receiving any formal training in data interpretation?	YES NO	73.0% 68.3%	0.6268
Receiving any formal training in data reporting and use of data?	YES NO	80.5% 62.2%	0.2803
Ever received formal training in any computer skills?	YES NO	70.1% 69.2%	0.9755
Do you use computer in your day to day work?	YES NO	70.3% 69.3%	0.3363
Ever received any training since joining the health sector?	YES NO	70.3% 70.1%	0.4399
Your ability with computers?	Intermediate/+ Beginner / -	69.6% 72.6%	0.9796
Do you collect data as part of your routine work?	YES NO	70.2% 71.4%	0.8565
Do you process or analyse data?	YES NO	73.1% 68.6%	0.7605
How do you produce reports?	Manually Use computer	69.0% 71.7%	0.5348

Table 6.13 Influence of training on percentages of health workers agreeing that electronic health records are needed

6.2.12 Influence of Training on Views of National Health Service (NHS) Number

Table 6.14 shows the influence training could possibly have on the views of health workers concerning the need for a national health service (NHS) number to be put in place.

PARAMETER	Response to parameter	% agreeing need for (NHS) Number	p value
Receiving any formal training in data recording?	YES NO	86.0% 81.7%	0.0893
Receiving any formal training in data analysis?	YES NO	83.3% 84.3%	0.0859
Receiving any formal training in data interpretation?	YES NO	82.2% 85.6%	0.0490
Receiving any formal training in data reporting and use of data?	YES NO	87.2% 81.5%	0.4257
Ever received formal training in any computer skills?	YES NO	82.1% 85.9%	0.6261
Do you use computer in your day to day work?	YES NO	81.7% 84.7%	0.1739
Ever received any training since joining the health sector?	YES NO	85.6% 84.7%	0.8721
Your ability with computers?	Intermediate/+ Beginner / -	82.6% 86.1%	0.3872
Do you collect data as part of your routine work?	YES NO	86.5% 79.8%	0.3760
Do you process or analyse data?	YES NO	88.8% 81.5%	0.0712
How do you produce reports?	Manually Use computer	87.3% 86.7%	0.3502

Table 6.14 Influence of training on percentages of health workers agreeing that national health service (NHS) numbers are needed

It has also become apparent that having received formal training of any kind does not exert much influence on the views of health workers on issues in the health service as can be seen in the percentages agreeing that there is the need for national health service number. Apart from formal training in data interpretation with a border line of significance (p-value 0.0490; approximately 0.05), all others are not significant. This indicates the independence of the health workers views on national health service number from reception of formal training of any kind. The message here is also a loud cry or need for a national health service number system to be introduced; 79.8 – 88.8% of health workers country wide.

It is interesting to note that 77.7% of HWs who agree that electronic (computerised) patient records system is long overdue also agree that the electronic health record is needed for everybody in the country. Surprisingly, 40.0% of those who do not agree or are not sure that an electronic (computerised) patient record system is long overdue still believe that an electronic health record is needed for everybody in the country.

Also, 90.0% of HWs who agree that an electronic (computerised) patient record system is long overdue also agree that it will be useful for everyone to have a national health service number. A reasonably high figure of 64.8% of those who do not agree or not sure that electronic (computerised) patient record system is long overdue still believe that it will be useful for everyone to have a national health service number.

Similarly, 92.4% of HWs who agree that electronic (computerised) health records is needed for everybody in the country also agree that it will be useful for everyone to have a National Health Service number. A reasonably high figure, 67.6% of those who do not agree or not sure that electronic (computerised) health records is needed for everybody in the country still believe that it will be useful for everyone to have a national health service number.

Also interesting is the fact that 85.7% of those who are intermediate or higher in their ability with computers agree that all health facilities need new health information systems. 90.0% of those who were novices or complete beginners in their ability with computers agree that all health facilities need new health information systems.

6.2.13 Impact of ever receiving training since joining health sector on health workers views of certain factors

Table 6.15 shows what impact, if any, ever receiving training since joining the health sector could have on the health workers' views of certain important factors concerning them and the health service as well as overall percentages of those who agree. It can be seen from the figures in the table that whether the health worker has received training since joining the health sector or not does not have any impact on the views they hold about issues concerning them and the health service. All p-values are much further from the significance value of 0.05 indicating non significance, but stressing that the views are independent of the factor "ever receiving training since joining the health sector". Thus, there was no difference between those who had and those who had not received training.

PARAMETER	% who agree	p value
% agreeing that there is the need for health workers to receive formal training in data recording.	98.6%	0.4803
% agreeing that there is the need for health workers to receive formal training in data analysis.	94.6%	0.0884
% agreeing that there is the need for health workers to receive formal training in data interpretation.	95.9%	0.2426
% agreeing that there is the need for health workers to receive formal training in data reporting and use of data.	96.9%	0.8134
% agreeing that development of health information system (HIS) should be on of the top priorities in The Gambia	87.8%	0.3617
% agreeing that the current health system need improvement.	98.0%	0.8233
% agreeing that all health facilities need a new health information system.	89.9%	0.3626
% agreeing that electronic patient record in health facilities is long overdue.	78.9%	0.6981
% agreeing electronic health record is needed for everybody in the country.	70.3%	0.4399
% agreeing, it is useful everybody having a National Health Service Number.	84.3%	0.8721

Table 6.15 Impact of ever receiving training since joining health sector on health workers views of certain factors

The high percentages (94.6 – 98.6%) of health workers (irrespective of having received training before or not) agreeing to the need for formal training of health workers in different areas of training in data handling signifies the urgency and importance of training. This training is needed to improve the health workers themselves and directly or indirectly for the improvement of patient care and healthcare in general. The same argument can be put forward for the urgency and importance for the improvement of the current health system, need for electronic patient record, electronic health record and the national health service numbers.

6.2.14 Deductions from the Quantitative Analysis

There is an urgent need:

- For formal training in all areas of the health sector particularly dealing with data collection and analysis. Results of the questionnaire analysis as indicated in tables 6.5 and 6.15 supports this deduction. During one of the interviews one of the health professionals said "... the divisional health teams are week, they don't have the capacity to manage healthcare delivery as staff are not trained" (see appendix 6.H.2).
- For the development of HIS to be considered as one of the top priorities in The Gambia. Results of the statistical analysis on the questionnaire as indicated in tables 6.6 and 6.15 supports this deduction. These results also support the next five urgent needs below. The tables show the numbers and percentages of health workers' opinions on the issues of HIS in The Gambia. The total percentage agreements on the issues were very high. Thus, "Development of HIS in The Gambia should be one of the top priorities", 87.8%. For improvement in the current health system, 98.0%.
- For the introduction or establishment of a health information system in all health facilities, 89.9%.
- For an electronic (computerised) patient records system to be put in place; 78.9%.
- For the introduction of electronic (computerised) health records for everybody in the country, 70.3%.
- For the introduction of a national health service number for everyone in the country, 84.3%

These results show that health information systems will be well accepted in The Gambia. The argument from some of the key tactical managers during the interviews however, is that there is lack of manpower and funding coupled with lack of infrastructure and stable electricity to support these urgent needs. One interviewee put it this way, "... it has been talked about for a long time but basically the overall delay has been the unavailability of resources to implement some of the recommendations of the earlier reviews.

Problem areas or limiting factors to the HIS development are:

- Low level of education. Table 6.8 supports this claim.
- Lack of training for people in the health sector (no comparison with other sectors). Results as indicated in table 6.1 supports this as well as appendix 6.H.2 third paragraph.
- Keeping or running of medical records units. Results in Table 6.2 shows that only 56.7% of request ever made were attended to and that only 31.8% were satisfied with the response to the request made to the medical records office(s).
- Gender.
- Communication

Some of the arguments raised for and against the problem areas to the development of HIS can be found in section 6.3 below and appendix H.

6.3 Interviews with Key Tactical and Strategic Personnel: Outcome

Over 50 key programme and unit managers were interviewed on various issues that directly or indirectly affect the provision of patient care in particular and healthcare delivery in general. There were strong personal views on issues but in the majority of cases there were basic agreements about constraints that they believe have an impact on the development and improvement of the health information system and health sector in general.

A list of the key people interviewed and their institutions can be found in Appendix E. Major extracts of the outcomes of this interviews have been documented and can be found in Appendix H. However, summaries of the view points from these extracts have been presented below:

In terms of why they think there are delays in any form of implementation, some said: "I think when you talk about developing anything you talk of manpower availability, availability of resources and maybe the will. It has been talked about for a long time but basically the overall delay has been the unavailability of resources to implement some of the recommendations of the earlier reviews."

In terms of problems and weaknesses in the present health system:

- In the majority of cases people thought lack of integration and staff shortage, high attrition rate, training and education, attitude of the people and lack of funds were the major problems and weaknesses in the present health system.
- There exist currently a number of vertical programmes, and related agencies or units, which have information and reporting requirements that are not integrated with the central HIS. This multiplicity of parallel systems has resulted in duplication of reporting and incompatible databases, which make information sharing difficult if not impossible.
- That at the basic health facility there is limited staff and limited capacity to be able to manage data, the necessary tools, data collection forms sometimes are not available. Where they are available, the people are not properly trained to collect the required and quality data.
- In the absence of a Master Plan for a health management and information system and a coherent organisational structure, there is little or no coordination among the programmes and managers of the various units. This is leading to duplication of effort and expenditure, unplanned software and hardware purchases and no provision for maintaining and troubleshooting equipment.
- That the divisional health teams are weak, they don't have the capacity to manage healthcare delivery as staff are not trained and also non availability of resources to provide the necessary forms for data collection and management. They do not have enough employed data entry clerks to cope with all the information which are generated from the field to put into a computer. The software they have is not the best.
- Most young people are identified, employed, given some In-service training, and just when you think they are competent to be able to take on a little bit more responsibility, they are off. A lot of them get scholarship to go abroad privately, from their own resources or otherwise or they get employed by other competitors, private sector, MRC and other NGO's etc.. They want to progress.
- In some cases there is disparaty in remuneration in that the laboratories under the Department of State won't get allowance whereas those under the hospital Board do.

So you have that kind of inequity in remuneration although they are all doing the same laboratory work, they all have the same responsibility.

- There are no properly coordinated existing health information systems in The Gambia; neither electronic nor properly established paper based systems. NGOs and other charitable organisations have different and separate systems that are not directly integrated into The Gambia National Health Service and no proper integration of the different health centres' facilities. There is actually nothing one can even call a National Computer Network in the country.
- There is no existing national enforcement of the registration of births, marriages and deaths and no proper training of staff dealing with records. There is no properly established national Health Information Systems' policy in place although a draft policy has been produced quite recently in April 2002 which is yet to be finalised and approved by all concerned.
- The telephone systems in The Gambia used to be one of the best in the sub-region but are presently deteriorating without any signs of being saved from total collapse. Without much money poured into its sustainability the telecommunications system will in the not too distant future be counted as one of those that are far behind the latest technology.

They all agreed that there are delays in sending or receiving reports from each other. Some of the reasons given are that there does not seem to be much linkage between the different health units.

To improve the situation, most thought they should make sure that the units are linked properly; that there should be a well established recording system, a reporting system and an integrated system so that they all know they are part of one system and have to report to each other.

It was agreed by many that the laboratory plays a major central role or pivotal role in the national healthcare and information system of any nation. Because that is where you get the confirmatory evidence of what disease patterns are, what are the infectious and non-communicable diseases etc. The information is what will truly guide policy. And also for management of patients it is absolutely important. That the collection and the data management in the laboratory needs a lot of support so that it can be strengthened.

"For year 2001 for personnel we have 1,858 people not including the hospitals, subtract 33 people for Women's Bureau; this excludes the 250 Cuban doctors, the Egyptian doctors and the Nigerian doctors. RVH 902, Bansang 309, Farafenni 229, Bwiam 194. Not yet opened but have made provision for it" says the Permanent Secretary for Health.
So, actually in the country we are talking about 1,858 plus 902 plus 309 plus 229 plus 194 to make the people who are really in the health service. "Yes, it is very close to 3,000 plus and if we take the cleaners and messengers, it will be heading towards 4,000."

Does your Ministry or the Government rely heavily on this information received from various health sectors of the ministry when making high level decisions or policies?

"Indeed, yes, we rely very seriously on that and that is why we are not getting much of an assistance both from Government and our development partners because we don't have the statistics readily available. Currently, we are working on our public expenditure review (PER) and part of this public expenditure review is this information on health financing. If the details were available somewhere the work on the PER would have been completed by now – the target was June but because these are not available they are now going back to the grassroots for details and without a PER we cannot access additional Government funds, just some. We cannot argue very strongly for a substantial increase in the health budget without the information."

In terms of patient care and healthcare in general, a lot of diverse areas were suggested, but virtually all of them mentioned strengthening the information system as one of the keys to a successful healthcare improvement. They did not generally consider it as the top-most priority, although one person did and commented that, "I think no.1 because information is power. It is on the basis of information that we come up with our policies, our plans, our interventions".

The Planning Unit was also mentioned as one area which needs a lot of strengthening because they believe is the backbone and if the people there have the training they can provide the guidance to all other units.

There were other diverse views, but most of the views centred around people wanting to have more trained staff to take care of the patient as being one of their major problems now and therefore needing attention. The other thing is the constant availability of drugs.

6.4 Action Research (Observational study)

The action research concentrated on gathering further information about the departments in the three main hospitals in The Gambia and various other health units and their operational activities that are likely to have an impact on the introduction of the HIAS. In addition general observations about conditions and the day to day activities of the health workers in various health units in the country were undertaken. The observations can be found in Appendix I sectioned 6.I.1, 6.I.1.1 – 6.I.1.13 and 6.I.2, 6.I.2.1 – 6.I.2.6.

Major areas that were observed included:

- Records clerks daily ward rounds;
- Registration of patients;
- Admission and discharge register;
    - Theatre / anaesthetic register and patient consent forms;
    - Discharge of patients;
    - Hospital ledger;
    - General and records office principles;
    - Forms and record book;
- Accident and emergency cases;
- Diabetic and hypertension clinics;
- Antenatal clinics;
- Children and other wards;
- Out- and in-patient departments;
- Pharmacy and drug administration;

- Admittance and referrals; and
- General observations in health units.

The information gathered were useful in the thinking process and were given the necessary consideration during the requirements analysis and the design specification process.

6.5 Summary

In this chapter the analysis of the study's survey questionnaire data, the relevant results obtained and its interpretation has been described. These included:

- frequencies of training received and experience in IT;
- frequencies of routine work undertaken by health workers;
- opinions on amount of health data collected, opinions on training needs;
- opinions on HIS situations in the country;
- institutional comparison of some important factors;
- influence of training on the use of computers;
- influence of training on day to day use of computers;
- influence of training on processing/analysis of data;
- influence of training on method used for producing reports;
- influence of training on views of electronic health records;
- influence of training on views of national health service number; and
- impact of ever receiving training on health workers views of certain factors.

The deductions made from these results and interpretations were also presented.

The important issues picked from interviews given to the key strategic and tactical people (unit managers, directors, permanent secretary etc.) were also presented.

The findings of the action research (observational study), which mainly described the observations made at the different departments of the hospitals and health centres and how they operate have also been described.

CHAPTER 7

REQUIREMENTS ANALYSIS

Having analysed the survey data and interpreted the results obtained, this chapter describes the requirements analysis that has been made based on some of those results and information obtained from the field study. This includes the overall health information and administration system's (HIAS) functional requirements as well as the overall HIAS non-functional requirements that encompass the support and coordination activities and the basic system's operational requirements. The procedure/workflow requirements, database and hardware (both functional and non-functional) requirements are also described.

The various functions of the health information system for The Gambia are looked at; that is, the "what" of the system and the necessary structure needed for its effective performance. There is also consideration of what the structure and the organisational material and resources needed for the system are like.

The proposed HIAS is divided into two functional areas namely a proposed Health Information System (HIS) and an accompanying Health Administration System (HAS). A top-down approach is adopted in discussing the functional and non-functional requirements of the proposed HIS and its accompanying HAS. First, there is a look at issues from the contextual point (national overview), then the tasks and processes of the systems (workflow), followed by software needs, and finally the hardware configurations necessary to achieve the HIAS objectives.

7.1 Overall HIAS Functional Requirements

One of the areas to consider in the development process is the functional requirements (i.e. what the HIAS should do and what should be expected of it). To implement an HIAS successfully for The Gambia, a number of key requirements have to be met. These requirements are discussed below.

The proposed system must incorporate the data and information flows in both operational and administrative functions of an HIS – to ensure meeting reporting needs at the operational, tactical and strategic levels.

There should be the daily collection and recording of data in all health units involved in the day to day care of patients. This is to ensure there is no piling up of daily records and to prevent delays in the sending of data to the DHTs for processing and forwarding to the central database at the ESU.

It is imperative that there is provision of monthly divisional information to the Epidemiological and Statistical Unit (ESU) from the Divisional Health Teams (DHTs) and the three major government hospitals; for example the number of patients attended to and treated, number of deliveries, deaths, referrals, types of diseases diagnosed, logistics used and costing, etc. There must also be a supply of monthly information to the ESU from the NGOs, private hospitals and clinics, detailing the parameters already mentioned for the DHT (but not necessarily logistics used) and costing. The monthly provision of the data is to enable the ESU to have a timely collation and analysis of the health data provided and to update the national health database for the timely preparation of reports and information provision for decision making.

It is also imperative to have a daily or least weekly despatch of drug administration information to the ESU – to give an indication of stock levels and to prevent national shortages. This is because one of the backbones of good patient care is the availability of the right drugs at the time when they are needed and the place where they are needed. The Gambia's health system has been hampered by drug shortages because of inadequate forecasting, hence the need for frequent information on stock piles.

There must be daily to monthly data analysis by each DHT covering key health indicators (epidemiological data) for the division. This should be done as and when they received daily data or weekly data from health units under their jurisdiction. This will ensure that the monthly target for the provision of divisional information to the ESU is met. The information should be passed on to the ESU by the middle of the following month. This will give time for health centres to bring in any remaining batches.

There must be a daily or weekly despatch of stock data from the National Health Laboratory (NHL) to the ESU in order to avoid encountering situations of possible shortages in logistics (such as biological reagents) needed by the laboratories.

There is the need for proper monitoring of the financial activities of hospitals, dispensaries, major and minor health centres. Guidelines and a code of adherence must be introduced to ensure the success of the Drug and Cost Recovery Programme, among others.

Epidemiological data must be sent from each DHT to the ESU at prescribed intervals to ensure that all processing is carried out uniformly to give coherence to outputs derived (including comparative analysis). Thus, there must be reasonable uniformity in the timing as well as the format in which the data are sent to the ESU by the DHTs and also other units required to send data. This reduces time scales in processing, that is collation and analysis.

The Census/Population office, Nutrition Unit and the National Environmental Agency should make available demographic and other relevant data to the ESU to enable the unit to properly discharge its duties (especially its planning and advisory roles). Since the information needed from these units is not critical to day-to-day patient care, they can be sent to the ESU on a quarterly or bi-annual basis and/or when it is deemed necessary or requested.

Transport and other logistical data are required from DHTs to produce the monthly infrastructure usage report. The added reason for such insistence is for patient and health worker safety (with regards to working environments, ambulances, mobile clinics, motor bikes etc.) and service reliability. Apart from such information helping the DHTs in their own operational planning, the distribution densities will aid policy makers in targeting neglected or under-performing regions.

7.2 Overall HIAS Non-functional Requirements

What is required is a cohesive, robust and adaptable system, capable of delivering information that is accurate, timely, appropriate and very importantly, providing a mechanism for supporting and/or improving decision-making at the district, divisional and national levels. Without this, the whole HIAS will be bogged down with delays, misinformation or a complete breakdown in communication (that is, no information when needed). Specifically, the benchmarks indicated below should be recognised and put in place.

For efficiency and high throughput, there should be a harmonisation (not necessarily uniformity) of computing resources of the units (hospitals, DHTs, etc) identified in the conceptual model described in chapter 4. Specifically, there should be hardware compatibility and as far as possible compatibility of the software. This may include interfaces for data conversion into required formats for national use or the processing system should identify the source of the information (eg. NGOs) and process the data in a predetermined way.

For a system of the magnitude proposed, security is of prime importance. The system should be capable of addressing security needs irrespective of configuration selected – both within units and subsystems, as well as for the different relationships found in the tables emanating from a database implementation.

Data being entered into the database need to be standardised irrespective of their source (ie whether from hospitals, DHTs, etc). This will save precious time that would have been spent re-formatting data and data transfer.

With the different levels of data collection and processing already existing in respect of the players to the proposed HIS, there needs to be a government policy to serve as a means to regulate, facilitate and coordinate the release of required information to the processing points. Without such a policy (directive), information sharing will be politicised by different players – with each party trying to protect their intellectual property.

Areas of existing health focus like malaria and AIDS where certain institutions have done considerable research such as the UK's Medical Research Council Laboratories in The Gambia will be obliged to make information available to fuel the national HIAS effort of the government.

Inadequate intellectual resources (in terms of content and numbers) both in health information and computing knowledge will require a radical re-training, training and education strategy to make the investment in a computerised system worthwhile.
The objective of such a strategy is four-fold:

- To address deficiencies in the capabilities of the health workers currently employed – whether in data collection, recording, analysis or interpretation.
- To boost the numbers of those involved in the HIS – to bring manpower to the different levels of the proposed HIS.
- To bring an awareness and appreciation of information issues, and in particular, the value, flow and timeliness of health information.
- In the longer run, to magnify the impact of decision-making of health-sector executives and provide government with a healthy health-care policy and approach.

Worthy of particular mention is the training of trainers. This has a multiplier effect that has been very successful and effective in dealing with grass-root populations.

There is the need for more public health workers. Unless measures are taken to employ more of the right calibre of health workers (through recruitment campaigns), the data collection, recording and some analysis functions will be characterised by inaccuracies, inconsistencies, and severe manpower shortage. This obviously creates data management problems and flaws the whole system.

In the long term, providing data entry clerks to each DHT will speed data entry and transmission, and will ensure more rapid, accurate and timely data analysis. While the latter may not be immediately possible, it must be considered as a priority for the near future.

There are other logistical requirements. This is because, with a large rural population, coupled with poor infrastructure and problems of accessibility to these areas, it is imperative that appropriate transportation is made easily available to health workers to facilitate the collection of relevant data.

To make a computerised HIAS operational and effective, workflows need to be clearly defined for the following reasons:

- Easy identification of data sources for proper data collection.
- Proper determination of what needs to be recorded. The collation process becomes important in this regard – to pool together data from different sources.
- Establishment/provision a suitable harmonised format for data recording.
- Setting out the type of processing necessary for different types of data.
- Ensuring output sets required are actually produced – whether categorised health information, activity reports or other – at the appropriate place and time.
- Putting checks in place to identify errors and omissions as far as possible.
- Having a mechanism to correct errors in a quick and efficient manner.

Despite problems with name similarities, unknown birth dates (by patients themselves) or inadequate registration information on births, marriages or deaths, the government should bear the responsibility of ensuring that every health facility henceforth collects and records this information, if the proposed HIS is to effective.

7.2.1 Support and Coordination

Certain basic requirements must be met before any data collection system is to function efficiently. First of all there should be the willingness of the health personnel to participate and any training should address that issue including that of staff attitudes. It must be recalled that the willingness and staff attitude problems are some of the issues raised during personal communications with the Medical Records Officer at the Royal Victoria Hospital as well as during some of the fieldwork interviews. Another important issue will be the maintenance of the accuracy and timeliness of the data reporting. In order to minimise the problems in these areas, consistent long-term supervision, by both DHTs and the ESU, must also be carried out diligently.

The senior level management of the Department of State for Health (DoSH), including the Director of Health Services, the Director of Planning and Information as well as the Permanent Secretary, need to be aware of their roles and responsibilities in making the proposed HIAS work.

In order to properly receive the information that is necessary for monitoring and evaluation of programmes, for planning and for management of resources, the DoSH must provide the DHTs and the ESU with the basic ingredients of the system. These must essentially include supplying personnel, equipment and stationary items needed to produce the data collection instruments as well as the equipment and technical support to maintain and analyse the database.

There must be a mechanism for proper and smooth inter-working between the DoSH and all stakeholders to maximise the success of the HIAS.

7.2.2 Basic Systems Operational Requirements

Feedback: An effective feedback mechanism is very essential and must be put in place. System performance cannot be monitored otherwise. Also, morale is lowered (to keep to standards) when the usefulness of an exercise is not seen by those making an input into the system. It is important in the case of The Gambia to see if the system is working at the grassroots level (understood by the health workers).

Modularity: An HIAS is not an end in itself, but forms part of a growing awareness of governments of the need for sustaining and improving the nation's workforce in the most rational ways possible. The proposed HIAS should be compatible with future healthcare applications such as the national health system.

Integrity: For some stakeholders, there may already be established data structures and reporting requirements in place. It is therefore important to harness the data in a seamless fashion, while maintaining the uniqueness of the data.

Scalability: As information needs become more complex and even more demanding, the HIAS should have the capacity to accommodate new and modified reports and also enable new HIAS related functions to be carried out smoothly. With the growing population and possible development towards the rural sector it is likely for the system to be tasked for expansion in some few years time. Equipment and software to be recommended should take this into consideration to reduce or avoid strains caused by an increasing number of applications.

7.3 Procedure / Workflow Requirement

As the workflow gives a description of the sequence of tasks being performed, it is important that these tasks are clearly defined and placed in a proper sequence. In addition, it is imperative that those, whose job functions relate to these tasks, should have a proper understanding of their roles and the importance of these roles. Identified areas of emphasis are itemised below.

- The identified health indicators should be categorised, with each division, health centre, hospital and other data recording centre handling some statistics.

- The proposed system must clearly identify what data are processed and at what level.

- There is the need to follow guidelines in health indicator reports to use standardised calculations for arriving at values. This will make it easy to perform comparative analysis.

- There is a need for proper training in the data management tools.

- There must be clearly defined subsystems and categorised information.

- Subsystems need to be functioning properly – reliability, dependability, accuracy, conciseness, appropriateness and timeliness of data.

- Environmental medical records are required for information in appropriate areas against epidemics.

- Proper data collection and recording techniques are required.

7.4 Database Requirement

At the core of an HIAS is a health database into which relevant data from all identified health units are entered, and from which emanates the valuable information for policy makers and administrators. The health data may be needed operationally to support the proper care of the very patients from whom the data were obtained. Bearing in mind that a national database is being proposed, the requirements enumerated below become very important.

- The database should incorporate all information to generate health indicators.

- Data (the final and verified) should be streamlined to prevent double entry.

- To effectively manage a system of this magnitude, a database management system (DBMS) must be implemented on high-powered robust equipment and in a fail-safe environment.

- Being a mission-critical application at the main server (ESU) end, will require the system to be online at all times.

- Data communication needs to be carried out in the most economical and yet efficient manner. The current ICT environment/infrastructure in The Gambia lends itself to the use of Internet protocols expanding for remote access.

- The database will mimic the processes in the HIS and HAS.

- The DBMS must cater adequately for data security and integrity issues. As DBMSs are built to service databases, it removes some of the headaches/challenges of moving a multiple database presenting, in this case health information system and health administration system's database.

- It is inconceivable to have a DBMS without a database administrator (DBA) or HIS Administrator to manage the database or database server. It is therefore imperative to identify and train someone to handle the DBMS, networking, relational databases, SQL, backups and restore processes and who very importantly, has a good understanding of the underlying HIS processes.

- At the same time, the computerised facility for data processing should create unique identifiers from a combination of name and other data such as health unit and date.

- The creation of a unique identifier must be standardised. The system should be interrogated when one such identifier is created to ensure that it does not already exist.

- There must be the provision of some form of transportation to assist health workers (TBAs/VHWs/CHN) in the discharge of their duties.

7.5 Hardware Requirement

7.5.1 Functional Aspects

The hardware configurations envisaged for the HIAS will differ based on operational loads per district or hospital with future growth considered in their choice. It is worth noting that with the rate of Information and Communication Technology (ICT) development, equipment costs have been markedly reduced making systems affordable with configurations that far exceed projected needs. System upgrade costs are relatively marginal. It therefore makes good business sense to purchase equipment that may serve or cater for new (undetermined) applications in the future. Irrespective of capacities and processing power, the following general functional requirements are necessary.

- There must be proper treatment of security considerations – with passwords, lock-outs, aged accounts (to prevent unauthorised access), firewalls (to prevent hacking) and anti-virus protection;

- There must be a Central File Storage with areas for local (individual client) processing, public (common access) domain, and applications / software;

- There must be printing facilities at the ESU (shared printing for its electronic data processing (EDP) / database), as well as local (health units) printing.

- There must be email (for quick and cheap communications and more capability confidential information sharing and exchange);

- There must be user access to the Internet (modem facilities);

- There must be a News / Discussion Groups facility;

- There must be backup and archive facilities. Secondary CPU, tape and disk main storage devices to enable information access and trend analysis to be carried out as necessary need to be provided – as a guide to policy formulation.

- There must be easy administration of hardware resources and operating system resources.

- There must be a Dial-in service facility to provide an on-demand service and not a 24-hour (round the clock) service to reduce overheads.

7.5.2 Non-functional Aspects

In addition to the above hardware functional requirements, a number of non-functional requirements need to be stressed for The Gambia. The following non-functional hardware requirements should also be satisfied.

- The equipment must be located within secure premises to prevent theft, fire and damage.

- The system must be easy to use, as any complex system would not be utilised.

- Support must be readily available in terms of trouble shooting, maintenance and repairs of equipment, therefore systems should be known locally. This way any system crashes can be accommodated.

- There must be suitable recording, storage and archival system.

- Reliability becomes very important to reduce any down-time (Mean Time Between Failures (MTBF) and Mean Time To Repair (MTTR)).

- The power supply must be stable and standby facilities should be available at each processing point; The Gambia has power outages, so generators and uninterrupted power supplies (UPSs) are essential.

- Protection from lightening, especially in the rainy season, is very important in The Gambia; this is especially in cases where modems are in use. Equipment has, on occasions been damaged through the phone connectors.

- Equipment must be kept in an air conditioned environment (or at least, in a well ventilated, clean and cool environment(s)). This is very important for equipment in the outlying DHT offices.

- There must be sufficient and relevant documentation to assist in operating and/or supporting the equipment;

- A telephone facility must be in place to permit dial up, email and Internet use.

For the data collection instruments it is important to ensure that every DHT has a functioning photocopier and paper for form reproduction. Since there is still the use of stencils for form production, there is the need to ensure that each DHT has a functioning stencil duplicating machine and is adequately provided with stencils and ink. With regards to the equipment and technical support it is essential that each DHT is supplied with a Pentium 4 computer and monitor, printer (same or another that can cut stencils), diskettes and telephone service for communication with ESU.

7.6 Summary

In this chapter, the requirements analysis, based on results and information obtained from the field study, has been described. The overall health information and administration systems (HIAS) functional requirements as well as the overall HIAS non-functional requirements and the basic systems operational requirements have been discussed. The procedure/workflow requirements, database and hardware (both functional and non-functional) requirements have also been described.

A top-down approach has been used in discussing the functional and non-functional requirements of the proposed HIS and HAS. The issues were looked at from the contextual point (national overview), then the tasks and processes of the systems (workflow), followed by software needs, and finally the hardware configurations necessary to achieve the HIAS objectives. The next chapter will go on to consider the design specification.

CHAPTER 8

DESIGN SPECIFICATION

The previous chapter described the requirements analysis which included the overall health information and administration system's (HIAS) functional and non-functional requirements, the basic systems operational requirements, the procedure/workflow requirements, database and hardware (both functional and non-functional) requirements. Having done that, this chapter presents the design specification of the proposed system. This considers the stakeholders involved and discusses the overall Health Information System (HIS) model proposed for The Gambia as well as the Health Administration System (HAS) component that goes with it. Work flow and Data flow diagrams for the HIAS are presented as well as their narratives. The Data Model (Logical Data Structure) and its entity description are specified. The network database configuration and the hardware configuration are also presented.

8.1 Overall HIS and HAS Stakeholders

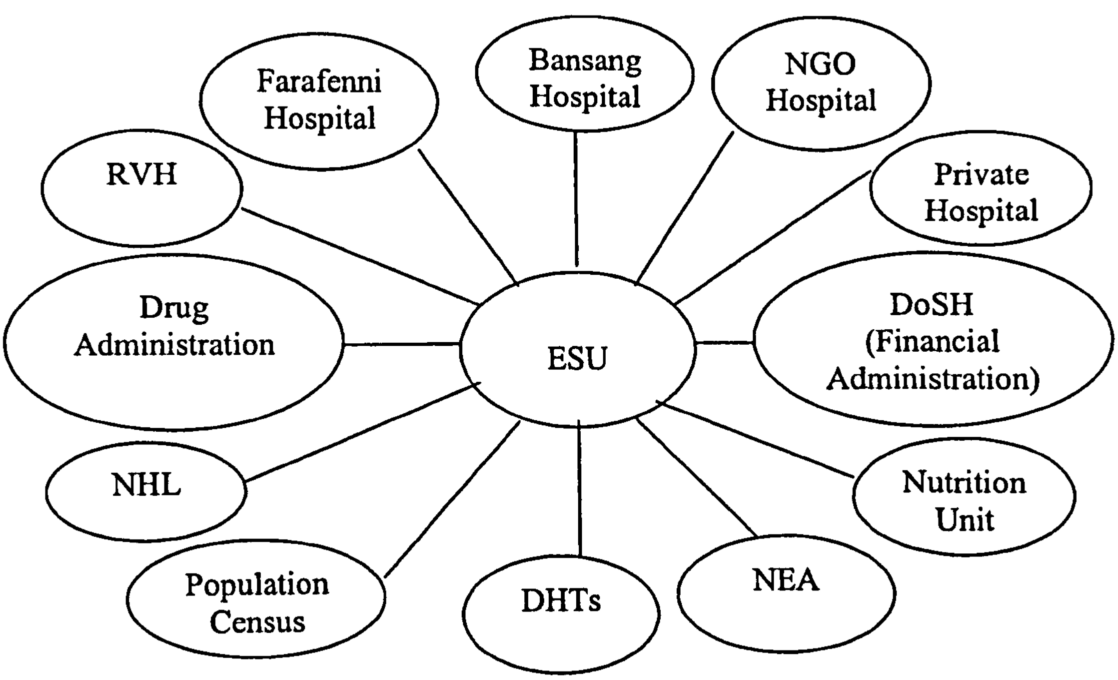

Figure 8.1: Overall HIAS: Stakeholders

The stakeholders of the overall HIAS (as shown in figure 8.1) will consist of those in charge of the three government hospitals in the country (Royal Victoria, Farafenni and Bansang hospitals), NGO or parastatal hospitals/clinics as well as private hospitals. They also include the Department of State for Health (DoSH), Drug Administration, National Environmental Agency (NEA), National Health Laboratory (NHL), and Participatory Health Population and Nutrition Programme (PHPNP (which can be represented by the Nutrition Unit and Population Census Office)).

