MASTER'S THESIS IN TELEMEDICINE AND E-HEALTH

TLM 3902

IMPLEMENTING EHR IN A DEVELOPING COUNTRY: POTENTIAL CHALLENGES AND BENEFITS

(A CASE STUDY FROM GHANA)

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May 2009

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Acknowledgements

I must first thank the Almighty God for the protection and guidance throughout all these years ("*Al-hamdu Lil-lahi*").

I am deeply indebted to my supervisor, Rolf Wynn (Prof.) for the supervision and critique. Similarly I wish to extend my heartfelt gratitude to Gunnar Ellingsen (Associate Prof.) for the suggestions and proof reading. To all the staff at the Telemedicine and E-health Master's programme, to my fellow students, Berglind, Neema and Odvar, and the staff at NST I say tusen takk for the support and useful suggestions.

For the opportunity afforded me by the Norwegian government to study here in Norway, I say *tusen takk for stipendet*. I am also very grateful to the Administrator of Tamale Teaching Hospital, staff of the Records and Laboratory Departments for allowing me to use their facility and the cooperation I enjoyed from them.

To my wife, Amina, I am even more indebted for the moral and spiritual support, the encouragement and having to endure my absence from home for about two years. I will be home soon dear. To my parents, whom I am most indebted, I say thanks for the support and the patience of having seen me through this far. I am equally grateful to my siblings for the support and encouragement. My friends whom I have always turned to, I say thanks; especially to Awal, Mr. Wahab, Dr. Sham-una, and Yussif. And to all those who have in diverse ways contributed to the making of this thesis I say thanks, especially to Hasiya, Eric and Aaron for the insightful readings.

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Contents

Abstract

Developing countries are slow adopters of new technologies, particularly with regards to the health services of these countries. This study explores the data collection and management challenges in a Ghanaian hospital using an interpretative case study approach and proposes implementing an Electronic Health Record (EHR) system as a solution to these challenges. The Technology Acceptance Model (TAM), Actor Network Theory (ANT) and Computer Supported Cooperative Work (CSCW) are used in discussing the acceptance and the collaborative use of a prospective EHR system in the light of the present work practice at the hospital.

This study is probably the first of its kind in Ghana; there have been some limited studies of EHR early trials in some developing countries assessing the challenges of implementation. This study briefly mentions two of such; the Cameroonian and Kenyan EHR projects.

Some challenges that would impede the implementation of EHR in a Ghanaian hospital are the initial huge start up costs, poor computer skills of healthcare professionals, poor maintenance culture, and people embedding political meaning(s) into the system. The weak state of information infrastructure at the hospital would be another challenge in an EHR implementation. EHR could potentially reduce waiting times for patients, reduce the cost of the hospital's operations, improve interdepartmental communication and collaboration, provide opportunity for sharing best practices among physicians within Ghanaian hospitals, and enhance better resource allocation. The data an EHR could primarily capture would be patients' demographics, care plans, laboratory results, billing and NHIS claims information.

Keywords: ANT, CSCW, EHR, Ghana, Implementation, Information Infrastructure.

Chapter One

INTRODUCTION

1.0 General Introduction

The use of Information and Communication Technology (ICT) in healthcare delivery is a novelty in Ghana. As far as I am aware there exists no EHR in any Ghanaian hospital, (the same maybe true with many other developing countries). There is no article, or journal about the implementation of ICT in Ghanaian hospitals. I found only one article on a survey conducted by a Ghanaian resident in the USA in 2000 on the applications of telemedicine. His finding was that there was no serious use of Telemedical applications; except for the traditional phone call and fax and sometimes email amongst practitioners (Osei 2000). As of July 2008, there was only one hospital in the country that was using a computer based system for transmitting laboratory results within the various units in the Laboratory to the Laboratory's reception, where they are printed out for patients. This is limited only to the Laboratory; wards and physicians' offices are not linked so they still prescribe on paper.

This thesis explores the conditions for successful implementation of Electronic Health Records system (EHR) in a Ghanaian Hospital. The core focus was the study of workflows in two departments (Records and Laboratory Departments) in a Ghanaian hospital from April 14th to May 24th 2008. Data collection and management presents a serious challenge to the operations of these two departments. The bulk of records are still paper based, with just a fraction inputted in computers for statistical outputs for onward transmission to regional and national health directorates.

Some benefits of EHR generally cited are: Improved quality of service (better data management), cost and time saving. With these benefits of EHR and its potential of solving the data management challenges in Ghanaian hospitals, it may be puzzling why no conscious effort has been made to implement EHR. Some challenges in implementing EHR will usually be funding, organizational restructuring and adaptation to the system

(Nir and Robert 2006). The laboratories and other units could benefit tremendously from electronic record keeping; my interactions with some patients revealed that they spend a greater part of their time in the hospital at the Laboratory Department waiting for laboratory reports. According to my own experience at the Laboratory, a greater amount of the time is used for clerical work, i.e. writing the patient report and entering this in records book after the test is completed.

There is very little literature regarding the implementation of EHR in developing countries. However there is quite an amount of literature regarding EHR implementation in developed countries. There is also some evaluation currently on going regarding successful EHR in implementation. Available literature points to the fact that wide usage of EHR has been largely government or grant driven (a case in point is the Norwegian EHR, which has taken on a national character). A search of literature reveals a Cameroon EHR trial, which had not been successful. Reasons attributed to this were the lack of funding (not a priority of funders and policy makers), insufficient training of personnel, leadership/organizational issues etc. (Kamadjeu et al. 2005).

1.1 Motivation

I find it particularly challenging to study the prospects of introducing EHR in Ghana because of the following:

- Because of scanty/poor health information, it is difficult to have up to date statistics on diseases, so continuous monitoring is always a problem. Disease might be in an epidemic state before any action is taken.

- There is no unique personal identification system in Ghana, so there is the possibility of entering the same patient in the paper based record more than once or mixing up the records of different individuals. EHR can help cut this waste and confusion. With EHR, identification numbers instead of names will be used; patients visiting the hospital at the Outpatient Department (OPD) will be given a

unique identification number which they will use throughout the care process and at all departments within the hospital. Patient demographics will be entered only once during the first visit; presently it is entered at all the departments the patient visits and each time s/he attends the facility.

- Missing laboratory reports is also a problem; sometimes patients receive reports from the Laboratory that are not meant for them; we do have similar names, and since most patients cannot read they may collect reports bearing names that sound similar to theirs. Outpatients/relatives spend the whole day at the hospital, the most time spent waiting for laboratory reports. They probably wouldn't need to wait for their reports with a functional EHR in place.

1.2 Research Questions

This research sought to find answers to the following questions:

- What is the current state of information infrastructure in Ghanaian hospitals?

- How can EHR improve present data collection and management and what data will the EHR capture (scope)?

- What are some of the challenges of introducing change in Ghanaian hospitals?

1.3 The Research Approaches Employed

To address the above research questions, interpretative case study, documentary analysis and interviews were employed. The study included a five week field study at two departments in a Ghanaian hospital. A detailed description of the research method is given in chapter four.

1.4 Expected Contribution of this Research

This study could serve as the basis for further studies in the introduction of EHR and other technologies in the health sectors of developing countries. The author also wishes to use this study as an advocacy tool for EHR implementation in the Ghanaian health service.

Chapter Two

THEORETICAL FRAMEWORK

Most ICT projects being introduced in the health sector to facilitate care delivery have not been successful (Grudin 1988), notwithstanding the fact that huge funds has been invested on those projects. The Electronic Health Record (EHR) however, seems to be one of the most successful telemedical applications in implementation. It is therefore not surprising that some politicians, notably President Barack H. Obama have pledged huge sums of money for the implementation of EHR in hospitals. Obama pledged some 50 Billion US dollars over the next five years towards the implementation EHR throughout USA hospitals. This according to the Obama's health policy document (2008) could result in the saving of some 77 Billion US dollars annually, coordinate care, measure quality, and reduce medical errors.

Core issues such as the state of information infrastructure, the peoples' interactions with technology, and their acceptance of it should be critically examined during the implementation of an EHR system. For this thesis, I used the Information Infrastructure (II) and Actor Network Theories to help analyze the II state and the healthcare professionals' behavior toward change in the hospital where I conducted this study. I also used Computer Supported Cooperative Work (CSCW) and the Technology Acceptance Model (TAM) to aid in the analysis of the use of EHR as a cooperative tool and its acceptance.

2.1 Information Infrastructure (II) and the Implementation of EHR

A solid foundation is a basic requirement for any structure that is meant to last. Any information system (but particularly an EHR) requires a solid infrastructure that can support the software and its users.

In Webster's dictionary 'infrastructure' is defined as:

″a substructure or underlying foundation; especially, the basic installations and facilities on which the continuance and growth of a community, state, etc. depends, such as roads, schools, power plants, transportation and communication systems, etc.″

Information infrastructure (II) is a complex array of information systems and other supporting components. II is supportive/enabling, shareable, open and heterogeneous as identified by Hanseth and Monteiro (1998) in their book *Understanding information infrastructure*. They admitted that there was no clear definition for II.

2.1.1 II and Shareability

II should support multiple users, even if they are using it differently to attain a common goal. Information Infrastructure is seen as irreducible, in the sense that even though the users share it they cannot split it into separate components.

The different elements of an infrastructure are integrated through standardized interfaces. Often it is argued that such standards are important because the alternative, bilateral arrangements are all too expensive. Standards are not only economically important but also a necessary constituting element. If an "infrastructure" is built on the basis of bilateral arrangements only, this is no real infrastructure, but just a collection of independent connections (Hanseth and Monteiro 1998).

2.1.2 II and Enabling

Infrastructure is supposed to support a wide range of activities; it is enabling in the sense that it is intended to open up new fields or endeavors, not just improving or automating an existing structure. This is opposed to being especially designed to support one way of working within a specific application field (Hanseth and Monteiro 1998). As a result, an implemented EHR at TTH which primary objective is to collect and manage medical

information efficiently can also support clinical decisions viz-a-viz alerts or even suggest clinical pathways given some parameters. A sound II will facilitate education of medical students and continuing medical education of practitioners.

2.1.3 II and Openness

There is no limit to the number of users, vendors and stakeholders involved. This defining characteristic does not necessarily imply the extreme position that absolutely everything is included in every II. However, it does imply that one cannot draw a strict border saying that there is one infrastructure for what is on one side of the border and others for the other side and that these infrastructures have no important or relevant connections (Hanseth and Monteiro 1998).

Hanseth and Monteiro illustrates this with an example from the healthcare as follows:

> "A hospital is exchanging information with other medical institutions, even in other countries. It is exchanging information with social insurance offices and other public sector institutions and it is ordering goods from a wide range of companies. These companies are exchanging information with other companies and institutions etc."

Hospital doctors might be involved in international research programmes. Accordingly, a hospital is sharing information with virtually any other sector in society. And the information exchanged among different partners is overlapping. Drawing a strict line between, for instance, a health care and an electronic commerce infrastructure is impossible. However wide an infrastructure's user groups, application areas, designers and manufacturers, network operators or service providers are defined, there will always be something outside which the infrastructure should be connected to.

For TTH, the submission of National Health Insurance Scheme (NHIS) claims could constitute an integral part of an EHR to be implemented, the regional health directorate and the Ghana health service can benefit from timely reports that an EHR can deliver.

2.1.4 Installed Base and II

Building large infrastructures takes time. As time passes, new requirements appear which the infrastructure has to adapt to. The whole infrastructure cannot be changed instantly - the new has to be connected to the old. The new version must be designed in a way making the old and the new linked together and "interoperable" in one way or another. In this way the old - the installed base - heavily influences how the new can be designed (Hanseth and Monteiro 1998). Information infrastructures cannot be built from scratch; there is always something in existence (the installed base) upon which it is built.

Information infrastructure is intricately linked to the organizational culture, which in my opinion forms part of the installed based, this aspect was not emphasized by *Hanseth* and *Monteiro* though.

2.1.5 IIs as a Socio-Technical Network

IIs are more than "pure" technology; they are also socio-technical networks. Infrastructures are heterogeneous concerning the qualities of their constituents. They encompass technological components, humans, organizations, and institutions. This is true for information technologies in general, as they will not work without support people (Hanseth and Monteiro 1998). An information system does not work either if the users are not using it properly.

2.2 The Actor Network Theory (ANT)

2.2.1 Defining ANT

Actor Network Theory, often abbreviated as **ANT**, is a distinctive approach to social theory and research which originated in the field of science studies. Although it is best known for its controversial insistence on the agency of nonhumans, ANT is also associated with forceful critiques of conventional and critical sociology.

Developed by two leading French Science and Technology Studies (STS) scholars, Michel Callon and Bruno Latour, the British sociologist John Law, and others, it can more technically be described as a 'material-semiotic' method. This means that it maps relations that are simultaneously material (between things) and 'semiotic' (between concepts). It assumes that many relations are both material and 'semiotic' (for instance, the interactions in a bank involve both people and their ideas, and technologies. Together these form a single network). ANT tries to explain how material-semiotic networks come together to act as a whole, e.g. a bank is both a network *and* an actor that hangs together, and for certain purposes acts as a single entity. As a part of this it may look at explicit strategies for relating different elements together into a network so that they form an apparently coherent whole.

Actor Network Theory is a social–technical concept that concerns itself with the alignment of the interests/needs of the actors, usually involving social negotiations in a social network. The actors usually consist of humans and non-humans; some prefer to call the human actors as actants and the non human actors simply as actors. Latour (1991) describes the non-human actors, as those that offer the possibility of holding society together as a durable whole.

An Actor-Network, then, is the act linked together with all of its influencing factors (which again are linked), producing a network. An actor-network consists of and links together both technical and non-technical elements (Monteiro 2000).

It provides a language to describe how, where and to which extent technology influences human behavior and vice versa. It is heterogeneous, meaning that there is an open-ended array of things that need to be aligned including work-routines, incentive structures, training, information systems modules and organizational roles (Monteiro 2000).

2.2.2 Inscription and Translation

Two concepts from Actor Network Theory are of particular relevance: ***Inscription*** and ***Translation***. The example of a hotel manager by Latour (1991) clearly illustrates these concepts. In his example, Latour (1991) talks about the desire of a hotel manager to have his customers leave hotel keys at the front desk as they left the hotel. He initially asked the customers to '*please leave their keys'* as they left the hotel; the desired response was not achieved, he therefore had to write that on a tag attached to the keys and only a few responded. Still most customers were not complying, so he devised an innovative measure of attaching metal weights to the keys.

The desired response was achieved with the introduction of the metal weight as the customers were more than willing to get rid of the bulging weight that was weighing them down (Latour 1991). The original statement 'please leave your key at the front desk when leaving the hotel' i.e. the initial inscription was not what was obeyed, but rather the translated message.

Akrich and Latour (1992) explain the notion of inscription in the following way: As actors from the outset have a diverse set of interests, stability rests crucially on the ability to translate, that is, re-interpret, re-present or appropriate, others' interests to one's own. The notion of inscription refers to the way technical artifacts embody patterns of use: "Technical objects thus simultaneously embody and measure a set of relations between heterogeneous elements" (Akrich and Latour 1992).

"This minor innovation clearly illustrates the fundamental principle underlying all studies of science and technology: the force with which a

speaker makes a statement is never enough, in the beginning, to predict the path that the statement will follow. This path depends on what successive listeners do with the statement. If the listener in this case the hotel customer forgets the order inscribed on the sign or doesn't speak the language, the statement is reduced to a bit of paint on a piece of board. If the scrupulous customer obeys the order, he had complied with the imperative, thereby adding reality to it. The strength of the statement thus depends in part on what is written on the sign, and in part on what each listener does with the inscription (Latour 1991)."

2.2.3 Programs and Anti-programs

The inscription includes programs of action for the users, and it defines roles to be played by users and the system. In doing this she is also making implicit or explicit assumptions about what competencies are required by the users as well as the system. In ANT terminology, she delegates roles and competencies to the components of the socio-technical network, including users as well as the components of the system (Latour 1991). The inscribed patterns of use may not succeed because the actual use deviates from it. Rather than following its assigned program of action, a user may use the system in an unanticipated way; she may follow an anti-program (Latour 1991). In Latour's hotel manager's example, some of the customers (only a few) took off the metal weight so they could carry their keys with them. The hotel manager formed *programs* to have customers leave their keys behind (tag and metal weight), the customers on the other hand formed *anti-programs* to take the keys with them while leaving the hotel (ignoring instructions and taking off metal weight).

2.3 Computer Supported Cooperative Work (CSCW)

In a complex work environment such as the hospital setting where individual healthcare professionals work either as individuals (contributions) or as a team in a concerted manner toward the delivery of care to a patient, cooperation and collaboration is essential to attaining the best possible quality of care for patients. The Electronic Health Record system is a classical tool for cooperative working; where proper functioning of the system will depend on individual healthcare professionals using the system. If for instance a section of healthcare professionals decide not to use the system, then the proper functioning of the system could be jeopardized.

Computer supported cooperative work (CSCW), a term first coined by Irene Greif and Paul M. Cashman in 1984, at a workshop attended by individuals interested in using technology to support people in their work, represents a socio-technical field of academic research on how people interact with computer groupware (Grudin 1994). CSCW is focused on understanding characteristics of interdependent group work with the objective of designing adequate computer-based technology to support such cooperative work.

The enormous growth in the use of communications and information technology in all aspects of healthcare provision including Electronic Health Records, data warehouses, integrated clinical, biomedical and administrative computer systems, telemedicine applications, computerized workflow and order entry, presents healthcare professionals with a wide range of opportunities and challenges in healthcare delivery. As computer-based systems become more complex and organizationally embedded (Procter et al. 2006), so are the challenges of developing dependable systems to meet the increased complex human-computer interactions. The key issue in developing a CSCW is its dependability. Dependable CSCW systems should be; *available* (readiness for correct service) to those who use it; *reliable* (continuity of correct service); safe (absence of catastrophic consequences); *maintainable* (ability to undergo repairs); and must have *integrity* (absence of improper system state alterations) (Procter et al. 2006).

CSCW systems should provide a platform to mediate access to shared work items. More so they should endeavor to share benefits and efforts as equitable as possible. One of the major drawbacks of CSCW tools adoption and use is the disparity between those who will benefit from the system and those who must do additional work (Grudin 1988). Another drawback Grudin (1988) identified is the lack of intuition on the part of management for CSCW systems. Managers look at CSCW systems through their own technological frames, and so CSCW systems they implement largely skew to their own benefit. In Orlikowski's article, "*Leaning from Notes: Organizational Issues in Groupware Implementation (1992)*, employees from the organization she conducted her research did not see it beneficial spending additional time to learn to use *Notes*. They wondered what they would charge these additional hours to, since every time spent working is billable in that organization.

In the facility where I conducted my study, units' heads of the Laboratory are expected to submit a tally of all cases recorded every quarter to the leader of the Laboratory for onward transmission to the administration of the hospital. They complete the quarterly reports very reluctantly, usually after the deadline. The leader of the Laboratory will have put a lot of pressure on them before the reports are submitted. They perceive no benefit for doing this additional work (reports), which they have to do usually after their normal routines.

The use of CSCW is context dependent; users can be at the same location and time (collocated and synchronous) or at different locations and time. The CSCW matrix (fig. 2.1) presents the space-time context of cooperative working.

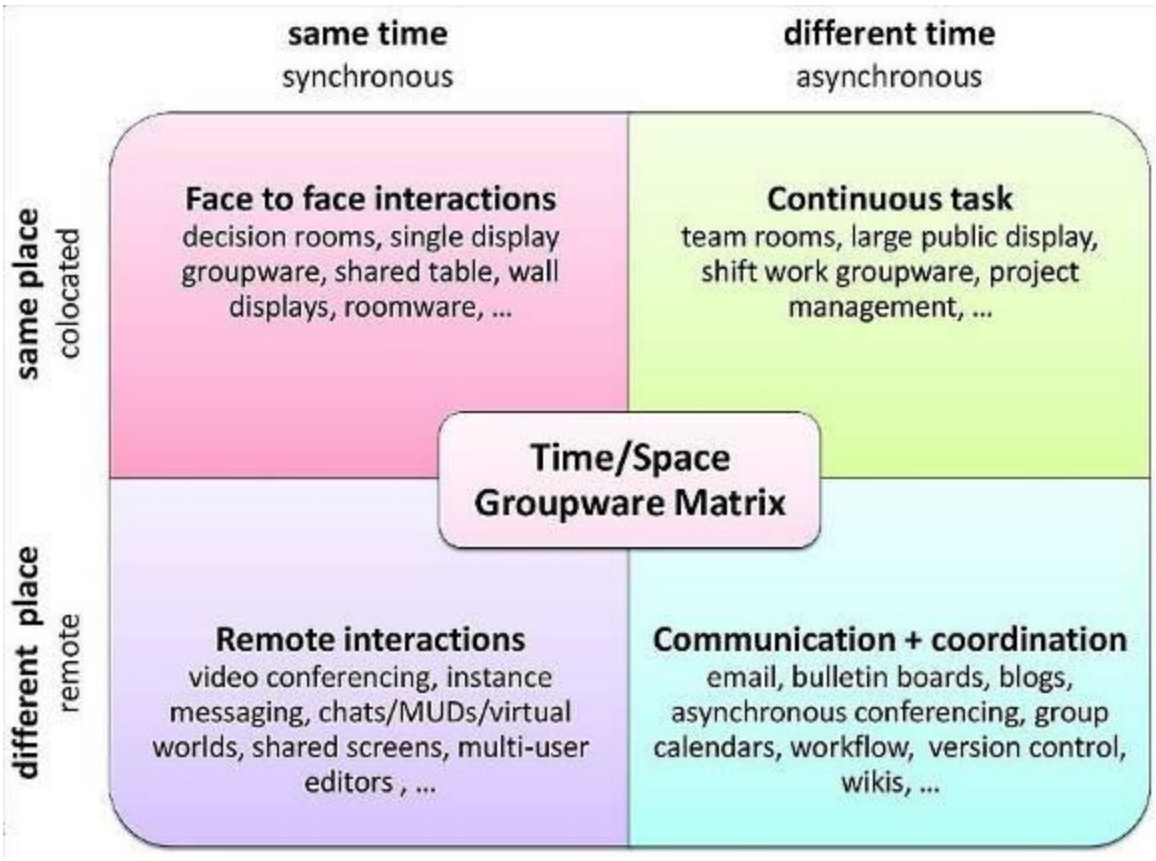

Fig. 2.1 CSCW Time/space matrix (adapted from Wikipedia.org)

For effective use of CSCW tools, individuals working together should share in the following perspectives:

- *Awareness*: individuals working together need to be able to gain some level of shared knowledge about each other's activities (Dourish and Bellotti 1992).