8.2 Overall Health Information and Administration System (HIAS) Model Proposed for The Gambia

The overall health information and administration system (HIAS) proposed for The Gambia is as shown in figure 8.2 below.

Based on the initial conceptual model and the results of the fieldwork undertaken, a final overall health information system for The Gambia is proposed as shown in figure 8.2. It is proposed that the health information system should have a centralised country wide patient database (national health database) at the Department of State for Health (DoSH) represented by the Epidemiological and Statistical Unit (ESU) and/or Department of Planning and information. There should be a main computer server with appropriate software and interfaces. The physical site should be the ESU building complex.

Contrary to the initial conceptual model, there is no need now for handheld computers to be used by the various health workers (TBAs/VHWs/CHNs) to input data from the rural areas where they attend to some patients. This is because of the lack of electricity and telephone system in the rural areas that will make it difficult for communication by handheld computers via modems. Besides, it will be comparatively too costly and inappropriate. Rather, at the end of each day or on a weekly basis, they (health workers) will send these paper based data to the dispensaries, minor or major health centres or directly to the Divisional Health Teams (DHT) (especially when the health worker is geographically stationed in the same town as the DHT). This is shown in figure 8.2 as dotted arrows.

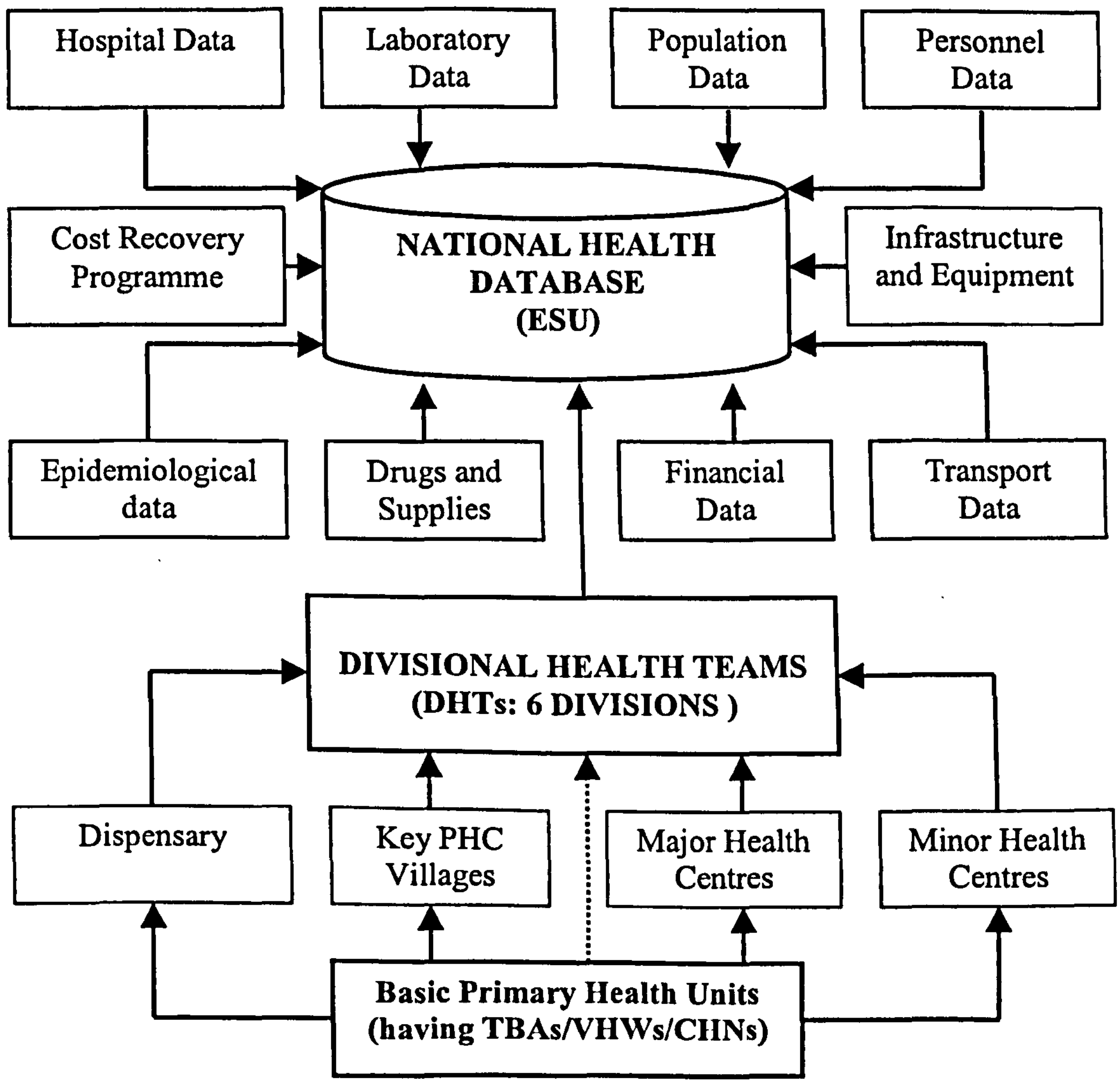

Figure 8.2: Overall Health Information and Administration System (HIAS) Model

The proposition of having a centralised approach to the system is based on the ease of management. The researcher took into consideration the lack of funds, lack of highly trained skilled personnel, as well as lack of adequate infrastructure such as inconsistent flow of electricity and problems with telephone systems which will make it more difficult to deal with the distributed approach or system.

The DHTs should have computers with modems to be able to input data from the basic primary health units, dispensaries, key health villages, minor and major health centres and do some statistical analysis for their divisional management and reporting as well as receiving information from the ESU. They will then be required to send a monthly data and/or emergency (as often as it happens) report to the main server at the ESU, which should be holding the central national health databases.

The three main hospitals, although semi-autonomous (including the Royal Victoria Hospital with its own Board of Directors) should also be feeding the ESU database, if the national database, located at the ESU, is to be complete. Because of their relative complexity, it is proposed that the hospitals have their own data collection sub-systems with local area networks to deal with the relatively large amount of routine daily collection of data. On a monthly basis (cf. weekly in the conceptual model), they should send data and information to the central database at ESU. This is to create uniformity in the timing of receipt of data by the ESU country wide apart from emergency data or reports.

Since the pharmacy department is the main unit with official authority to receive and distribute government drugs to the hospitals and health centres, it is important that data on drug administration are added to the central databases. For the majority of patients, recovery depends on quick access to prescribed drugs. It is proposed therefore that the sending of these data should be done on a daily basis because of the importance attached to the availability of drugs at all times to avoid any catastrophic delays due to shortages. In a situation where there is lack of manpower (which should be avoided), the timing can be weekly but not longer than that in terms of frequency. It is worth mentioning here that it takes months between placing orders and the imported drugs to reach the country.

Data from the National Health Laboratory should also be sent to the central database on a daily or weekly basis to enable analysis to be carried out and quicker reviews performed of possible shortages of important biological reagents and those of higher priority in a particular season. Similarly importation of chemicals or laboratory reagents into the country also take months.

Data from the Nutritional Unit should also be sent to the central database on a monthly basis, since nutritional status in most African countries including The Gambia has some kind of relationship with infant and child mortality. Comparatively, the nutritional data are not too crucial and can therefore be allowed to be sent quarterly or bi-annually.

It is proposed that some form of Financial Administration Information System (FAIS), a subset of the health administration system should be established in each of the three hospitals and in the six DHTs to monitor the financial activities of the hospital, dispensaries, minor and major health centres. They should then send data on a monthly basis to the central database for the purposes of planning, policy and decision making.

Epidemiological data for disease outbreaks and data from surveys of national interest should also be sent to the central database as soon as and when it happens. The Census or Population Office should occasionally send demographic data of interest concerning health and healthcare to the central database. Quarterly or bi-annual is a reasonably acceptable frequency

Transport data including the numbers of ambulances, motor bikes for fieldwork, their road worthiness and usage should also be sent to the central database on a monthly basis. Data on the states of infrastructure and equipment should be sent at six-monthly or yearly intervals as this constitutes important information to be considered for patient safety and reliability of services.

8.3 Workflows for the Proposed Health Information System for The Gambia

8.3.1 Workflow for the DHTs

Figure 8.3 shows the workflow for the DHTs for the proposed health information system for The Gambia. Data collected by the different health units (hospitals, major and minor health centres, private and NGO clinics), DHTs, National Health Laboratories, are recorded and batched for processing at specific intervals depending on the health unit/organisation.

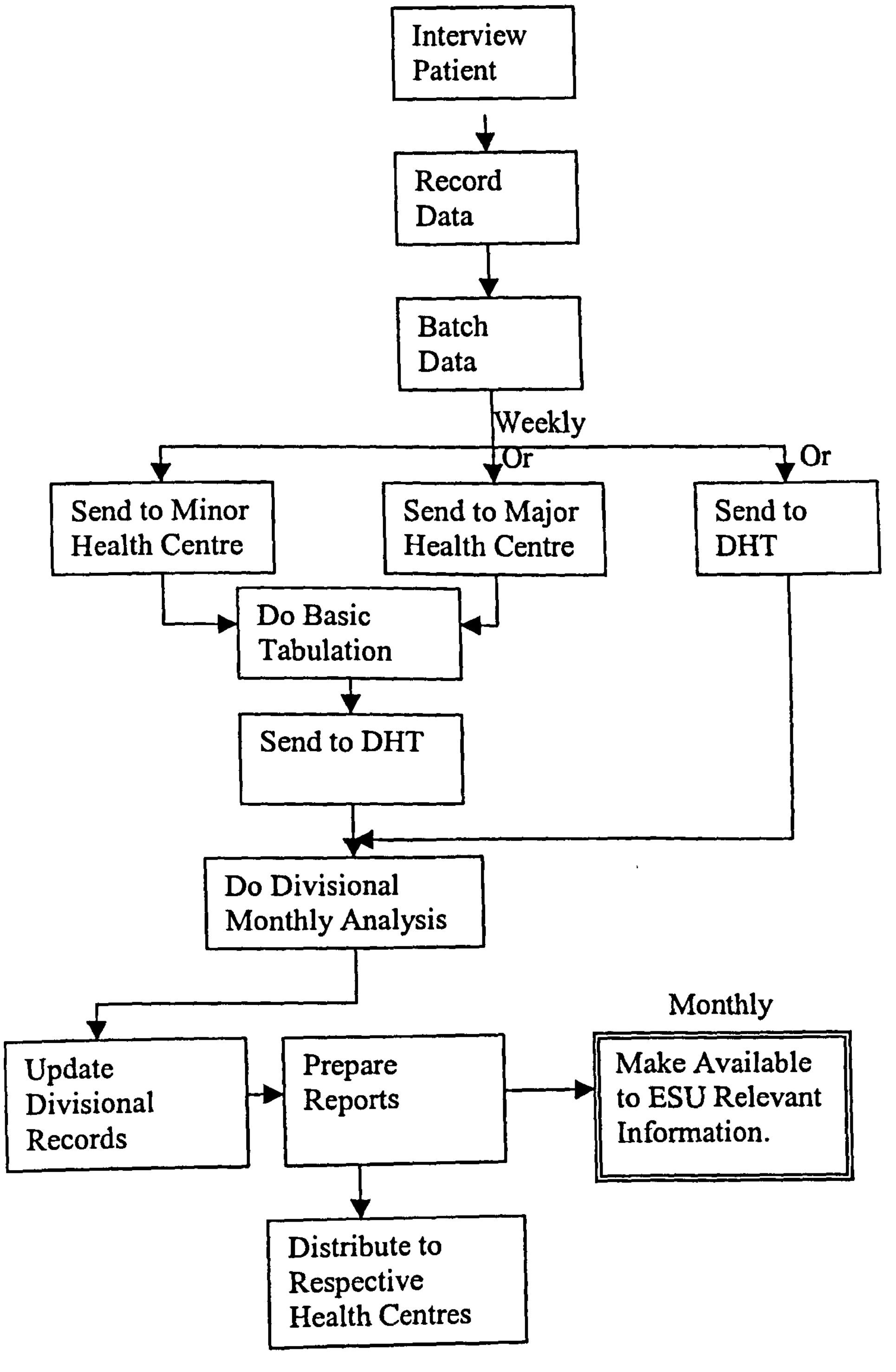

Figure 8.3: Workflow for DHTs for the Proposed Gambian HIAS

Processing consists of tabulations, updating records within the health units, and preparing reports. These reports are distributed to the respective units or health centres.

The relevant aspect of the updated file is made available to the ESU. The ESU collate the data from the different points, analyse them, update the HIS database, produce national health indicators of interest and other reports (such as comparative analysis, trend analysis), and make this information available to appropriate parties, including the DoSH.

8.3.2 Workflow for Healthcare Units

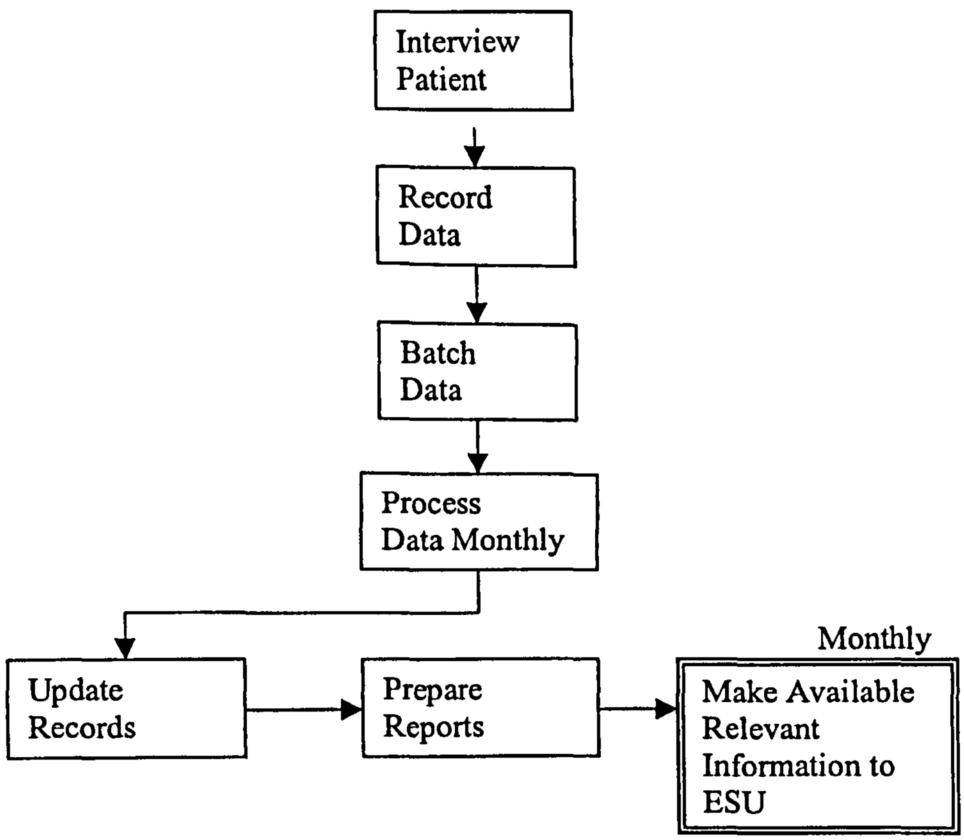

Figure 8.4: Workflow for Healthcare Units for the Proposed Health Information System (Government, NGOs and Private Hospitals and Clinics)

Figure 8.4 shows the workflow for the healthcare units (government, NGOs, private hospitals and clinics) for the proposed health information system for The Gambia. Similarly to what happens in the DHTs, these health units record, batch and process data collected, update and prepare reports and make available to the ESU relevant updated information.

8.3.3 Workflow for Proposed National Health Laboratory

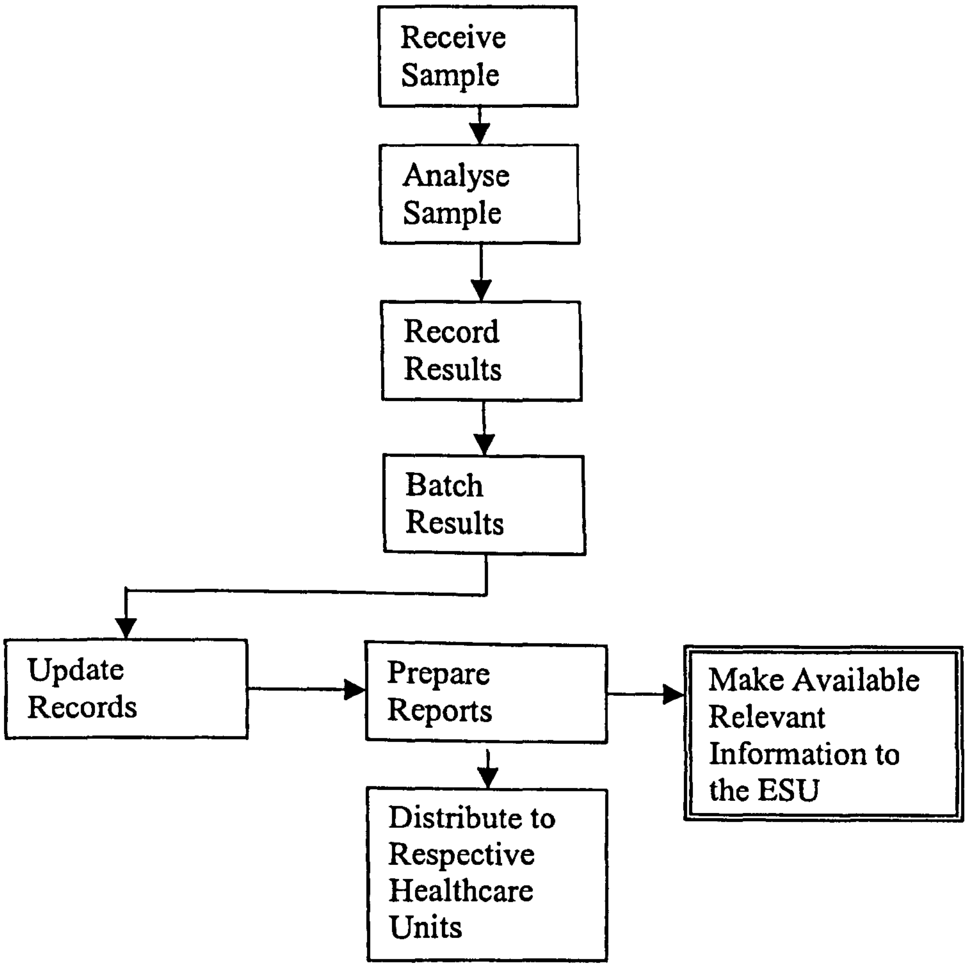

Figure 8.5: Workflow for National Health Laboratory for the Proposed Health Information System

Figure 8.5 shows the workflow for the National Health Laboratory for the proposed health information system for The Gambia. Samples received by laboratories within the different health units (government hospitals, major and minor health centres), are analysed and results recorded and batched. The records are then updated and used for the preparation of laboratory reports.

These reports are distributed to the respective health units and the relevant information is made available to the ESU.

8.3.4 Workflow for Drug Administration (Pharmacy)

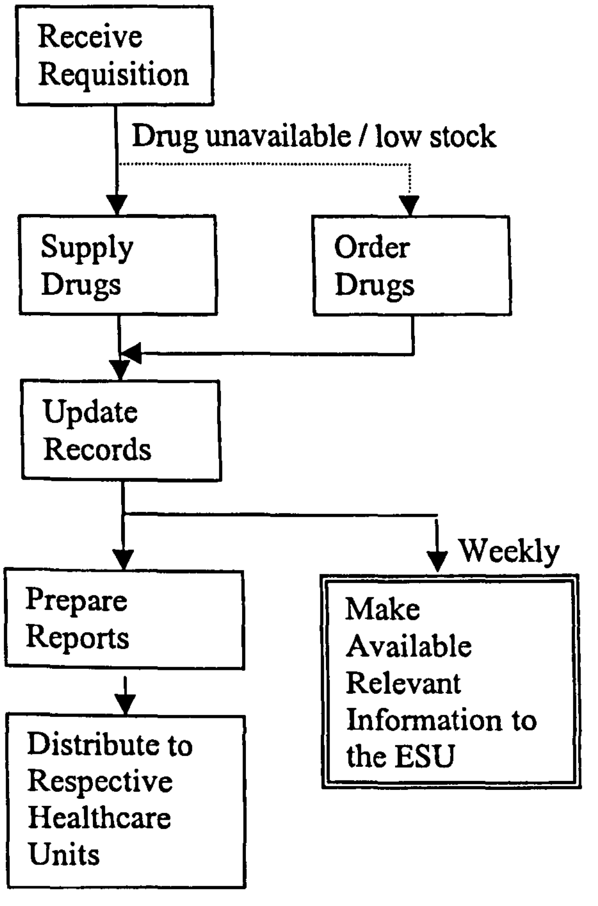

Figure 8.6: Workflow for Drug Administration for the Proposed Health Information System

Figure 8.6 shows the workflow for the Drug Administration (Pharmacy) for the proposed health information system for The Gambia. Requisitions for drugs received by the central pharmacy from the different health units (government hospitals, major and minor health centres), are supplied and drug records updated. If particular drugs are unavailable or stock levels are low, an order is placed for the drugs with an update of the drug records.

The relevant information from the updated records is then made available to the ESU. The updated records are also used to prepare drug administration reports which are then distributed to the respective healthcare units.

8.3.5 Workflow for ESU

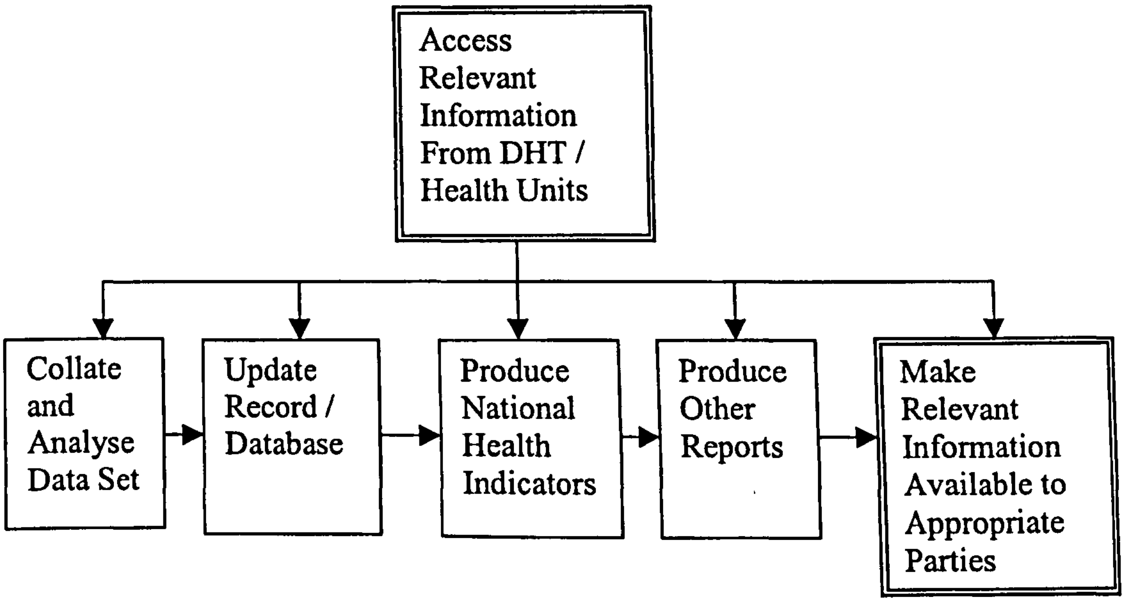

Figure 8.7: Workflow for ESU for the Proposed Health Information System

Figure 8.7 shows the workflow for the Epidemiological and Statistical Unit (ESU) for the proposed health information system for The Gambia. The ESU is where the central national health database resides, and accesses relevant data and/or information from the DHTs and other health units. The data set is now collated and analysed and used to update the central database or records. The records are then used to produce national health indicators of interest and other reports and relevant information is made available to appropriate parties.

It is worth noting here that depending on the type of data or information accessed, the ESU can simultaneously update records and/or produce national health indicators and/or produce other reports and/or make relevant information available to appropriate parties without necessarily going through the collate and analyse data set function route.

8.4 Workflow for the Proposed Health Administration System for The Gambia

Similar to the HIS description, data collected are recorded, batched and processed at the appropriate frequency.

Processing consists of data analysis, updating, preparing local reports and making updated information available to the ESU.

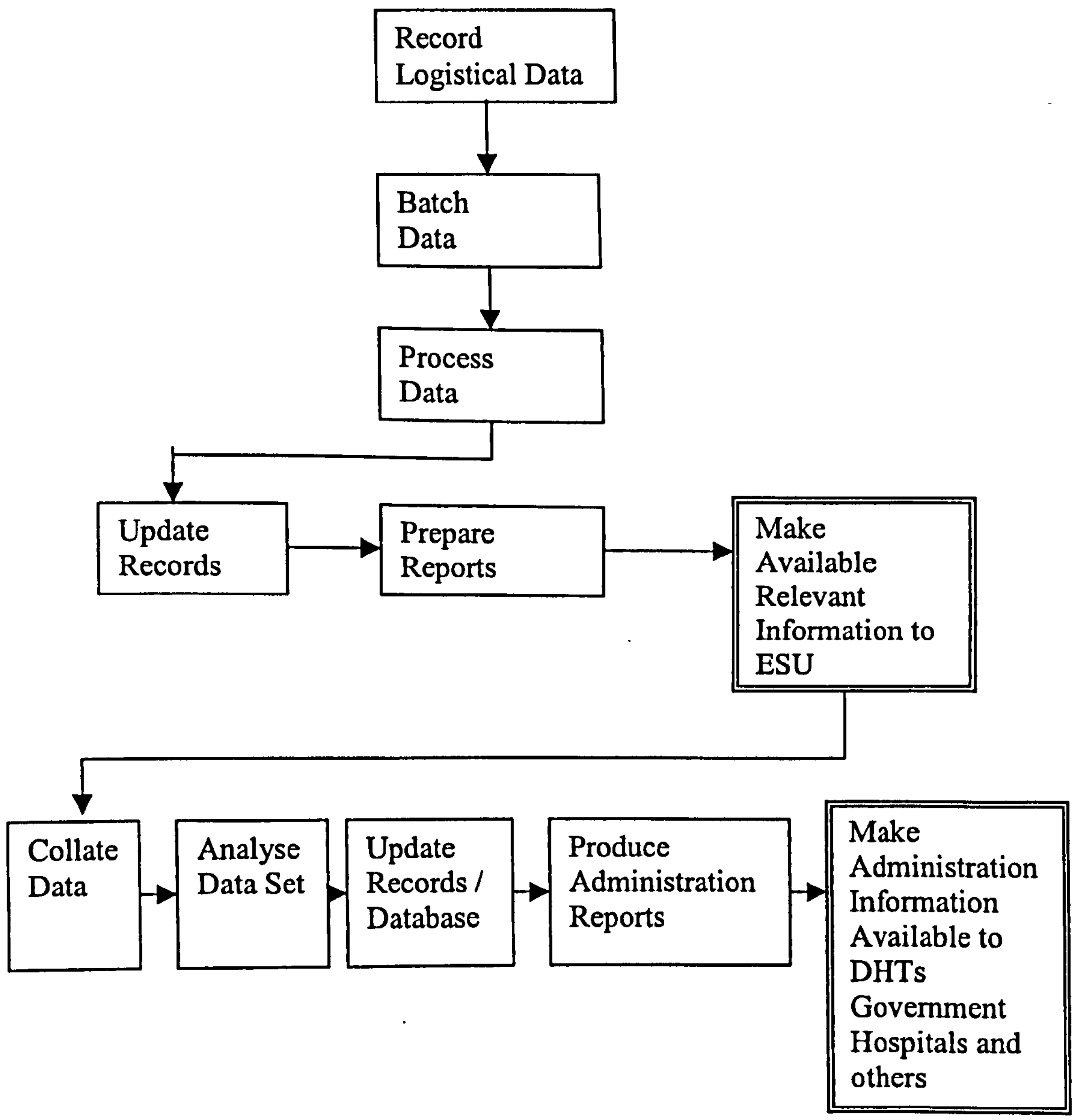

Figure 8.8: Proposed Health Administration System (HAS)

Again the ESU collates the data from all points, analyses them, updates the HAS database, produces multi-level administration reports and makes this information available to appropriate parties, including the DoSH.

Data flow diagrams and descriptions, data model and dictionaries as well as the algorithm put in place to produce unique identification for patients are described in Appendix J coming under various sections from 8.J.5 – 8.J.7.5.

8.8 MS SQL Server as the Database Choice for the Proposed HIAS and Advantages

A crucial decision for most systems is the choice of database software since most of the data and information documented in DFDs are stored in databases. Currently, almost all business software depends on relational databases. Relational databases provide a way of exchanging information among software components that are otherwise independent.

Even though any relational database can handle an information systems network, issues such as proven ability, robustness and further database development, particularly a completely computerised national health database (such as that in the UK) make it imperative to make an informed choice. Budgetary considerations are equally important where implementation is being considered in a developing country like The Gambia. Finally, the ability to utilise and maintain the database (in terms of ease of hiring and using available local skills) is something also to think about. This has resulted in the choice of Microsoft's SQL Server version 7 (tested and proven to work) as the database implementation choice for the Gambia's HIAS.

8.8.1 Why MS SQL Server is Suitable for The Gambia

Structured Query Language (SQL) is needed for any relational database management system (RDBMS). However, most people cannot write SQL programming codes. The Gambia does not have SQL programmers; there is a greater lack compared to many countries. Microsoft (MS) SQL server has some important characteristics that will favour the Gambia's experience.

Easier Operation after set up

- The SQL server is a Windows application that runs as a service. This means that it runs in the background and requires very little user interaction after it has been set up. It provides all of the functionality for managing user connections, providing data security, and servicing query request. It only requires you to create the database and the application that interacts with it (in this case HIS and HAS). You don't have to worry about any of the background processes.

Windows Platform Based

- As most computer users in The Gambia are used to the WINDOWS platform and the more affordable Intel-based servers (when it comes to server choice), the SQL server will be a rational choice. This is because of its full compatibility with Windows NT server and now with the SQL Server also capable of running in the Windows 98 environment. It is also very robust.

Graphically-Based Management Tools

- For any newcomer, the graphical management tools make it extremely easy to manage the server. Using the SQL Enterprise Manager allows the merging of Windows NT, Internet Information Server, SQL Server, and many other products from a single application.

Centralised Management

- For the type of implementation envisaged from the conceptual model (see figure 4.3), it is possible to manage multiple servers from a central location (HIS, HAS) even if the servers are separated by hundreds of kilometers. Limited manpower resources requires that The Gambia have a central monitoring point (in this case, the ESU).

Supports Multiple Client Applications

- Because the SQL Server supports ODBC (Open Database Connectivity driver set), it is designed to make development for different database platforms faster and easier. Customised applications that can connect to any RDBMS can be created. This is useful for future database development applications.

Supports many Different Development Platforms

- When creating new applications to access the SQL Server, elementary development platform (including ACCESS) can be used. This is useful or helpful for The Gambia's HIAS once many are comfortable with Access use.

Enterprise-Class Application

- Large scale organisations worry sometimes about the limitations in the size of handling huge databases (commonly known as warehouses). Enterprise-class applications are software applications that have the ability to run very large databases. This is comforting to know as size will not be a consideration for further development on the HIS and HAS. It can cater for Gambia's needs for many years to come and will not reach the capacity in terms of space for and handling of data and information.

Systems Data Replication

- Replication is a process which, ensures that data needed by users are where they need it, when they need it. Not only can replication reduce the amount of network bandwidth, it takes to return data to your users, but it can also lower the overall frustration level of your users by lowering the time it takes to get the data they need.

Supports Distributed Transaction

- A distributed transaction is a transaction that occurs on several Servers at the same time. This is useful if HIS data is placed on one server, and HAS data in another. A distributed transaction is necessary to ensure both servers get updated.

Can Support Data Warehouse

- Data warehouses are normally extremely large databases that contain data from transactional oriented databases. These huge databases are used to search for trends that are not apparent from a cursory examination of data.

Has Built-In Online Analytical Processing (OLAP)

- These services, known as MS DS Services (Microsoft Decision Support Services) are built into the server – suitable for data analysis.

Cost of Ownership

- The cost is less than its competitors.

It is worth mentioning that the only other application in the country, pulling together information from rural/district areas into an analysed database, is that of the Electoral Commission. This runs on an SQL Server application and as a result there will be local expertise as backup when support/technical assistance is required urgently.

8.8.2 Justifying and Linking Workflows and DFDs to the specific specification

A good database is expected to mirror the processes that exist within a system. The workflows therefore provide a logical sequence for understanding what the database management system will be configured to do.

In a similar view, the data flow diagrams show the processes or functions which enable data to pass from one point to another. Again, this scenario determines how the database management system (DBMS) is set up so that communication in the database configuration (seen in figure 8.15) mirrors the DFDs described earlier. This is seen more clearly in figure 8.16 which shows what information is being passed between health units and the ESU.

The database configuration resulting from the work and data flows, as well as the HIAS requirements, lends itself to the technique of replication by Central Subscriber/Publisher.

With this technique, The Gambia's health executives and policy makers can access information from any point (unit) that has been made available under directives or government policy (for those outside direct government control).

At the core of any DBMS are the databases that store data on any subject relevant to the workings of the particular application (in this case the HIAS and its subsystems). The data model described earlier provides the basis for the physical design of these data stores or databases.

As a certain amount of data processing takes place at the DHTs and hospital levels, the data model identifies the subjects about which data is stored in each of these units namely PATIENT, VISITS, HEALTH WORKER and HEALTH UNIT files.

Each unit carries out some analysis, the results of which are communicated to the respective health units (in this case DHTs) or passed on to the ESU through the DBMS, from where the ESU carries out further analysis for national purposes. The fact that the ESU requires information from these units makes it assume a Subscriber status and the health units being Publishers.

However, the standard configuration is modified to give the ESU's DBMS a Publisher function as well to enable it to:

- Pass relevant data back to the DHTs and other stakeholders as and when necessary;
- Backup data from the central file server for security reasons.