- *Articulation work*: cooperating individuals must somehow be able to partition work into units, divide it amongst themselves and, after the work is performed, reintegrate it (Strauss 1985; Schmidt and Bannon 1992).

- *Appropriation (or tailorability):* how an individual or group adapts a technology to their own particular situation; the technology may be appropriated in a manner completely unintended by the designers (Mackay 1990; Schmidt 1991; Dourish 2003).

2.4 The Technology Acceptance Model (TAM)

Top most on the minds of those who implement new technologies in an organization is the success of this implementation. Key measure of how successful the implementation of a technology is is its acceptability (Broens et al. 2007; Obstfelder et al. 2007). The technology acceptance model (TAM) is an Information system and a behavioral theory that models how users accept and use technology. This theory models the acceptability of a technology based on two behavioral premises; the *perceived usefulness* (PU) and the *perceived ease of use* (PEU) of the technology.

TAM has been useful in predicting how acceptable a technology will be. TAM considered as an extension of Ajzen and Fishbein's theory of reasoned action (TRA) was developed by Fred Davis and Richard Bagozzi ((Davis 1989; Bagozzi et al. 1992). There have been several studies to validate TAM (Adams et al. 1992; Hendrickson et al. 1993; Segars and Grover 1993 ; Subramanian 1994). Other researchers, notably Venkatesh & Morris have worked to broaden the scope of TAM and this has culminated in the development of the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh and Davis 2000 ; Venkatesh et al. 2003; Venkatesh and Bala 2008). They sought to address the 'perceived' inadequacy and simplistic nature of TAM. UTAUT has added four dimensions (*performance expectancy, effort expectancy, social influence, and facilitating conditions*) to help broaden the understanding of determinants of usage intention and behavior posited in TAM.

TAM has come under some critique, notably from one of the early proponents of the theory (Bagozzi 2007). Perceptions will always remain perceptions, and perceptions can sometimes be difficult to decipher. A meaningful way forward for TAM will be usefulness and ease of use rather than *perceived usefulness* and *perceived ease of use* of the technology. In that case the technology should have demonstratively shown that it can be useful and easy to use; where it can accommodate both advanced users and beginners.

Chapter Three

THE ELECTRONIC HEALTH RECORD SYSTEM (EHR)

Given the complex nature of healthcare delivery and the numerous decisions that must be made, sometimes under very challenging circumstances, the need for accurate, reliable and timely information becomes very crucial. Paper-based records cannot provide the flexibility and leverage that EHR presents. Table 3.1 contrasts a paper-based record to an electronic record. The ministry of health (Ghana) clearly identifies the need for an efficient health information management system in its Health Information (HI) strategic Plan draft document (2006).

Table 3.1 Paper based and Electronic records: *adapted from Coiera (2003)*

Feature	Paper based Record	Electronic Record
Portability	Can be carried around easily, no need to plug in.	Desktops are bulkier and cannot be carried around; PDAs are quite portable but have less use so far. Laptops have the potential (will require trolley for ward rounds) but still expensive.
Ease of Use	A familiar form for information recording, no special training required.	May require special training of health professionals to be able to use.
Accessibility	Limited to user(s) at one location at a given time. Difficult to locate record if there are several stacks of old records (fig. 4.1)	Available across several locations at any given time to authorized users. Record can be located easily with a few clicks.
Reliability	Paper is susceptible to damage and may degrade with time. Paper-based records can get missing easily.	With backup systems, records can be kept for a longer duration of time.
cost	Relatively cheap, but maybe more expensive over a long term period.	Start up cost very expensive, but cheaper to run
Data Entry	Freestyle data entry makes paper-based records easy.	Predefined format of data entry must be adhered to.

Add-ons	No possibility of adding tools that may facilitate care delivery.	Alerts, reminders and clinical decision support systems can be added.

3.1 The EHR

Electronic Health Record is defined in several ways by different authors and in different countries; there is no agreed international definition for EHR. For this study, I will adopt the definition proposed by the International Organization of Standardization (ISO) in a draft technical report, ISO/TC 215 (2003). EHR is here defined as a repository of information regarding the health of a subject of care (patient), in computer processable form, stored and transmitted securely, and accessible by multiple authorized users. This information usually can be in the form of patient demographics, medical history, laboratory report, billing information, etc.

Overlapping terminologies such as Electronic Patient Records (EPR) and Electronic Medical Records (EMR) are sometimes used loosely as synonyms of EHR. The English National Health Service (NHS) defines EPR as "an electronic record of periodic health care of a single individual, provided mainly by one institution" (NHS 1998). EMR is defined similarly, but very much medically focused. Other lesser used terminologies such as Computerized Patient Record (CPR), Personal Health Record (PHR), Digital Medical Record (DMR), etc., have also been used in the health informatics world.

3.2 Developments of Health Information Management in Ghana

There have been reforms in the health information management systems recently aimed at improving the quality of health information, and this has largely been in response to requests from donor agents like the UNDP and also as a commitment to meeting the Millennium Development Goals (MDGs) (MOH 2006). The National Health Insurance Scheme (NHIS) of Ghana, which was passed by an act of parliament in 2003, promises to

be a lead promoter for the introduction of ICT in the Ghanaian health service. NHIS is in the process of introducing electronic identification cards to help minimize fraudulent claims and also for easy identification of NHIS clients at health facilities throughout the country.

Of the various interventions in Health Management Information Systems (HMIS), the UNDP supported Maternal and Child Health Information System is the most extensive and significant. Piloted between 1987 and 1993 in three out of the ten administrative regions of Ghana, it focused on organized collection of data and reporting at the departmental level (MOH 2006). Little is mentioned of the success of this intervention though, and whether it had been replicated in the remaining seven regions of Ghana.

The District Health Information Management System (DHIMS) is one of Ghana's first attempts of modernizing health information capture using ICT. It was first piloted in twenty districts across the country and then deployed in all district/municipal health hospitals/administrations throughout the country in 2007. The software is used to capture data solely for management and policy development. The data captured is forwarded to regional Health Administrations for analysis and onward transmission to the National Health Administration (the Ghana Health Service [GHS] and/or the Ministry of Health) (GHS 2007). The Ministry of Health has however identified poor human resources, low levels of investment in ICT, and the uncoordinated nature of Health Information Systems (HIS) deployment as some of the startup challenges of an effective HIS. Steps have been taken by the Ministry of Health to address the human resource challenge through the development of a curriculum to train health information officers at the Kintampo Rural Health Training School.

Fig 3.1 some paper-based records at the research site

3.3 Implementing EHR

The demands for equitable and quality healthcare are far from been met in developing countries, especially in the face of limited resources, both human and capital. Ghana, a developing country is no exception and still grapples with the problem of providing equitable and quality healthcare to its citizens. With a population of around 23 million, access to healthcare, especially for those in the rural communities is very limited. Even in most rural communities where there are clinics, the healthcare professionals to run these facilities are usually inadequate in number or inadequately trained to carry out these duties. Table 3.2 depicts the doctor patient ratio in Ghana from 2001 to 2007.

Table 3.2 Doctor – Patient ratio In Ghana
(*Adapted from Ghana Health Service 2007 Annual report*)

Year	Doctor – Patient Ratio
2001	1:20036
2002	1:18274
2003	1:16759
2004	1:17733
2005	1:17929
2006	1:15423
2007	1:13683

Implementing an EHR system could help to significantly address these gaps of inadequate access and poor healthcare quality currently delivered in rural Ghana. This could help create a national repository of health data, and will therefore make the deployment of telemedicine applications easier in the future as was mentioned by the communication ministry ICT (Ghana) for accelerated development policy document (2003). Far to reach communities presently referred to as 'overseas' in Ghana could have access to specialists services with a functional telemedicine application in place.

The **primary purpose** of the EHR is to provide a documented record of care that supports present and future care by the same or other clinicians. This documentation provides a means of communication among clinicians contributing to the patient's care. The primary beneficiaries are the patient and the clinician(s) (ISO 2003). Implementing a new technology (such as EHR), especially in complex work environments such as in the health sector requires a careful thought out plan and strategy, not only to ensure a successful implementation but also to strike a balance between conflicting important goals. Important goals such patient safety/privacy, healthcare quality, process efficiency, the organization's business plans and goals and the EHR usability all need to be balanced (Walker et al. 2005). Implementation of EHR should not be a mere automation of existing workflows, but rather it should be geared towards the development of new and efficient workflows.

Electronic health record implementation could be *problem* or *technology* led; where in the former the existence of a problem necessitates the development of a technological solution to solve it, whereas for the latter an existing technology is used to facilitate or improve present workflows. The existence of data collection and management challenges in Ghanaian hospitals will necessitate the use of technology to solve these challenges. The following section gives a brief overview of implementation approaches/modalities of EHR.

3.4 Information System Implementation Approaches

Successful implementation of a clinical information system depends on multiple factors, the two most important issues are not related to the technology but to organizational and people issues (Lorenzi et al. 2004). These factors are usually given less attention; with much emphasis placed on the technological aptness of the information system being implemented. In implementing an information system such as the EHR in a hospital setting, a greater portion of the institution's implementation time and resources should be devoted to organizational issues and human resource development. The intentions of the implementation team should be properly and adequately communicated to the end users of the EHR system. Adequate training should be provided, and users must be given sufficient and convincing reasons to use the new system.

While some argue for the rapid deployment of a new technology throughout an organization and then allowing users to interact and get familiar with the new technology, others are of the opinion that a painstakingly gradual deployment of a new technology should be employed; with prototyping and piloting over a period of time and then deploying it throughout the organization. During this piloting phase, challenges arising are addressed, and in addition experiences gained during the piloting are incorporated in the training of end users.

In her article, *Learning from Notes: Organizational Issues in Groupware Implementation*, Orlikowski (1992) explains how an organization's desire to radically change the way they

work led to the rapid deployment of a communication groupware (*Notes*). The chief information officer (CIO) of this organization was tasked with this responsibility; after having encountered *Notes* and as he stated later; '*after playing with Notes for a few days he came to the realization that Notes was the breakthrough technology sought after by the organization'.* The CIO then set the tone for the deployment strategy, generating interest from the top; he pursued a top down approach. Because of this approach, the greater portion of the organization's end users did not get sufficient education about this product. Some of the findings of Orlikowski were rather interesting;

"I first heard that the firm bought Notes through Wall Street journal. Then your study [Orlikowski's] was the next mention of it".

"It is big email".

"I have heard that it is a hard copy of email… but I am not very clear what it is exactly"

(Orlikowski 1992)

The quotations above were remarks made by some individuals of the organization just a few weeks to the deployment of *Notes*. Some early observations she made were that, instead of using *Notes* as a groupware, some resorted to using it as personal tools while others did not feel motivated to learn and use *Notes*.

Prototyping and piloting seems a more plausible way to go. During piloting, there is enough time for users to change or reform their technological frames to accommodate the new technology being introduced. Concerns and challenges can be addressed early during the implementation process; bugs for instance can be identified and fixed before an organizational wide deployment, new protocols can be made. The advantage of this approach is that both organizational issues and technological issues are given cognition and addressed early in the implementation process.

3.5 The EHR Design and Usability

The goal of any implementation team in introducing an EHR should go beyond changing the way the organization does things, improving efficiency, etc. It should seek to develop a usable and an acceptable EHR. The design of the EHR should be given much attention as the concerns for a successful implementation. Users should be involved during the design phase, and their inputs and concerns taken into account. In designing a usable and acceptable EHR, the requirements of the organization should be assessed. For most organizations it is often difficult to distinguish between a needs assessment and a wish list; and wishes lie along a spectrum of utilization and feasibility (Walker et al. 2005).

In the design of the EHR the needs of the organization should be carefully balanced with what is feasible. In a typical needs assessment for an EHR design questions such as *who needs what information, at what times, location and for what purpose* are core to designing a good EHR. These questions should be asked in the context of present workflows. Answers to these questions should be geared towards accomplishing certain goals (table 3.3) for both patients and healthcare professionals. Moderate and realistic goals should be set; this should be properly and adequately communicated to the eventual users of this system.

Table 3.3 What a good EHR should Accomplish - *adapted from Walker et al. (2005)*

Patients
• Decreased waiting time [might not necessarily be the case; physicians may end up spending more time with computers than patients]
• No unnecessary repeated tests, interviews, or other data gathering
• Enhanced access to treatment [the assumption here is EHR will decrease waiting time, and therefore more patients can be attended to]
• More convenient communication with physician practices
• Consistent, best quality care across the health system
Clinicians
• Clinical information available in exam rooms, offices, and home

• Consistent care delivery across practices
• Actionable feedback on clinical performance
• Improved communication with colleagues
• Medical reference information available (electronic library)
• Extended geographic reach of specialist resources

The usability of a technology is key to its acceptability by users. In designing an EHR, user interfaces should be as user friendly as possible. Poor usability will only not meet resistance and subsequent rejection by users, but can potentially endanger patients. The experiences of users with similar technologies should be maximized when designing EHR. This phenomenon termed transference, (*the observation that previously acquired knowledge and skills carry over and affect learning of new information and skills*) was 'exploited' by DIPS A/s in the design of EHR for most hospitals in Norway. The DIPS EHR modeled the user interface to that of Microsoft office Word, and this has aided in its acceptability and success.

Box 3.1 Example of a Positive Transference *Source Walker et al. (2005)*

If a new application closes when the user clicks on the small box with an X in it in the upper right hand corner of the screen, that part of the application will not require learning at all. It will seem intuitive, if the user even becomes conscious of it. Using the same labels for the same functions and locating the same function in the same place are two important ways to use the power of positive transference to help EHR users.
On the other hand, if the user must click on a "standard" close box in some settings, a different box, labeled "Close", in other settings, a button labeled
"Exit" in other settings, and a box labeled "Exit Workspace" in yet others, the result will be confusion and very hard learning. The confusion will be compounded if the boxes are in different places on different screens.

To ensure a more acceptable EHR design and a usable system, designers of EHR systems should incorporate the following questions into their design objectives. Giving cognizance to these questions during the design phase can impact on the success of the EHR system.

The Usability Questions

- How easily can the user accomplish the task?
- Is the screen space well organized?
- Is it easy to find your way around?
- Does the system appear easy to learn?
- Are both beginners and experts accommodated?
- Are extraneous, confusing choices offered?
- Does the EHR make the work easier?
- Does it make the work faster?

3.6 Managing Change in EHR Implementation

It is important to recognize that an organization is like any other social system and change—where everything and everybody's actions are interrelated is not limited to one entity (Hunt et al. 2004). All departments in an organization are integrated and interdependent. Implementation of change in one department affects the function of another. It is also likely that change, although embraced in one department, may be completely resisted by another. Additionally, there may be other changes occurring within the organization that affect or will be affected by the proposed system implementation. Managers must completely assess the effects of change on the entire organization and develop a plan to motivate each department to participate in the implementation and adapt to change (Hunt et al. 2004).

Lewin's (1969) classic work suggests that behavior in an institutional setting is not a static habit or pattern but a dynamic balance of forces working in opposite directions within the social-psychological space of the institution (Fig. 4.2). Lewin identified three stages for accomplishing changes in behavior: unfreezing the existing equilibrium,

moving toward a new equilibrium, and refreezing the new equilibrium. To initiate the unfreezing of the equilibrium, there are three strategies.

- Increase the number of driving forces
- Decrease the number of resisting forces
- A combination of the two preceding factors

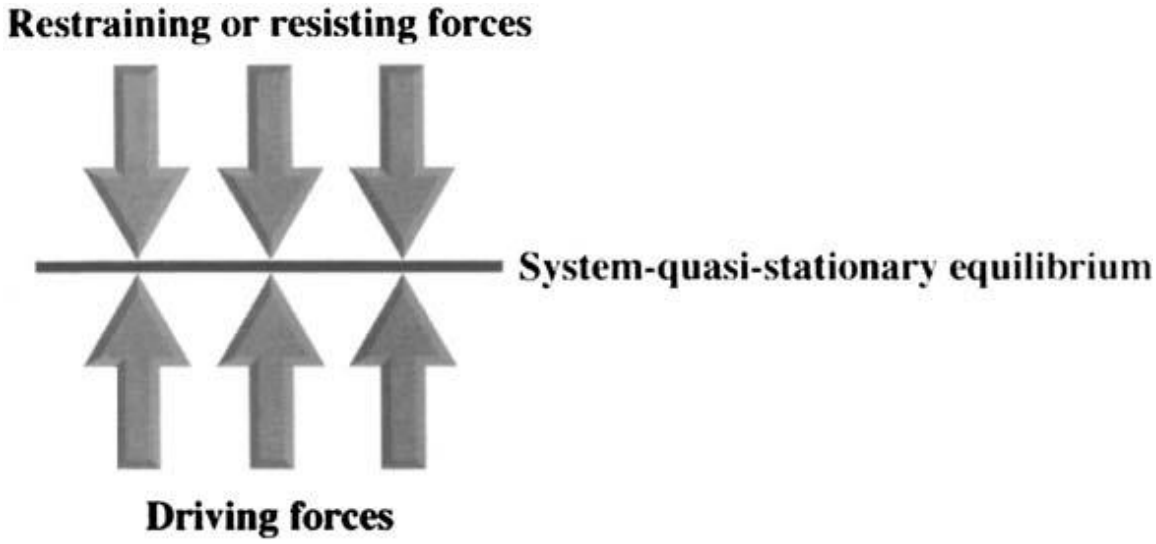

Fig.3.2 Lewin's Dynamic balance of forces. (Lewin 1969)

In an organization experiencing change, these driving forces should be carefully managed so as to attain a suitable and sustainable balance. The key components that engineer the interplay of these driving forces are the people/organizational issues, the hardware and the software. In managing organizational change during the implementation of an EHR, the people/organizational issues should be prioritized.

Usually managements and IT supporters first focus on hardware and software and then – if at all on people/organizational issues. This might be because of lack of the understanding for – or lack of knowledge about the importance of the people/organizational issues, when implementing new IT-systems. This aspect is however extremely important. As Lorenzi and Riley (1995) have shown, the greatest problems when implementing EHR are those of organizational nature in the form of resistance from the employees towards the new system, and thus not of technical nature

(Lorenzi and Riley 1995). It has also been found, that the resistance is focused on different aspects:

- Against those responsible for the changes (political)
- Against the frequency of changes
- Against changes in the organization
- Against the specific IT-system which is to be implemented

Besides this, the results of Lorenzi and Riley (1995) study show that resistance against changes is closely related to the way each individual employee experiences the following conditions:

- Pressure connected with having to develop new skills
- Fear of looking stupid or incompetent within these new skill areas
- Fear of losing professional status (respect)
- Pressure connected to the expectations by the management about better performances and more effectiveness
- Pressure connected to the expectations about fewer mistakes due to more control exerted by the management
- Pressure connected to the fear of losing one's job because of the new technology

A lot of cooperation and collaboration is required to translate some of these skepticisms into trust and consensus building. Training and adequate communication between management and the ultimate users of this system is essential in attaining this goal.

Chapter Four

THE RESEARCH METHOD

There are no right or wrong methods; there are only appropriate methods for a given topic (Silverman 2005). Choosing an appropriate research method can be very challenging, especially for a beginner like myself. I was initially unsure of which research method(s) to employ for my research, given a myriad of research methods available to me. Reviewing other master students' approaches and given the research questions and the expected impact of this research, I decided using multiple qualitative research strategies. Observation, interviews, documentary reviews were some of the strategies used in this research.

Haven had experience of research in the laboratory at the bachelor's level, doing a field study was new and exciting for me. Till now, I was exposed to only quantitative research method.

4.1 The Research Questions Guiding This Study

- What is the current state of information infrastructure in Ghanaian hospitals?
- How can EHR improve present data collection and management and what data will the EHR capture (scope)?
- What are some of the challenges of introducing change in Ghanaian hospitals?

4.2 Qualitative Versus Quantitative Research

Research methods are broadly categorized into *qualitative* and *quantitative*. Table 4.1 summarizes the features of qualitative and quantitative research.

Table 4.1 Features of Qualitative & Quantitative Research

Quantitative Research	Qualitative Research
Assumptions • Social facts have an objective reality • Primacy of method • Variables can be identified and relationships measured • Etic (outsider's point of view)	**Assumptions** • Reality is socially constructed • Primacy of subject matter • Variables are complex, interwoven, and difficult to measure • Emic (insider's point of view)
Purpose • Generalizability • Prediction • Causal explanations	**Purpose** • Contextualization • Interpretation • Understanding actors' perspectives
Approach • Begins with hypotheses and theories • Manipulation and control • Uses formal instruments • Experimentation • Deductive • Component analysis • Seeks consensus, the norm • Reduces data to numerical indices • Abstract language in write-up	**Approach** • Ends with hypotheses and grounded theory • Emergence and portrayal • Researcher as instrument • Naturalistic • Inductive • Searches for patterns • Seeks pluralism, complexity • Makes minor use of numerical indices • Descriptive write-up
Researcher Role • Detachment and impartiality • Objective portrayal	**Researcher Role** • Personal involvement and partiality • Empathic understanding

Source: http://www.gifted.uconn.edu/siegle/research/Qualitative/qualquan.htm (accessed Nov. 2008)

Although some social science researchers (Guba and Lincoln 1994; Schwandt 1989) perceive qualitative and quantitative approaches as incompatible, others (Patton, 1990; Reichardt & Cook, 1979) believe that the skilled researcher can successfully combine

approaches. The argument usually becomes cluttered because one party argues from the underlying philosophical nature of each paradigm, and the other focuses on the apparent compatibility of the research methods, enjoying the rewards of both numbers and words. Because the positivist and the interpretivist paradigms rest on different assumptions about the nature of the world, they require different instruments and procedures to find the type of data desired. This does not mean, however, that the positivist never uses interviews nor that the interpretivist never uses a survey. They may, but such methods are supplementary, not dominant. Different approaches allow us to know and understand different things about the world. Nonetheless, people tend to adhere to the methodology that is most consonant with their socialized worldview.