8.8.3 Network and DBMS Configuration for the Design Specification

The HIAS starts from the health workers interaction with the patient anywhere but the computerised implementation for the proposed system starts from DHTs, hospitals and other units to the reporting functions and decision-making enhancement for policy makers.

Figure 8.15 shows the network system (involving hardware) and database management system's configuration. All DHTs and stakeholders involved with the day to day activities of patient care and administration have publisher servers linked to the central subscriber / publisher server at the ESU with a backup server.

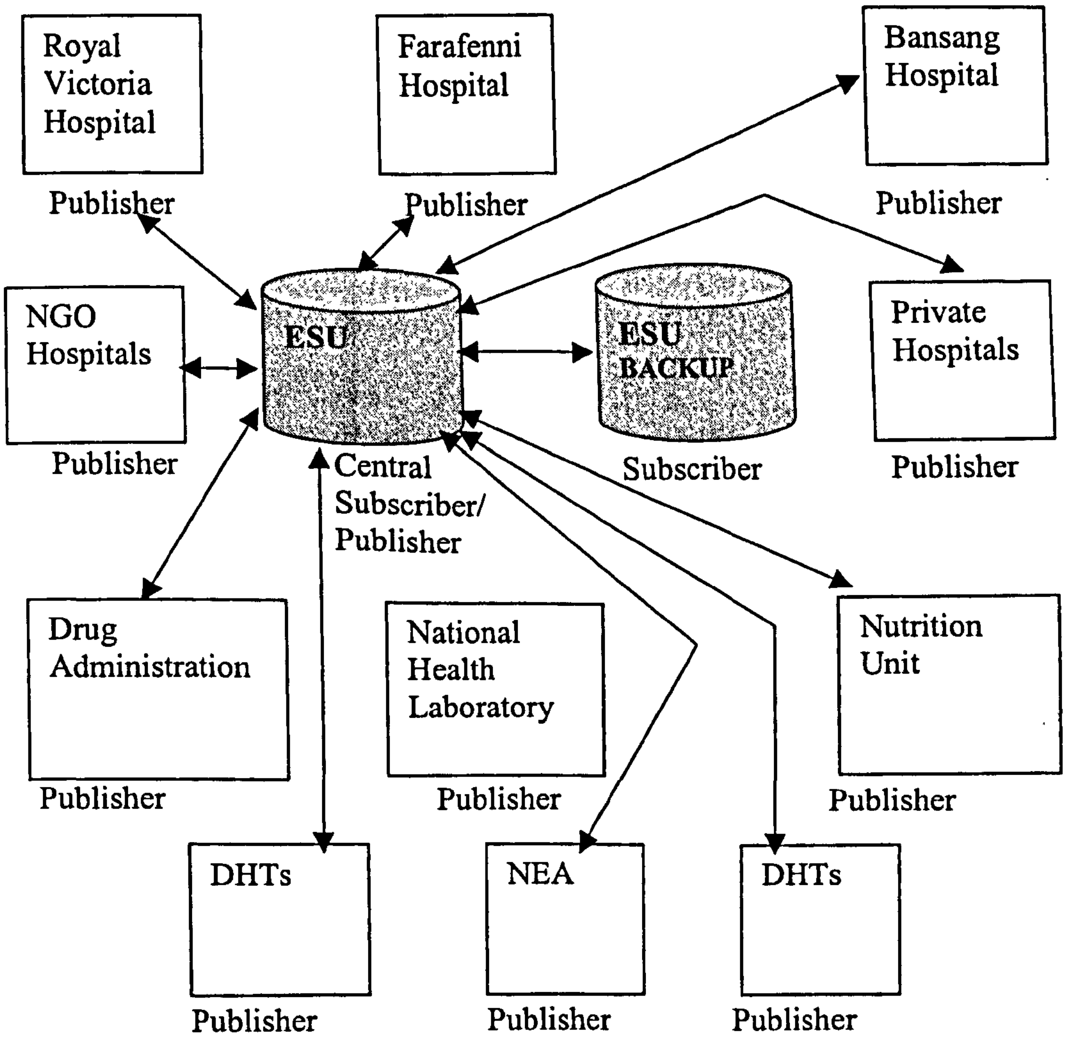

Figure 8.15: Network and Database Management System's (DBMS) Configuration

The chosen DBMS configuration is best for the purposes of The Gambia HIS (incorporating on HAS) because:

- It provides a central location that has all the data from other locations (hospitals, private sector and NGO's, DHTs, National Health Laboratories, etc...);

- It provides for roll-up reporting which is the process of bringing data from remote locations to one central server for the purposes of generating reports.

Note on implementing Central Subscriber scenario:

- One has to take some precautions with this implementation to make sure that all the data remain synchronised and are not over-written.
- Create a column that contains a unique identifier of the data type UNIQUE IDENTIFIER for the data that will be replicated from each site (DHT, hospital etc. ..)
- Add the column that contains the unique identifier to the primary key.
- Perform a manual synchronisation of the table.

8.8.4 How Will Data Replication Be Implemented?

The means by which data will be replicated (sent to the ESU) from DHTs, hospitals and other units is described here. The method chosen is the Pull Subscription procedure – managed by Subscription Server.

This is set up and managed at the subscription server. The subscription server connects to the publication sever and pulls down the required subscription and any subsequent data changes. This method allows the administrators of the subscription servers to choose which publication they want.

Advantage: allows all the work to be done from the ESU and not have to rely on the outlying units to send the data. Less manpower required and fewer technical problems.

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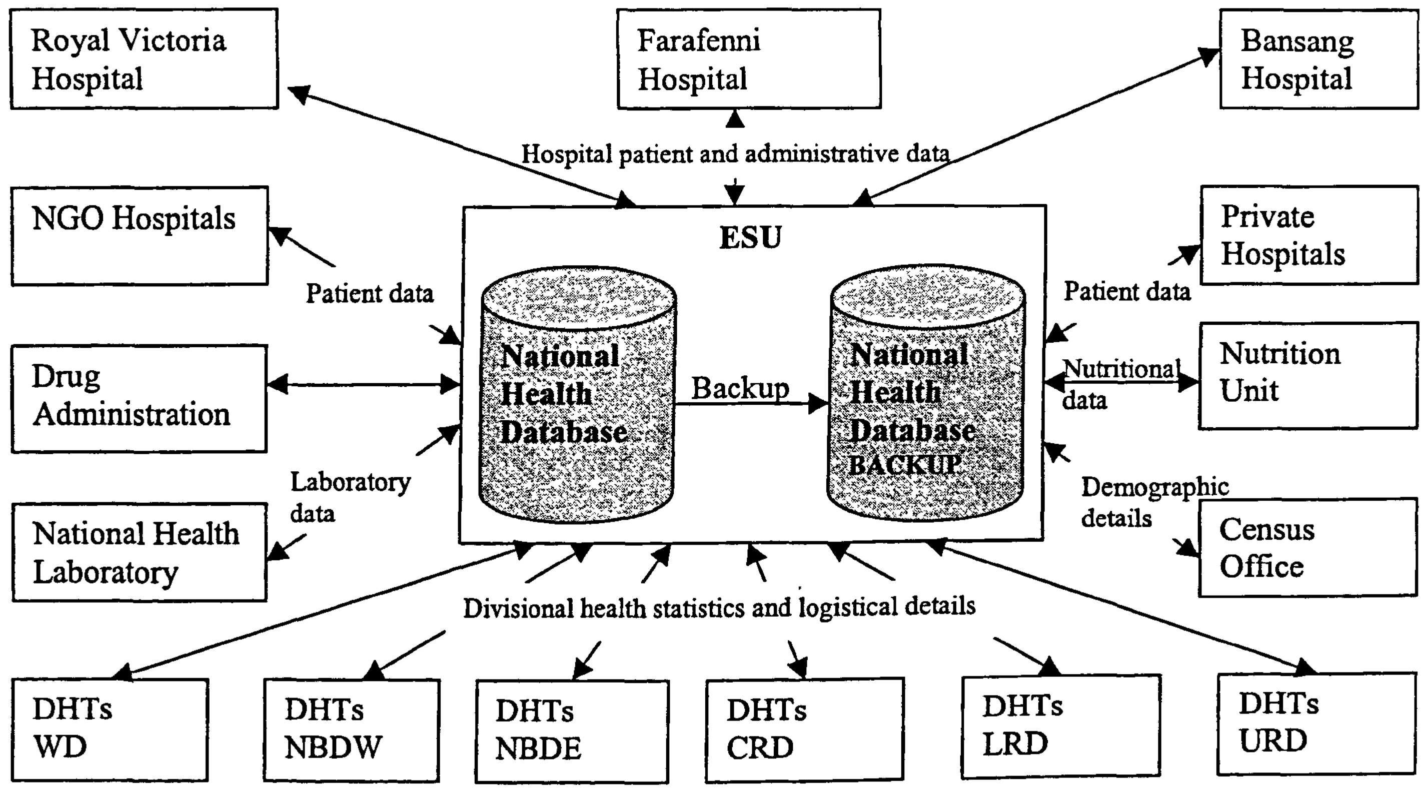

Figure 8.16: Database Configuration with information links from health units.

8.8.5 Hardware Positioning

To appreciate the choice of the network database and hardware configuration it is important to understand the geographical positioning of the hardware and the distances between these positions and the central database and server. Figure 8.16 is a map of The Gambia showing the capital Banjul (where the ESU and Royal Victoria Hospital are situated), the healthcare divisional capitals where the DHTs are and where the two other government hospitals Farafenni and Bansang) are also situated. On the map, the positions are shown with dots.

The divisional capitals where the DHTs are situated and their approximate distances from the countries capital Banjul where the ESU is situated are displayed in table 8.6 below:

DIVISION	DIVISIONAL CAPITAL (DHT)	DISTANCE FROM BANJUL OR ESU
Upper River Division	Basse	375 km
Central River Division	Bansang	320 km
Lower river Division	Mansakonko	181 km
North Bank East Division	Farafenni	220 km
North Bank West Division	Essau	15 km
Western Division	Kanifing	14 km
<u>Hospitals</u> Royal Victoria Hospital Farafenni Hospital Bansang Hospital	 Banjul Farafenni Bansang	 - 220 km 320 km

Table 8.6 Health divisional capitals shown on map of The Gambia and distances from ESU

WHERE DHTs ARE SITUATED (OR WHERE COMPUTER HARDWARE WILL BE SITUATED) AND CENTRAL DATABASE POSITIONING FOR THE GAMBIA'S HIAS

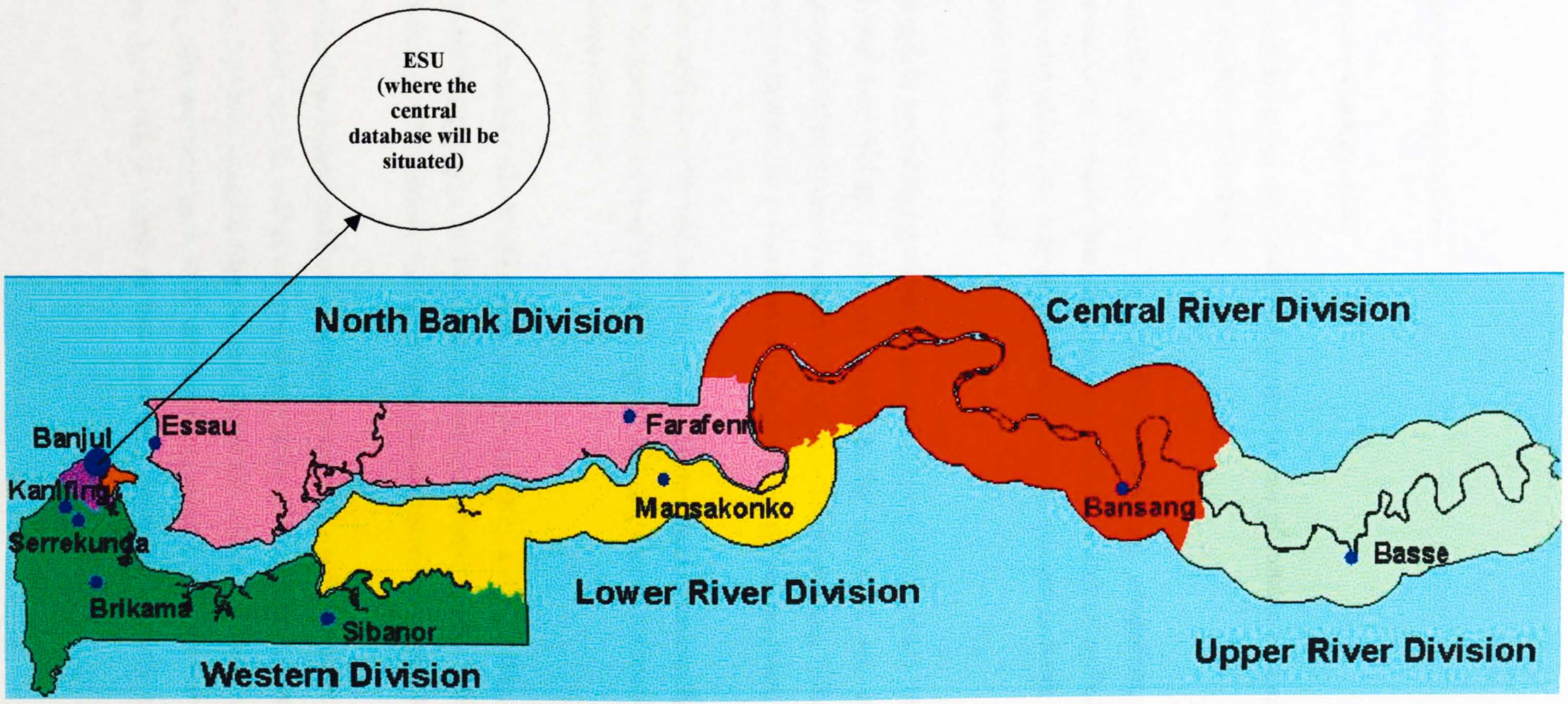

Figure 8.17 Map of The Gambia showing the divisional health teams (DHTs) and ESU

8.9 Hardware Configuration

8.9.1 Network Configuration

Any information system application will require the use of suitable equipment to make it a successful initiative or operation.

With particular reference to The Gambia's budgetary constraints, the inadequate telecommunications infrastructure and very importantly the lack of sufficient manpower in large scale networking and database applications makes the star network configuration the most suitable at the present time.

With this option, key hardware resources are concentrated at the central location (ESU) with essential (but less strategic) resources placed in the divisional and other health units. Communication in the proposed system is by phoning (dial-up) using TCP/IP (Internet based technology) to gain access to data from outlying units for analysis purposes.

Fibre optic cable (even though boosting system performance dramatically) is prohibitive in cost for The Gambia and hence the dial-up protocol being used as the medium of establishing communication links.

To meet the requirements of robustness, support durability and reliability, a choice of a dell file server is being chosen to be the hub of the national network system. Dell has maintained a strong presence in The Gambia with authorised representation and support readily available.

From the file sizes determined from each entity's record (i.e patient date etc) and the projected visits per health unit, as well as the overall population of The Gambia, hard disk capacities of 2 GB and 200 MB should suffice for the central file server and mini-servers respectively. However, with the rapid pace of IT development, prices have been markedly reduced and minimum specifications raised, so that even entry point systems have more in processing power, speeds and capacities far in excess of The Gambia's needs and yet very affordable in price.

Dell's PowerEdge 6600 (described in section 8.9.2) is therefore being chosen for the systems hub. It represents a proven hardware for networking globally and can be adequately supported in The Gambia.

The OptiPlex models (mentioned in section 8.9.3) make a good choice for the health units, and as much as possible should be recommended for purchase by the private hospitals and NGOs as well as to create a seamless operation for the HIAS.

All equipment have capabilities for expansion and upgrade should there be a need for more storage and or processing power.

8.9.2 Main Server

Server: Dell PowerEdge 6600
Reason: It is the solution for systems that need high accessibility, extreme data security, high performance and maximum up time. It is useful for mission-critical enterprise systems and features among other things, the new Intel MP Xeon processor.
Specification:

- Intel MP Xeon 1.4GHz, 512k L3 cache processor
- Quad processor support
- ServerWorks Grand Champion HE Chipset
- 512 MB ECC DDR SDRAM memory (max 16 GB)
- 18GB 10K SCSI Hard Drive (expandable to 876GB – 12 drive bays)
- Dual embedded Gigabit NICs with fail-over support
- Redundant power supply and fan
- Server Status LCD
- Tape Backup
- Mass Storage Device (disk drive)

- 56k Modem

* Approximately £4000 (four thousand pounds)

8.9.3 Work Stations (at ESU and Relevant Health Units)

Workstation Type: Dell OptiPlex GX 260 SD

Reason: Fast processing for multi-tasking and more.

Specification:

- Intel Pentium 4, 2.0GHz
- 128 MB, 266MHz DDR RAM Memory
- 40GB Hard Disk
- 17 " Dell Monitor
- Integrated Intel Gigabits Ethernet NIC
- 40 x CD-RW (re-writable) Drive
- MS Windows XP Pro
- 56k Modems

* Approximately £600 (ex. VAT).

8.10 Summary

In this chapter, the final design specification of the proposed health information and administration system for the Gambia has been described. It considered the stakeholders involved and discussed the overall proposed Health Information System's (HIS) model for The Gambia as well as the Health Administration System's (HAS) component that goes with it. Work flow and Data flow diagrams for the HIAS were presented as well as their narratives. The Data Model (Logical Data Structure) and its entity description have also been presented. The network/database configuration and the hardware configuration as well as the geographical positioning of the hardware at divisional health teams and hospitals were also described. The next chapter presents the general overall discussion about the entire study.

CHAPTER 9

DISCUSSION

The data collected from the survey conducted in The Gambia have been analysed and the results interpreted (see chapter 6). The requirements analysis and the design specification have been described (see chapters 7 & 8 respectively). Having done these, this chapter discusses the key issues arising from these chapters and how they can affect the implementation and sustainability of the proposed health information and administrative system (HIAS) in The Gambia. These can be summarised as follows:

- The general importance and need for the health information and administration system;
- The major constraints or inhibitors to the development of the HIAS;
    - the general weaknesses within the current health system;
    - economic poverty and the burden on HIAS and healthcare delivery;
    - leadership, planning, attitudes and technophobia;
    - problems with medical records;
- The impact of national policies on the success of the HIAS and healthcare delivery;
    - implementation, budget and operational organisation;
    - improving motivation;
    - ensuring actual implementation and evaluation;
- The importance of communication, coordination and integration of all stakeholders;
- The need for computerisation and why limited to only hospitals and District Health Teams (DHTs) for now;
    - security and confidentiality issues;
- The need to enforce the institution of unique identification or national health number system;
- The importance of training and education and capacity building; and
- The impact the proposed HIAS can have on the improvement of patient care in particular and healthcare in general.

Each of these issues will now be considered in turn in the sectors which follow.

9.1 The General Role of the HIAS on Healthcare; the Need and Costs

Major contributions to health and healthcare have been made in the past by research providing knowledge on the causes of diseases and ill health and by developing the technology to cure and prevent disease and by promoting health. Despite the considerable amount of available knowledge and technology however, many people today still remain unable to achieve the targets of Health for All. The question everybody asks is WHY?

Improvements in the health conditions of the people have reasonably been achieved by the government of The Gambia. Yet, The Gambia comparatively still suffers from health problems such as high prevelance of infectious diseases, mortality and fertility and unfortunately has a weak health management system. Therefore, the need for properly structured information is becoming increasingly important for management and accountability of the health sector in The Gambia.

Because of cultural, economic and logistic barriers to reaching both urban and rural homes in The Gambia, preventive health services are relatively very difficult to promote. There is a greater need more than ever before for convenient and low-cost health services throughout the country. To serve the health needs of the nation, it is important to apply available technology in an optimal manner, within the limited resources available.

At most of the government health units, including the Royal Victoria Hospital (RVH), all recording and compilation activities are currently done manually. Attempts have been made of late to properly establish and enhance the capabilities of the medical records offices in the three hospitals in the country and to retrospectively enter existing records. However, the efforts lack systematisation and computers. There is thus a real need for a modern and efficient information system approach and technology. There is the need for a number of computers, in the absence of which there will always be unavoidable delays with the statistical compilation of data and other usage of relevant data. As of 2001 (during the survey), the 1998 – 1999 annual report for the RVH, for example, had not yet been produced due to "lack of facilities" including not being computerised.

Increasingly, health information systems are becoming crucial and having an important role to play not only in the healthy development of individuals, families and societies, but in the safe delivery of a healthy baby as well as the dignified care of the elderly who are weak. Good healthcare relies on quality records. Without accurate, up to date and accessible patients records medical staff may not be able to offer the best treatment. Lack of records may have serious consequences for the patients. It can lead to misdiagnosis and inappropriate treatment and waste. Whatever system is used, it is imperative that these records are filed and/or kept accurately as a great deal of time can be wasted searching for mis-filed records.

Without accurate information, you do not know what is going on. You cannot define your needs, you cannot manage your system, you cannot tell if you are achieving anything. Accurate information is the key to any rational management, planning, budgeting development, within the health sector, within the education sector, within any sector. If you do not know what's going on, you cannot plan. You cannot even respond to any problems faced.

Amongst the most significant challenges facing the health sector in The Gambia today are quality of information and cost control. The increasing use of information technology is transforming health service delivery in most developed countries and can therefore do the same for The Gambia, a developing country. As the focus of healthcare and treatment moves beyond the hospital bed, the capture and management of reliable health information becomes very important and critical. For this reason it is essential for the current and future issues associated with the capture, integration and dissemination of health information in The Gambia to be addressed and HIAS is the answer.

Traditionally, The Gambia National Health Service (GNHS) has been poor (or weak) in relation to information technology (IT) and more so health informatics. When it comes to recording patient data, paper is still the top technology and this poses several problems to patients, doctors and researchers in their search for medical information. Things need to change. IT and patient care in health are so important that the UK government for example in 2002 announced massive increased funding for its NHS IT over the coming years with their Department of Health appointing an NHS IT director to lead the project. That should convince developing countries that there is a role that health informatics can play in healthcare.

Information Technology (IT) can be used as an all embracing technology that affects strategic and operational issues [1]. Developing countries have used it extensively and found a high potential value for it. Apart from having a big influence on society in general and healthcare in particular, IT has become an important tool in the development of almost all sectors of a nation. It is said that "no country can afford not to join the information revolution, nor can it avoid its impact" [2].

A report of a World Health Organisation (WHO) meeting in 1987 clearly linked improved management to health information systems: "Of the major obstacles to effective management, information support is the one most frequently cited."

In 1989, The World Health Organisation (WHO) identified the lack of information, or untimely and unreliable information, as one of the major obstacles to healthcare management in developing countries [1].

The Gambia is poor and a developing country, but does not need to be left behind. If the technology is good for developed or western countries then it must be good for The Gambia and Africa. Adjustments however need to be made to the software and hardware imported from developing countries if they are to work properly.

Table 9.1 shows an estimated costs to be incurred if the HIAS for The Gambia is to be implemented based on requirements and specifications discussed in chapters 7 and 8.

Category of Costs	Amount	
Capital		
The two servers at ESU @ £4,000	£ 8,000	
Minimum of 4 computers at ESU @ £600	£ 2,400	
Minimum of 2 computers at each of the 6 DHTs making 12 computers @ £600	£ 7,200	
Computer furniture at ESU Minimum 5 desks + 5 chairs @ £300	£ 1,500	
Computer furniture at the each of the 6 DHT's @£300	£ 1,800	
Air Conditioner at Computer Server room in ESU @ £500	£ 500	
Air conditioner at Computing room at ESU	£ 750	
Air conditioner at each computing room at each of the 6 DHTs @ £500	£ 3,000	
Printers 2 at ESU and 1 at each DHT @ £450	£ 3,600	
Uninterrupted power supply at ESU (2) and each DHT @ £250	£ 2,000	
Sub-Total		**£ 30,750**
Recurrent		
Consumables (Floppy disks, Printing paper, printer cartridge for a year)	£ 1,000	
Electricity Bills @ £1000 per year per DHT + ESU	£ 8,400	
Subsidised Electricity bill for each of the 3 hospitals @£600 per year	£ 1,800	
Telephone Bills @ £600 per year per DHT + ESU	£ 4,200	
Subsidised Telephone Bills for each of the 3 hospitals @ £360 per year	£ 1,080	
Data entry clerks salaries @ £1200 per year per Clerk (2 each at DHTs, 2 each at the hospitals and 4 at ESU)	£26,400	
HIS Administrator salary for 1 year	£12,000	
Training budget (one off)	£ 1,000	
Sub-Total		**£ 55,880**
TOTAL (first one year)		**£ 86,630**

Table 9.1 Estimated costing for the implementation of the HIAS

NB: The estimated costs for the capital aspect of the system is **£30,750** for the first one year while that for the recurrent cost is **£55,880** also for the first one year of the implementation. This brings it to an overall total cost of **£86,630**. It is worth mentioning here that the capital cost will not change much over the next three to five years after implementation if the system is cared for and maintained properly.

9.2 Constraints or Inhibitors to the Development (Implementation) of HIAS

9.2.1 General Weaknesses Within The Current Health System

There are various weaknesses within the current health system that are presently inhibitors or constraints to the effective implementation and sustainability of the proposed HIAS unless some actions are take quickly by government. These include:

- insufficient budgetary provisions for the health sector;
- lack of adequate maintenance facilities and logistical support;
- lack of planned and preventive maintenance programme;
- too much bureaucracy in decisions concerning the health sector;
- high attrition rate amongst trained doctors, nurses, laboratory technicians and other health workers which has led to capacity constraints;
- limited training opportunities with limited possibilities for growth;
- lack of financial and human resources for operational activities;
- weak management information systems for monitoring, controlling and decision making;
- inadequate technical and planning skills;
- lack of continous supply of electricity;
- lack of proper communication system among health workers because of lack of telephones or its use in offices, sometimes due to non-payment of bills and therefore being cut off; and
- lack of cooperation or integration between government, the private sector and NGOs. This leads to unnecessary duplication of efforts and waste of resources.

These weaknesses or problems are discussed further under appropriate headings below.

9.2.2 Economic Poverty and the Burden on HIAS and Healthcare Delivery

Economic fortunes in most African countries, especially sub-Saharan Africa, seem to be dwindling rather than getting better and healthcare systems have indirectly been hit, and seem to be deteriorating at a faster rate. In some African countries, poor basic facilities and healthcare are encouraging the spread of some diseases, including HIV/AIDS, tuberculosis, malaria, tetanus, acute respiratory infections, cholera, measles and diarrheoa. The health services are ill equipped to deal with many epidemics.

In The Gambia, electrification, roads and communication systems still remain poorly developed. Some of the health centres and hospitals are operating with limited essential drugs, without adequate communication facilities, such as the telephone, and without constant electricity or fuel to run generators when the electricity supply fails. The population is unfortunately largely illiterate. To make it more problematic, the present facilities do not seem to be able to cope with the ever-increasing growth in population. The end result of these problems is that the quality of healthcare services in these areas is poor and improvement can only occur if there is adequate funding.

Resources are not available, for instance, to operate sustainable information and communication technology (ICT) and therefore proper coordination of health activities in the country. This means that the existing problems and up and coming ones will continue. The social and economic consequences of the disease crisis in Africa are apparent. It is only hoped, therefore, that other countries will continue to support the development of health and educational services within Africa, which is aimed at controlling the spread of the diseases.

In 1993-94, the estimated per capita income was \$249.6 and the country was ranked 162nd out of the 174 poorest nations. This is bound to have a financial impact or set back on the money needed to develop or implement HIS further, a good example of poverty being a burden on diseases or delivery of healthcare in Africa. It is understood that the World Bank has given a loan towards the move to the introduction of a health management information system (HMIS). The next question is how far can the loan go?

The benefits of a good health information and administration system and continous education through all media of communication are still very important in the healthcare system in resource-poor countries including The Gambia.

9.2.3 Leadership, Planning, Attitude and Technophobia

Although resources and the money to support the system are relatively small, that is not necessarily the key. The willingness to hire, to provide the human resources, to train the people to invest in developing the resources that will be needed before the need occurs is lacking. A great weakness in the system is that there is lack of proper routine planning. The strategic and tactical people tend to respond to situations when they develop rather than see them coming. It is a culture, a responsive culture rather than an act of foreseeing culture, which has its roots in a lack of finance and therefore an application of the priority barometer on survival now, future later. One of the biggest blockages or problems in developing any type of information system is that of behavioural, human behaviour walls.

You can do an amazing amount of things with very little money. One does not need to have state of the art high technology if you have people who understand the need for planning, people who can ask appropriate questions, and can analyse information. There is a need for people who value information, and value it for its own sake, not only because donor countries or organisations or central government wants it. There is a need to have the right combination of people (with the right attitude and skill) and the needed equipment. It is not a question of computers and networks or emails alone, but also partly attitudes at all levels that are adverse to risk taking. Usually, there are spectacular examples all around of the wrong people making the wrong decisions for healthcare at an exceptionally inappropriate time.

Another important problem in every country is that of technophobia, namely prejudice against computers and advanced medical instruments. This must be addressed. It may be necessary to provide opportunities for training in the operation of the terminals, and to help conquer the technophobia relating to computers and keyboards.

Some problems include difficulties in retrieving medical histories and frequent error messages. Doctors are likely to complain that "They're logging into a computer when they'd like to be at a patient's bedside;" that "It's still easier to flip through a chart instead of having to go through several computer screens".

A fundamental question which most healthcare professionals, medical students and even senior clinicians ask themselves is why on earth should they bother with medical informatics at all. However, it is becoming increasingly obvious and necessary now more than ever that doctors and other health professionals should have a good fundamental understanding of health informatics.

The 'knowledge base' of clinical medicine (the number of facts needed to 'know the whole of medicine'), has been estimated as over 15 million and even in the specialities the amount of data is growing exponentially; quoted F.T de Dombal [10, pp 8] in his book. Information science indicates that it is quite difficult, if not impossible, for the young student or doctor today to keep up unaided with advances in medical practice. It has been realised nowadays that, with the increasing complexity of modern medicines, doctors' decisions are made in totally different circumstances. On a daily basis, sometimes under conditions of substantial uncertainty, they continue to make life and death decisions. In recent years, three developments namely (a) the advent of personal computing, (b) the advent of networking, and (c) the development of multimedia technology make it imperative, urgent and worthwhile for doctors and other healthcare professionals to know something about health informatics.

9.2.4 Problems with Medical Records

"The potential of the medical records office can only be realised when it is recognised as being much more than just a storage area for patients' files; that it is as an office capable of producing valuable information which can lead to improved patient care, and also provides factual evidence to aid future planning and development." [14], [15].

There are constraints that are likely to continue to affect the functioning of the medical records units, some of which are summarised below:

- The units continue to encounter problems with doctors not inserting final diagnosis on the patient case notes. This is necessary for the purpose of accurate coding of a patient's diagnosis under the International Classification of Diseases (ICD) system. Besides, information on patients in case notes is still very scanty, leading to an immense lack of valuable information in the continuity of patient care and for future research, teaching and referral purposes.
- The poor provision of a well-organised arrangement for handling of patient records or case notes between nursing and clerical staff. This affects proper administration of patients' admission, clinical registration and discharge procedures. It is important that notes are complete and available when they are needed for patient treatment or referrals.
- There is a shortage of staff and some of the few available have moral and attitudinal problems because of the lack of remunerative incentives for extra hard work (work load) they are expected to do. This is affecting the timely collection, compilation and analysis of data for decision making and patient management. There are also times when there are acute shortages of even basic stationary coupled with a lack of good typewriters, not to speak of computers and photocopiers. This affects the smooth running of the hospital's activities.

To ensure continuity, accuracy and efficiency in a good system of record keeping, the government has to review the situations in the medical records offices of its hospitals for now and the major health centres in the near future. If we are to achieve this important goal of providing valuable information that can lead to improved patient care, then there is the need for a proper recruitment of staff, and the selection must not be governed by shortage. There is also the need for the introduction of in-service or other training programmes.

9.3 National Policy and Success of the proposed HIAS and Healthcare Delivery

9.3.1 Implementation, Budget and Operational Organisation

There is the urgent need for the government to embark on the speedy implementation of the proposed system and continue to strengthen it by developing skills needed by the health workers. This will need the introduction of proper maintenance and the use of records, processing and basic concepts of health informatics in the country's health curricula or institutions. This way, the government of The Gambia will be able to reap the benefit of health informatics; which is to support health workers in identifying, managing and properly utilising the information they need.

One of the first problems is that of the budget for implementation and operation of the health information system. A typical example will be the financial need for the improvement of the telecommunications system to link the appropriate network(s) of computers for when a proposed NHIS network(s) is to be implemented. There will also be the need to extend in the nearest future the links to the rural areas, where most of the health problems with the requirement for basic health facilities can be found. This could pose a serious problem with an under-funded health budget.

To make wise and intelligent investment and strategic choices in health, there is the need for good and relevant information. There is a collection of large volumes of data in the country. Unfortunately, the data are not available in the format where they can easily be used as information that is critical to policy makers or healthcare managers for the improvement of patient care in particular and healthcare in general. For example, at the present moment data on both out-patients and in-patients are not routinely reported at the national level either in total or by cause of illness and attempts to obtain private sector and NGOs facilities data are even more difficult. Secondly, most of the health budgets are disproportionately spent on the urban populace, although the majority of the population in The Gambia is predominantly rural.

The 1994 – 2000 health policy recognises that a strong health delivery infrastructure and an adequately resourced and reliable transport system are essential for effective service delivery. Yet, another constraint is the lack of a reliable transport fleet and difficulties in obtaining spare parts and consumables. In view of this, there is the need to develop a maintenance strategy that will include among other things the development of an inventory system to include all equipment and furniture and buildings; this will enhance accountability and the proper handling and management of government property. The health administration system (HAS) of the overall HIAS is put in place to deal with this problem which the health entity in the design specification (chapter 8) is to address. There is also the need for a proper development and utilisation of the maintenance staff, given the wide dispersion of health facilities and their needs.

The health policy of The Gambia recognises that for decentralisation to be effective, control over operational budgets, the accounting system and staff development must be delegated to the Divisional Health Teams. However, this is still not the case. The success of the process also hinges to a large extent on the provision of the required resources such as office space, housing, manpower, transportation, adequate furniture and other logistics. This situation underscores the need to develop capacity to keep pace with the volume and intensity of transport operations and related maintenance activities.

The costs associated with the hiring of a highly qualified individual (a health informatician) are admittedly high. However, without a full-time, on-site person, who is capable of fulfilling the role of the information architect, the difficulty of the task increases to the point of becoming nearly impossible.