4.3 The Research Method

I share in the view of Yin (1994), that case studies is the preferred research strategy to answering 'how?' and 'why?' questions; this view is also shared by the interpretative school of thought as noted by Walsham (1995). In implementing EHR the 'how?' and 'why?' questions become even more cogent; one will be interested in knowing the scope the EHR should take and how to go about that, and for what reason the implementation is being carried out in the first place.

Case study attempts to shed light on a phenomenon by studying in-depth a single case example of the phenomena. The case can be an individual person, an event, a group, or an institution. I used interpretative case study for my research and the case I studied was data collection and management challenges at TTH.

4.3.1 Interpretative Research Method

What we know or think we know, is but our own interpretations of the reality. Interpretative research method considers knowledge as a product of social construction (Klein and Myers 1999).

"Interpretive studies assume that people create and associate their own subjective and intersubjective meanings as they interact with the world around them... The intent is to understand the deeper structure of a phenomenon ... to increase understanding of the phenomenon within cultural and contextual situations..."

(Trauth 2001)

Kleins and Myers (1999), in their article 'Evaluating Interpretative field studies' proposed seven guiding principles for interpretative field studies. *The fundamental principle of the Hermeneutic Circle, The Principle of Contextualization, The Principle of Interaction Between the Researcher(s) and the Subjects, The principle of Abstraction and Generalization, The Principle of Dialogical Reasoning, The Principle of Multiple Interpretations and the Principle of Suspicion* are the principles espoused by Klein and Myers. These principles, summarized in table 2.1 are very relevant to my research.

Table 4.2 Summary of interpretative Field Research Principles (*Source: Klein & Myers* 1999)

1. The Fundamental Principle of the Hermeneutic Circle This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles. Example: Lee's (1994) study of information richness in e-mail communications. It iterates between the separate message fragments of individual e-mail participants as parts and the global context that determines the full meanings of the separate messages to interpret the message exchange as a whole.
2. The Principle of Contextualization Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged. Example: After discussing the historical forces that led to Fiat establishing a new assembly plant, Ciborra et al. (1996) show how old Fordist production concepts still had a significant influence despite radical changes in work organization and operations.

3. The Principle of Interaction Between the Researchers and the Subjects

Requires critical reflection on how the research materials (or "data") were socially constructed through the interaction between the researchers and participants.

Example: Trauth (2001) explains how her understanding improved as she became self-conscious and started to question her own assumptions.

4. The Principle of Abstraction and Generalization

Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.

Example: Monteiro and Hanseth's (1996) findings are discussed in relation to Latour's Actor Network Theory.

5. The Principle of Dialogical Reasoning

Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings ("the story which the data tell") with subsequent cycles of revision.

Example: Lee (1991) describes how Nardulli (1978) came to revise his preconceptions of the role of case load pressure as a central concept in the study of criminal courts several times.

6. The Principle of Multiple Interpretations

Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.

Example: Levine and Rossmore's (1993) account of the conflicting expectations for the Threshold system in the Bremerton Inc. case.

7. The Principle of Suspicion

Requires sensitivity to possible "biases" and systematic "distortions" in the narratives collected from the participants.

Example: Forester (1992) looks at the facetious figures of speech used by city planning staff to negotiate the problem of data acquisition.

I was particularly wary of multiple interpretations and suspicion on the part of the actors. To make sure what I was told by the actors was accurate, I crosschecked with what I had observed and documents made available where applicable. I interacted freely with the actors, helped them do some clerical work (entering patient records) just to build trust.

4.4 The Research Design

I went into the field with a fair idea of what to observe, what documents to review and how to get additional information from the actors (using interviews/informal talks). The research was to be carried out in two Ghanaian hospitals, even though I ended up conducting the study in one hospital, due to time and financial constraints.

Interpretative case study was the research method utilized for this study. The seven principles proposed by Klein & Myers for conducting an interpretative field study were taken into account in designing this study. Principles 2, 3, 4 & 6 were particularly important in my study. I started this study with little or no theoretical preconceptions; but as the study evolved; it became increasingly clear that theories like Actor Network Theory (ANT) and Information Infrastructure (II) will be the main theories for analyzing my data. Technology Acceptance Model (TAM) and Computer Supported Cooperative Work (CSCW) are some other supporting concepts for the analysis of acceptance of change and cooperative working in the facility where I conducted this study.

4.5 The Research Site

Tamale Teaching Hospital is located in the Northern part of Ghana, Tamale, the capital of the northern region. It serves the Tamale metropolis (with 300,000 inhabitants), it also serves as a referral facility for hospitals within the Northern region and others in two neighboring regions. The Laboratory and Records Departments of this hospital have serious challenges regarding infrastructure and more so with data collection and management. The Laboratory runs on the average 350 tests a day; there are six units making up the Laboratory (Biochemistry, Hematology, Microbiology, Histopathology, Parasitology and Blood bank). These units before 2006 worked independently with little

interaction. In 2006, to address the data collection challenges a central collection point (CCP) was introduced. Before the introduction of the CCP patients had to go to the various units of the Laboratory for blood samples to be taken (if they were to perform more than one test). They have by this, thus established a coordinated and cooperative way of working. It has seen some challenges, and will require a lot of restructuring and patience.

The Records Department, where I also conducted a three week observation and some interviews had similar challenges as the Laboratory. All records are still paper based, and this requires a lot of man-hour to accomplish. The department is relatively small in size and crowded with old records; there is little space in the working area of the department. As of May 2008, approximately 12100 new records were created this year (2008).

In the main working areas of both the Laboratory and the Records Departments, there is no PC, so everything is still paper based.

4.6 Data Collection

Before I went for this field study in Ghana (April-May 2008), I conducted three phone interviews; to get an update of what change had been effected in the hospital (regarding data collection) since I left for my master's study.

An introductory letter (Appendix A) indicating that I was a student of UiTø, written by my supervisor was presented to the hospital's Administrator. He became very interested in my study and took me to the head of the Records Department personally; where he introduced me to the head. I started the study right from there; sitting at a position where I could observe and hear what was going on in there.

For three weeks I was in the Records Department observing how they collect and process data, identifying some of the challenges with this mode of data collection. Daily, I observed and interacted with the personnel of this department for 5 hours on the average.

I positioned myself so as not influence the data generated; I avoided getting in the way of actors, (sitting at a corner just observing, helping only when it was absolutely necessary), asking leading question etc. None of interviews at this department was tape recorded. At the Laboratory, where I conducted a two week study, it was much easier getting access to almost all units in the Laboratory, since I had previously worked there. The staff were very willing to talk to me and were comfortable with a tape recorder, so I made four tape recordings that were transcribed while I was still doing the study.

Field notes were frequently taken while at the site and additional notes made while at home about previously forgotten and recalled events, analytic ideas and inferences, personal impressions and feelings as well as notes for further information, or observational questions. Three modes of data collection were utilized;

4.6.1 Observation

Silverman (2005) identified observation as been fundamental to understanding another culture. I observed the participants, how they interacted, their routines, rituals, temporal elements or critical incidents, interpretations and social organization. This was informed by the suggestion of Denzin (1989) as to what to observe in a field study.

4.6.2 Interviews

Most of the interviews were semi–structured with open-ended questions. I also used largely informal talks to get clarity of issues that were not clear to me. In total I conducted ten interviews; seven face to face and three over the phone. Of the interviewees, 6 were males and 4 females. The youngest was around 25 and the oldest 35. Four interviews were tape recorded and others largely recorded using the traditional note taking. The six that I did not tape record, did not feel comfortable with tape recording.

Table 4.3 Interviews and durations

Interviewee	Department	Interaction	Duration
Laboratory technologist #1	Laboratory	F2F*	25 minutes
Laboratory technologist #2	"	Tel**	10 minutes
Laboratory technologist #3	"	Tel	17 minutes
Laboratory technologist #4	"	F2F	45 minutes
Laboratory technologist #5	"	Tel	22 minutes
Statistician #1	Records	F2F	9 minutes
Statistician #2	"	F2F	28 minutes
Statistician #3	"	F2F	12 minutes
Statistician #4	"	F2F	39 minutes
Administrator #1	Administration	F2F	55 minutes

* Face to face
** Telephone

4.6.3 Textual Analysis.

I did extensive study of literature regarding implementation of EHR, organizational restructuring and the introduction of new technologies in the health sector in general. I also studied the ICT policy of Ghana and budgetary allocation to the health service (with focus on ICT funding). These resources were accessed from the net and the library at UiTø.

Chapter five

FINDINGS

Ghana, a developing country in sub-Sahara Africa has embarked on a vigorous quest of providing affordable and accessible healthcare to its citizenry over the past two decades. Spending around 6.5% of its GDP over the last four years in human resource development and infrastructure in the health service (WHO 2007), there are still inadequacies in human resources and infrastructure in most parts of the country, especially so in rural Ghana. There has also been significant progress toward the expansion of human resource development institutions, notably the addition of medical schools at the University for Development studies [UDS] and Cape Coast University. The establishment of health assistants' training schools throughout the country and plans to establish one additional medical school in the Volta Region are all aimed at improving the human resource situation for the health service in the country. Efforts have also been made to retain healthcare professionals in the country; the healthcare worker is one of the best paid public service sector worker in Ghana today. These efforts to provide affordable and accessible healthcare have largely been geared toward training more healthcare professionals and the provision of physical infrastructure (hospitals and clinics) throughout the country. There is little emphasis on the development/adoption of new approaches of healthcare delivery. There is for instance little expenditure in information and communication technologies in the health sector. Even when funds are expended on ICT projects, it is usually for administrative facilitation.

5.1 The Organizational structure of Tamale Teaching Hospital (TTH)

Tamale teaching hospital (TTH), where I conducted this study, is located in the Northern part of Ghana and has a daily attendance of around 500 patients. With less than 30 physicians (2008) to attend to this increased attendance, especially with the introduction of the National Health Insurance Scheme (NHIS) (this has largely addressed the

affordability issue of healthcare); the few physicians in TTH are over-stretched as a result.

The hospital (TTH) is organized into several units and departments. The administration, with the Chief Executive Officer (CEO) as the head, has the oversight responsibility of the daily operations of the hospital. The CEO, a medical doctor is assisted by the Director of Administration, who does most of the administrative work. The hospital is organized into an Outpatient Department (OPD) and an Inpatient Department, the OPD is usually the first point of call for all visiting patients. At the OPD, patients are triaged and referred to the appropriate consulting rooms. Based on the outcome of the consulting, patients are either admitted as inpatients or outpatients. The hospital is also organized into several wards, namely the Maternity Clinic, Pediatric Ward, Surgical Ward (Male/female), Intensive Care Unit, Causality Ward, and the Gynecology Ward.