Decisions or policy making towards the delivery of healthcare will have to take into consideration the fact that there is a tendency towards urban migration from the rural areas, which results in over population and unemployment in the urban areas. This is a trend, not only in The Gambia, but in almost all African countries. It is worth reiterating that a principal issue in relation to health or medical informatics is the mobility of the population.

The youth constitute the majority of the country's populace with about 45% being under 15 years and 18% being between the ages of 15 and 24 years. The age group of 65 years and above accounts for only 3.4% of the population. Decisions on healthcare should consider the majority being the youth and the healthcare needs of that group.

One area that has developed into an important source of income for the country is tourism. The industry contributes about 10% of the GDP and provides employment for about 2% of the labour force mainly on a seasonal basis. However, tourism has its own disadvantages of bringing in (importing) diseases. However, the need for taking care of 'imported' diseases should not be played down. It is important therefore to have timely and accurate data to enable health personnel to deal with this problem. There is also the need to register all entering the country and recording their basic health details.

9.3.2 Improve Motivation

In some health units including the RVH, the medical officers, midwives, nurses, auxiliaries and the domestic staff are involved in endless rotation within the various departments. RVH also forms a "pool of staff" for postings. These categories of staff are bound to feel that they do not belong to any department or to the RVH itself. In the interest of continuity and commitment to patient care, it is strongly recommended that deployment of a minimum core of "permanent staff" of all categories to each department be considered.

During the survey, most health workers said the government under-funds the health sector, human resource or development, improving the working conditions, for the health workers to improve staff retention, information based planning, rational decision-making. There is a need for strongly increased support for, and a greater valuing of, the primary health system because it has been seriously neglected over the years.

However, people with the necessary skills are far more difficult to come by. Beyond that there has to be an understanding and willingness and the climate, political or otherwise, that will facilitate the implementation, sustainability and the use of the information. At the present salary scales, the government may never be able to attract people with all the ready-made credentials. Those people can make a lot more money somewhere else. The Gambia government must make frantic efforts to improve salaries.

A benefit from the introduction of a health information and administrative system is that the attraction of learning to use the technology can act as an important incentive to boost staff moral.

9.3.3 Ensuring Actual Implementation and Evaluation

In order to ensure a successful implementation of the proposed system, The Gambia government is urged to follow as strictly as possible the requirements put forward as in the requirements analysis in chapter 7. An implementation committee should be set up to oversee the carrying out of the implementation process taking into account all the technical and strategic issues involved including ensuring a successful transition phase.

It is the function of the HIAS to organise and analyse data collected in order to provide or present information in the format that planners, managers and decision-makers can use. However, it is not the HIAS or information unit, but the planners, managers and decision-makers, who have to use the information and make recommendations; it is their responsibility or choice.

Between one month and a year after the implementation, an evaluation should be conducted again to be overseen by the implementation committee. This is essential in order to assess how effectively and/or efficiently the proposed system is working and what improvements can be made if any. It is recommended that the evaluation process use the example of the stakeholder matrix analysis described in Carson et al. [68]. This uses a range of necessary criteria such as; is the system physically usable, does it work and is it capable of performing the task it was built for, is it readily acceptable by the users, is it safe and is it reliable such that it will not crash easily.

9.4 Communication, Coordination and Integration of all Stakeholders

The key decision-makers (the interviewees) all agreed that there are delays in sending or receiving reports from each other. Some of the reasons given are that there does not seem to be much linkage between the different health units. There is no organised system of reporting to each other and communication is not happening very effectively.

To improve the situation, most of those questioned thought they should make sure that the health units (government, NGOs and private sector) are linked properly with good coordination, if things are to work properly. That there should be a well established recording system, a reporting system and an integrated system so that they all know they are part of one system and have to report to each other.

From observations made during the action research the researcher has concluded that in The Gambia, one of the biggest problems confronting proper patient care and healthcare in general is the lack of communication between all the healthcare professionals though as a team they all have one main objective; that objective, being the welfare of the patient.

At present, only a relatively small number of senior level personnel in government are involved in decision making without the involvement of the NGOs and private sector. It is not going to be an easy process to get all participants, users, computer scientists, administrators etc. to be continuously involved with both the development and implementation of the system and also to contribute to the decision-making process, whilst management implements the decision.

More often than not, HIS is developed in the atmosphere of central offices and is mostly driven only by the concerns and needs of central planners. It is also usually biased by the needs of people who are far removed from the population to be served. This results in the design of systems that focus mainly on central information needs, often providing very little information that health workers on the ground need to do their jobs effectively.

An HIAS that extracts information from health workers, without assisting them with their work routine, undermines morale and generates data that contributes little of use to central management. A better approach to HIS development is to incorporate (encompass) in the system design a workers perspective. This requires health workers to be actively involved if efforts to improve healthcare and its related programmes are to be successful. It is also important to consider the proper roles of government, NGOs and the private sector and the necessary actions to be taken to improve the accessibility to the quality of services offered by the NGOs and private sector.

In addition, old and emerging diseases in the country are increasingly becoming more complex. There is the need therefore for an increased specialisation of healthcare professionals and this includes health informatics. This also needs a greater amount of cooperation among the health units, health workers and all stakeholders. There is also a greater need for a proper establishment and increase in shared care for patients in The Gambia. For this to work effectively, it requires an increased communication between healthcare professionals, units and stakeholders.

In a nutshell there must be a mechanism for proper and smooth inter-working between the Department of State for Health (DoSH) and all stakeholders to maximise the success of the HIAS.

9.5 Computerisation and Why Hospitals and DHTs Only

In most African countries, there is a vast amount of clinical data that has not been analysed to give an indication of disease patterns and provide information for decision and policy making. This problem needs to be tackled, but can only be well addressed if there is an effective and well-computerised health information system in place despite the poverty 'hurdle'.

Despite years of trying hard, Nigeria which, is considered one of the largest (in size and population) and richest in Africa still struggles with the development of health information systems. Akinde et al. [38] mentioned that the explosion of information in aspects of human endeavour in Nigeria is beginning to pose serious problems and were thus calling for computerisation. That the government should see the computer and their national health information system project as valuable resources and thereby take appropriate steps to make provision for their continuous serviceability and availability.

There is a practical advantage in computerising The Gambia's HIAS. First of all, the health sector has a service objective that requires timely reporting of health indicators to allow the role played by service operators in the improvement of the healthcare in general to be effective. Secondly, from a management perspective, it makes sense to use the availability of present day technology that is comparatively cheaper and yet more effective and efficient in aiding health professionals than ever before. With the sheer volumes of work and lack of manpower, doing things manually is increasingly becoming more and more difficult and error prone. Computerisation of the HIAS data would permit various efficiencies and allow a wider range of operational management than would be possible with manual systems alone.

From their experience in Haiti, Auxila and Rhode in 1988 [43] noted that the process of computerising in and of itself can in fact serve as an opportunity to review and improve dysfunctional manual systems and procedures. This runs counter to the conventional wisdom in the information systems field that suggests that there is little point in computerising poorly functioning systems. Similarly, Sandiford, Annett & Cibulskis in 1992 [44] noted: "The introduction of microcomputers provides the opportunity for a complete rethinking of information needs and a change of staff attitudes towards the utility of data".

Computers, though a useful technology, should be sparingly used, but strategically placed. Many health centres in this country either have no electricity, or only solar panels that run cold chain freezers. Environmental conditions are not suitable for protecting the electrical equipment. The system as it is now would not support full computerisation in these areas.

Hospitals and DHTs, at that level, yes. It needs to be expanded at the individual health team level certainly, but beyond the divisional health teams, no.

Right now in the schools they are introducing computer training in all the senior and many of the junior secondary schools. Ten years from now the country will hopefully have a substantial pool of computer literate, computer comfortable, people entering the work force. Right now you have a mixture of some people who are very comfortable with technology and instruments and other people who are quite literally afraid of them. Those people need a lot of remedial work or they will never be able to use them. Those are the people working in the field now. Giving them computers would not necessarily help.

However, it is true though, if you look around, that you would find small villages out in the bush, with television sets attached to batteries and people watching football games. The decision on that level is 'we like television, we like that technology'. The GSM, the small mobile phone, was introduced barely a year ago and everybody is using it. People have taken to that technology because they want to, and there is a lesson to be learnt here. This goes to show that, if the technology is appropriately available in developing countries, people will use it and this applies to HIAS. Technology in developing countries, where the people and resources can support it, is wonderful. Presently, Internet cafés are springing up; there are computer technology companies popping up all over the place. However, technology requires maintenance and that cannot be separated from technology itself. Maintenance throughout the country will be difficult.

9.5.1 Security and Confidentiality

Hospital medical records are confidential, therefore it should be a strict policy to ensure that all staff observe strict confidentiality. The location and ways of keeping records at the moment do not ensure strict patient confidentiality.

The accessibility of relevant data on the one hand and measures for data protection on the other hand are conflicting. When data must be promptly available in an emergency situation, it can be seen then that each threshold that has been put up to ensure that HIS users have access only to the data to which they have been authorised access is an obstruction. Whether it concerns the access regulation to the HIS or the assurance that a backup of the database is regularly made, each of these data protection measures along with the corresponding procedures is a combination of hardware and software. For backup of the database for instance, equipment must be available and present so that a copy can physically be made and retained. The same holds for software that is able to control and check the equipment and for procedures that ensure that the backup is performed at fixed times, including holidays, when the operator is ill, and so forth.

The problem of file security arises once a system requires a file. Since the information recorded on a file is vital to the efficient working of the total system, it is very important that this information is not corrupted in any way or destroyed.

There should be physical security to ensure that that there is no damage to the files while they are awaiting processing. This responsibility should rest on the HIS administrator. Part of their functions should be to ensure that suitable house keeping facilities exist for the files and this should include fire protection for all master copies. This person will be responsible for keeping all magnetic media free from dust, in a suitable atmosphere without excess temperature or humidity and away from stray magnetic fields. They should also make sure that correct files are issued to the operating staff and that proper records are kept on the movement of all files.

When computer patient records (CPR) or electronic patient records (EPR) data becomes available for different purposes, it is very important to protect the data in order to guard the patients' privacy and to protect the professional interests of healthcare professionals. Even though privacy laws exist in different European countries to control healthcare data, it will be difficult to totally prevent the improper use of data stored in CPRs. If it is difficult in Europe which is developed, it is going to be much more difficult in The Gambia, an African country which is one of the poorest in the world. Despite this, attempts should however be made to put the best available and affordable security system in place.

Operationally, there is the need to put in place security controls and procedures to protect the data against accidental or intentional disclosure to unauthorised persons, or unauthorised modification or destruction of data. Users must be positively identified by the system before they are given access to the data.

9.6 Unique Identification and National Health Service Number

The proposed algorithm for creating a unique identifier for each person as a national health service number was presented in chapter 8 section 8.7.5 and was also discussed in chapter 5 section 5.6. It is important for the government to create a policy to ensure that all health units are obliged to make sure that patient details are captured in the registration and patient record system. Every patient must have a patient's folder containing his/her medical record. It is the responsibility of the nurse in charge of the ward to ensure that patients' folders are kept safely, and all patient documentation is filed promptly and in the right order within the correct folder. Overwhelmed with work, however, with shortage of manpower, things are not done properly (not intentionally).

It would certainly facilitate record keeping, however, if there was a realisation that this country is not fully abreast with any registration system. A prime requirement should be to register everyone at birth and give them a unit number. There needs to be the political will and financing to provide the compulsory registration system that is needed. That is probably more important than who was born and has died, one of the first things one wants to record. Of greater concern however, is the fact that there are a lot of names; people with similar names and data.

Right now the country cannot manage to register births in a timely way, and people do not care about registering births, but within this country people register vehicles, why? Because on the first of February of every year, if you have not renewed your registration, paid your insurance fees, the police impound your vehicle. The first week in February you cannot get anywhere because all the bush taxis are pulled off the road, by the second week in

February, everything is paid up and everyone is back on, because they can enforce the regulation. There has to be the understanding within the population that this healthcare regulation of registration has to be adhered to and the government needs to enforce that.

9.7 Training and Education and Capacity Building Problem

9.7.1 Training and Education

One of the most effective ways of upgrading the technical knowledge of a person is by giving him/her education and training. Unfortunately, in most developing countries including The Gambia, the current health education is very deficient in the informatics component of medical and general healthcare training.

An important and crucial criterion for a successful implementation and integration of any HIS is effective training of healthcare providers. It is important also that the trainers involved should be members of the whole design and evaluation process, with special knowledge in health informatics. This study has identified many shortfalls or problems concerning education and training and capacity building among health workers in The Gambia (see chapter 6).

The level of education within the various health workers in The Gambia varies. Some of the health workers only get on the job-training. Apart from doctors and other specialised medical assistants, there is a large number of nurses working in The Gambia who are trained in The Gambia. Although they have had an education similar to that of nurses in developed countries, they are handicapped by a lack of modern tools and further developmental training. Environmental and hygienic problems are common in The Gambia and health inspectors play an important role in healthcare, including pest control, housing and latrines and food and meat inspection. Apart from nurses and health inspectors, there are those workers such as village health workers who have had only a short term local training, but who are working in their communities to promote hygiene and provide advice on health related problems and treating simple diseases such as diarrhoea.

If good timing and quality of the health data required for an effective HIS is to be efficiently provided by this calibre of health workers then, there is the real need to provide further and periodic training and education for them.

In The Gambia, women are generally responsible for most of health related tasks such as producing and preparing food, carrying drinking water and nursing the children. Therefore, taking care of sick people is usually considered the work of women. However, the percentage of women employed in the health sector is relatively low and the literacy and basic education for women is very low in the country. It is recommended that the gender issue in the level of education, training and lower employment in the health sector (apart from nurses) should be addressed by the government.

In The Gambia, it is difficult for health professionals to get hold of medical journals, newsletters or have meetings and exchange information between health workers within and outside the country. A dialogue between different healthcare systems is non-existent and therefore there is no system of continuing education or training on the job. It is therefore difficult to use or support healthcare capacity building in this area. It must be emphasised that health worker training provides an opportunity for the growth of resources in a poor country like The Gambia. It is for this reason and others that the newly proposed system has been designed to have email, Internet and group wise facilities for educational and other communicational purposes. Internet technology is appropriate to these problems because it provides interoperability and independence of technology, place and supplier. It only requires the user to have a browser on the network, from then on, what used to be islands of information now become accessible.

The government should not try to wean people from the need for official formal training particularly when dealing with information technology and the availability of training lags behind the need to use the equipment. However, self-training is a very important part of keeping current. This is something formal programmes should address because it is essential for the growth and the best functioning of the information unit for everyone to have an attitude of self skill development. One thing that is needed is a change in attitudes and people having the courage to teach themselves and make mistakes. However, the government may need first of all to train some people who would then become trainers.

If one trains certain people selectively, it could have a tremendous impact. There is the need for health workers to go through the HIS, data entry, recording analysis and general computer literacy training process. That small training, expensive as it may be, will have tremendous impact. This is because it will give them a stronger foundation on which to be the directing force for knowing what components have to be brought in, what decisions need to be made, to get the effective functioning of the HIAS. The training would have the advantage of taking hundreds of people and sitting them down and training them to drive home the role of health information systems in providing better patient care and healthcare in general.

In the interim, there is the need for the government to hire a systems analyst and an HIS administrator who can also take care of the network administration. As part of their job description, these people should also be made to train health workers so that they can eventually hand over their skills to the local people. In terms of the HIAS, one or more persons will be hired to work as HIAS administrators, network administrators, and system analysts. Generally, the content of training, needs to be assessed in relation to workers' actual job content.

The assessment of training and its content should be continuous and periodically evaluated with appropriate evaluation methods. Rojas, Haran and Neil [72] reported: "Evaluation has so far revealed little efficiency enhancement in those who participated in intensive training programmes of Central America, relying, as it does, solely on participant questionnaires at completion of instructions. ...**ARE** such courses without benefit **OR** are current evaluation methods faulty". The results of this study (reported in chapter 6) suggests that the situation could be different in The Gambian (or African) setting.

9.7.2 Capacity Building

As a team, healthcare professionals have one main objective; that objective, being the welfare of the patient. The important thing is to be able to provide physical and emotional comfort to the patients in that hour of his/her need and in ensuring that the prescribed treatment is administered properly.

In The Gambia, there are major problems in terms of human and physical resources, technology and pharmaceuticals (drugs). There are many fewer qualified health personnel than needed; most staff are inadequately trained, poorly paid and work in obsolete facilities with chronic shortage of equipment. Among other things, this results in the few professionals who are talented, but demoralised, being "brain drained". They either move into private practice or go abroad for greener pastures. The end result is that it is the poor who are mostly affected.

There is a greater need for more doctors, health professionals and information technology personnel in The Gambia. Doctors, nurses and others who are currently training need to be trained to be more accustomed to the use of information technology and to appreciate the role of health informatics in healthcare not only in The Gambia but the African continent in general. Moreover, due to pressures on population and economic decline, the doctor to patient ratio in some African countries including The Gambia is continually getting smaller. The implementation of the proposed HIAS will help improve this situation and government is urged to speed things up.

The final draft of the health policy framework (Changing for Good: Health Policy Framework) was completed in September 2001 [40]. In the preamble to the section on health information, the policy mentions that: "The current weaknesses in the Health Information System (HIS) include the limited capacity at all levels to collect, analyse and use information effectively. There is an inadequate surveillance system and an out-dated health database. This policy will ensure that HIS provide an effective framework to facilitate planning, budgeting, and monitoring and evaluation of the healthcare delivery system.

The Department of State for Health does not have a strong research base to generate data for management. Also, the findings of some researches conducted in The Gambia are not easily accessible, let alone used in health management. There is a need to establish a Health Research Unit that will promote, coordinate and evaluate all research activities in the country, and to ensure they are relevant and safe."

So what needs to been done is to identify several people who have the initiative and the foundation technical skills and start them off. The government can then ask for help from donor countries or organisations such as the VSO to provide volunteers (system analysts, programme managers, HIAS administrators) for at least two years. Among other things, they can then be the on the job trainers of these people who have the basic technical skills to go through the whole process with these consultants of the implemented HIAS; the data gathering, the decision making, the software training and trouble-shooting. With that type of training, assuming we do not send people away for formal training before the volunteer consultants leave, there will be people at the end who can function at a very high level. This is essential if it is very intense training. So training is such a big thing.

9.8 Impact New System will have on Health workers and Healthcare in General

When Huruki et al. considered it important to make inquiries for assessing the status of hospital information systems (HospIS) in Japan and to evaluate the effects quantitatively they used questionnaire surveys to assess the status of HospISs in Japan for shaping policies for future developments. They found out that the percentage of hospital managers planning to introduce a HospIS ranges from 20 to 30%; same holds for subsystems. This they said shows that HospISs are well accepted in Japan and are being extended. The survey in this study showed that the percentage of health workers agreeing to the introduction of health informaton systems and electronic (computerised) health records ranges from 70.3 to 87.8% indicating that HIS will be highly accepted in The Gambia.

The Gambia health sector has relatively large amounts of non-analysed data (mostly paper based) which, presently are of little or no interest to practicing doctors and other health professionals who actually need operational and administrative information at and about the point of care. If and when the newly developed and proposed HIAS is properly and carefully implemented, the system will be capable of providing doctors, nurses and other health professionals with quick and easy access to the information they need to care for patients. This information will be available or provided when they need it, where they need it, and in the form they find most useful.

Policy makers need to know why health systems perform in certain ways and what they can do to improve the situation. This research has attempted to do that and has managed through questionnaires, observations and interviews to provide some insight into the existing problems, not only from different tactical and strategic perspectives but from grass root or operational levels as well, which is vital.

Presently, there is no system such as a national health account (NHA) in The Gambia. The researcher strongly proposes that one be established as soon as possible. Generally, the government has too little information on financial flows and the generation of human and material resources in the health sector. To correct this, there should be the introduction of a national health account (NHA) or a financial accounts information system (FAIS) as suggested by the proposed HIAS. This system will be able to capture public as well as private inputs and usefully assemble data on physical quantities such as the number of doctors, nurses, laboratory technicians, medical equipment, district health centres as well as their costs. Eventually, NHA data will allow the Ministry of Health to think carefully and critically about purchases by all fund holders in the health system.

This research has provided a platform for improving the working of The Gambian Health Service (GHS) by developing an information technology framework for management of information; enabling people to use IT effectively in the National Health Service. It has revealed and been brought to the attention of the government that, for any section of the health service to function properly, training of staff must be considered and improved significantly.

If properly and fully implemented, this research would have helped to create an environment in which The Gambia Health Service (GHS) can extract the maximum benefit possible from IT; an information system, which will become person-based and integrated: enabling 'seamless' care, while maintaining security and privacy. Such a system should impact in broad terms on healthcare professionals, and drive towards the development and implementation of a Gambian Health Service – a nation wide area network with linkages for divisional local area networks.

Health informatics is a means by which health units, funders and other stakeholders can improve the cost effectiveness and the quality of healthcare. Information is power and integrated healthcare information is even more powerful if it can be controlled properly. Just as information has become a principal product in most of the post industrial economies, so has health informatics a big role to play in healthcare now and in the future and that is what the proposed HIAS is designed to and can do.

As mentioned earlier, the government of The Gambia will be able to reap the utmost advantage (role) of health informatics; which is to support health workers in identifying, managing and properly utilising the information they need. Information may be available, but not in the right format or convenient form. The HIAS, if it comes into being, would provide it in a convenient form, however, people would have to be aware of using it and be willing to do so. There are certain decisions that will have to be made by government in this connection.

Patient data can be easily exchanged between providers on the same level (e.g between different clinicians) and between the different levels (e.g., data flowing from clinicians to the national authorities). Users may benefit from CPR data on all levels. Patient care centres on the use of individual patient data. At the hospital or departmental level, one is interested in information on a broader scale. Statistical reports and bills can be generated automatically on the basis of data contained in the patient record. At a higher level the benefit of CPR-coded data enables the generation of cost-efficiency reports, and the data can serve as input for management and planning. Examples of reports are the number of admissions and outpatients per department or speciality, disease profiles of in- and outpatients, the average cost per diagnostic category or per type of intervention, or overview generated as a function of resources and utilisation of tests. Researchers too may benefit from the CPR by electronically retrieving information about patients according to specified criteria. The information that had been retrieved can then be processed using statistical programs.

A good health information system is like a torch light to guide the health delivery system for better patient care; the drugs, the ambulance, management, decision-making, all these come into play. Health information is crucial in determining policy. The proposed HIAS will ease a lot of the burden on government and therefore decrease the workload for the government.

The general feeling is that, although expatriates may have good intentions, they are often eager to implement their solutions before actually understanding the real problems at the grass roots level. Some feel that the consultants come and they repeat the same things and do not take into consideration the implementation issues and end up over studying the HIS area with reports (they know are not implementable) that are filed away to gather dust. Rather, they want to see consultants who will look at taking the issues further, like indicating what the next steps would be and what it would take to move to those steps. This is one area this study has attempted to address by the conduct of the survey to identify the constraints and the opinions of not only the tactical and strategic decision making personnel, but the grass roots or operational level personnel through interviews, questionnaires and action research.

The design of this HIAS has constructed for the first time in the sub-Saharan region in Africa, a database of reasonable sophistication that past and present healthcare information about individuals can be integrated into as a single database. The inclusion of such a database would be a health record of each patient with a unique national health identifier (or number) that can be used to access his/her records anywhere in the country. This would be able then to provide healthcare records, updateable after each of as many visits made by a patient as appropriate. The design of an HIAS with a patient oriented database and provision of a unique national health service number in an African country is a significant contribution to knowledge; more so in The Gambia where the problem of too many similar names, with people not knowing their dates of births makes the situation worse.

In order to improve on the performance of the health system, it is important to identify the factors (both within and outside the country) that affect the performance and this includes balancing human resources and financial capital. This is what the study sought to do and did through the conduct of the survey's questionnaires, interviews, reports reviews, action research and general literature reviews.

The study has also shown that with the right approach, governments can adequately address healthcare delivery issues from a logical, comprehensive and persuasive perspective rather than in the usual ad-hoc manner of solving problems.

If properly implemented in The Gambia, the HIAS design offered by this study will help to increase the generation and use of information for patient care, health expenditure, services and outcomes. This is because the system will make better use of the available information and help to fill some of the gaps in missing data.

For an implementable project like the one this study has proposed, it is not the theories or the intelligence of the people alone that matter. If at least one child's life can be made better then the project has been successful.

9.9 Summary

This chapter has discussed the principal issues that can affect the implementation and sustainability of the proposed health information and administrative system (HIAS) for The Gambia. In the final chapter, which follows, general and overall conclusions will be presented in terms of the extent to which the objectives of the project have been achieved, contributions to identified and recommendations made.

CHAPTER 10

CONCLUSION AND RECOMMENDATIONS

Having in chapter 9 discussed in detail the major issues arising from this research, this chapter presents the conclusions and recommendations made. The extent to which each objective of the study has been met is indicated. The major findings of the study are presented. The contributions to knowledge in the area of study are discussed. This includes: understanding the complexities of the problems; building on this understanding in terms of requirements analysis and design specifications; and methodological issues. Recommendations to The Gambia government concerning the proposed system are presented. These are put under three main areas as policy recommendations, resources recommendations and training and motivation recommendations. What should happen in the future is also outlined.

10.1 Meeting the Aims and Objectives

The primary aim of this study was to develop a prototype health information system (HIS) in The Gambia that should be capable of providing doctors, nurses and other healthcare professionals with quick and easy access to the information to care for patients. The aim was also to provide this information when they need it, where they need it, and in the format in which they find most useful. This aim has been substantially achieved by the researcher being able to propose a health information and administrative system with its requirements analysis (chapter 7) and a design specification (chapter 8). This has been based on an extensive review of literature, reports of consultants and a thorough investigational study through interviews, questionnaires and action (observational) research. What is left is for the government to implement the proposed system.

The first specific objective of reviewing and documenting the existing knowledge, experiences, status and achievement of health informatics to date in both developed and developing countries has been achieved. Chapter 3 documented the results of this review.

The second objective was to investigate, describe and document the current situation, the provision and challenges of healthcare delivery in The Gambia. This was achieved through preliminary interviews, personal communications with relevant health professionals and document reviews. The findings have been presented in chapter two and in section 3.2.3.5 of chapter 3.

The third objective was to specify areas from the literature review that could be applied to the development of an HIS in The Gambia in recognition of the needs and expectations of The Gambian people. This has also been achieved through the review of experiences in different countries across the globe. The specified areas are described in chapter 3 under section 3.3 captioned as "lessons learnt".

The fourth objective was to investigate factors influencing the provision of proper healthcare in The Gambia and identify those that could be addressed by putting in place a proper HIS. The fifth objective was to identify factors that may influence the introduction or development of a health information system in The Gambia. These objectives together, two of the main reasons why the survey part of this project was conducted. The methodology, as described fully in chapters 4 and 5, has mainly relied on the use of questionnaires, the interviewing of key strategic and tactical managers, action research and reviews of documents and reports by previous consultants. The major findings of these investigations have been described in chapter 6 as data analysis, results and interpretation.

The sixth objective was to develop a prototype health information system using appropriate information technology which is convenient and at a comparatively low cost. Based on the findings of the survey and the strong views expressed by the health workers (future users of the system), a requirements analysis was performed (chapter 7) and a design specification produced (chapter 8). Constraints in the programme of research were such that it was not possible to continue on with a prototype implementation based on this design. Hence it is now for The Gambia government to implement the proposed system.

The seventh objective was to make recommendations to The Gambian government concerning the implementation and sustainability of the health information system to be put in place. These are presented below in section 10.4, having taken into account the factors that may seriously affect the introduction of the proposed system.

10.2 Major Findings of the Study

Major conclusions have been reached during the conduct of this study. These major findings are presented below.

Virtually all health workers in The Gambia agree that development of a health information system should be one of the top priorities of the government. 87.8% of health workers agreed that the development of HIS in The Gambia should be one of the top priorities, 98.0% agreed that the current health system needs improvement and 89.9% agreed that all health facilities need a new health information system. 78.9% said that electronic (computerised) patient records in health facilities are long overdue, 70.3% said that electronic (computerised) health records are needed for everybody in the country and 84.3% said it will be useful for everybody to have a national health service number.

It is evident that information and communication technology (ICT) is relatively a new concept in The Gambia and that traditionally The Gambia has been lagging behind in information technology (IT) and more so in health informatics. When it comes to recording patient data, paper is still the top technology and this poses several problems to patients, doctors and researchers in their quest for medical information.

There is a lack of systematisation and computers in most health units especially in the area of medical record keeping. There is thus a real need for modern and efficient information systems and technology. There is also a lack of computer training within the health sector. The percentage of health workers receving formal training of any kind concerning data is inadequate (35.3% to 54.6%).

With regards to computer usage, only 38.4% of the health workers claim to use a computer in their day to day work although 55.4% said they have used a computer before. Only 14.4% said they have a computer of their own to use. Interestingly, 47.0% of health workers (HW) have email addresses. A total of 72.5% use email or access the internet weekly indicating that if the technology was to be made available to the health workers with appropriate training and motivation, the interest would be there to use it.

The study (see chapter 6) showed that having received formal training of any kind in data handling or computer skills has a great impact on whether the health worker ever uses a computer or not (with highly significant p values from 0.0000 – 0.0002). For example, 94.2% of those who have ever received a formal training in computer skills have ever used computers (compared to 30.2% who have not received formal training in computer skills who have ever used computers). Those who have are 37.36 times more likely to use computers than those who have not received any formal training in computer skills. Similar arguments can be built for all the other factors, highlighting the message that receiving formal training in data handling and/or computer skills will greatly influence the use of computers by health workers. This is important in a world where, despite great leaps in computer technology, people are still technophobia and sceptical about the introduction of computers which is seen as coming to replace their jobs sooner or later.

78.9% of health workers produce their reports manually, only 19.0% produce electronically, while 2.2% use both methods. This high level of manual reporting needs to be addressed in future.

There are many fewer qualified health personnel than needed; most staff are inadequately trained, poorly paid and work in obsolete facilities with chronic shortage of equipment. This results in the few professionals who are talented but demoralised being "brain drained".

There is a general cry by all cadres of health workers for training and further education in the health profession. 96.3% of health workers agreed in total that there is a need for training of one kind or another in the handling of data in the health service. The entire Gambian population is unfortunately largely illiterate.

There is insufficient budgetary provision for the health sector and a lack of financial and human resources for operational activities. The control of the operational budget, the accounting system and staff development, which should be delegated to the Divisional Health Teams (DHTs), is still not effected.

In The Gambia, there is presently first of all no proper system in place to facilitate finding the information needed to use for better delivery of care. No information means there is a continueing burden on healthcare delivery. No basic structure or policies exists for collecting data, what is available is error prone and no properly centralised computerised or paper based system is in place in the country.

There are no properly coordinated existing health information systems in The Gambia; neither electronic nor properly established paper based systems. NGOs and other charitable organisations have different and separate systems that are not directly integrated into The Gambia National Health Service and no proper integration of the different health centres' facilities. There is actually nothing one can even call a National Computer Network in the country.

There is no existing national enforcement of the registration of births, marriages and deaths and no proper training of staff dealing with records.

There is no properly established national Health Information Systems' policy in place although a draft policy has been produced quite recently in April 2002 which is yet to be finalised and approved by all concerned.

There is a lack of continous supply of electricity and no generators are available as alternatives in the case of power failure. Equally there is a lack of a proper communication system among health workers because of lack of telephones and hence of their use in offices.

The telephone systems in The Gambia used to be amongst the best in the sub-region but are presently deteriorating without any signs of being saved from total collapse. Without much money poured into its sustainability the telecommunications system will in the not too distant future be counted as one of those that are far behind the latest technology. If there should be a proper implementation of the proposed National Health Information System then provision should be made for a telecommunications system to link the appropriate network(s) of computers and this system must be reliable and stable and less likely to be affected by new constructions. This is one area where the economic strength of the country, priorities and the government's willingness to carry health policies through can be tested.

There is a lack of cooperation or integration between the government, the private sector and NGOs. This leads to unnecessary duplication of effort and waste of resources.

The Department of State for Health does not have a strong research base to generate data for management. Also, the findings of some researches conducted in The Gambia are not easily accessible, let alone used in health management. There is a need to establish a Health Research Unit that will promote, coordinate and evaluate all research activities in the country, and to ensure they are relevant and safe."

10.3 Contributions to Knowledge in Health Informatics: The Gambian Experience

The study has demonstrated the value and role of health informatics in the provision of healthcare in a developing country. It has contributed to a greater understanding of the complexities of the problems in The Gambia (and in developing countries more generally), building on this understanding in terms of carrying out the requirements analysis and design specification and the methodology adopted.

It has become apparent from this study that in the development of an HIS in The Gambia (and for that matter poorer developing countries), it is not only the technological hardware and software availability that matters, but also the sociological, cultural, attitudinal, political, financial and infrastructural settings as well as the methodological approach adopted.

Summarising, the contributions to knowledge are presented below.

10.3.1 Understanding the Complexities of the Situation

The study has contributed by identifying operational lapses and policy defects that previously eluded experts contracted to look into healthcare issues in The Gambia. It has also enhanced understanding of the spectrum of difficulties and challenges posed in relation to healthcare provision in The Gambia.

The study has also shown that experts (mostly from developed countries with good intentions) often eagerly implement their solutions before actually going down to the grass root level to try and understand the real problems. Often the result has been that implementation issues have not been considered and this renders the reports produced not implementable.

The study has also shown that in developing countries, researchers need an extensive level of authourity to do things and that it takes a longer time and the willingness of the government to initiate action or see projects through, regardless of the soundness of the project. When planning projects in developing countries, as exemplified by The Gambia, it is necessary to allow for unexpected delays in the project's duration when undertaking gantt chart planning. This should be in the range of a quarter to a third of the total normal planned project duration. This will generally cater for unexpected delays.

The study has demonstrated the importance of knowing that the attitudes of the people involved, including their cultural values. Also, that it takes a long time and many bureaucratic steps to get things going. Time must be allowed for dealing with bureaucracy likely to be encountered, recognising that the cooperation of several levels of authority is essential in order to secure the right political backing for the project.

10.3.2 Building on this Understanding in Terms of Requirements Analysis and Design Specification

The study has contributed to knowledge in the area of building a feasible construct (framework) to adequately address healthcare delivery issues (in a logical, comprehensive and persuasive manner), in contrast to the ad hoc approaches that have gone before. This is the approach needed if governments are to adequately address healthcare delivery issues.

The study has also made available the necessary tools to enhance and markedly accelerate the full implementation of this system. The design specification of an HIAS with a patient oriented database and provision of a unique national health service number in an African country is a significant contribution to knowledge; all the more so in The Gambia where the problem of too many similar names, with people not knowing their dates of birth, making the situation worse.

Based on the extensive requirements analysis and design specification undertaken, as well as recommendations provided, the study has carved a clear path for the future of healthcare provision in The Gambia.

10.3.3 Methodological Issues

Methodologically, the study has shown the need to use a judicious mixture of techniques in extracting the knowledge or information needed. To fully understand the issues affecting the development of health information systems (HIS) in developing countries, it has been shown to be necessary to adopt a mix of methods (including a combination of interviews, questionnaires, action research reports and review documents) and not just one. Moreover, in designing questionnaires, there is the need to consider the culture of the people involved, with a possible piloting before attempting to go into the field.

The methodological lessons learnt from this specific study would be applicable across complex situations more generally in the environment of a developing country.

10.4 Recommendations

10.4.1 Policy Recommendations

- The Gambian government is urged to embark on a speedy implementation of the proposed system and to continue to strengthen it by developing the skills needed by the health workers.
- Implementation should be stepwise before it finally goes to the rural areas.
- An implementation committee should be set up to oversee the carrying out of the implementation process, taking into account all the technical and strategic issues involved including ensuring a successful transition phase.
- Power supply issues need to be addressed. Many health centres in this country either have no electricity, or only solar panels that run cold chain freezers. Environmental conditions are not suitable for protecting the electrical equipment. The power supply system as it is now would not support full computerisation in these areas. Hospitals and DHTs, at that level, yes. It needs to be expanded at the individual health team level certainly, but beyond the divisional health teams, no.
- Legislation needs to be put in place to oblige all health units (private, government and NGOs) to comply to provide the minimum needed health indicators for the country.
- There is the need to legislate a policy that is specifically aimed at HIS.
- Legislate for and enact the registration of births and death and the introduction of unique identification of the general population.
- As a matter of urgency, a policy needs to be adopted to mandate the creation of a nation-wide national health service numbers.
- Introduce proper maintenance and use of records, processing and basic concepts of health informatics in the country's health curricula and institutions. This way the government will be able to reap the benefit of health informatics; which is to support

health workers in identifying, managing and properly utilising the information they need.

- Introduce an Electronic Patient Record system and plan for the process of building an Electronic Health Record system in the nearest future.
- Introduce continuous communication between the central level (strategic and tactical) and the lower level (operational), in the form of sensitisation.
- In order to achieve the important goal of providing valuable information that can lead to improved patient care, there is the need for a proper process of recruitment of staff, with the selection not being governed by shortage. There is also the need for the introduction of on-the-job and other training programmes.
- In the interest of continuity and commitment to patient care, it is strongly recommended that deployment of a minimum core of "permanent staff" of all categories to each health department in health units be considered.
- Develop a maintenance strategy that includes among the development of an inventory system to include all equipment including furniture and buildings; this will enhance accountability and the proper handling and management of government property.
- In terms of health policy in The Gambia, recognising the need for decentralisation to be effective, with local control over operational budgets, the accounting system and staff development must be delegated to the Divisional Health Teams.
- It is imperative that there is provision of monthly divisional information to the Epidemiological and Statistical Unit (ESU) from the Divisional Health Teams (DHTs) and the three major government hospitals; for example the number of patients attended to and treated, number of deliveries, deaths, referrals, types of diseases diagnosed, logistics used and costing, etc..
- There must also be a supply of monthly information to the ESU from the NGOs, private hospitals and clinics, detailing the parameters already mentioned for the DHTs (but not necessarily the logistics used) and costing. The monthly provision of the data is to enable the ESU to have a timely collation and analysis of the health data provided and to update the national health database for the timely preparation of reports and provision of information for decision making.

- Make it also imperative to have a least weekly despatch of drug administration information to the ESU – to give an indication of stock levels and to prevent national shortages. This is because one of the backbones of good patient care is the availability of the right drugs at the time when they are needed and in the place where they are needed. The Gambia's health system has been hampered by drug shortages because of inadequate forecasting, hence the need for frequent information on stock piles.
- There must be a or weekly despatch of stock data from the National Health Laboratory (NHL) to the ESU in order to avoid encountering situations of possible shortages in logistics (such as biological reagents) needed by the laboratories.
- Establish a proper monitoring of the financial activities of hospitals, dispensaries, major and minor health centres. Guidelines and a code of adherence must be introduced to ensure the success of the Drug and Cost Recovery Programme.
- At present there is no national health account (NHA) in The Gambia. It is strongly proposed that one be established as soon as possible. Generally, the government has too little information on financial flows and the generation of human and material resources in the health sector.
- With the different levels of data collection and processing already existing with respect to the players in the proposed HIS, there needs to be a government policy to serve as a means to regulate, facilitate and coordinate the release of required information to the points at which it is processed. Without such a policy (directive), information sharing will be politicised by different players, with each party trying to protect their intellectual property.
- Despite problems with name similarities, unknown birth dates (by patients themselves) or inadequate registration information on births, marriages or deaths, the government should bear the responsibility for ensuring that every health facility henceforth collects and records this information, if the proposed HIS is be to effective.
- There must be a mechanism for proper and smooth inter-working between the DoSH and all stakeholders so as to maximise the success of the HIAS.
- At the same time, the computerised facility for data processing should create unique identifiers from a combination of name and other data such as health unit and date.

- The creation of a unique identifier must be standardised. The system should be interrogated when one such identifier is created to ensure that it does not already exist
- The proposed system should be evaluated using the example of the stakeholder matrix analysis described in Carson et al. [68]. This incorporates a range of necessary criteria such as: is the system physically usable, does it work and is it capable of performing the task it was built for, is it readily acceptable by the users, is it safe and is it reliable such that it will not crash easily.

10.4.2 Resource Recommendations

The estimated overall cost of implementing the system for the first one year is £86,630 (£30,750 for capital costs and £55,880 for recurrent costs).

- Provide each DHT and the three hospitals as well as the seven major health centres with at least two computers each.
- Provide more manpower and prevent the high attrition rate by improving salaries in the health sector.
- Provide data entry clerks at all DHTs and hospitals as well as major health centres.
- Improve the provision of basic tools for the collection and compilation of data.
- There is the need for more public health workers. Unless measures are taken to employ more of the right calibre of health workers (through recruitment campaigns), the data collection, recording and some analysis functions will be characterised by inaccuracies, inconsistencies, and severe manpower shortage. This obviously creates data management problems and flaws the whole system.
- In the long term, providing data entry clerks to each DHT will speed data entry and transmission, and will ensure more rapid, accurate and timely data analysis. While the latter may not be immediately possible, it must be considered as a priority for the near future.
- There are other logistical requirements. This is because, with a large rural population, coupled with poor infrastructure and problems of accessibility to these areas, it is imperative that appropriate transportation is made easily available to health workers to facilitate the collection of relevant data.

- In order to properly receive the information that is necessary for the monitoring and evaluation of programmes, for planning and for management of resources, the DoSH must provide the DHTs and the ESU with the basic ingredients of the system. These must essentially include supplying personnel, equipment and stationary items needed to produce the data collection instruments as well as the equipment and technical support to maintain and analyse the database.
- It is inconceivable to have a DBMS without a database administrator (DBA) or HIS Administrator to manage the database or database server. It is therefore imperative to identify and train someone to handle the DBMS, networking, relational databases, SQL, backups and restore processes and who, very importantly, has a good understanding of the underlying HIS processes.
- The power supply must be stable and standby facilities should be available at each processing point; The Gambia has power outages, so generators and uninterrupted power supplies (UPSs) are essential.
- A telephone facility must be in place to permit dial-up, email and Internet use.
- There must be a dial-in service facility to provide an on-demand service and not a 24-hour (round the clock) service so as to reduce overheads.
- For the data collection instruments it is important to ensure that every DHT has a functioning photocopier and paper for form reproduction. Since there is still the use of stencils for form production, there is the need to ensure that each DHT has a functioning stencil duplicating machine and is adequately provided with stencils and ink. With regards to the equipment and technical support it is essential that each DHT is supplied with a Pentium 4 computer and monitor, printer (same or another that can cut stencils), diskettes and telephone service for communication with ESU.

10.4.3 Training and Motivation Recommendations

- Train local staff generally.
- Motivate and retain trained staff, increase the numbers of trained staff; currently they are so few in number that they do not have much time to spend with patients.
- Increase supervision at all levels.

- Introduce computer literacy in all health-related professional institutions, including the School of Nursing, School of Public Health and the newly opened medical school.
- Provide in service training and encourage health professionals already in the system to be interested in computing and other areas of health informatics.
- Medical records offices should be introduced in all major health centres and hospitals and existing ones should be strengthened in terms of equipment, human resources and training. These are areas to be encouraged and personnel should be encouraged to engage in research.
- There is the need to establish and train people for the purpose of accurate coding of patients' diagnosis under the International Classification of Diseases (ICD) system.
- Worthy of particular mention is the training of trainers. This has a multiplier effect that has been very successful and effective in dealing with grass-root populations.
- The percentage of women employed in the health sector and at senior positions is relatively low and the literacy and basic education for women is very low in the country. It is recommended that the gender issue in the level of education, training and employment in the health sector (apart from nurses) should be addressed by the government.

10.5 Where Do We Go From Here: Future Investigations

There are areas of concern where further exploitation or study is needed on the part of the government. The major areas are:

- Evaluate, a year after the implementation of the HIAS, the impact it has on patient care in particular, healthcare in general and the health workers themselves.
- Conduct a one year post implementation survey on user acceptability of the new system and its impact on general technophobia among health workers.
- Investigate further any hidden constraints or inhibitors to the improvement of ICT in general in the entire country.
- Set up a committee to look into the future expansion of the HIAS to encompass the whole nation, particularly the rural areas.

- Set up a committee to investigate further the problem of the high attrition rate or brain drain amongst workers in the health sector.
- Investigate further the training, education and capacity building needs of the various health units.
- Conduct a feasibility study pertaining to the establishment of a national computer network for the whole of The Gambia.

If properly implemented in The Gambia, the HIAS design offered by this study will help to increase the generation and use of information for patient care, health expenditure, services and outcomes. This will be achieved because the system will make better use of the available information and help to fill some of the gaps in missing data.

Health informatics continue to have a great potential to benefit the healthcare sector from government health departments, making of health policies, hospitals, major and minor health centres to private hospitals and clinics, health insurance organisations, non-governmental as well as research organisations.

For an implementable project like the one this study has proposed, it is not the theories or the intelligence of the people alone that matter, but that if at least one child's life can be made better then the project will have been successful.

10.6 Summary

In this chapter the study conclusions and recommendations have been presented. The extent to which each objective of the study has been met was indicated. The major findings of the study were presented. The contributions to knowledge in the area of study were discussed. This included: understanding the complexities of the problems; building on this understanding in terms of requirements analysis and design specifications; and methodological issues. Recommendations to The Gambia government concerning the proposed system were presented. These were put under three main areas as policy recommendations, resources recommendations and training and motivation recommendations. What should happen in the future was also outlined.

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APPENDIX A: Draft Terms of Reference for Technical Assistance for the Design of Health information System

PARTICIPATORY HEALTH POPULATION AND NUTRITION PROJECT

DRAFT TERMS OF REFERENCE

FOR

Technical Assistance for the Design of a Health Information System

Background

The health information system of the Department of State for Health, Social Welfare and Women's Affairs (SDH) has been studied on several occasions in the last few years and the issues identified ~~are~~ can be summarised as follows:

- Lack of government policy on HIS, a.o. defining regulations for HIS operations and identifying the supervisory lines for Epidemiological and Statistical Unit (ESU) and its financial allocations.
- Lack of minimum set of indicators for health monitoring,
- Lack of standard case definitions for some definitions of epidemic potential and of public health importance,
- Lack or inadequacy of knowledge in data recording, analysis, interpretation, reporting and use at all levels,
- Lack or inadequacy of skills in computer use at the central and divisional levels.
- Lack of feedback at all levels.
- Lack or inadequacy equipment and software.
- Inadequate allocation of budgetary resources.
- Poor housekeeping at ESU.
- Too many data collected.
- Lack of analytical skills of staff at all levels.

General Task Description

For the Financial Information System (FIS) and the Human Resources Information System (HMIS) the situation is not much better. All inform systems need therefore a thorough review and redesign. The consultant will occupy him/herself with the health information system, but will work together with others who work on the design of the HRIS and FIS and make sure that compatible systems are being set-up.

The consultant will focus first on the redesign of the information system of the first and second level of care and especially on the PHC system in The Gambia. Her or she will work closely with the authorities and staff at central and divisional levels in SDH and make sure that the results of the consultancy are a combined effort of him/her and the Gambians.

Specific outputs

1. The consultant will assist in the design of a HIS policy, defining the role of the HIS, the responsibilities of the ESU (Epidemiological and Statistics Unit) in the DPI (Divisional Health Teams) and different levels of health workers in HIS. The policy will decide on the functions of the major tools of the HIS such as regular data collection, disease surveillance systems, and surveys.

2. In a participatory way the consultant will help establish a well-defined list of indicators, based on the priority health problems, priority of SDH, and based on sound management principles to enable SDH to measure efficiency and cost-effectiveness of the health system.

3. After a review of the present data collecting instruments a new coherent set of instruments will be designed. The data collecting instruments should facilitate the monitoring of program performance and evaluation of program impact at all levels in the sector, from the level of the Community Health Nurse (CHN) to the national DPI.

4. The consultant will advice on the introduction of software to make it possible that the HIS is computerised at central and DHT level.

5. The consultant will develop training materials for all levels to make the introduction of a revamped HIS possible.

6. The consultant will provide TOT (training of trainers) for the introduction of the HIS. The training should include computer training, skills training in data collection, analysis and reporting for the appropriate levels.

Time Frame

It is expected that the consultant will carry out the task over a period of one and a half to two years, starting mid-98.

Profile of the Consultant

- Master of Public Health, with at least 5 years experience in Health Information Systems in the setting of a developing country.

- Proven track record of good communication skills, and working in a participatory way,

- Ability and Willingness to train staff at different levels,

- Fluent in written and spoken English.

Conditions of Service

SDH is responsible for the provision of a visa to the consultant. It will make appropriate office space and equipment available.

The consultant will report to the Director of Planning and Information, and work in close co-ordination with the Head of the ESU.

The consultant will be provided with SDH transport whenever this is considered necessary for the implementation of the scheduled activities.

The consultant is responsible for his/her own housing arrangements.

The remuneration is based on a salary of (USD 4,000 in the first and last month).

Compensation of international travel (economy class) will be provided for a maximum of two round trips during the consultancy, including initial and final home travel.

APPENDIX B: Final Draft of Terms of Reference for Technical Assistance for the Design of Health information System

Lawrence Kweku Yamuah

From: dawda <djoof@qanet.gm>
To: Lawrence Kweku Yamuah <L.K.Yamuah@city.ac.uk>
Sent: 28 March 2001 09:38
Attach: Technical Assistance for the Design of a HMIS ver 3a.doc
Subject: HMIS TOR

Dear Lawrence,

Find attached the HMIS TOR for your information.

Dawda

Terms of Reference for Technical Assistance for the Design of a Health Management Information System

Development of a Health Management Information System Phase I:

Identification and evaluation of user information needs, system design and preparation of a Master Plan for HMIS development

(12 weeks)

Background

The Government of The Gambia has received a credit of $18.0 million from the International Development Agency (IDA) for the Participatory Health, Population and Nutrition Project (PHPNP), managed by the Department of State for Health and Social Welfare (DoSH) with IDA support. The overall goal of this project is to improve family health throughout the country. One of the PHPNP components focuses on management and implementation of the Family Health Programme. The ready availability of timely and accurate information is essential for effective management of the health system and for cost-effective planning that is responsive to the needs of the communities being served.

In order to strengthen DoSH's programme management, as well as its planning and monitoring and evaluation capacities, the foundation for a comprehensive Health Management Information System (HMIS) is to be developed. The core of the system will include: the ***Health Information System*** (HIS, including Health Indicators Database, Reference Databases and Disease Control Database), the ***Finance and Accounting Information System*** (FMIS), the ***Human Resources Information System*** (HRIS) and the ***Drugs Information System*** (procurement and inventory management). To accomplish this, two consultancies are planned, at first to develop a guiding Master Plan, organisational structure and system architecture, and then a second to begin to implement that plan.

At present, a draft health policy has been prepared and is under review. This draft policy includes general recommendations for HMIS policy and strategies, and for implementation of these strategies within the DoSH.

A set of key indicators for disease surveillance, for monitoring health conditions across the country, and for supervising and evaluating health care delivery has been developed. These will be in use when the consultancy begins.

There exist currently a number of vertical programmes, and related agencies or units, which have information and reporting requirements that are not integrated with the central HIS. This multiplicity of parallel systems has resulted in duplication of reporting and incompatible databases, which make information sharing difficult if not impossible.

In the absence of a Master Plan for an HMIS and a coherent organisational structure, there is little or no coordination among the programmes and managers of the various units, leading to duplication of effort and expenditure, unplanned software and hardware purchases and no provision for maintaining and troubleshooting the equipment.

Without a Master Plan, there has been inadequate staffing, and no significant training in information management, computing and information use.

It is envisioned that development of a Master Plan would include organisational structure and reporting responsibilities, recommendations for core modules and the phased expansion of the HMIS, for essential staffing and management of the system, as well as equipment and resource requirements to sustain the function of the HMIS.

The DoSH will establish an HMIS working group to support and coordinate the project, working with the consultants throughout the duration of the mission.

Plan of Approach

Development of an HMIS for the DoSH will be conducted in two phases, requiring two separate, but related consultancies. The first mission will develop various viable options for a Master Plan for the system, addressing user needs, reporting, system architecture, and organisation and policy issues. The second mission will comprise implementation of the HMIS from the option selectedby the DoSH.

After submission of the Master Plan options, organisational material and the recommendations developed in the first phase, these various options will be reviewed by the HMIS Administrator, designated staff of the Directorate of Planning and Information and senior managers of the DoSH, who will select the most appropriate plan for implementation. Final Terms of Reference for the Implementation Phase will be developed based upon the option selected by DoSH and a separate solicitation for this phase will be made. The consultant group selected for Phase I may or may not be continued, subject to satisfactory performance in the initial assignment.

Objectives

1. To identify and incorporate the essential information needs of end users at all levels of the health system, including central level managers and units, divisional health teams, health facilities and hospitals and communities.
2. To develop, with the Department of State for Health, various viable options for a Master Plan and organisational structure for the phased development of a comprehensive HMIS, including recommendations for the sequence and time frame for the sequential phases.
3. To develop the system architecture for the core components of the HMIS, taking into account the ability to expand the system to include additional modules.
4. To prepare options for a plan of action to implement the stages of HMIS development.

General Task Description

The consultants will work closely and collaboratively with managers and staff of the DoSH at all levels, particularly with the HMIS administrator and designated staff of the Directorate of Planning and Information (DPI) and the Information Unit, including the director, the health economist and senior planners, as counterparts, not simply as outside advisors. Other counterparts in Phase I will include, but not be limited to, Director of Health Services, the Principal Public Health Officer and the Chief Nursing Officer (for human resource matters), the Chief Pharmacist, the DoSH Senior Accountant and their designated staff. Hospital Chief Executives and Administrators and Divisional Health Team Officers-In-Charge will also participate. An essential feature of this consultancy will be training of the counterparts, in HMIS organisation and processes.

The contract will be supervised by the Director of Planning and Information and by the HMIS Administrator.

Specific Tasks

1. To identify and evaluate the essential information requirements of end users of the information at all levels of the health system, including central level management, peripheral managers and community level decision makers as well as donor partners. This should be accomplished with the participation of staff from all levels of the DoSH.

2. To identify and evaluate the information systems currently in use or under development within the DoSH. This evaluation will focus on the core modules listed in the above Background section and will concern itself with information flow (both of data and information feedback), transmission methodology (both electronic and paper as appropriate to each level), and communication needs and support systems. The evaluation will not concern itself with recently developed HIS indicators currently being used or with modification of patient record keeping underway at Royal Victoria Hospital.

3. To assess the willingness of each level of the DoSH to support a centralised HMIS, and evaluate the ability of the system to accommodate special units' information needs in the central system.

4. To recommend various viable options for a Master Plan for the phased development of the HMIS. These options will include policy, administrative organisation, responsibilities and procedures. The plans will define information flow, identify key personnel for management of the HMIS, define their interaction and reporting responsibilities, recommend a process for integration of the vertical reporting systems existing in various departments, directorates and units, and propose appropriate plans of action for implementation of each of the HMIS options.

5. To propose system architecture incorporating the core modules, and able to accommodate additional expansion, detailing the advantages and disadvantages as well as the estimated costs of the proposed plans.

   The consulting group will work with the HMIS administrator and/or designated staff of the Directorate of Planning and Information in developing the system architecture for the HMIS. They will recommend preferably locally supported, standard hardware, software and network capacities, which will allow sharing of information among the various database components. The consultants will liase with the Department of State for Finance (Central Statistics Department), Department of State for Education, National Environment Agency (for Geographic Information System/GIS-related activities), Non-governmental Organisations and donor partners and with other departments and agencies as appropriate. The goal will be to insure the maximum possible compatibility of the HMIS with financial and demographic systems in use, or in development, in other departments of government.

6. To identify specific equipment, communication, supply, staffing and training needs, at community, facility, divisional and central levels, necessary to introduce and to maintain the long-term functioning of the HMIS. This should include cost estimates.

7. To prepare recommendations for personnel, material and resources, including cost estimates, required to sustain the HMIS.

8. To advise on the phased introduction of additional components of the overall HMIS, including estimates for the personnel, material and financial resources necessary to support such additions.

9. To evaluate training needs in use, maintenance and support of computing, MIS management and planning at each level of the system and recommend steps to address these needs.

Time Frame

A preliminary draft of the Master Plan and supporting documentation should be provided to the HMIS Administrator and the DPI after six weeks. The final plan and all supporting material and documentation will be delivered to them at the end of the 12 weeks.

Reporting Requirements

The consulting group will report to the Director of Planning and Information and/or the HMIS administrator. It will furnish bimonthly progress reports during the contract period.

A preliminary draft of the Master Plan and supporting documentation should be provided to the HMIS Administrator and the DPI after six weeks. The final plan and all supporting material and documentation will be delivered to them at the end of the 12 weeks.

At the completion of the mission, it will furnish "Options for A Master Information System Plan" for the phased development of an HMIS, detailed organisational structures, proposed system architectures, and details of personnel, equipment and material necessary to implement each option proposed for the HMIS, including cost estimates.

Payments to the consultants will be in increments, linked to the delivery of a satisfactory draft and final Master Plan.

Criteria for Selection of the Consultant Group

- Because of the complexity of the tasks involved, the consultancy will require a group effort, with expertise in health care delivery in developing countries, in data processing and computing and in information system management.
- The group should be experienced in all aspects of strategic planning of Management Information Systems.
- The group should have strong credentials and previous experience in developing and implementing Health Management Information Systems, including financial and human resource management information.
- The group should have a proven track record of excellent communication skills, training expertise and experience in working in a collaborative manner.
- State of the art knowledge of database and management software, computing hardware and remote and local network systems is essential.
- Previous experience in West Africa would be desirable.
- The group will be fluent in written and spoken English.

APPENDIX C: Definitions of Health / Medical Informatics

The American Medical Informatics Association AMIA adopted as the theme of its1999 annual conference four concepts or cornerstones for a new information management environment for healthcare [16]. They point out that many of the "megachanges" in healthcare that will occur in the next decade will concentrate on the manner and extent to which information is gathered, disseminated, managed, and used throughout the healthcare system. The pre-eminent role of information will dramatically affect the delivery and administration of healthcare and will have a profound influence on the content and techniques for training, continuing education, and research designed to support and improve the healthcare system. The development of a new robust information management paradigm will be required, and four major cornerstones form the core of this new paradigm.

These AMIA cornerstones can serve as a functional "definition" of medical informatics. They are: *representing medical knowledge, acquiring and presenting clinical information, managing change, and integrating information.* These are key functions well-suited for medical informatics leadership.

A more in-depth definition from Columbia addresses the critical non-technological, social-science and self-evaluation aspects of medical informatics: "*Medical informatics studies the organisation of medical information, the effective management of information using computer technology, and the impact of such technology on medical research, education, and patient care. The field explores techniques for assessing current information practices, determining the information needs of healthcare providers and patients, developing interventions using computer technology, and evaluating the impact of those interventions. This research seeks to optimize the use of information in order to improve the quality of healthcare, reduce cost, provide better education for providers and patients, and to conduct medical research more effectively.*" by Stephen B. Johnson of Columbia University [17].

Dr. Johnson further points out that medical informatics, in addition to its technological base, needs to provide scientific methods to study information needs, not just to assume a particular technology is the answer, and must show true impact of systems, not just develop applications or assume that things work.

Scot Silverstein [18] says, after a decade of working in medical informatics, it has become apparent to him and many informatics professionals that significant confusion and misconceptions exist. It exists in hospitals, industry, and the world at large about what medical informatics is, and what experts in medical informatics do (and are able to do if given the opportunity). Also, there is confusion as to what medical informatics *is not.*

Medical informatics he argues is *not* equivalent to "computers in medicine", and using a computer in some medical way (such as by publishing a web site on some medical topic, or running a hospital information services department) does not necessarily make an individual a "medical informaticist." Medical informatics is a formal field of study and a scientific discipline. *Computers in medicine* is *not* the equivalent of *medical informatics*.

Scot Silverstein offered his definition of medical informatics as: *"Medical Informatics is the science and art of modeling and recording real-world clinical concepts and events into computable data used to derive actionable information, based on expertise in medicine, information science, information technology, and the scholarly study of issues that impact upon the productive use of information systems by clinical personnel."* S. Silverstein [18].

In his concluding remarks, Silverstein argues that, if medicine is to become a true information-driven enterprise and achieve the highest quality possible, the people who "revolutionise" it must have expertise in both medicine and management of information.

A view on medical informatics from the British Medical Journal (Jeremy Sims) [19] points out the importance of improved organisation and communication of health information, and the role of medical informatics at the centre of these objectives. Medical informatics links such areas as knowledge management, guidance on best practice, education of professionals and the public, and the use of new communication and computer technologies. The article describes medical informatics by analogy: *"In the same way that surgeons use scalpel and needle, those involved in medical informatics use tools such as clinical guidelines, medical languages, and information and communication systems to assist the study and dissemination of medical knowledge."*

One of the most comprehensive definitions of medical informatics available comes from the "Handbook of Medical Informatics" (Editors: J.H. van Bemmel, Erasmus University, Rotterdam, and M.A. Musen, Stanford Univerity, Stanford, CA) [20, pp XXXI - XXXIII]:, *"Medical informatics is located at the intersection of information technology and the different disciplines of medicine and healthcare ... We shall also use the term health informatics without entering into a fundamental discussion of the possible differences between medical informatics and health informatics.*

Medical informatics has both distinctly applied features and more fundamental characteristics. Just as medicine itself is multidisciplinary, so is medical informatics. The main reason for this convergence of disciplines is that, in principle, medical informatics deals with the whole field of medicine and healthcare. Blois [21] summarised the heterogeneity of medical science quite eloquently and related the multidisciplinary nature of medicine directly to the basis of medical informatics:, "In medical informatics we develop and assess methods and systems for the acquisition, processing, and interpretation of patient data with the help of knowledge that is obtained in scientific research."

Computers are the vehicles used to realise these goals. In medical informatics, we deal with the entire domain of medicine and healthcare, from computer-based patient records to image processing and from primary care practices to hospitals and regions of healthcare. Some areas of the field are relatively fundamental; others have an applied character. The challenge in developing methods and systems in medical informatics is that once the systems have been made operational for one medical specialty, they can also be transferred to some other specialty."

The path to clinical computing success is not one of dedication or effort alone. Healthcare computing is distinctly an endeavour where *not having enough experience* in each focus of the "information architect triad" - that is, medicine, management, and IT - can seriously impair efforts despite the best of intentions. Medical informaticists bring exactly these three skills to the table, in a cross-disciplinary, synergistic manner. The classic article "The Clinical Information Architecture as a Member of the Healthcare Team" (D. Sittig et al.) [22] discusses these three areas and concludes with the following wise advice about medical informatics:

"There are many different constituencies, and hence views, which must be considered when attempting to develop an integrated clinical information management system in any large medical centre. While the costs associated with the hiring of such a highly qualified individual [a medical informaticist] are admittedly high, we believe that without a full-time, on-site person, who is capable of fulfilling the role of the information architect described, the difficulty of the task increases to the point of *becoming nearly impossible.*"

In a commentary on a New England Journal of Medicine article "The American healthcare system – the movement for improved quality in healthcare" by Thomas Bodenheimer [23], informatician Dr. Gil Kuperman, observed that the quality improvement 'crusade' in healthcare has increased the expectations of healthcare consumers and the healthcare industry about information systems. The reviewer also observed that conventional healthcare industry thinking, which tends towards a belief that quality improvement data can simply "fall out" or be extracted from existing healthcare information systems (such as financial systems), is false. The information systems must be properly designed for quality measurement and improvement purposes, their datasets properly modelled, and they must be properly installed, evaluated, and continuously improved by those who understand medicine and medical information science.

APPENDIX D: Letters of Authorisation / Permission to Carry out Fieldwork

THE REPUBLIC OF THE GAMBIA

Department of State for Health
& Social Welfare
The Quadrangle
BANJUL

Ref: HP 241/01/Part II/(103)

Date: 12 June 2001

Lawrence K. Yamnah
Medical Research Council Laborations
Fajara
Bakau

RE: SUPPORT FOR HEALTH INFORMATION SYSTEMS FIELDWORK

I am directed to acknowledge receipt of your letter dated 10th May 2001 and addressed to the Permanent Secretary on the above-caption.

Please be informed that the Permanent Secretary is glad to grant you approval to conduct your fieldwork research on Health Information Systems (HIS) in The Gambia, and use of Medical Records for the same research. Mrs. Drammeh would also be glad to grant you a personal interview as well. Please liaise with the Secretary for an appointment.

Harry P.F. Sambou
FOR: PERMANENT SECRETARY

Tel No 225715 Fax No 229325

THE REPUBLIC OF THE GAMBIA

DEPARTMENT OF STATE FOR HEALTH, SOCIAL WELFARE AND WOMEN'S AFFAIRS
THE QUADRANGLE
BANJUL

Tel Nos. 227605/228624/228709/225715 *Fax Nos.* 229325/223200

Ref: PRG 555/01/(101) Date: April 8, 1999

Mr Lawrence Kweku Yamuah
Data Manager
Medical Research Council (MRC)
Fajara

PERMISSION TO USE MEDICAL RECORDS

Reference is invited to your letter of 31st March, 1999 relating to the above subject matter.

I am directed to inform you that the contents of your letter are well noted. Your initiative to look into the recording system of the Health Sector in the Country is a step in the right direction.

Hence, your request for permission has the approval of this Department of State and with our blessing, you are allowed to go ahead with your proposed Study.

You can always count on our support to realise the objective of this proposed Study.

L. YABOU
FOR: PERMANENT SECRETARY

cc: Chief Executive - Royal Victoria Hospital

The Republic **of The Gambia**

REPUBLIC OF THE GAMBIA

Directorate of Planning & Information
Department Of State For Health
Banjul

Dear Sir/Madam

<u>HEALTH INFORMATION SYSTEMS WORKSHOP</u>

I would be grateful if you could avail yourself for a one-day workshop on health information systems at the School of Nursing on Wednesday 7th of November 2001 from 9:00 AM to 3:00 PM.

The workshop hopes to address the present state of the development of HMIS. Discussions will include constraints facing the development of HMIS, unique identification of patients and individuals as well as vital registration of births and deaths and the impact all these are likely to have on health care delivery in the country. Health indicators as well as the role of DHTs and health centre administrators, will also be discussed.

Thank you in advance for your cooperation.

Yours Sincerely

....
Mr. Saihu Janneh

....
Mr. Lawrence Yamuah

DR B. Camara
pls attend on
my behalf.
2/11/01

RECEIVED . . . 2001

LIST OF PARTICIPANTS

Deputy Permanent Secretary
Director of Health Services
Head, Department of Planning and Information
Director, Participatory Health Population and Nutrition Programme
Acting Head ESU
All DHTs
Asst. Director, Disease Control
Head, Maternal and Child Health
Head, Expanded Programme on Immunisation
Head, Health Education Unit
Director, Central Statistics Department
Chief Pharmacist
Chief Executive, Bansang Hospital
Chief executive Farafenni Hospital
Chief Executive Officer, RVH
Medical Records Officer, RVH
Principal Nursing Officer, RVH
Head, National Health Laboratory
Director, national AIDS Control Programme
Principal Health Officer, MoH
Head, School of Nursing and Midwifery
In-Charge, Serekunda Health / Fajikunda / Brikama
Administrator, Cancer Registry (Hepatitis / MRC)
Statitician (Ministry of Health)
Gambia Family Planning
UNICEF
WHO
WEC Mission
Dr. Sallah, Lamtoro Clinic
Director – Gambia Food & Nutrition Association
Bamako Initiative coordinator
Lawrance Yamuah
Principal Health Planner
DHT - NBE
DHT - NBW
DHT - W- Division
DHT – URD
DHT – CRD
DHT – LRD
DHT -

MRC

Medical Research Council

MRC Laboratories, Fajara
PO Box 273 Banjul
The Gambia
West Africa

switchboard (+220) 495442/6
switchboard (+220) 494072/9
administration fax (+220) 495919

Lawrence K. Yamuah

10th May 2001

The Permanent Secretary
Department of State for Health (DoSH)
The Quadrangle
Banjul
The Gambia

Dear Madam,

SUPPORT FOR HEALTH INFORMATION SYSTEMS FIELDWORK

I am currently a PhD Research Student at the Centre for Measurement and Information in Medicine , City University, London, U.K. with my home institution being the Medical Research Council (MRC), The Gambia. The aim is to contribute to the development of health information systems in The Gambia the purpose of which is to improve clinical performance and patient outcomes. In order not to be a researcher in isolation, I have already been fortunate to participate in last year May's World Bank supported Indicator's workshop at Tendeba Camp here in The Gambia.

I would be grateful if you would grant me the necessary support needed for my fieldwork research on health information systems (HIS) in The Gambia. In 1999, I had an approval from your department for the use of medical records for the same research.

The fieldwork will involve interviewing programme and unit heads in health related areas of the country as well as Divisional Health Teams, Chief Executives of the three hospitals and the administrator in the hospitals and health centres. I would therefore be grateful if you could grant me the official permission to conduct these interviews and would be more than delighted if you would grant me a personal interview as well.