The Maternity Clinic and the Pediatric Ward happen to be some of the busiest wards within TTH. A majority of the patients admitted daily are children and antenatal cases. The wards have their own 'mini' Records Departments, where records of patients admitted into those wards are stored; there is, however, little communication between these records 'stores' and the main Records Department of the hospital. The main Records Department has shifted focus mainly to handling NHIS clients records (ID, facility attendance cards and billing information). TTH is also equipped with an analytical laboratory where samples for both inpatients and outpatients are analyzed. It also runs samples from district hospitals within the region. There is also a pharmacy/dispensary unit at TTH that serves both inpatients and outpatients.

5.2 State of Information Infrastructure at TTH

Information infrastructure at TTH is still very basic, and therefore most of the interactions are 'physical'. In the Laboratory wards/GPs offices and other units of the hospital, there exists a telephone intercom system where you can call to enquire about, say a laboratory test report. Unfortunately there are some units of the hospital that are not

yet connected to the hospital's intercom; these units did not exist when the intercom system was introduced.

The hospital has no computerized networked system for data and information interchange. My checks revealed that no consulting room or ward in the hospital has been equipped with a computer. The administration, the NHIS Claims Processing Unit, the Pathology Laboratory and the Office of the Head of the Records Department were equipped with 'stand-alone' computers. The NHIS Claims Processing Unit had about six computers making it an interesting case of research for me, but since that was not in the purview of my initial research plan and given the limited time, I will consider doing further studies there in the future.

In the Laboratory (one of the units where I conducted my study) apart from the Biochemistry and Hematology departments that have a chemistry analyzer and cell dynn with capability of archiving patient reports in computer processable form, other units have no computers. The archived results can be reprinted, should the initial print out be missing (a common occurrence). The Pathology Laboratory was equipped with a personal computer and a printer (at the time of my study) at the behest of the doctor in charge; hitherto, all his reports were handwritten. This only did not give him additional work, but his writing sometimes were ineligible, given the fact that he had to work under challenging circumstances and having had most of his education in a language not the least related to English in terms of alphabets. He no longer needs to write all his reports from scratch; with a PC he has created a template for his reports and only modifies it to suit particular diagnosis. That has helped to significantly save time and the reports turned out are more readable.

The hospital as a whole still need to do a lot of work to strengthen II, if it desires to address the numerous challenges of data collection and management then this should be pursued with some urgency.

5.3 Data Management Constraints at TTH

Tamale Teaching Hospital presents a classical example of a hospital that urgently needs to restructure the way data is collected and managed. The lack of appreciation of the usefulness on the part of those who collect and manage data is a serious hindrance to accurate and reliable data collection. In the Laboratory, the personnel there are more interested in running lab tests than keeping proper record of the tests they run. It is standard procedure at the Laboratory for records of all tests run to be entered in a notebook for future audit; but sometimes this is overlooked since it contributes to a high turnout time.

The present data collection tools do not present sufficient incentive for those involved in data collection and management. Paper based records have certain inherent limitations (see chapter 2) and this does not make it the most ideal medium for data capture in an environment with other competing needs for time, space and accuracy. During my study at the Records Department, the personnel there had to temporarily suspend work for about half an hour, because they had run out of billing sheets. Paper and pen is undoubtedly the most familiar tool for data capture, but some are yet to perfect the art of proper use of this medium. Physicians in Ghana have earned notoriety for ineligible writing, especially when it comes to prescriptions (fig. 5.1). This may be as result of their desire to attend to as many patients as possible in a day, and thus speed compromises the legibility of their prescriptions.

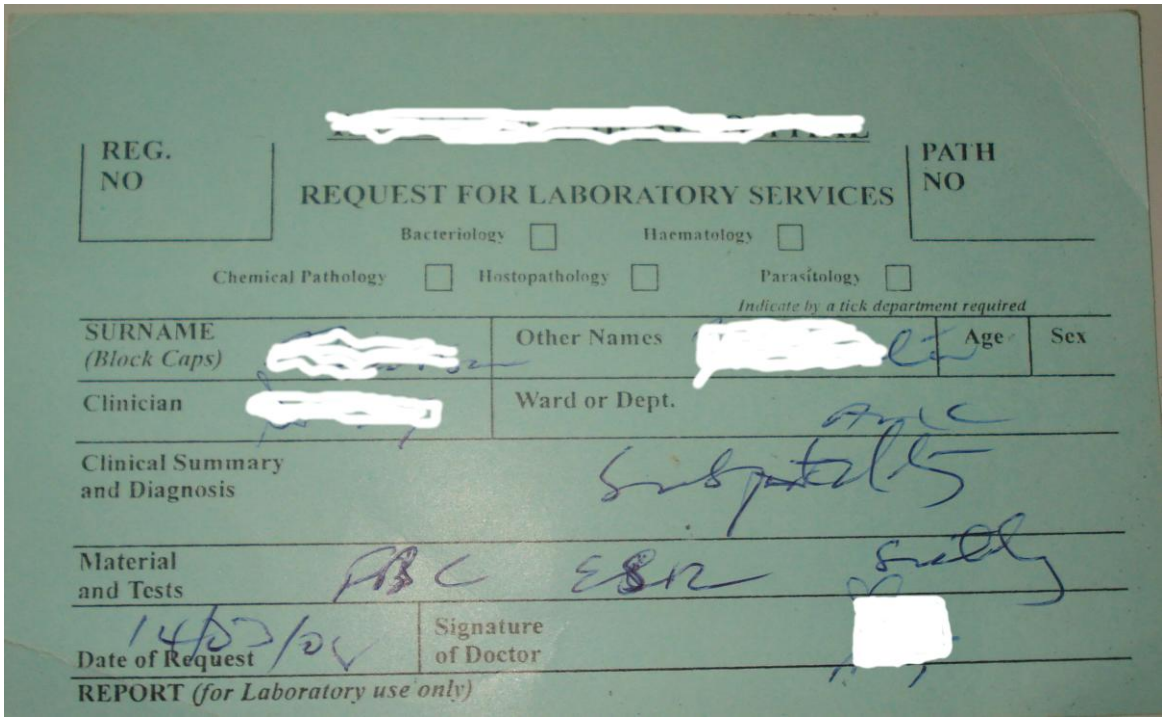

Fig. 5.1 A Laboratory Requisition

The uncoordinated nature of data collection and poor communication among those who collect and manage data seriously hampers effective data collection and management at TTH. During my study, I noticed that there was this confusion of where some patients' folders were been kept at any given time. Usually all NHIS clients' folders are kept at the Records Department after the patients have been through the care procedure; at specified intervals though, the NHIS Claims Processing Unit comes for some of the folders to work on. These folders are returned to the Records Department after processing, but due to poor communication structure between these two units, personnel at the Records Department may not be aware where those folders are. They will spend fruitless time and effort trying to retrieve these folders should patients turn up for it during this period; the personnel will after several failed attempts either tell the patient the folder is 'missing', or s/he should go and check that up from the NHIS Claims Processing Unit. Personnel at the Claims Processing Unit are not usually pleased with these referrals, so they will normally turn referred NHIS clients back to the Records Department. The solution usually is the creation of another folder for the client provided they still have a facility attendance card

issued in triplicate by the NHIS Metro Office (some 6 kilometers from the hospital). If the patient has exhausted all three Health Facility Attendance cards, then they are asked to go to the NHIS metro office. The result is that the patient might not receive care under the NHIS; for those who do not want to go through this hassle, the way out is to pay out of pocket for services to be rendered.

Cooperation and information sharing between different programmes within the health sector and with different agencies is minimal because of the different priorities, the multiplicity of indicators and data collection procedures in use.

Another challenge is the lack of management's commitment to enhancing data collection and management. It does appear that management is more concerned with running the hospital as a profitable entity, rather than equipping personnel adequately to collect and manage data accurately. My interview with one of the statisticians at the Records Department exemplifies this:

"At the moment attendance at the hospital is rising but we are running out of space to file our folders. We thought the new management will bring something new but they have also run out of funds. 'Our northern disease' [lackadaisical attitude] has afflicted them already. So we are getting choked up with the folders. That they haven't cleared the debt for the little renovation they had undertaken yet and so they can't do anything for us at the moment, it is making our work difficult and boring". (Statistician #1)

In addition to these broad constraints, the Ministry of Health also identified other information management setbacks. The first is the poor communication between users and producers of health statistics. The Health statistics does not support planning activities but operates as a unit which produces statistical information as an ends in itself. The information produced for instance relates very little to the current priorities and focus

of the sector. This has led to a situation where information is largely organized within departments and programmes in the bid to satisfy specific programme requirements. Data reporting and analysis is thus uncoordinated. The shortage of information management manpower at each level also makes for the lack of an integrated health information system. In addition to this most of the statistical forms are either outdated, irrelevant or are duplications and the forms are hardly reviewed. A review of reporting formats within the Ministry shows that health facilities are required to complete between 36 and 40 different forms from 15 different units and programmes for submission to higher levels. Medical care requires that 8 reporting formats should be completed, while disease control requires 14. There are no forms for reporting on environmental health, health education and supplies (excluding drugs) and information on about 90% of these forms are submitted as raw data (MOH 2006).

5.4 Challenges of Change Management at TTH

Change usually comes with a price to pay. At TTH change has brought some unique challenges to the workflows. I joined TTH as a biomedical scientist in 2005; at the Laboratory where I worked for two years, the Head of the Department called us for a meeting somewhere in 2006 and informed us of his intention to restructure workflow within the Laboratory. He tasked three personnel to see to this restructuring. After about four months, they came up with the idea of creating a Central Collection Point (CCP). The CCP was supposed to address the issue of patients having to move from one unit to another within the Laboratory; this was time consuming and painful for patients who had to have their blood samples taken more than once.

The CCP concept was communicated back to the staff and after one month it was implemented. Details of the functioning of the CCP was sketchy, as we were only told all patients' samples would be taken there and all reports from the various units would be delivered there. When CCP was operational, two persons were initially tasked to see to the day to day operation of the Unit; one responsible for registering patients and issuing laboratory reports, the other was responsible for taking patients' samples. After a day of operation, it was realized that patients spent much time waiting to be served. Two more

people were therefore recruited to the CCP to assist in the operation of this unit. Other units had to suffer staff shortage; because these personnel were drawn from them. One of the objectives for establishing CCP was met, as a patient's blood sample was taken only once at the Laboratory irrespective of the number of tests that was going to be run on the sample. For the other objective (shortened waiting time) it presented a mixed result; for some patients waiting time was reduced while others had to wait a little longer than they normally would pre-CCP. For patients who had laboratory investigations to be conducted by only one unit, the waiting time was shorter before the implementation of CCP; they now have to queue at CCP with patients who may have laboratory investigation(s) to be conducted by other unit(s), hitherto, they only queue at the unit that was running this investigation where the queue was much shorter and consequently had a shorter waiting period. For patients who had more than one unit of the Laboratory to carry out these investigations, they had to queue at each unit. For instance if a patient was required to have his/her sample(s) investigated at the Hematology, Parasitology and blood bank units, they will be required to queue say at the Hematology unit and after they are attended to, then they will be referred to say the Parasitology unit and then the blood bank. This is a routine investigation (Hematology Parasitology and blood bank) for antenatal patients. They spent nearly the whole day at the Laboratory pre-CCP, but with the introduction of the CCP they now spend about two hours on the average at the Laboratory.