The estimated period of the fieldwork is 5 months and will also involve observing the day to day activities at the various out-patients clinics and how data is collected and maintained at the medical records offices and the ESU or divisional health teams. There will also be an administration of a general questionnaire to different categories of health personnel working in the health sectors.

This will enhance the design of the health information system's process, which is a repetitive activity that needs to continue to be improved until every aspect of the proposed system has been considered and the final and complete design has been reached. The fieldwork is an integral part of the process that would allow this final and complete design stage to be reached.

This fieldwork will involve interviews with key individuals, questionnaires administration to determine acceptability, action research in the form of observation to help clarify current practices in the health sector and data collection and analysis of existing government clinical records. This will not only provide and verify facts, it will also help to provide an opportunity to meet and overcome user resistance. Additionally, this is necessary to help gather more information that will enable the systems specification to be completed.

National health indicators (parameters) that The Gambian health authorities want to be included in the health information systems to be put in place will be discussed.

A general questionnaire aiming at gathering information from health professionals about constraints that hinder a better collection and dissemination of information needed for better delivery of health care to patients and for decision making will be administered.

Please find enclosed a summary of the planned fieldwork. I look forward to hearing from you at your earliest convenience.

With many thanks for your consideration.

Yours Sincerely,

Lawrence Yamuah

Lawrence K. Yamuah
Medical Research Council
P.O. Box 273
Banjul

30th August 2001

The Chief Executive
Royal Victoria Hospital
Banjul
The Gambia

medical records
please sort
3/9/

Dear Madam,

SUPPORT FOR HEALTH INFORMATION SYSTEMS FIELDWORK

I am currently a PhD Research Student at the Centre for Measurement and Information in Medicine , City University, London, U.K. with my home institution being the Medical Research Council (MRC), The Gambia. The aim is to contribute to the development of health information systems in The Gambia the purpose of which is to improve clinical performance and patient outcomes.

The fieldwork will involve interviewing programme and unit heads in health related areas of the country as well as Divisional Health Teams, Chief Executives of the three hospitals and the administrator in the hospitals and health centres. I would be grateful if you would grant me the necessary support needed for the aspect of my fieldwork research on health information systems (HIS) at the RVH and would be more than delighted if you would grant me a personal interview as well.

The fieldwork at RVH will, among other things involve observing the day to day activities at the various in-patients as well as out-patients clinics and how data is collected and maintained at the medical records offices. There will also be an administration of a general questionnaire to different categories of health personnel working in the hospital.

This will enhance the design of the health information system's process, and to help gather more information that will enable the systems specification to be completed.

Please find enclosed a summary of the planned fieldwork. I look forward to hearing from you at your earliest convenience.

With many thanks in advance for your consideration and approval.

Yours Sincerely,

Lawrence Yamuah

FIELD WORK

This fieldwork will involve interviews with key individuals, questionnaires' administration to determine acceptability, action research in the form of observation to help clarify current practices in the health sector and data collection and analysis of existing government clinical records. This will not only provide and verify facts, it will also help to provide an opportunity to meet and overcome user resistance.

Interviews

The interviews will be geared towards gathering information on possible organisational changes in the health sector, materials or financial availability and human resources and the possible impact on the health service in general. It hopes to obtain information on the aspects of the current situation, including the problems being faced in the health service.

Where acceptable to the respondents, the interviews will be recorded with an audio cassette recorder.

General Questionnaire

These include questionnaires for surveys concerning acceptability of the proposed changes that are due to be put in place as a result of the introduction of proper health information systems.

The questionnaire will be aiming at gathering information from health professionals on the ground about constraints, especially resources that hinder a better collection and dissemination of information needed for better delivery of health care to patients and for decision making.

Action Research (Observational Study)

Action research in the form of observations to be made in Out-patient, In-patient and Accident and Emergency settings will also be undertaken. This design will help to clarify current practices within the different units of the health sector. It will for instance allow the observation of how the referral system works; information that accompanies a referred patient and how it is treated.

Also to be observed are the number of steps the data collected from patients go through before they reach a records office or wherever they may be kept; the process of retrieving a patient's paper based file when s/he comes back for next appointment. This will help in the review of the process with a view to cutting down the number of steps needed.

Data Collection and Analysis of Existing Government Clinical Records

Data will be collected retrospectively through the government's clinical recording system for all proven diagnoses of episodes of malaria and other diseases of importance and their outcomes. This will help give an indication whether the data items collected are in conformity with those of developed countries and whether essential data items needed for better care have been collected or missed or ignored. Apart from checking on whether standard nomenclature and coding system have been applied to the data from all the centres, it will also help to determine whether there is

APPENDIX E: Complete List of Interviewees (key personnel) and their Institutions

NAME	POSITION	ORGANISATION
1. Mrs. Therese Drammeh	Permanent Secretary	Department of State for Health
2. Mr. Harry Sambou	Deputy Permanent Secretary	Department of State for Health
3. Mr. Dawda Joof	Manager	Participatory Health Population and Nutrition Unit (PHPNP)
4. Dr. Rueben Mboge	Deputy Director, Medical Services	Department of State for Health
5. Dr. Mariatou Jallow	Chief Executive Officer	Royal Victoria Hospital
6. Mr. Musa Jorbateh	Chief Executive Officer	Bansang Hospital
7. Mr. Sisawo Conteh	Chief Executive Officer	Farafenni Hospital
8. Dr. Kebba Manneh	Asst. Director, Disease Control	Department of State for Health
9. Mr. Saihu Janneh	Director	Department of Planning and Information
10. Mr. K.O Jaiteh	Head of Department	Epidemiology and Statistical Unit
11. Dr. Margeret Grant	Consultant	Epidemiology and Statistical Unit
12. Mr. Shehu Ceesay	Director	National AIDS Control Programme
13. Dr. Alieu Gaye	Director and Proprietor (Also, Clinician)	Pakala Clinic Royal Victoria Hospital
14. Mrs. Ma Marie Jagne	Principal Nursing Officer	Royal Victoria Hospital
15. Mrs. Amie Jorbateh	Medical Records Officer	Royal Victoria Hospital
16.	Records Officer	Bansang Hospital
17. Ms. Mamie Camara	Principal Nursing Officer	Bansang Hospital
18. Mr. Bernard Gomez 19. Malang Ndong 20.	Principal Nursing Officer Administrator In-charge of A & E Department	Farafenni Hospital Farafenni Hospital Farafenni Hospital
21. Mrs Maram Bobb	Principal	School of Nursing and Midwifery
22. Ms. Abie Khan 23. Ms. Adam Njie	Head, Divisional Health Team Public Health Officer	Western Division Western Division
24. Mr. Malang Fofana	Head, Divisional Health Team	North Bank Division East
25. Dr. Kebba Gibba	Head, Divisional Health Team	North Bank Division West
26. Mr. Saidy Khan	Head, Divisional Health Team	Lower River Division
27. Mr. Omar B. N'jie	Head, Divisional Health Team	Central River Division
28. Mr. Bafoday Jawara	Head, Divisional Health Team	Upper River Division
29. Ms. Nellie Lloyd-Evans	Chief Microbiologist	National Health Laboratory/RVH
30. Mr. Momodou Jaye	Senior technologist	National Health Laboratory/RVH
31. Mr. Samba Conteh	Principal Public Health Officer	Environmental Health Unit
32. Mrs. Ramou Cole Ceesay	Head, Maternal and Child Health	Department of State for Health
33. Mr. Ivan Coker	Officer In-charge	Basse Health Centre
34.	Officer In-charge	Bansang Health Centre
35.	Officer In-charge	Farafenni Health Centre
36. Mr. Alieu Jammeh	Officer In-charge	Mansakonko Health Centre
37. Mr. Sainy Cham	Officer In-charge	Essau Health Centre
38. Ms. Yvonne Sarr	Officer In-charge (Acting)	Serekunda Health Centre
39. Mr. Cherno Camara	Officer In-charge	Fajikunda Health Centre
40. Ms. Binky Sanneh	Officer In-charge	Brikama Health Centre

NAME	POSITION	ORGANISATION
41. Mr. Bolong Jorbateh	Officer In-charge	Births and Deaths Registration
42. Mr. Karamo M. Kanteh	Head, Health Education Unit	Department of State for Health
43. Dr. Mamou Jawla	Malaria Control Unit	Department of State for Health
44. Mr. Alpha N'jie	Head, Expanded Programme on Immunisation (EPI)	Department of State for Health
45. Mr. Alieu Ndow	Director, Central Statistics Dept.	Population and Census Office
46. Mr. Momodou K. Cham	Coordinator	Bamako Initiative
47. Mr. Lamin Jagne	Director, Internet Business Service	Gambia Telecommunications (GAMTEL)
48. Mr. Albert Cox	Director	Gambia Food and Nutrition Association (GAFNA)
49. Dr. Ayo Palmer	Coordinator / Project Officer	UNICEF
50. Mr. Momodou Gassama	Health Information Officer	WHO Office, The Gambia
51. Dr. Adama Sallah	Director & Proprietor	Lamtoro Clinic
52. Dr. Jack Mbye Faal	Director & Proprietor	N'deban Clinic

APPENDIX F: Sample General Questions in the Semi-Structured Interviews

STRUCTURED INTERVIEW QUESTIONNAIRE by Lawrence Kweku Yamuah

MED. DIR. PAKALA CLINIC (Dr. Alieu Gaye) **Date: 11th December, 2001**
(Also at Royal Victoria Hospital) Govt.

Organisational Structure and Level of Support

1. Organisationally, how is the Pakala clinic structured?
Run by me alone 3 nurses 4 - 8 o'clock
2 hours Owner overall
1992 public service act allowing to do private practice. Most patients seen in hospital

2. What are the main functions or objectives for operating as a private clinic?
Save improve quality of life giving quality service excellence, respect for patients education

3. Approximately how many people are employed in this clinic?
4.

4. Does your clinic collaborate with any other units/departments, or health centres or hospitals or organisations towards the improvement of health care in general?
Need support of RVH as an anchor emergencies to RVH use other services with [illegible] SOS.
Don't admit

5. There have been talks about developing a national health information system for The Gambia. Are you aware of it? Yes, I am

6. How and when did you become aware of it? Was director of health services in 1995. Have develop strategies and activities in [illegible] PHPNP some

7. Has this clinic been asked to play a part in the development of this country's HIS? No no Gambian developed my own HIS got brand new computers

8. Is there an existing or do you have plans for developing a health information systems in this clinic? Yes have our own indicators. Retire and software package

9. It is several years now since HIS was talked about, why are we still not close to any implementation?

Do not know. Need operational things
Money is there why isn't it being used

10. How would you consider the role private clinics in the country are playing towards the provision or improvement of patient care and general healthcare in the country?

Private sector Seen as Complementing gov't effort
73% of Gambian don't wake up $1

11. How much support do private clinics give if at all towards developing a health information system in the country? Gov't should be a driver. No developed insurance system. Central bank regulator Re

12. Are there any constraints that are making it difficult for a 100% support from your clinic or other private clinics towards the HIS development?

Coordination of all clinics

13. What in your view (opinion) do you think or recognise as being the problems and weaknesses in the present health systems with regards to the development of HIS?

Operational research to give the answers for proper planning. She's been paid so she has to do the work

Training and Resources

14. What strategy if any has your clinic put in place in an attempt to help the training of health sector staff? Very biased on Non-communicable dis
workshops by Gov't get staff to go One hour training on weekends. Believe in empowering people.
Few occassions open door policy. 40% of my patients don

15. When was the last time any member of staff of your clinic was trained?

16. What kind of training was/were they?

17. How many members of staff of this clinic have received computer training?

All of them

18. Was this training local or international? Quantum Net provides

19. What was the level of training?

20. Was it / were they certificated? 1.) Yes ✓ 2.) No.
Paid for 4 senior nurses in RVH Fatima Jayne

21. What is the level of computing in this organisation? (How much computing is done)

22. How many computers do you have in the entire clinic?
2 static 1 mobile

23. Are they linked to each other? Yes, linked

24. Do you use computers yourself? How often (daily/weekly/..../ monthly)?
Daily

25. Could you please comment on its usefulness.
Made life much easier. If data entry complete a lot can be done create space. Increased efficiency serv"

Communication, Reporting and Information Flow

26. When was the last time if any was the clinic approached by the government (DoSH) for collaboration of any kind in the health sector?
Happened a few times to look at how closely work'

27. Do you expect to receive reports from various health sectors of the health ministry or other private clinics? (weekly/monthly/quarterly .. etc) It should happen but not happening. Never invited to depar

28. How often and in what formats (descriptive writing, statistical tables, graphs etc)?

29. If received late, what are usually the reasons given for the delays?

30. What do you think can be done to improve the situation?
If Dynamic focal point in MoH
Major health sector reform which goes ~

31. Does your clinic rely heavily on this information when making policies?
Not that comprehensive. to see weaknesses and problems and planning no

32. To what extent do you think the reports and statistical data influence the decisions you make for your clinic?

33. Does the Ministry of Health (DoSH) expect your clinic to produce reports concerning diseases and their numbers seen in the clinic. If so how often? (weekly/monthly/ .. etc) NO. Nowhere in terms of reference to
I think there should be a legislation to provide info

34. How often if at all do you make recommendations to the government based on the data or information gathered from your clinic concerning diseases and patient care?
There is no focal person to be sent to and a feedba
no regulation in anyway.
People there are not medically qualified.

Opinions

35. Please list the five most important things you would like to see the government address in the health sector:

Most important	Information from the health sector.
Second most important	Restructuring reform in MoH. we are not ready to ch
Third most important	Integral health service
Fourth most important	Emerging diseases to be addressed. 27%
Fifth most important	Improving Communication b/n staff

Not impl some of policies.
sectoral approach
Not much interaction in MoH. Technical meeting.

36. In your view, what role can NGOs or private clinics like your own play in the area of HIS development? Well coordinated atmosphere there sho be proactive. DoSH must have their acts together. PClinic should develope and go in when gov't calls though with no national
The problem is attitudinal

37. What would you like to see the government do towards the struggle to develop a better HIS?
1) Valid information, timely, appropriate

38. Do you please have any other comments / observations / views concerning the development of a national HIS?

No need for needs assessment

improvement of existing

Bring all

39. Electronic (computerised) patient records in the hospitals, health centres and private clinics is long overdue. Could you please comment on this statement.

Took 7 yrs to complete and finalise. Need to clearly define what system is develop. Health indicator Building the capacity 1st before computerisation

40. There is the need for electronic (computerised) health records on every individual in the country. What are your views on this?

Lets do it peacemeal slowly and progressively over time. Should not bog ourselves down to information that we will not use eg under 5 mortality. Let's look at what we want.

41. It will be useful for everyone to have a national health service number. Would you like to comment on that? Worker

Having one number in a system eg National ID card the nos should be representative killer assumption. Have one number in a computerised. No

Structural reform at MoH needs to be given for

42. What are your views concerning a possible integration of the private sector and NGOs and government when it comes to HIS development?

It is possible. Develop my system

Attitudinal problem and motivation.

43. What in your opinion is the role HIS can play in the delivery of better health care in the country? Generate valid vital information for decision making. Planning etc

44. Please tell me what you think should be done to improve patient care in particular and healthcare delivery in general in The Gambia.

Primary prevention invest more in preventive more than curative medicine. Patients report late in patient this to long if can shorten that time we can save money; Econom improve and standard of living to go up. No Managerial training for managers

lack of knowledge for the patient point of view. But we don' have much information
Services too centralised. Educate our staff to decentral the services.

THANK YOU VERY MUCH FOR YOUR TIME AND COOPERATION

Lawrence Kweku Yamuah

Health sector reform to answer this. Need evaluation Should do it and seek the help of the

APPENDIX G: Example of General Survey Questionnaire Answered

QUESTIONNAIRE 0082

GENERAL SURVEY WITH HEALTH WORKERS

Dear Sir or Madam:

We need your help!

You have been selected as part of a representative sample of the health sector to participate in an assessment study for the development of a national Health Information System (HIS). Since this i a very important project your response is vital. This survey will provide us with information that will enable us to develop a better health information system that will help improve the quality of healthcare delivery and patient care.

The design and development of a health information system (HIS) is in progress. This needs to be done from the basic health facilities level to the national level. Data collection instruments and manuals have to be created and the documentation of the database of information has to be prepare with great care to include all information that should be routinely collected from all health units every month/quarter/annual throughout the country.

An assessment is needed to provide the health information department with concrete recommendations for its planned fulfilment of the information needs of the health sectors and formulation of proposals for its improvement and a critical review of the intended national HIS. The development of the new HIS needs to be relevant to, integrated with and functional for most if not all, healthcare activities. The databases should be those that are necessary and contain sufficien amount of information needed to be collected at all health units.

I know we are asking for your time, which is difficult to come by these days. However, please invest some time to help us in this important programme and plan for the future of a well develope HIS.

We would appreciate the return of the questionnaire in the shortest possible time of your convenience. Please call the office of the PHPNU (contacting Dawda Joof at telephone number 227872) or Mr. Lawrence Yamuah at MRC telephone numbers 494072 up to 494079, if you have any questions about this survey.

Thank you for your time and comments. The results of this survey will help us to improve the national health services information system.

Yours Sincerely,

L.K. Yamuah

1. Which health sector or unit do you work for?
Government ☐ Private Clinics or Hospitals ☑ NGOs ☐ Parastatal ☑

2. Please state the name of the Organisation: M . R . C
What unit are you attached to? Specify: Nursing

3. How long have you been involved/employed with the health care sector? 6 years

4. How long have you been with your current unit or department? 4 ~~years~~ months

5. Which town/village or DHT of the country do you normally work from?
BASSE, UPPER RIVER DIVISION

6. Do you know if there is a standard case definition for diseases of epidemic potential?
1) Yes, I am aware ☑
2) No, I am not aware ☐
3) It does not exist ☐
4) I don't know ☐

7. Do you know if there is a standard case definition for diseases of public health importance?
1. Yes, I am aware ☑
2. No, I am not aware ☐
3. It does not exist ☐
4. I don't know. ☐

8. Have you ever been trained in the use of any kind of standard case definitions?
1). Yes ☑ 2.) No ☐

9. Have you ever received any formal training in data recording?
1) Yes ☑ 2) No ☐

10. Have you ever received any formal training in data analysis?
1) Yes ☑ 2) No ☐

11. Have you ever received any formal training in data interpretation?
1) Yes ☑ 2) No ☐

12. Have you ever received any formal training in data reporting and use of data? YES

13. Have you ever used a computer? 1.) Yes ☐ 2.) No ☑

14. Have you ever received any formal training in any computer skills?
1) Yes ☐ 2) No ☑

15. If yes what kind of computer skills training did you receive?

16. How long was the training for?

17. What level of training? ___________

18. Did you receive a certificate? 1.) Yes ☐ 2.) No ☑

19. Do you use computers in your day to day work? 1.) Yes ☐ 2.) No ☑

20. When was the last time you used a computer (How many/days/weeks/months/years ago)?

____

21. Do you have an email address? 1. Yes ☐ 2. No ☑

22. How often do you use it? 1. Daily ☐ 2. Weekly ☐ 3. Monthly ☐ 4. Other ☐

23. Do you have access to the internet? 1. Yes ☐ 2. No ☑

24. How often do you use it? 1. Daily ☐ 2. Weekly ☐ 3. Monthly ☐ 4. Other ☐

25. How will you like to grade your own ability with computers?
1. Novice ☑
2. Complete beginner ☐
3. Intermediate ☐
4. Competent ☐
5. Advanced ☐

26. Do you personally own a computer you can use, apart from the one at your organisation?
1. No Computer ☑ 2. PC ☐ 3. Laptop ☐

27. Do you collect health data as part of your routine work? 1.) Yes ☐ 2.)No ☑

28. If yes how often?
1. daily ☑ 2. weekly ☐ 3. monthly ☐ 4. quarterly ☐ 5. Yearly ☐

29. Do you send data of any kind within or outside your unit? 1.) Yes ☐ 2.) No ☑

30. If yes how often do you do that?

1. daily ☐ 2. weekly ☐ 3. monthly ☐ 4. quarterly ☐ 5. Yearly ☐ No

31. By what method? (1. manually ☐ 2. by computer (electronically) ☐ No

32. Do you process /analyse data? 1.) Yes ☐ 2.) No ☑

33. How often? 1. daily ☐ 2. weekly ☐ 3. monthly ☐ 4. quarterly ☐ 5. Yearly ☐ No

34. Do you produce report of any kind to be used within or outside your unit? 1.)Yes ☑ 2.No ☐

35. How often? (1. daily ☑ 2. weekly ☐ 3. monthly ☐ 4. quarterly ☐ 5. Yearly) ☐

36. How do you produce the report? 1. manually ☑ 2. using computer ☐ 3. both ☐

37. In what format do you send this report
1. descriptive writing ☐ 2. statistical tables ☑ 3. graphs ☐ 4. Combination ☐

38. Do you receive reports from outside your unit? 1). Yes ☐ 2.) No ☑

39. How often? (1. daily ☐ 2. weekly ☐ 3. monthly ☐ 4. quarterly ☐ 5. Yearly) ☐ . NO

40. Are you able to cope with the amount of data collected or generated during your routine work? 1). Yes ☑ 2.) No ☐

41. Any comment: Data collection in all forms should be ma available to all staff.

42. There is too much data being collected. Some of the data collected are not necessary.
1. I strongly agree ☐
2. I agree ☐
3. I am not sure ☑
4. I disagree ☐
5. I strongly disagree ☐

43. If it is too much, in what way is it too much?

44. There is too little data being collected.
1. I strongly agree ☐
2. I agree ☐
3. I am not sure ☑
4. I disagree ☐
5. I strongly disagree ☐

45. If it is too little, in what way is it too little?

46. Some important data to be collected are not being collected
1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

47. What are some of the data you think need collecting?

Datas of all epidermic, diseases must be collected, staff data must also be collected and be updated.

48. There is the need to train health workers in the use of standard case definitions?

1. I strongly agree ☑
2. I agree ☐
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

49. What in your opinion is the importance of medical records in the health sector?

Medical records in the health sector are important because they give us update record/report at all time. Without Correct Medical we cannot improve in our health delivery System.

50. What do you think are the present major problems with the medical records office?

Inavailability of equipment (Materials) Trained personnel and sometime insufficient ~~pers~~ and inefficiency personnels.

51. Have you ever made a request to the medical records office for data/information/ or service of any kind? 1). Yes ☑ 2. No ☐

52. Was your request attended to? 1). Yes ☑ 2). No ☐

53. Were you satisfied with the response to the request? 1). Yes ☐ 2). No ☑

54. Do you think medical records are kept properly in that office?
1.) Yes ☐ 2.) No ☐ 3.) I don't think so ☑ 4) I don't know ☐

55. Do you interact with the medical records office 1). Yes ☑ 2.) No ☐

56. What aspect of your work asks for the services of the medical records office?

Patients past medical Records

57. Do you have any comments (positive or negative) about the medical records office?

Just as I said before, the medical record office needs more sufficated equipment, sufficent and effi personnels.

58. What in your opinion do you think should be done to improve the organisation, storage and request procedures of the medical records?

More Rooms should be provided to Man the med record offices. This should contitude equipment, perso and intentives.

59. There is the need for health workers to receive a formal training in data recording?

1. I strongly agree ☑
2. I agree ☐
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

60. There is the need for health workers to receive a formal training in data analysis?
1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

61. There is the need for health workers to receive formal training in data interpretation?
1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

62. There is the need for health workers to receive a formal training in data reporting and use of data?
1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

63. Have you received training of any kind since joining the health service?
6. 1.) Yes ☑ 2.) No ☐

64. If yes what kind of training did you receive?

On Data, reporting, collection and analysis but at a low level

65. Have you heard of HIS before this questionnaire was sent to you? 1. Yes ☑ 2. No ☐

66. If yes, how long ago was that? 7 (weeks/months/years)

67. Are you fully aware of what it is all about?
1. No idea at all ☐
2. Just a faint idea ☐
3. Reasonable good idea ☑
4. Very good idea ☐

68. Development of HIS in The Gambia should be one of the top priorities
a. I strongly agree ☐
b. I agree ☑
c. I am not sure ☐
d. I disagree ☐
e. I strongly disagree ☐

69. The current health system needs improvement
1. I strongly agree ☑
2. I agree ☐
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

70. All health facilities need a new health information system

1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

71. Please list the five most important things you would like to see the government address in the health sector if it was possible:

1. Most important: TO review the present H/system
2. Second most important: To adopt the international one.
3. Third most important: To Train more health personel
4. Fourth most important: To review the present pay scale a to improve on it
5. Fifth most important: To mentain the above four.

72. Electronic (computerised) patient record in health facilities is long overdue.

1. I strongly agree ☑
2. I agree ☐
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

73. Electronic (computerised) health record is needed for everybody in the country.

1. I strongly agree ☐
2. I agree ☑
3. I am not sure ☐
4. I disagree ☐
5. I strongly disagree ☐

74. It will be useful for everyone to have a National Health Service number.

1. I strongly agree ☐
2. I agree ☐
3. I am not sure ☑
4. I disagree ☐
5. I strongly disagree ☐

75. Please use this space below to tell us what you think should be done to improve patient care in particular and healthcare delivery in general.

In other to improve patient care and health delivery in general, more modern medical rec system should be provided. To improve the training of the health carers. To improve on the pay scale of the health carers. But most important the economy must be improved.

The last few questions are optional but will appreciate if you answered.

76. What is your gender? 1. Male ☑ 2. Female ☐

77. What is your profession? Nursing

78. What educational qualification have you obtained?

O' LEVEL

79. What is your job title? Nurse

80. What is your age group?

1. under 25 ☐
2. 25 – 35 ☑
3. 36 – 45 ☐
4. 46 and over ☐

THANK YOU AGAIN FOR YOUR TIME, COMMENTS AND COOPEARTAION

APPENDIX G1: Categories of Health Workers Responding to General Questionnaire

Health Worker Category	Number of Respondents
Nurse Midwife	16
Nurses	123
Community Health Nurse	9
Public Health Officers	31
Doctors	20
Dispensers	2
Pharmacists / Assistants	3
Radiographer	2
Health Educators	7
Health Field Workers	27
Laboratory Technicians	19
Research Scientist / Microbiologist	16
Research Assistants	3
Lecturers	3
Medical Records Clerks	10
Nursing Students	3
Statisticians	2
Computing / IT (Software and Hardware)	20
Data Entry Clerks	11
Administration	13
Driver / Maintenance	2
TOTAL	**334**

APPENDIX H: Major Extracts of the Outcomes of the Interviews of Key Personnel

6.H.1 Delays in any Form of Implementation of HIS

The question was asked: "It is several years now since development of a national health information system was talked about. Why in your personal view are we still not close to any implementation?". A lot of different answers were received, but the majority is summed up by one particular answer; "I think when you talk about developing anything you talk of manpower availability, availability of resources and maybe the will. The manpower of course, not only numbers but appropriate training and the resources, you have equipment and all .....". Then an individual's historical view from a finance point of view is given below:
"Initially, WHO promised to provide the necessary support and resources to develop the health management information system and they were fully involved and provided the necessary resources for the reviews that were referred to with the World Bank intervention, which started with an appraisal in 1994, and subsequently the signing of the PHPNP in 1998, one of the sub-components of the project is the development of health management information system. It has been talked about for a long time but basically the overall delay has been the unavailability of resources to implement some of the recommendations of the earlier reviews. With the World Bank intervention and the availability of required resources under the PHPNP, implementation has been a vision since two years ago. There has been a delay due mainly to the epidemiology and statistics unit who are directly responsible for HMIS in collaboration with the Director of Planning and Information who is responsible for health management and information based on the health policy from 1994 to the year 2000. To take on the implementation of the HMIS involves first and foremost, the development of terms of reference in agreement with the World Bank, seeking approval and the development of a request for proposal. Then expression of interest first of course going to a short-list development of request for proposal and from their evaluation of the request for proposals both technical and financial and moving forward. There have been delays both on the side of government and on the side of the World Bank. One has occurred in terms of government quickly putting together the terms of reference to move the process forward, secondly there were delays and this arose also from the bank side in relation to their providing technical input and agreement to the finalisation to such terms of reference. All these contributed to the delay.

Currently, the terms of reference that were agreed with the bank are being reviewed once more with the view to trying to ensure that whatever we are going to put in place in terms of health management information, we are going to get the best. Recently the bank's thinking has been not to rush this whole process because it is very critical that we should really ensure that a good job is done so that at the end of the day we have what we want. A health management information system that will be able to respond to our need that will provide information for planning and management etc. These are the main reasons for the delay."

6.H.2 Problems and Weaknesses in the Present Health System

They were asked "What in your personal view do you think are the problems and weaknesses in the present health system with regards to development of health information systems?". In the majority of cases people thought lack of integration and staff shortage, high attrition rate, training and education, attitude of the people and lack of funds were the major problems. One statement goes "I think in the present health system, getting information through to and from other health units as a collective effort is a difficult thing. For instance, in the hospital it seems as if we are isolated from the others. We collect our own data, its just recently that we are being asked to liaise and send information to them and even that, I think there is a lot of weakness in the linkage, we just try to move on."

A longer response which mentioned a lot of things is presented here: "The present system is very centralised based at the centre, the system of health data collection processing and information, especially on the periphery is all done manually which has its own problem. First and foremost, in the collection of data itself, most of the people at that level are not trained and maybe do not value data and appreciate the need for collecting data, and for that matter quality data. Most of the people at that level are over-worked with their day-to-day work. For example looking at the maternal and child health services, where you have very few nurses and public health officers who are responsible for providing maternal and child health services at the periphery having to see 300-400 mothers and babies during a clinic session, and at the same time collecting the necessary data that are required. Then at the end of the day collate that information accurately, not from one centre but mainly from 5 – 10 up to 15 different centres and then transmit that information to the divisional health team level, which is the administrative and management headquarters at the divisional level.

At that level as well, the divisional health teams are weak, they don't have the capacity to manage healthcare delivery as staff are not trained. They don't have the necessary resources, the necessary materials to be able to cope and manage such data and they have to do it for the whole division and then transmit such data to the central level. In a sense what I am saying is at the basic health facility level, starting from the family level, the village health workers are not trained most of the time, the necessary stationery for collecting data is not available, even where the data are collected maybe they are not reliable.

In terms of supervising those village health workers who generate information at the family level, the community health nurses who are supposed to ensure that supervision is done, some of them are not mobile. Where motor bicycles are provided the necessary spare parts are not forthcoming, they themselves are not trained to be able to understand and appreciate the need for data collection. At that level there is very little analysis done which will be used for planning and management purposes and such data are then transmitted to the basic health facilities from the village health service to the basic health facility by the CHN supervisor.

At the basic health facility as I mentioned earlier also there is limited staff and limited capacity to be able to manage data, the necessary tools, data collection forms sometimes are not available. Where they are available, the people are not properly trained to collect the required and quality data. And at that level as well some data are not analysed for the planning purposes. At the divisional health team the supervision required at the primary or basic services level is not adequately given.

The DHTs have their own problems, non availability of resources to provide the necessary forms for data collection and management. After receiving the data they are supposed to collate and analyse the data and use it for their own management and planning purposes as well. |However, in the end all those data collected even though they may be of the right quality are sent to the epidemiology and statistics unit who unfortunately also have their own problems. The epidemiology and statistics unit don't have their own budget allocation so they rely on donor support and other partners like the WHO, UNICEF to provide resources for the ESU to run their computers, to provide their consumables and to take care of their machines. The machines are not regularly serviced. They don't have enough employed data entry clerks to cope with all the information which are generated from the field to put into a computer. The software they have is not the best. They can only do limited analysis and even the maintenance of the systems is not also forthcoming. So data that are sent from the village/district to the centre are not always collated and analysed and there is no feedback, so these are some of the problems. Staff at this level are not trained to code the data."

6.H.3 Receiving and/or Sending Information from/to Other Health Units

Opinions were sought as to how often they would want to receive and/or send information from/or to other health units. There were different views about the frequencies, but in the majority of cases people tended to favour monthly or quarterly, apart from what they consider emergency data. Typically they said, it depends on the type of information because some information can wait for a month, but if you have a notifiable disease or things happening in the community that you need to take necessary action on, it should not take long. For epidemic-born diseases like meningitis we should not wait for a month to get the information, but rather on a daily basis. Things like rabies breaking out somewhere, we should have the information promptly, but if things that are not really life threatening we can have their monthly report.

They all agreed that there are delays in sending or receiving reports from each other. Some of the reasons given are that there does not seem to be much linkage between the different health units. Sometimes it is only after receiving a referral note much later that you know you have a patient with meningitis from that particular area. There is no organised system of reporting to each other and communication is not happening very well.

Also, some believe right now they are solving logistic problems out at the peripheral levels. The first problem was producing and distributing adequate data collection instruments because some facilities will say we don't have them and that the problem can be solved or alleviated with the help of equipment purchase. However, now the biggest bottleneck is a shortage of staff to do the little data entry (only some) or compilation of data at the divisional health teams. There are still some facilities that have organisational problems with the divisional health teams having difficulties doing their data entry or compilation.

An example was given where with the Central River Division the officer in charge has been transferred somewhere else, the divisional public health nurse is in UK on training, the senior CHN tutor has a hypertension problem, which leaves only two people running the divisional health team. The question to me was, who is supposed to do all the data entry or compilation and all the administrative work?

To improve the situation, most thought they should make sure that the units are linked properly; that there should be a well established recording system, a reporting system and an integrated system so that they all know they are part of one system and have to report to each other.

6.H.4 National Health Laboratory

The Chief Microbiologist at the department of state for health (DoSH) was interviewed and among other things the national health laboratory (NHL) was discussed. The relevant aspects are presented below.

Organisationally, since you've been here, how is the RVH laboratory structured and how different is this from the so talked about national health laboratory?

Okay, perhaps I should just put the RVH Laboratory in context. You know the national health laboratory is a network of laboratories in The Gambia which is made up of this laboratory, which is the central laboratory and the main coordinating centre for all these network of laboratories. We have laboratories in two other main hospitals which are Farafenni - AFPRC hospital and Bansang hospital and various major health centres. So, there are like six major health centres and one minor health centre where we have laboratories and these serve the whole country, but the coordination is from this laboratory here at RVH which we call the central laboratory.

The day to day activities of the laboratories apart from this one, are supervised by the divisional health teams (DHTs) or the various hospitals Chief Executives that are in the other two hospitals. They work in collaboration/consultation with us. So just the day to day things are what I supervise here.

So you will call it already implemented? The National Health Laboratory?

Well, in a way. Except we just need it to be spelt out.

What in your opinion is the importance of the implementation of the NHL?

The complicating factor at the moment is that each of the laboratories in the hospitals are under the various Boards, but the health centre laboratories are under the Ministry or the Department of State for Health. So they get all their salaries and allowances paid from each of those bodies. If you understand what I mean, like the hospital Boards are responsible for salaries and allowances of the laboratory staff in their various laboratories, whereas the health centres' laboratories are paid from the Ministry. That is the big difference. So you have a disparaty now, in remuneration in that the laboratories under the Department of State won't get allowance whereas those under the hospital Board do. So you have that kind of inequity in remuneration although they are all doing the same laboratory work, they all have the same responsibility.

What do you think are the present major problems with the RVH laboratory?

Personnel. Professionally qualified personnel. The attrition rate is extremely high as you probably know of, and that is not only the laboratories, but I think the health service in general. At the moment it is going to be very difficult as far as the staff turnover in the laboratory in the hospital are concerned because of the very high attrition rate of professionally qualified people. In recent times we were even experiencing that with our Laboratory Assistants. Like young people, identified, employed, given some In-service training, and just when you think they are competent to be able to take on a little bit more responsibility, they are off. A lot of them get scholarship to go abroad privately, from their own resources or otherwise or they get employed by other competitors, private sector, MRC.

So what's the reason for this high attrition rate?

That's what I am just giving you now. They want to progress, and then the competitors to the Department of State, in the sense that the private sector, MRC, you know.

So, what in your opinion do you think should be done to improve some of these problems and the Organisation of the laboratory itself, request procedures and your records?

The Organisation of the laboratory I think, if we have more professionally qualified senior staff then it will be easy to manage because you will have people who can supervise to train and to give you quality service. But right now we are few senior professional qualified people and we have to do, not only the administrative but also the supervisory diagnosis services. And as you know, the role of this laboratory is like four-fold. It is not only provision of services delivery diagnostic but we also do public health function and a teaching function. We teach, not just laboratory staff but we also teach in the school of public health, the school of nursing and then we have this Diploma course in bio-medical science with the University of Westminster. Some of our staff are tutors in that course, and then also we have had some with the medical school. And then we also have research because we are involved with research programmes in collaboration with MRC and with other international organizations. So really that is one of the problems, therefore it is difficult to be able to carry out all those functions and in the process of all that, the record keeping, you need to be able to supervise so right now we are really handicapped.

Problems?

Well, all laboratory activities are recorded in Laboratory Day books, so each unit in the national health laboratory have Laboratory Day books. All investigations performed are recorded there. So there is an added record of what investigations are done, these are also, after it has been reported and those records in some other units we have to computerise (at least in Micro-biology). I think it is the main one, we've got a lot of data (some of the data already in computer) need to be computerised for analysis so that we can look at the trends and all that, and we plan to do that for all the units. You can see we've got a couple of computers we have problems with our monitor so there is very little we've done. And then we've got template for monthly analysis, for statistics collection for all the various units and now we need to put that in place so that we get monthly records.

In your personal view, what do you think the national health laboratory's role would be in the area of health information system development?

In fact a central role, because really, like I said the laboratory has a pivotal role in the national healthcare system of any nation. Because that's where you get the confirmatory evidence of what disease patterns are, what are the infectious and non-communicable diseases, so they play a central role. The information is what will truly guide policy. And also for management of patients it is absolutely important. So really for the information system the laboratory has a major role. I mean I could elaborate on and on and on but I see you don't have enough lines.

No, no, you can say as much as you like and I will always get it.

The laboratory has a pivotal role and therefore the information system, collection of information should be really strengthened. The data management in the laboratory needs a lot of support so that we can strengthen it. You've seen a few of the kind of things, even all the constraints we have we are able to produce such data and that I think, I am not trying to blow our horn but I think we are trying. We'll give you even more if we have the support.

6.H.5 Health Sector Workforce

Information about the health sector workforce (health workers) was sought from the Permanent Secretary of DoSH. Her views on training strategies for health workers and reliance on information provided was also sought (see below).

Approximately how many people are employed in the entire health service of the country?

I don't know whether we can give you an accurate statistics but I can use the budget and give you an indication of the numbers we are talking about. Those that are directly with us, you know the hospitals have their own staff, they are appointed by the hospital boards, Farafenni, Bansang and RVH. We have overall responsibility for those staff but they are not included directly in this list that I am giving you, although Govt. pays a subvention to these hospitals which is meant to go towards the payment of salaries of those people. So I will try and see if I can give an indication look at their subvention. For year 2001 for personnel we have 1,858 people not including the hospitals, subtract 33 people for Women's Bureau; this excludes the 250 Cuban doctors, the Egyptian doctors and the Nigerian doctors. RVH 902, Bansang 309, Farafenni 229, Bwiam 194. Not yet opened but have made provision for it.

So can I get this document somewhere else to have a look at another time?

Yes, you can always borrow my copy but these are people who are salaried or established paid staff. There are also the daily wage staff, temporary staff namely the cleaners, orderlies, the cooks, the laundresses they may not all feature here but they can also be a good number, so you should bear that in mind. To get those figures you have to go to the institutions themselves some of them are at the health centres.

So, actually in the country we are talking about 1,858 plus 902 plus 309 plus 229 plus 194 to make the people who are really in the health service.

Yes, it is very close to 3,000 plus and if we take the cleaners and messengers, it will be heading towards 4,000.

Does your Ministry or the Government rely heavily on this information received from various health sectors of the ministry when making high level decisions or policies?

Indeed, yes, we rely very seriously on that and that is why we are not getting much of an assistance both from Government and our development partners because we don't have the statistics readily available. Currently, we are working on our public expenditure review (PER) and part of this public expenditure review is this information on health financing. If the details were available somewhere the work on the PER would have been completed by now – the target was June but because these are not available they are now going back to the grassroots for details and without a PER we cannot access additional Government funds, just some. We cannot argue very strongly for a substantial increase in the health budget without the information.

What strategies do you have in place for future training or present training of health?

It has something to do with resources, we only have the World Health Organisation (WHO) funds as far as I know for health staff and that one also is limited. There is the central government budget for training of all civil servants but that one is one lump sum for 16 institutions to share, for about 14,000 civil servants so you can imagine it is a league competition. I use also various seminars and workshops that are announced and funded by UNICEF, WHO, or other organizations, it's a form of training. For long term training - 6 months and above it is usually from WHO fellowship. There is something on training under the African Development Bank (ADB) which we have identified and a health staff has gone.

So, it is probably unfair to ask the question where does the Government place health in terms of all the 16 institutions competing for the national cake?

If we look at the overall Health is placed very high on the budget, we are using consumables constantly. I am also told that apart from Education, health is also again taking a big chunk. We are consuming all the time, it's not easy, it is dynamic. We swallow the medication we utilize the reagents, it is not easy to access.

In terms of priority and urgency in the health area itself, which areas do you think personally need more people to be trained?

Planning Unit because that is the backbone, if they have the training they can provide the guidance to all other units.

6.H.6 Opinions on Important things Government Should Address

They were asked, in their opinion, to list the five most important things they would like to see the government address in the entire health sector. A lot of diverse areas were suggested, but virtually all of them mentioned strengthening the information system as one of the keys to a successful healthcare improvement. They did not generally consider it as the top-most priority, although one person did and commented that, "I think no.1 because information is power. It is on the basis of information that we come up with our policies, our plans, our interventions. I think information should better be top of the priorities because without information how can we really plan for our services. I think that would be difficult".

The Permanent Secretary of Health had this to say:
"I will start with malaria, bringing the prevalent state of malaria down; providing enough insecticide, making sure that there is an adequate supply of mosquito nets; sensitising the public to sleep under nets, making sure that all our health facilities use the dipped nets. Making sure that we have adequate supply of the malaria drugs in our drugs store and that they are distributed evenly to all the health facilities and that we have doctors.
Then the second one is to also very closely related to malaria, that is bringing the mortality and neonatal and maternal mortality down. People are talking about the referral system not functioning to its ultimum. We want to make sure that ambulance services are available to ferry people who need care quickly to where they can get care health facilities, major, minor hospitals, adequate ambulances that can do that; to make sure that our minor and major health centres can provide minimal laboratory services.
Most of these referrals come all the way to Banjul or Bansang or Farafenni simply because there is a blood transfusion that could not be done at some health centre level. If only we have the equipment, generators, trained staff to put the drips on. In some major health centres if they can also provide obstetric and gynaecological services to help women who have difficulty in childbirth, saving their lives and that of their children.
The fourth one will be making sure that we have adequate vaccines, it is all in the prevention, we have vaccines and properly distributed. The cold chains working up and running and have our health staff available and we sensitise the mothers to take their children on time, get them vaccinated.
The other one of course is what you are talking about, the health information system, people can get the culture of taking down information details and taking them down in such a way that it could be useful to the HIS. Then arrange a way where the HIS staff can access

this information quickly, then that would have solved it. I know that at the touch of a button I have the information needed."

6.H.7 Opinions on Patient Care and Healthcare in General

They were also asked to say what they thought should be done to improve patient care in particular and healthcare delivery in general. Again diverse views, but most of the views centred around people wanting to have more trained staff to take care of the patient as being one of their major problems now and therefore needing attention. The other thing is the constant availability of drugs.

For healthcare delivery, there should be more communication between hospitals, so that for example when a patient is referred, they know beforehand what is going to happen and can prepare at the receiving end. They can prepare to take care and make sure that they receive the patient properly and do what is needed urgently. In general, ambulances too and other resources are needed.

They mentioned that if they have information then they can help in the planning of disbursement of funds and to see where to put their money, which area has more of this disease and how do we go about starting it properly.

APPENDIX I: General Observations about Conditions and Activities During the Action Research (Observational Study)

6.I.1 Further Information obtained about RVH

The records office is one of the sections of the Royal Victoria Hospital (RVH), and is one of the nerve centres of the hospital. The office is headed by a Medical Records Officer (MRO). The staff are responsible for the day to day registration of out-going and in coming patients records, of the hospital.

In offering this service the office operates daily from 08:00 hours to 16:00 hours from Monday to Friday. At present there is no weekend work. Records clerks do go round all the clinics and wards of the hospital to register incoming patients and collect the folders of patients being discharged. from the ward and medical documents which contains patient's name, age, addresses and cause of disease. They try to ensure that individuals documents relating to the treatment of patients are filed correctly in the folder and are available and easily found when required. The patients' medical records are kept in the records office on shelves in alphabetical, numerical or terminal digit order.

When patients come for a follow up or next visit, it is the responsibility of the clinic records clerk to ensure that these patients are identified and have their medical records made available at the time they attend.

The folder is issued by the registration office and bears an assigned folder number that is considered the patient hospital number. A patient's folder remains in the ward throughout the patient treatment period. Patients can come again, not remembering their number, and will be given a different number and/or because it is a different visit.

6.I.1.1 Records Clerks' Daily Ward Rounds

Each day a pair of the records clerks visits each ward and, bed by bed, enter details of every patient in the ward round book. There is a separate ward round book for each ward. Details to be entered into the book include the date, hospital number, patient's name, address, age, sex, referral centre (if referred from a health centre) and doctor who attended to the patient.

From the above information recorded in the ward round book and the patients' folders, attempts are made to compile daily statistics for each ward, for example: the number of admissions, transfers, discharges, deaths or deceased (coded DCD), absconded, re-admission, still in ward and hospital days (days spent in hospital). However, time and lack of extra helping hands make this exercise almost impossible for some nurses and clerks. However, when urgent situations arise for vital statistics, people will take some work home or stay extra hours at work to provide the pains-taking manual compilation needed. Daily totals are supposed to be aggregated into monthly totals for submission to the hospital management for their statistical information. The timings for the statistical compilation are usually not met.

Apart from the ward round book (which is left in the ward), ward round sheets are completed manually every day by a ward clerk during a bed to bed check. The names of new patients are added to the current sheet. Patients' outcomes or changes in status such as transferred, discharged, absconded or deceased are noted. When a sheet is full, it is returned to the records office. Daily statistics are then compiled into monthly and yearly totals. It can be seen how easily duplications can occur.

6.I.1.2 Admission and Discharge Register

The record office maintains its own admission and discharge register. The information is extracted from the patient folders when they are returned to the records office following the patient's discharge or death. Duplication of efforts and records are clearly evident.

6.I.1.3 Theatre / Anaesthetic Register and Patient Consent Form

This register is kept for patients receiving an operation (surgery). It includes personal details about the patient and also important information about the anaesthetic technique used and the patient's post-operative condition. Entries into this register are completed by a theatre nurse. Details recorded include: theatre number, date, hospital number, patient's name, ward / address, age, sex, diagnosis, Hb g/dl, physical status, nature of operation, elective / emergency, anaesthetic technique used, anaesthetist, surgeon /nurse, patient's post operative condition, immediate or after 24 hours.

Every patient who undergoes an operation is required to sign a consent form giving his/her consent to the procedure. If the patient is in (not) capable of signing the form (for reasons of being too sick, too young, too old etc.), a relative is required to sign. The consent forms are kept for this purpose.

6.I.1.4 Discharge of Patients

When a patient is discharged from a ward, the discharge date, is recorded on the patient's appointment / discharge card. Patients requiring follow up appointments are instructed to report to the registration office where the arranged appointment date will be recorded on the appointment card. The nurse in charge of the ward checks that all necessary medical records relating to the discharged patients are on the discharged patients' folders which are later collected by the ward records clerk on the ward round and taken to the records office.

6.I.1.5 Hospital Ledger

The hospital ledger is a pre-printed loose leaf volume containing basic details of all in-patients treated in the hospital. A ledger entry is completed by records office staff for each discharged or deceased patient when the patient folder is returned to the records office. Patients' details are entered in the ledger by records office staff and these includes data from the ward round book.

The hospital ledger can then be used to provide summary information about in-patients including their treatment in the hospital. Details recorded in the ledger include: patient's name, address, nationality, age, date of admission, ward, hospital number, consultant (if any), provisional diagnosis, date of discharge or death, cause of death or final diagnosis, or referral. After completion of entries in the ledger, folders are passed to the coding section for clinical coding.

6.I.1.6 General Principles

It is the responsibility of clinic clerks to ensure that all necessary patients' medical records are retrieved from the records office and are available in the relevant clinic in time for patients to be seen by medical staff.

Normally, doctors give their clinic clerks the names of patients who needed appointments, or alternatively gave the clerks their diaries with the appointments for a clinic day already entered. The clinic clerk would prepare a list for the records office so that medical records could be retrieved in time for the clinic. Clinic clerks try to ensure that all patient records are available for appointments.

6.I.1.7 Records Office's Computer

The entire records office is equipped with only one main (properly) functioning computer (not even a pentium series) which was donated by H.E Alhaji Dr. Yaya A.J.J. Jammeh (the President of The Gambia). There is only one reasonably computer trained (not to a high level though) member of staff who is responsible for the operation of the computer.

6.I.1.8 Forms and Record Books

There are large ancient types of quire books kept by the records office, as well as forms and cards that are issued by the different departments of the hospital. In all, the researcher counted twenty six (26) different types of forms and record books found in the records office. These included: accident and emergency register, admission/discharge register, theatre/ anaesthetic register and X-ray register. Then, A&E treatment card, A&E out patient treatment record card, prescription form, appointment/discharge card, master patient index card, and tracer card. Then patient folder, continuation sheet / case notes, consent form, clinical coding sheet, patient transfer form, X-ray request/report form, clinic preparation form. Then cause of death certificate / medical certificate of death, summary statistics for patients, ward rounds monthly statistics, monthly statistics for out- patients, and pathology records. It also includes, the ward round book, hospital ledger, appointment book, microbiology and laboratory record book.

The records office is the custodian of used and unused (new) forms and cards.

During the period 1998 – 2001, there has been some amount of ICD coding going on, but not fully operational and the Medical Records Officer complains that there is not enough support for training in this area.

6.I.1.9 Accident and Emergency Cases

The accident and emergency (A&E) department deals with patients involved in accidents and genuine emergencies needing immediate treatment. The A&E is one of the busiest sections of the RVH and operates daily 24 hours, Monday to Sunday. Patients may also attend an Accident and Emergency Department following referral from another hospital or healthcare facility by ambulance, taxis or private vehicles.

All patients attending A&E irrespective of the reason are seen comparatively quickly and with more care and attention. Cases of serious injury are given priority attention over minor injuries and are usually attended to by the medical staff before any documentation procedures take place.

All cases brought to the A&E are examined by the by senior nursing staff or medical officer on duty or in charge of A&E. S/he then decides to: discharge the patient without further treatment, treat the patient further before discharge, refer the patient to an out patient clinic, or admit the patient to a ward.

The hospital keeps a record of all patients who attend A&E. Information for accident and emergency records must be obtained either from the patient, a relative or other person accompanying the patient, or a member of the ambulance service or other emergency service including the police.

Details of each patient are recorded by nursing staff in the accident and emergency register. Details include: name of patient, age, sex, address, diagnosis (injury or nature of complaint), hospital number (if any), treatment rendered (with doctor's remarks (completed by doctor)), time in and time out.

Ideally, the register should be completed immediately after the patient arrives and/or is seen by the medical team. Nursing staff or the records clerk are entrusted to maintain the register and are responsible for recording information about patients, but things do not happen as instituted.

Emergency patients arriving between the hours of 04.00 and 08.00 are admitted via A&E. For non emergency between the hours of 08.00 and 16.00, patients are directed to the OPD clinic or to a ward if found to need admission later.

For accidents or cases involving the police the nursing staff complete an out-patient treatment and record card which is given by the records officer. These cards are retained by the records office and kept in numerical order and may be used again for other purposes required by law.

A&E patients requiring a prescription are issued with a duplicated prescription form. The form is taken to the pharmacy. The top copy is retained by the pharmacy. The other copy is kept by the patient.

Patients who are referred by other hospitals or health centres are usually admitted via A&E. The normal procedure is for the patient to be accompanied by a nurse from the referred centre who hands over the patient, and the patient's records to the nurse in charge or on duty at A&E. The patient's condition is then assessed and the doctor in charge briefed.

In terms of logistics, the A&E has, as a minimum, a qualified medical and/or surgical doctor, with their trained staff with their wheel chairs and trolley beds for carrying patients from the ambulances and taxis. There is small ward attached to the A&E clinic containing six beds for minor injury admissions.

The surgical doctor is responsible for surgical cases such as accidents, assault, burns, fractures, and dislocations. The general medical doctor deals with cases such as celebral malaria, ulcers, ccf, asthmat, liver cirrhosis, hepatomas, hepatitis, tuberculoses etc.

Cases above the jurisdiction of the medical/ surgical doctor's capability are immediately referred to a consultant (if one is available; not always available), who makes the final decision about the patient's case.

A&E admits its patients in eight different types of wards within the Royal Victoria Hospital, namely: Sir Andrews, male medical, female medical, 6/7, I.C.U and Eye wards.

6.I.1.10 Diabetic Medical Clinic

This is one of the clinics of the RVH and operates daily from 08.00 to 16.00 hours. The clinic concentrates mostly on non-communicable diseases such as Asthma, CCF, ulcers and diabetes. This clinic operates only on an appointed day in the week, that is Thursdays.

When patients arrive in the clinic's consulting room, they are registered with serial numbers following the last one recorded in the patients' daily register book. After registering patients, the nurse or clerk will collect patients' previous medical documents and write particulars in the daily register.

Before patients can receive drugs they have to buy ticket from hospital cashiers who are attached to clinics to issue tickets to patients before receiving drugs. The ticket, costing D5.00, goes towards defraying part of the cost of drugs; a new initiative called the drug revolving fund.

After examination, the results of any examination are written on the patient's prescription form. If the patient's condition is not serious or improving, s/he is provided with medication to be used at home to reduce the possibility of a serious diabetic shock or condition.

If a patient's condition is a serious one, such a patient's medical history is passed on to the medical doctor without delay. Most of the patients after being seen by a doctor, are given a lot of drugs for home use, though some of them get admitted to hospital wards. Some of the patients were referrals from health centres or homes, due to serious attacks, with most of them arriving unconcious and hence are treated as emergencies.

The records clerk attached to the clinic also has his/her patients' daily register consisting of patient name, age, address, sex, cause of sickness for the purpose of hospital data entry and record keeping in general.

6.I.1.11 HBP – Hypertension Clinic Day

Here, patients use the same clinic as the diabetic patients, the clinic operating as a high blood pressure (HBP) clinic only on Mondays. On most of the days of observation or visit to the clinic by the researcher, approximately 85% of the patients attending the clinic were follow up cases. Patients are registered in the daily patients' attendance register and the records clerk attached to clinic also registers the patient by recording patients particulars in the records office register. Note that if a patient is diabetic as well, s/he will have two hospital numbers (a diabetic clinic one an HBP one).

A nurse examines the patient, takes their blood pressure and records the particulars in the patient's prescription form. The patient is required to buy a ticket for D5.00 ($0.25) before being able to collect medication from the pharmacy department. Again the cost of the ticket goes towards defraying part of the cost of drugs; a new initiative called the drug revolving fund.

Most of the patients are referred by health centres sometimes in situation requiring an ambulance. All referral patients are supposed to have a referral certificate or letter from the person or health centre that referred them. The referral letter is the communication link between the health centres and the senior doctors at the RVH.

6.I.1.12 Antenatal Clinics

This clinic generally deals with pregnancy cases from day one to 26 weeks, and pregnant women with complications. It operates daily. At any visit, if there are no complications in the pregnancy, the nurse prescribes antenatal drugs. The patient carries the prescription form to the pharmacy for collection. Patients are registered on the antenatal clinic patients' attendance register. There is a scanning room for ultrasound. The clinic also embarked on weekly tetanus toxoid immunisation for women.

In the event that the nurse considers there to be serious or complicated signs in the pregnancy, s/he without much delay will refer the patient to the clinic doctor, who will examine her further and take action to discharge or admit.

Some of the antenatal patients are referral cases from other hospitals, clinics or health centres, sometimes in serious condition and being transported by ambulance. The records clerk attached to the clinic also registers patients in the records office patients' register with name, address, sex, age and primary cause of disease. Abortion cases are also admitted by the unit. Most such cases are admitted for 1 to 2 days until they are deemed fit to be discharged.

The unit admits in five different types of hospital ward namely:
(a) acute post-natal ward known as labour ward after delivery;
(b) antenatal ward – which admits women before they delivery;
(c) premature unit ward – which admits premature cases only;
(d) post natal-1 – which admits deliveries without problem and
(e) post natal-2 – which admits deliveries with problems.

6.I.1.13 Children's Ward

This unit concentrates on cases affecting children. Patients are registered in the daily register book. The nurse assists with the patient record, forms and medical card. There is a procedure room.

Most of the patients here are children suffering from diseases or conditions affecting children in The Gambia such as: (a) lethargy (b) poor feeding (c) vomiting (d) convulsion (e) fever (f) fast breathing.

If a baby becomes unwell in the first three days of life it is likely that the infection has come from the mother. Before admission, the nurse weighs the baby and takes a baseline record of the temperature. If the baby has signs of respiratory distress (high RR, chest in drawing, nasal flaring, they give oxygen to the baby), they take blood for BF (blood film for malaria parasite check), full blood count (FBC). The information written on patient's medical certificates will help the medical doctor to choose the right antibiotic for the baby.

The unit consists of four different types of wards namely:
(a) Infant ward 1 – admission of infant only and premature cases,
(b) Infant ward 2 – admits patients from 1 month old to 1 year old,
(c) Acute ward – Admits all complicated cases,
(d) Surgical ward – Admits children with accident and emergency cases.

The ward keeps oxygen bottles and incubators for premature infants. Premature babies are kept in incubators for as long as recommended by the doctor.

6.I.2 Information about Bansang Hospital

This is the second biggest hospital in The Gambia and takes some referrals from neighbouring health units. It is in the northern part of the country some 317 kilometres from the Royal Victoria Hospital (RVH) in Banjul which, is the main referral and biggest hospital in the country.

Just like the RVH, the staff include foreign doctors like Cubans, Nigerians, Ghanaians, Sierra Leoneans as well as Gambians. There is a shift system of work to ensure as close as possible a 24 hour service. It is semi-autonomous like the RVH and has a Chief Executive.

6.I.2.1 Out-Patient Department

This is one of the hospital's nerve centres and operates daily. Patients report first to the out-patient department (OPD) waiting and registration room, which accommodates nurses / nurse assistants sharing one big table in the centre of the room as well as having several long benches for the patients. There is one cashier and one records clerk. There is another big room at the OPD clinic which accommodates at least three nurses and two doctors, and six emergency beds.

6.I.2.2 Registration of Patients and Pharmacy

Patients first report to the OPD registration room upon arrival. They go directly to the cashier who sells drug revolving funds tickets to patients at five dalasis (D5.00) each. The issued ticket is clipped to two prescription forms. A nurse assistant will collect the patient prescription forms, and drug revolving fund ticket. One of the nurse assistants will register patients in OPD daily patients' attendance register with particulars including name, age, address, date etc.. Each patient has a folder that has BANSANG HOSPITAL THE GAMBIA printed on top of it.

The folder contains a small yellow card on which patients' particulars such as Name, National Voter/EPI/ID Cards permanent address, sex nationality, age or date of birth, next of kin, admitted or discharged date as well as folder number are written. There is also a Management Board Continuation Sheet which has more information about the patient record written on it. The extra information can include things like the prescription form number or laboratory results form details.

The prescription form is the linkage certificate between the diagnosis or disease and the pharmacy or treatment or drug given.

The patient carries the prescription form, which is in duplicate form, straight to the pharmacy for the medication. After receiving the medication, the patient returns the duplicate prescription form and discharge card to the nurse.

Unlike the RVH, patients are advised to keep the discharge card and come with it the next time they report to the hospital. The patient must produce the discharge card so that the nurse or record clerk can easily trace the folder, which consists of the patient's medical history. The problem here is that patients misplace the card, soil it beyond recognition of the details written on it, or have it partly destroyed. This can create problems especially with identification of the right person.

After issuing the medication, the nurse at the pharmacy end retains the day revolving fund receipt and the original of the prescription form. The pharmacy issue medicine to both out-patients and in-patients.

6.I.2.3 Drug Administration

At the pharmacy, there is a document receipt book in carbon duplicate with sections for name and signatures of issuing and receiving officers. This is in the pharmacy. With the signed receipt book a store keeper will supply the items to the pharmacy and retain original copies of the drug requisition order forms for auditing purposes.

Items to the main store of the Bansang hospital are supplied by the Central Medical Stores at the Medical and Health Unit headquarters in Banjul. The supplies are delivered mostly on a monthly basis but will do emergency supplies when the need arises.

Generally, the central medical stores distribute drugs in bulk to the Bansang hospital as well as to various relevant health units and DHTs after receiving drug requisition forms like the one shown below.

CENTRAL MEDICAL STORES COMBINED REQUISITION
Issue Note
Retention by Cms
Station no. 17238/

Item No	Description please print clearly	Unit	Stock on hand	stock	No units supplied

By receiving supplies from central stores and issuing to users, the appropriate health unit stores are expected to prepare monthly drug reports with particulars such as in the example below.

DRUG CONSUMPTION REPORT BANSANG HOSPITAL
Period of recording – 24th September – October 2000.

	Description	Balance c/f	Received	Qty consumed	Balance
1	Aluminium Hydroxide	nil	Nil	nil	Nil
2	Magnesium Trisilicate	141	Nil	20	121
3	Bentrofluazide 5mg tab	4	11	6	9

6.I.2.4 Minor and Serious Cases

Minor cases are dealt with by a nurse / nurse assistant who will diagnose the cause of sickness, and prescribe medicine on a prescription form.

With serious cases the nurse refers the patient to a doctor attached to OPD who will temporarily admit the patient on emergency beds at the OPD. Cases beyond the OPD doctors are referred to a consultant (if any is available) or immediately to the RVH which is the main referral centre and biggest hospital in the country.

6.I.2.5 Admittance and Referrals

Bansang hospital has only five wards namely, Female Ward, Male Ward, Maternity Ward, Children Ward and TB/Eye Ward. Critically ill patients are admitted and kept under observation for the necessary period until discharged or death do them part.

At the discretion of the physician attending to the patients, some of the patients are referred to the RVH by ambulance or taxis (in the absence of ambulance). Most of the referrals are extremely serious emergency cases such as serious accidents, assaults or serious attacks of any disease.

6.I.2.6 Records Office at Bansang Hospital

The records office at Bansang hospital is responsible for the day to day keeping of patients' medical records, for the use by the doctors and the hospital management. This is one of the newest sections of the hospital. The records office started its operation only on the 11th September 2001. There are seven record clerks employed who are headed by a records officer.

The records office has purchased two computers to be used for data entry purposes. Each of the records clerks is assigned to a particular ward for collection of patients' folders. After collecting these folders they are arranged on the records office's shelves according to the folder numbers.

During ward rounds, record clerks also register newly admitted patients and record discharged patients' particulars on the ward round sheets such as; A – admitted, W – still in ward, T – transferred, D – discharged, AB – absconded.

Anytime the patient reports again to the hospital, s/he reports directly to the records office where he/she will produce their discharge card. With his/her discharge card the record clerk gives the patient his/her folder bearing the same number as the card. The patients then carry their own folders from the records office to the clinic to be seen and given prescriptions for medication to pharmacy or admittance if necessary.

Patients will leave the folder in that particular clinic. The clinic will repack all the folders. It will be collected by the records clerks who will carry it to the records office for safe keeping. The same folders are used throughout the patient's visit to the hospital, enclosed with management board continuation sheet, which consists of the history of the patient.

The folder contain patients details such as name, address, age, next of kin in the event the patient lost his/her discharge card which give him/her access to collect his/her folder.
Being newly established, the Bansang hospital records office, unlike that of the RVH, is yet to introduce things like hospital numbers, ICD code numbering or a register dedicated to the dead. There is however a shelf that is separately dedicated to keeping only folders of dead patients.

There is a pre text counselling form that is completed for people who are to do specialised test such as HIV. This form includes details such as: name, age, region, town/village mother/father, reason for testing, telephone number, tests requested:e.g HIV [ ] or VDRL [ ], marital status, number of wives, number of children, history of travel – Africa, Europe, USA others and then the requesting doctor.

6.I.3 Other observations in Health Units in General

In some health centres, once the country's electricity grid is off (sometimes for days), the health centre is out of serious action too for the same period of time because there is no generator. The few that have old and not well maintained generators do not usually have enough fuel (diesel) to run them. Being a hot country, there are implications; drugs and reagents to be kept at specific low temperatures (refrigerators and freezers) cannot be so maintained. Fans and air-conditioners cannot work and on a very hot sunny day workers work under unbearable sweaty conditions. This is enough to let the most careful person make mistakes with procedures including medical records.

Some of the problem areas that need more attention are shortage of drugs, shortage of beds, irregular supply of meals to the unit due to the constant failure of machines especially the boilers for cooking, renovation to be carried out including electrical products and shortage of space. Frequent power failures and inconsistency in the flow of electricity is an added problem. To cater for the high influx of patients, there is the need to expand units and whole health centres. There are times when two or three patients have to sleep on the same bed and some on the floor because there are not enough beds. Shortage of bed space continues to be a major problem. There are instances when patients even after surgery had to remain on the trolley until alternative arrangements could be made for such emergencies to be admitted. The demand for in-patient accommodation continues to be a serious problem. This is because the demand made on the service is huge coupled with limited bed spaces.

Sometimes, security in the hospital is a big problem for the management. The number of guards needed to maintain proper order and security in the hospital needs to be reviewed. The acute shortage of staff means that total care to be given to the patients at all times is limited and escorts usually help the nursing staff; psychologically though, patients react in a better way when their loved ones are by their side. This is believed to help in their recovery. However, the risk of cross and droplet infection increases with every added escort in the hospital and the large number of escorts does not help proper cleaning of the hospital to take place.

APPENDIX J: Data Flows and Model and Unique Identification Algorithm for HIAS

8.J.5 Data Flows for Proposed Health Information & Administration System (HIAS)

A greater percentage of computing activities in the healthcare environment involves obtaining data from patients, laboratories and healthcare personnel and then transmitting, storing, transforming, summarising and analysing the data in order to help health workers, managers as well as patients to make decisions and plan for interventions. The use of data flows is to help people to understand the work the systems or subsystems do. Data flow diagrams (DFDs) which are graphical representations of data flows, provide concise and clear ways to the understanding of the objectives of systems. They represent the sources of the data, the processes for transforming the data and the points in the system where long-term or short-term data storage are required, and the destinations where reports generated or where results from queries are presented.

At the contextual level (level 0), the health information and administration system consists of the health information system (HIS) which deals mainly with patient care data and the health administration system (HAS) which deals mainly with the administrative aspects of providing the healthcare. This is depicted in figure 8.9.

The HIS consists of hospital patient data (from government and other health units), divisional health statistics (from all DHTs), laboratory data (from national health laboratory), nutritional data (from the nutrition unit), healthcare information (from the national health database), as well as demographic details (from population or census office). It also includes multi-level indicators and a healthcare summary from the Department of State for Health (DoSH).

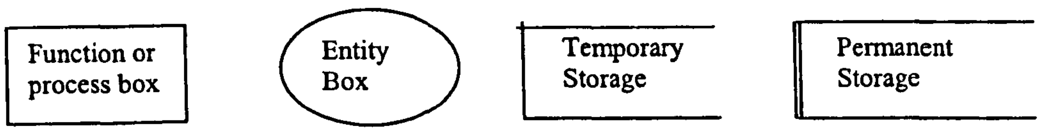
The HIS is further decomposed into levels, 1,2 and 3 (see figures 8.10 – 8.12 below).

The HAS on the other hand consists of hospital administrative details (from the government hospital only), divisional logistic details (from DHTs), environmental support information (from the National Environmental Agency), as well as stock and administrative analysis (from central pharmacy or drug administration). It also includes cost and logistical details from the DoSH.

The HAS is further decomposed to level 1 (see figure 8.13 below).

The narratives of the components of the data flows in figures 8.10 – 8.13 can be found after the data flow diagrams; (that is in sections 8.5.1 – 8.5.2).