Because most patients cannot read and write, they turn to leave behind some reports (fig. 5.2). Reports from the various units are not delivered to the CCP at the same time, and so for patients having more than one unit's investigation, they may only claim some of the reports.

Fig. 5.2 Unclaimed Laboratory reports

The secretary at CCP was recruited from the Hematology Department; she was responsible for registering and recording patient lab results. When she left the Hematology Department there was no replacement, so the laboratory technologists at the department had to take up her responsibility in addition to theirs. This has gravely affected the turn out time for laboratory results at the Hematology Department, as the technologists are more enthused running tests than recording these reports. As a result, tests might be run, but it will take a little longer to record them and then issue the report.

Just about three months into the operation of the CCP, TTH signed up to provide services to NHIS clients; this brought some additional work for those responsible for data collection in all departments within TTH. The CCP initially had serious challenges handling NHIS clients together with 'out of pocket' ('cash and carry' in Ghana) patients; since it was much easier to handle 'out of pocket' patients the secretary at CCP resorted to registering them first before NHIS clients. With NHIS clients the secretary was required to enter some billing information in the NHIS billing sheet; this was time consuming. Additionally everything about the NHIS was complicated from the beginning, since no formal training was given to those who would handle NHIS clients.

At the Central Collection Point (CCP) of the Laboratory a note book is used to record patient data and the one in charge is usually overwhelmed with so many people just sitting next to her and grumbling because she has not attended to them yet. The patients can be very impatient sometimes, to the extent that they will verbally abuse the secretary at CCP. As laboratory technologist 2 puts it in an interview:

"The 'confusion' is still there (CCP), especially after the introduction of the National Health Insurance Scheme, the workload and pressure has increased" - laboratory technologist (#2)

Another challenge with the introduction of the CCP has got to do with labeling of samples within the units of the Laboratory, as laboratory technologist 1 puts it in a chat:

"hmmmm! for there you know, the only problem I have seem is when they are labeling their samples at the units they use the last 2 digits of the path # (normally 4 digits from CCP) for simplicity sake. Sometimes numbers are mixed up, eg 2055 and 3055, since only the last two digits will be entered (i.e. 55). That is not the best; this could lead to cross matching of samples. I will prefer that the technician write all the four digits"-laboratory technologist #1

The Records Department also got its dose of the challenges that NHIS presented to the hospital; it now largely handles NHIS clients' records, and this has resulted in very long queues at the Records Department daily.

Fig. 5.3 Patients waiting 'impatiently' at the Records Department

5.5 EHR as Data Management Facilitator at TTH & the Scope

The present data collection and management challenges at TTH can be effectively addressed by deploying a tailored made EHR system. An open EHR can be adapted, since that will be cheaper to do than a commercial EHR. EHR, where it has been deployed has helped improved access to information, better resource utilization, reduced cost etc. (Norris 2002; Nir and Robert 2006); TTH can also benefit from the promises that EHR systems presents. Computerized information management has already proven beneficial at two units within TTH; the Pathology Department and the NHIS Claims Processing Unit. The NHIS Claims Processing Unit was equipped with computers to facilitate fast and accurate claims processing. The hospital had a back-lock of unprocessed claims due to the slow pace of manual processing. When I was at the facility in May 2008, they were still processing 2007 claims.

These two units could serve as pilot for future EHR deployment. The Laboratory in most hospitals has always been the department where EHR is piloted. A Laboratory Information System (LIS) with order management functionality can effectively serve as a collaborative tool for the Laboratory and say the consulting rooms. This will enable physicians order laboratory tests from their offices and then receive the results when they are completed. The EHR needs of TTH will be one that will have:

- Order and prescription management,
- Care management,
- Determination of patient's eligibility (e.g. NHIS client),
- Claims submission,
- Result display,
- Registration of new patients,
- Patient scheduling and
- Secure email functionalities.

Order and prescription management, result display, claims submission and registration of new patients should be a priority for TTH EHR implementation. Another key issue will be the security of information, and therefore the appropriate access levels should be set for the various care givers. For instance, can a nurse write a prescription or order a test? Under the current arrangement at TTH nurses may order some laboratory tests if a physician is not around, but this is not one of their duties as spelt out by the Ghana Health Service job description. One of the administrators particularly expressed his reservations about the restrictions EHR will impose viz–a–viz access to certain information. He puts it:

"I may for instance want to cross check that a particular laboratory test has been performed before processing claims, if I can't have access to the patients' results, how do I know?"

(Administrator #1)

We had a healthy chat, and I made it clear to him that it will depend on what he as an Administrator is permitted to have access to under the current arrangement of the hospital, and that the information he should have access to can be incorporated in the EHR system build.

Working in a less cluttered office can be reassuring and bring about some job satisfaction. The stack of old folders and files will be gone and less time will be spent trying to retrieve files. Ultimately patients will accord record keepers some respect; a patient I had a little chat with was of the opinion that record keeping was no difficult job, and that anyone who can read and write can do that without training.

Chapter six

DISCUSSION

The challenges of implementing EHR in Ghanaian hospitals will be a daunting one. A lot of effort will have to be put in the restructuring and reorganization of workflows to effectively implement a successful EHR. Information infrastructures in Ghanaian hospitals are still weak (if II at TTH reflects a typical Ghanaian hospital's), and data collection and management is a serious challenge yet to be surmounted. Some of the immediate challenges of successful EHR implementation in Ghanaian hospitals will be human resource and the funds to procure and maintain hardware; sustainability of such system is another issue.

6.1 The Information Infrastructure at TTH

Information infrastructure must not be perceived merely in the light of computers, software and cutting edge communication technologies … in the case of TTH the present workflows and the interactions between the various actors within the hospital will constitute a solid foundation (installed base) upon which future II can be built. The use of the intercom within the hospital can also serve as an II installed based on which future expansion of communication and data exchange can be based. The provision of computers to some units in the hospital and the experiences from these units with computers can facilitate the development of a solid II at TTH.

The EHR as an II should be able to support the development of efficient workflows; it should address the current bottle-necks of slow information exchange between departments, especially the non-delivery of some laboratory results. It could also enable the development of clinical decision support, integrated alerts and alarms, automatic scheduling systems for patients and physicians. It also should support a wide range of users; both medical and non-medical personnel and it should be able to communicate with other systems, such as accounting systems, NHIS claims processing system: it should be open and enabling (Hanseth and Monteiro 1998).

6.2 Collaborative Working and EHR Acceptability

EHR should present a platform for collaborative working at TTH; the present workflows do not support effective collaborative working. Each department is more or less an island on its own. At the Laboratory for instance there was little interaction between the various Units within the department until the establishment of a Central Collection Point (CCP). In the implementation of an EHR, the end users should participate fully and they should be informed about the need of using the system cooperatively. The information one actor (health professionals) inputs into the system will be used by another. Therefore, emphasis should be placed on collaborative use of the system. Health professionals at TTH who have had experiences with computers are only familiar with single user tools like Microsoft Word Processor; training and education will therefore be required to reorient the technological frames of these professionals to use the new system in a cooperative manner. In Orlikowski's (1992) article; *Learning from Notes*, she cites the example of some managers of the organization using notes as a personal tool. They did not want their mistakes to be noticed by their colleagues and they also did not want to place vital information in the hands of their colleagues that could make them out-perform them in such a competitive environment. Particularly in TTH, healthcare professionals would not like their mistakes to be noticed by their colleagues and those of junior range because they would like to maintain the respect between them and also not to be 'unnecessarily' embarrassed.

Using collaborative tools requires some sacrifices; as some will be required to do more work and might not be the direct beneficiaries of this additional work. Others will benefit from this additional work. A negotiated compromise should therefore be arrived at. For those who will be required to do additional work, some form of incentive or motivation should be provided to encourage the use and acceptance of the system. For instance, those involved in data collection will have to put in additional effort and time to learn how to use the new system. For those who presently input data into computers for statistical analyses purposes, their roles will have to be redefined.

Some group of users might have a political agenda embedded in the new system. Insight in the working patterns of other groups, for example, or access to another group's information resources. Such agendas might lead to open conflict with other groups, thus leading to non-use of the system (Berg 2001). Political embeddings should be avoided as much as possible. For instance during the implementation of an EHR system, all end users should be actively involved, so that some will not feel sidelined and will therefore form resistance to the implementation either by forming *antiprograms* against the system or a total non-use of the system.

By TAM postulations, *perceived usefulness* will be a positive factor towards the acceptance of an EHR system at TTH, as those I interacted with were of the view that a computer system could be a solution to the current data collection and management challenges at the hospital. They however lamented how difficult it might be for them to learn how to use such a system. Their concern was typing speed; inputting data into a computer will require them type faster and accurately. Even though the system might be perceived to be useful, if it is not easy to use, then it might turn out to be useless after all. An implemented EHR system at TTH should therefore be one with minimal requirement for typing.

6.3 The Benefits and Challenges of EHR Implementation

Benefits:

EHR can effectively address some of the challenges currently inherent in paper-based records at the Tamale Teaching Hospital. For instance patients demographics will not be entered at all departments; it will be entered only once and during the patient's first visit to the hospital; this could help save some time, consequently patient waiting times would be reduced. Presently, at the Records Department of TTH, patients are required to leave their NHIS ID cards at the Department when they are taking NHIS folders. The reason behind the 'seizure' of patients' ID cards is to ensure that they return their folders after the care process. Patients will no longer be required to leave their ID cards (there are cases of missing IDs and patient haven to queue for their ID) at the Records Department

with the implementation of an EHR system. In fact there will be no need for patients to pick their folders, as that will be electronic and will be available at all units and departments at all times. The Records Department primary role then will be to validate and register returning and new NHIS clients.

Similarly, there will be no need to start over a patient's care process. In Ghana, patients have no physicians assigned to them. It is 'who is available where'; no appointments are made prior to a visit to the hospital, and based on your symptoms you are assigned to a physician. It is not guaranteed that during your next visit you will be attended to by the same physician, so if the new physician is not abreast with what happened during your previous encounter s/he is likely to start over the care process. Because information about previous encounter(s) is not handy, physicians repeat clinical processes that might have been done by their colleagues. This not only wastes the already limited resources (time, human resource and capital) of the hospital, but could also potentially endanger the patient. An effective EHR will place information just a few clicks away and this will help curtail the waste of repeated clinical history taking, laboratory tests, etc.

An up and running EHR system will significantly improve interdepartmental communication and interactions, therefore enhancing a better care process. The work of the departments can easily be coordinated and monitored. For instance, the Head of the Laboratory can get updates from the units on whether controls have been run and are ok. Integrated clinical alerts and reminders will effectively enhance patient care. Physicians will be abreast with their schedules without putting in additional effort to memorize when to attend to a patient. Allergic reactions of patients and drug-drug interactions can be reduced. Medication errors will also be minimized; an FDA (Food and Drug Administration - USA) study of 400 deaths caused by medication errors found that 16 percent were due to name mix-ups; only the wrong dose was a larger culprit (Walker et al. 2005). Clinical decision support (CDS) systems will facilitate better care delivery and will be an important aid to clinicians, especially medical residents. A medical e-library will make available to clinicians up-to-date medical literature. The Ghana Medical Association publishes a quarterly journal on various health topics both online

(http://www.ghanamedassn.org/Journal/html/journal.html) and a hard copy version. Findings from other clinicians on best practices/treatment are usual published in this journal and can be made readily available to fellow clinicians with access to the internet or a medical e-library. EHR can make available a platform for both internet access and an e-library.