In the drawing of the data flow diagrams, the following conventions have been used:



Proposed Health Information and Administration Systems: Data Flow diagram – Context (level 0)

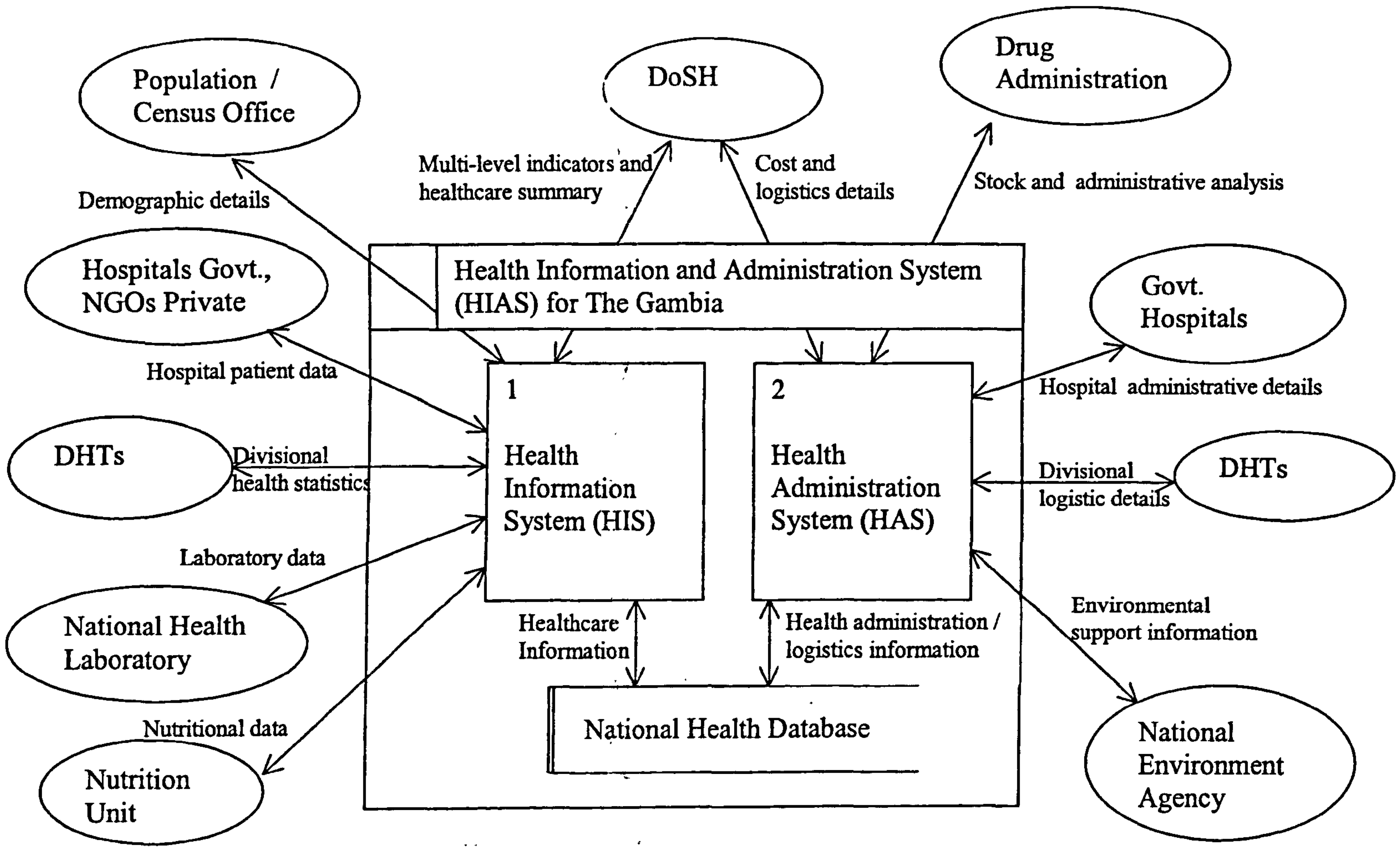


Figure 8.9: Proposed Health Information and Administration System (HIAS) Data flow: Data Flow Diagram – Context (Level 0)

Proposed Health Information Systems: Data Flow Diagram – Level 1

Health Information System

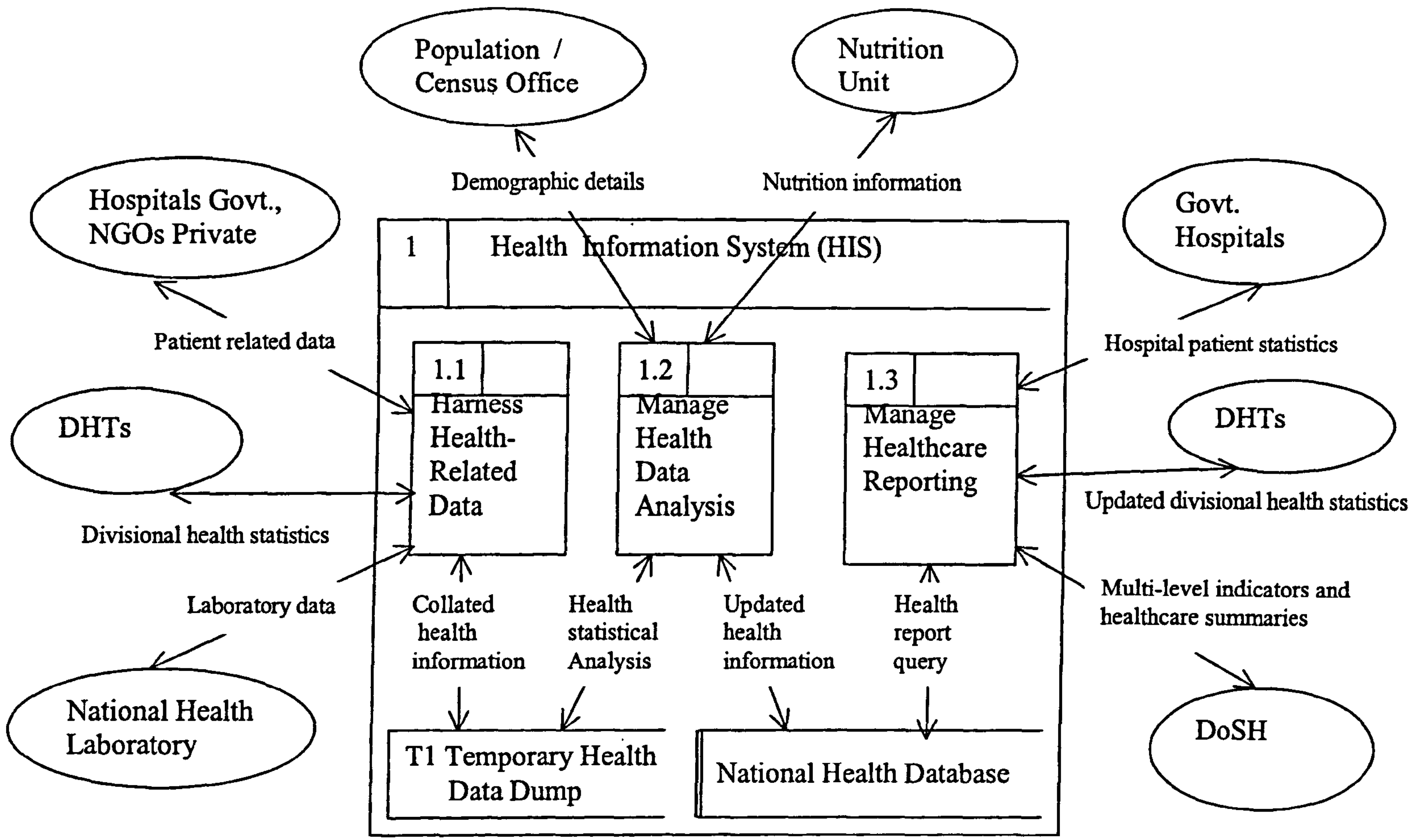


Figure 8.10: Proposed Health Information System (HIS): Health Information System: Data Flow Diagram – Level 1

Proposed Health Information System: Data Flow Diagram – Level 2

Manage Healthcare Reporting

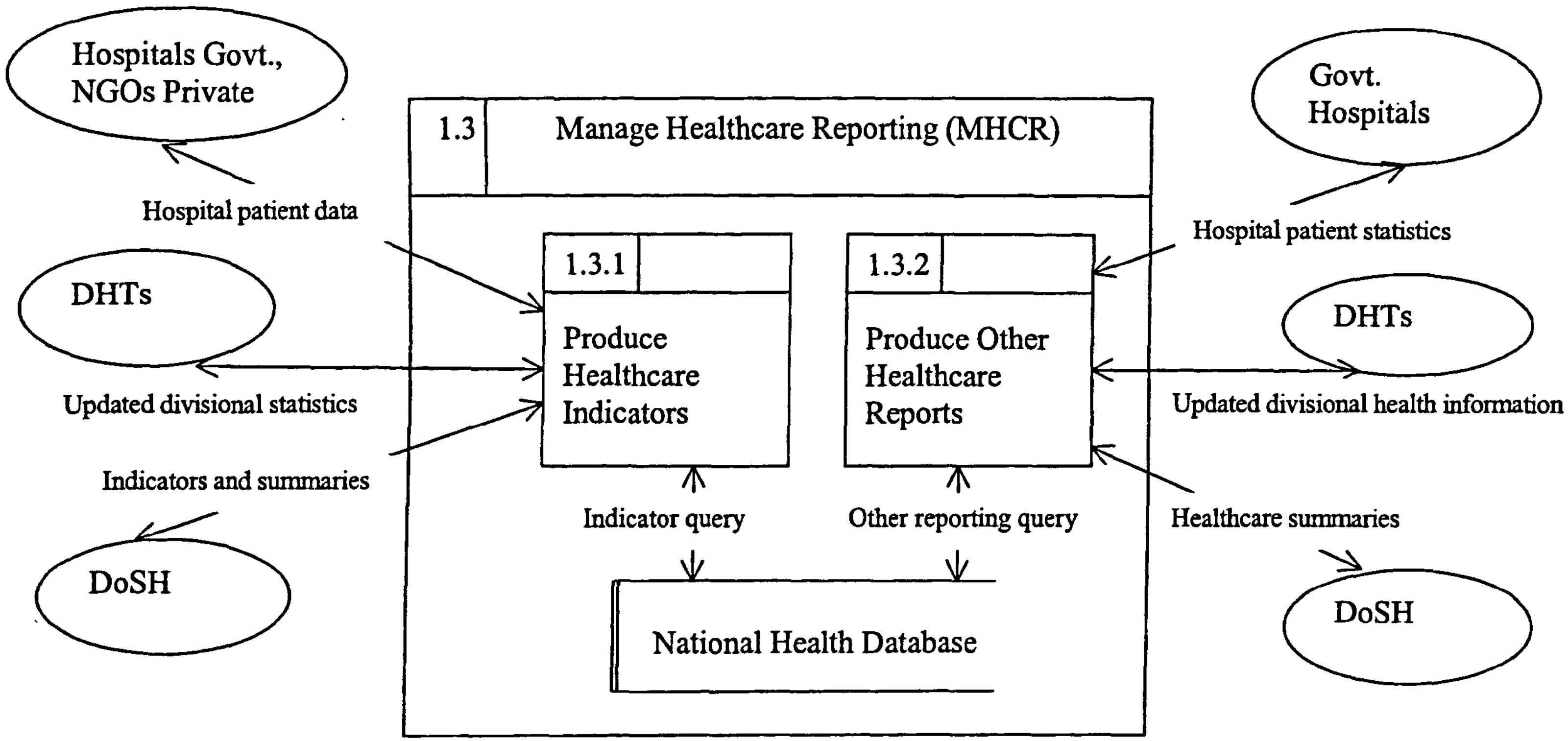


Figure 8.11: Manage Healthcare Reporting: Proposed Health Information System (HIS): Data Flow Diagram – Level 2

Proposed Health Information System: Data Flow Diagram – Level 3

Produce Healthcare Indicators

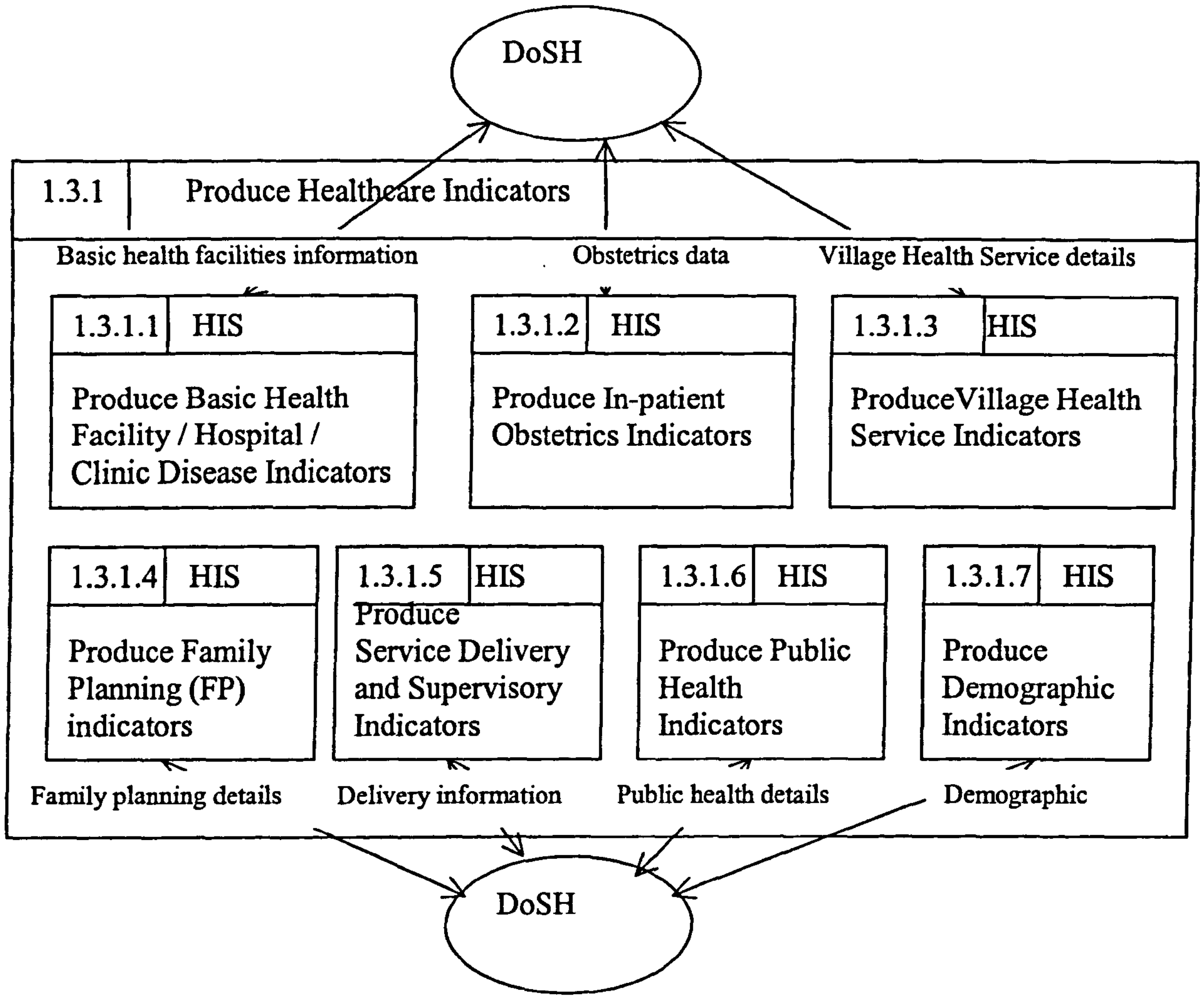


Figure 8.12: Produce Healthcare Indicators: Proposed Health Information System (HIS): Data Flow Diagram – Level 3

Proposed Health Administration System of HIAS: Data Flow Diagram – Level 1

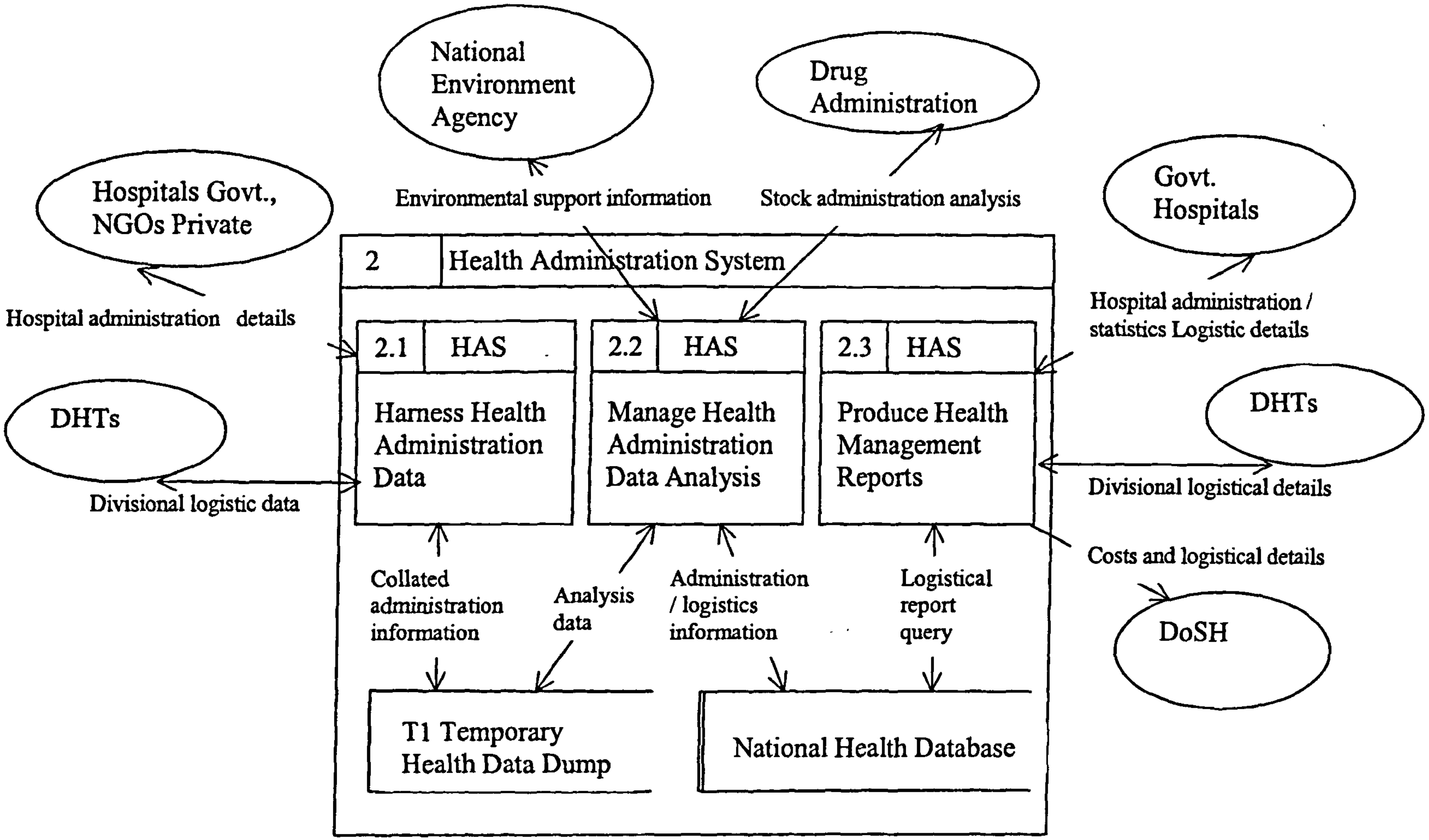


Figure 8.13: Proposed Health Administration System (HAS): Data Flow Diagram – Level 1

8.J.5.1 Data Flow Process Descriptions for Proposed Health Information System

As mentioned in section 8.5 above, the narratives of the components of the data flow diagrams in figures 8.10 – 8.13 can be found in this section, 8.5.1 – 8.5.2 below. Sections 8.5.1.1 – 8.5.1.3.2 give process descriptions in the data flow diagrams of the proposed health information system (HIS).

8.J.5.1.1 Harness Health-Related Data (1.1)

At regular intervals, data are made available to the ESU from the DHTs, hospitals and National Health Laboratories consisting of district health statistics, patient-related data and laboratory results respectively. A temporary data file bank is created for all the incoming data.

8.J.5.1.2 Manage Health Data Analysis (1.2)

The ESU analyses the data made available to it (in the temporary file) and puts the processed health data into the database (National Health). From time to time, it receives some input from the Nutritional Unit and Population Census Office to complete certain health indicators.

8.J.5.1.3 Manage Healthcare Reporting (1.3)

The ESU produces a number of reports including national health indicators, comparative analysis and trend analysis from the bank of information in the National Health Database. Other reports may be produced or developed depending on the type of query (received by the ESU, or made by the ESU). The appropriate reports are sent to the DHTs, hospitals and DoSH among others.

8.J.5.1.3.1 Produce Healthcare Indicators (1.3.1)

From data analysed by the ESU (and stored in the National Health Database) are several standardised calculations performed which are categorised as follows: Basic Health Facility

/ Hospital Clinic Disease, In-patient Obstetrics, Village Health Services, Family Planning, Public Health Demographics. There may be other beneficiaries (such as the DoSH).

8.J.5.1.3.2 Produce Other Healthcare Reports (1.3.2)

The ESU makes other reports and data available such as historical information, comparative analysis, trend analysis, to name a few.

8.J.5.2 Data Flow Process Description for Proposed Health Administration System

Sections 8.5.2.1 – 8.5.2.3 give process descriptions in the data flow diagram of the proposed health administration system (HAS).

8.J.5.2.1 Harness Health Administration Data (2.1)

At regular intervals, data are made available to the ESU from the DHTs (districts multi-level logistical and operational data) and government hospitals (logistics data). A temporary file is created for all the incoming logistics data.

8.J.5.2.2 Manage Health Administration Data Analysis (2.2)

The ESU analyses the logistics data (from the temporary file) and puts the processed health logistics data into the National Health Database. From time to time, the ESU receives some input from the National Environment Agency and Drug Administration to help it arrive at certain health logistics results.

8.J.5.2.3 Produce Health Management Reports (2.3)

The ESU produces a number of reports including health indicators relating to logistics and comparative analysis and reports. Report types and number will vary depending on queries (received by or made by the ESU). The appropriate reports and relevant data is made available to DHTs, government hospitals and DoSH, as well as others that may be recognised as qualified or authorised to report or other.

8.J.6 Data Model for the Proposed Health Information and Administration System

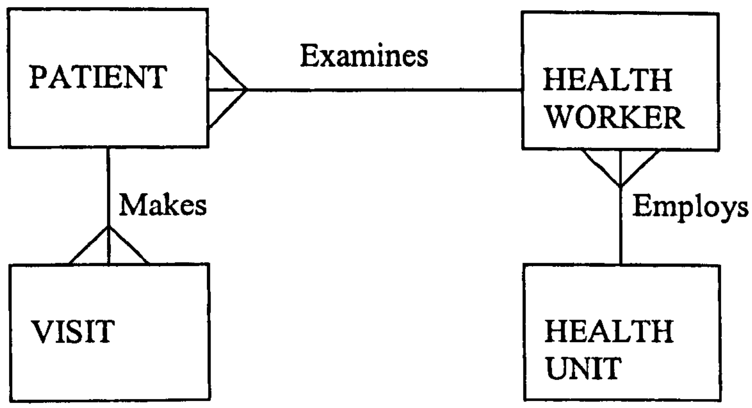


Figure 8.14: Data Model: Logical Data Structure for HIAS

Figure 8.14 is the Data Model (logical data structure) for the proposed health information and administrative system for The Gambia. It shows that a patient can be examined by many health workers (doctors, nurses, laboratory technicians, Village health workers, Community Health nurses etc.) hence the 1:many (in the health worker to patient) relationship. It also indicates that a patient can make several visits to a particular health unit or different health units hence the 1:many (in the patient to visit) relationship. Also portrayed is the fact that a health unit employs more than one health worker hence the 1:many (in the health unit to health worker) relationship.

8.J.7 Entity Description (Data Dictionary) for the Data Model

The data model shows entities about which information for the HIAS will be stored. The identified entities represent the core subjects about which data will be stored that will enable the fore going requirements to be met.

As the above model is only logically presented, a physical data structure of each entity identified in the system is provided. The attributes of each entity have been specified and described (data dictionary). Each entity and its associated attributes directly translate into a table as defined in relational database implementations. Table 8.1 shows these entity descriptions (data dictionaries) of the data model for the HIAS as already mentioned.

PATIENT	VISIT	HEALTH WORKER (HW)	HEALTH UNIT
Patient number Last Name First Name(s) Sex Date of Birth Age Place of Birth Address Town District Mother's Name Father's name Ethnic group Nationality Registered Date Occupation Height Weight	Visit Date Health Unit Name **Patient Number** **HW Number** Name of HW Seen Fee Paid Test Done 1 Test Done 2 Test Done 3 Diagnosis 1 Diagnosis 2 Diagnosis 3 Treatment 1 Treatment 2 Final Outcome Follow-up Date Referred From Referred To	**HW Number** Last Name First Name(s) **Health Unit Name** Position / Rank Sex Date of Birth Age Qualification Date of employment	**Health Unit Name** Town District Type of unit (Minor, Major, Hospital) No. of Employees Logistical Data Drugs stock Medical supplies Transport Etc.

Table 8.1 Data Model: Entity Description (Data Dictionary) for HIAS

Table 8.2 shows the characteristics of the attributes of the entity patient. It can be seen that it requires a maximum of 342 characters (i.e. 342 bytes) per patient record. If it is assumed that the whole of The Gambia's population of 1.038 million will have this core data on them, it will need 342 x 1,038,145 (355,045,590) bytes of hard disk space for storage. This translates to 346,724.2 k (355,045,590 divided by 1024 bytes) or approximately **347 MB** for the whole nation.

The patient number length of 13 is obtained from the algorithm for unique identification in section 8.7.5. For age it was assumed someone could be a hundred years hence 3 characters. For names, addresses, nationality and ethnic groups the longest possible was what was considered.

PATIENT	DESCRIPTION	DATA TYPE	LENGTH (characters)
Patient number	Patient's Unique Identification	Alphanumeric	13
Last Name	Patient's last name (surname)	Alphabetic	15
First Name(s)	Patient's first name	Alphabetic	20
Maiden Name	Maiden name if female	Alphabetic	15
Sex	Gender (male or female)	Alphabetic	1
Date of Birth	Date of birth if known	Alphanumeric	8
Age	Age (known or estimated)	Numeric	3
Place of Birth	Place of birth	Alphabetic	8
Address	Home or residence address	Alphanumeric	80
Town	Town or village	Alphabetic	20
District / Division	Division	Alphabetic	25
Mother's Name	Mother's name	Alphabetic	35
Father's name	Father's name	Alphabetic	35
Ethnic group	Tribe or ethnic group	Alphabetic	20
Nationality	Nationality	Alphabetic	10
Registered Date	Date of first registration	Alphanumeric	8
Occupation	Patient's Occupation	Alphabetic	20
Height	Patient's Height	Numeric	3
Weight	Patient's Weight	Numeric	3
Total Record Length			**342**

Table 8.2 Characteristics of the attributes of the entity patient

Table 8.3 shows the characteristics of the attributes of the entity visit. It can be seen that it requires a maximum of 398 characters (i.e. 398 bytes) per "visit" record. It is known from chapter 2 that there are 3 government hospital, 7 major health centres, 12 minor health centre, 20 dispensaries, 177 outreach stations (OS) and 396 village health post (VHP).

If it is assumed that there is a mean of 300 visits per day for the 3 hospitals, 7 major health centres, 12 minor health centres, 20 dispensaries and 4 largest NGO hospitals in the country this gives 300 x 46 (138,600) bytes. On the assumption of 50 visits per day at each of the OS or VHP this amounts to 50 x (177 + 396) bytes i.e. 28,650 bytes. This gives a total of 138,600 + 28,650 (167,250) bytes for the visit record for the whole country per day or

167,250 x 365 (61,046,250) bytes per year. This translates to 59,615.5 k or 59.6 approximately **60 MB** per year. Very little will be needed by the private hospitals or clinics and the smaller NGO clinics.

VISIT	DESCRIPTION	DATA TYPE	LENGTH
Visit Date	Date patient visited health unit	Alphanumeric	8
Health Unit Name	Name of the health unit	Alphabetic	25
Patient Number	Patient's Unique identification	Alphanumeric	13
HW Number	Health workers number	Alphanumeric	8
Name of HW Seen	Health worker's full name	Alphabetic	35
Fee Paid	Amount patient paid to cashier	Numeric	4
Test Done 1	Laboratory or other test done	Alphanumeric	30
Test Done 2	2nd or additional test if done	Alphanumeric	30
Test Done 3	3rd or additional test if done	Alphanumeric	30
Diagnosis 1	Final diagnosis by clinician	Alphanumeric	30
Diagnosis 2	2nd Final diagnosis by clinician	Alphanumeric	30
Diagnosis 3	3rd Final diagnosis by clinician	Alphanumeric	30
Treatment 1	Treatment given by doctor	Alphanumeric	30
Treatment 2	2nd treatment by doctor if any	Alphanumeric	30
Final Outcome	Discharged / admitted / dead	Numeric	10
Follow-up Date	Follow up date if any	Numeric	8
Referred From	If referral case which health unit was patient referred from?	Alphabetic	25
Referred To	If patient needs referral, where is patient referred to?	Alphabetic	25
Total Record Length			**398**

Table 8.3 Characteristics of the attributes of entity visit

Table 8.4 shows the characteristics of the attributes of the entity health worker. It can be seen that it requires a maximum of 152 characters (i.e. 152 bytes) per health worker record. With an estimated 2 - 3,000 health workers in the government sector, we are not dealing with more than 4,000 health workers in the whole country. This amounts to 152 x 4,000 (608,000) bytes or 594 k or **0.6 MB** approximately and this is once and for all unless more health workers are employed in the system.

HEALTH WORKER	DESCRIPTION	DATA TYPE	LENGTH
HW Number	HW's employee number	Numeric	8
Last Name	Health worker's last name	Alphabetic	15
First Name(s)	Health worker's first name	Alphabetic	20
Maiden name	Maiden name if female and any	Alphabetic	15
Health Unit Name	Name of health unit of HW	Alphabetic	25
Position / Rank	Position or job title	Alphabetic	25
Sex	Gender (male or female)	Alphanumeric	1
Date of Birth	Health worker's date of birth	Numeric	8
Age	Health worker's age	Alphanumeric	2
Qualification	Academic qualification	Alphanumeric	25
Date of employment	Date HW was employed	Alphanumeric	8
Total Record Length			**152**

Table 8.4 Characteristics of the attributes of the entity health worker

HEALTH UNIT	DESCRIPTION	DATA TYPE	LENGTH
Health Unit Name	Name of health unit	Alphabetic	25
Town	Town/village of the health unit	Alphabetic	20
District / Division	Health division	Alphabetic	25
Type of unit (Minor, Major, Hospital)	Type of health unit (minor or major health centre, hospital, NGO or private).	Alphabetic	20
No. of Employees	Number of HW's employed	Numeric	3
Drugs stock	Types of drugs and stock level	Alphanumeric	10 – 15,000
Medical supplies	Medical supplies and stock levels	Alphanumeric	10 – 15,000
Transport Etc.	Type of transport (Ambulance, motorbike, mini bus etc.) and the state or condition they are in.	Alphanumeric	10 – 15,000
Total Record Length			**30 – 45,093**

Table 8.5 Characteristics of the attributes of the entity health unit

Table 8.5 shows the characteristics of the attributes of the entity health unit. It can be seen that this requires between 30,093 to 45,093 bytes per health unit record. The variability in the records is due to the fact that the types of drugs, medical supplies, transport etc. will differ from one period to the other; there are times certain items may not be in stock all and do not need to be itemised. This compilation is assumed to be feasibly done only at the DHTs and the three main hospitals although the data will be coming from all the healthcare units. Not much can be done to interfere with the internal logistic administration of NGOs and private hospitals or clinics.

With 6 DHTs and 3 government hospitals dealing with a maximum of 45,093 bytes of health unit record per week, we are talking about 9 x 45,093 x 52 bytes per year or 21,103,524 bytes. This is equivalent to 20,608.9 k or **21 MB** approximately.

All in all we are talking about sizes of records that can be handled very easily by present day computers in terms of hard disk space and software manipulations on the data sets.

8.J.7.5 Algorithm for Unique Identifier (Patient Number)

As mentioned in chapter 5 section 5.6 a consensus was not reached on the discussion of an algorithm for the unique identification. However, all the participants at the November, 2001 workshop agreed that it is important for a solution to be sought, which has led to the proposed solution in this section.

It is worth noting the arguments put forward earlier in section 5.6 that, apart from date of birth and first and last names other demographic data could have been used such as social security number, postal code, area code and telephone number. But only a small percentage of the population have these. Non-demographic data such as ethnic group, native language or nationality and passport number (only a low percentage have one) could also be considered together with physical attributes such as hair or eye colour, disability or scars etc. but these may be too difficult to deal with.

The proposed solution for the creation of the patient number which is the unique identifier nationally is to follow the algorithm below:

1. Take the first letter of the patients first name (e.g. Lamin take **L** or Fatou take **F**);
2. Take the first letter of the patients surname (e.g. Bojang take **B** or Singateh take **S**);
3. If patient has middle name or compound name take first letter of it;
4. Each health unit should have a two or three letter code. This is to be added to the first letters of the names (e.g. Serekunda health centre will be **SK**);
5. Add the last two digits of the year (e.g. 2003 take **03**);
6. A five-digit serial numbering provided to each health unit (say **1** – 90,000) should be assigned to patient sequentially as they register for the first time when the new system starts. These numbers should ideally be pre-printed as stickers. A five-digit is chosen as maximum because in the worse scenario of envisaging 200 new registrations a day in a particular health unit for 365 days gives a maximum of 73,000. It is thought carefully that the more the digits a health worker has to deal with the more the chances of introducing errors.

From the above description of the algorithm, a patient called Lamin Abubakar Bojang attending Serekunda health centre on 30th January 2003 and being the 333rd new patient since the new system started will have a national health service number **LABSK0300333**. Similarly, a patient called Lawrence Kweku Yamuah attending the Medical research Council clinic in December 2004 and was the 85,000th new patient since the system started will have a national health service number **LKYMRC0485000**.

For physical identification purposes (in cases of impersonation or police etc) pictures of patients can be taken the first time and kept in patient's folders rather than electronic photographs. This is because people can outgrow photos easily or change faces or obtain marks on face later etc.

Again, there is the need to note the arguments put forward in section 5.6 against the consideration for use of finger prints and/or photos, that most of the arguments against these were that it will culturally and according some communities' beliefs not be acceptable. In that part of the world some people tend to believe that if someone wants to kill you spiritually, it is very easy to do it through your photos and therefore shy away from parting with their photos. From a social and legal perspective, they have the misconception that signing a document or putting their finger print on anything means agreeing to anything that happens or is done to you by the people to whom you gave your consent. Logistically these two options may need more storage space and sophistication of the software as well as human to take photos.

THE END

ALL IS WELL THAT ENDS WELL

GOD IS GOOD

ALL THE TIME