Challenges:

Huge start up cost is undoubtedly one of the major challenges to the implementation of technologies in developing countries. The health service in Ghana is already budged down with huge bills to pay for medical supplies and for services rendered by healthcare professionals. The prices of personal computers have fallen over the past years, but it may still be expensive for hospitals in Ghana. Government intervention will be required to fund such a capital intensive venture as an EHR system. Most countries in Europe and North America have had governments support in EHR implementation projects. Locally tailored made EHR system will reduce cost significantly, and there is the competence to do that in Ghana. An open source will come in handy in this respect. In my interactions with the leader of the IT Department of University hospital of North Norway (UNN) he admitted the huge cost involved and suggested that open source code will be much cheaper to adapt.

Another challenge in implementing an EHR system is human resource. The human resource that is required to keep the system running will be a serious challenge towards a successful implementation in Ghana. The computer literacy rate is still very low in Ghana and among health professionals; especially those who graduated a decade ago or more. The curriculum in our health professionals training institutions will have to be redeveloped to build the competence of health professionals in computer use. Some institutions have already started, but with limited access to computer laboratories, these professionals will only be computer literates in theory.

Maintenance and sustainability is another key issue that will affect a successful EHR implementation. We are not the best of ‘maintainers’ especially when it comes to public

or collective property. An unstable electricity supply and frequent outages can easily damage these equipments and therefore effective plans should be made for backup generators and Uninterrupted Power Supply systems (UPSs). For instance, when the UPS of the chemistry analyzer (ATAAC 8000) broke down just moments before I left for my master's programme, the Biochemistry Department had to be shut down for about six weeks because there was no backup plan. The UPS had broken down several times in the past when the nation was experiencing a serious energy crisis in 2006-2007. Other hospitals in the country have experienced similar fates; when the MRI scanner at Korle Bu Teaching Hospital (the Nation's premier) broke down for a very long period; services for an MRI scanner had to be sought from South Africa i.e. for those who could afford it. Effective back up plans ought to be made to ensure a successful EHR implementation. Technical support staff (an IT-helpdesk) should be available to restore any system failure as soon as feasible. A mirror or shadow system should be planned for and be ready to take over the EHR system should there be any system crash.

Unrealistic expectations will lead to unmet goals and objectives. Computers should not be a replacement for humans; it should supplement and complement human efforts. An EHR system will not be a technological solution to ancient procedural problems and will not magically improve the quality of care (Hunt et al., 2004). The scope of the EHR should be what is necessary, desirable and feasible. Goals should therefore be realistic and attainable; if goals are set too high, then the system might be bound to failure if after a period of usage the attainment of these goals is not insight. Users will be discouraged and managers and funders will be disillusioned. The system then risks being abandoned.

In units of TTH where stand alone computers have been provided, some personnel have found another use for the computers than that initially intended. Personal letters and CVs are typed using this computer; some even use it to play games. It is also very common for laboratory technicians to run laboratory tests free of charge for friends and relatives; they therefore will not like this to be captured on the computer, since that is illegal. They will thus form antiprograms against this program. Antiprograms in the various units of TTH will be some of the greatest challenges to the introduction of a new technology;

favoritism is very prevalent, where people known to the staff are always given a priority irrespective of when they come to that unit. It is also very common for staff from other units to just walk in to the Records Department to either ask the staff there to look for a folder or ID card for a relative/friend/acquaintance or they do that themselves. This greatly slows the work of staff at this department and unduly puts pressure on them. In fact, there is very little restriction as to who gain access to this unit so long as you are an employee of the hospital or if you claim to be so. It is therefore not surprising to find cases of misfiled folders and ID cards.

One of the critical challenges and opportunities of implementing an EHR is the task of defining the scope of practice and the supervisory relationships of each distinct type of caregiver in the organization and then translating these definitions into your EHR system build (Walker et al. 2005) It is difficult to move an organization forward with current technology and trends. Many are reluctant to move beyond the decade in which they were schooled. For example, clinicians who are used to viewing themselves as experts and are asked to learn new processes and skills may be uncomfortably pushed into a situation in which they are not the expert and they will resist.

6.4 Lessons from Other Sectors' ICT Implementation

Though general ICT uptake in Ghana is still low, some institutions and organizations have fully deployed ICT in most of their transactions. The banking sector is undoubtedly one of the most successful ICT implementers in Ghana today. This has helped improve customer service in the banking sector and almost all the commercial banks have had their branches networked throughout the country. There are fewer queues in most banks than was perhaps a decade ago. The e-governance project is a Government of Ghana computerization programme for all State Departments and Institutions. Ministries, State Universities, Research institutes/centers and organizations such as the Customs, Excise and Preventive Services (CEPS), Driver and Vehicular Licensing Authority (DVLA) have all incorporated computer systems into their daily transactions.

The health sector in Ghana seems to be left out in the ICT revolution in the country. Two hospitals are currently online; the Apam Catholic hospital in the Central Region (webpage last updated in Dec 2007… latest news in November 2007 as of April 2009) and Komfo Anokye Teaching Hospital (KATH). The content of these Web pages is basically a description of the hospitals' organizational structure and news articles. Korle Bu Teaching Hospital, which also had an official website, has been offline for over a year now. There is however some efforts in place to address this low level of ICT penetration in the health sector. The Ghana ICT for Accelerated Development (ICT4AD) policy document with contributions from the Ministry of Health clearly identifies the need for the use of ICT to improve access, quality, and efficiency of healthcare delivery in the country. Medical records system, budget and planning systems are prioritized by the ministry's ICT for health document submitted to the ICT4AD consultative committee in 2004. No time frame and implementation strategies are mentioned in this draft document. The emphasis of computer use so far has been for administrative purposes and not for the daily transactions of hospitals in Ghana. With the right political commitment and will an EHR system can derive some useful lessons that the ICT use in Banking and e-governance project presents.

6.5 EHR, Legal and Ethical Framework

The implementation of an EHR system will present some challenges regarding patients' privacy. If this compromises patients' medical confidentiality then patients might oppose it. There are no data protection laws in the country yet and that might be a bit worrying for those who will be implementing an EHR system. The code of conduct for health professionals clearly assures patients of the confidentiality of their medical condition, but that will not be enough to protect patients' privacy from external attacks by hackers, for example. The Computer Crime Act, (2005) and the proposed Electronic Transaction Bill 2005 does provide some assurances of protecting data in general from unauthorized access. The issue should not merely be about laws but it should be about the enforcement of these laws to ensure the protection of patients' rights to privacy.

Though these laws have been made with the financial sector in mind they can be extended to include other spheres of society. Processes and guidelines should be established to enhance effective health information transmission and reporting. The laws of Ghana regarding health information reporting pertain to financial reporting by health administrators to the Ministry of Health (MOH 2008). There is no emphasis on the reporting of health information for public health related issues.

The universal requirement for patient privacy calls for stringent security measures, and the appropriate access levels to the various users of an EHR system must therefore be set in order to meet this requirement. In setting security levels, the current work practice should be taken into consideration; if for instance, nurses by their job description cannot order laboratory tests or write a prescription, but given the current environment in Ghanaian hospitals where there are few physicians and nurses do order some laboratory tests in the absence of a physician, provisions should be made to accommodate such an arrangement in an EHR system. There should be a clear definition of roles and responsibilities to dispel ambiguity and to avoid negligence.

6.6 The Kenyan/Cameroonian EHR Experience

The health services of developing countries still use predominantly paper for data capture in hospitals; the use of computerized data capture tools is still a novelty in most of these countries. Some developing countries have however made trials of integrating computers into their hospital data capture tools menu; India, South Africa, Kenya and Cameroon are some of the countries that have attempted computerized systems. The Kenyan and Cameroonian EHR trials do share some similarities. Both countries' EHR implementations suffered almost the same setbacks; power interruptions, poor computer skills of personnel, limited institutional framework and political commitment, work overload and poor motivation(Hannan et al. 2000; Kamadjeu et al. 2005).

Another issue was the sustainability of the system; computer breakdowns due to frequent power outages and users losing interest in the use of the system and others dropping out

due to trained personnel leaving the practice or the facility (Kamadjeu et al. 2005) seriously hampered the continuous running and use of the system.

The Kenyan EHR (or "The Mosoriot medical record system: design and initial implementation of an outpatient electronic record system in rural Kenya") was started in 1998 and operationalized in 2000 (Hannan et al. 2000). The Kenyan EHR project was part of the Indiana University and the Moi University Faculty of Health Sciences (IUMUFHS) collaboration. The design and implementation teams were led by three Americans, one Australian and a Kenyan. The system was modeled along the current data collection processes to allow for easy adoption, a medical dictionary was incorporated into the system and this primarily was to aid users input data without having to spend lot of time typing. The Kenyan EHR was based on a stand-alone computer at the registration point and patients visiting the facility were registered into the system, given an encounter form to carry to all clinics they were visiting. The encounter form was collected after patients had visited the clinic(s) and some selected data inputted into the system. The selected data was epidemiological in nature and this was to be used for public health assessments. The team had to use a host of fields to make patient identification easy since Kenya like many developing countries has no identification numbers for its citizens. An assigned eight digit record number, patient's name, home village, date of birth and patient's mother's name were the fields entered at the point of registration.

The Cameroonian EHR implementation team was led by three Cameroonians and the software was locally made with local expertise. However, the leader of this group was a Cameroonian resident in USA. It does appear that most of the initiatives in developing countries have had some push or support from 'outsiders' and little pull from the local users. Any future EHR implementation and sustainability must be based on local need and demand so that users can perceive it as 'their own'. Sustainability seems to be a serious issue in ICT implementation in developing countries, this usually borders on human resource (competence and motivation), existing information infrastructure (usually weak in developing countries) and the social context in which the ICT is being implemented.

Chapter Seven

Conclusion

"new" is not necessarily better!

Electronic Health Record presents a great opportunity for the health services of developing countries in the enhancement of the quality of healthcare delivered, the opportunity for early detection of epidemics and clinical audits. It has so far received very little attention from policy makers of these countries.

This research carried out in a typical Ghanaian Hospital sought to find the information infrastructure state in a Ghanaian Hospital, the challenges of introducing EHR in Ghanaian hospitals, the benefits of EHR to Ghanaian Hospitals and what sort of data an implemented EHR system would capture. Some of the challenges of EHR implementation that I identified are the initial huge start up costs, poor computer skills of the healthcare professionals, poor maintenance culture, and people embedding political meaning(s) to the system. The weak state of information infrastructure at the hospital will be another challenge in an EHR implementation. EHR could potentially reduce waiting times for patients, reduce the cost of the hospital's operations, improve interdepartmental communication and collaboration, provide an opportunity for sharing best practices among physicians within Ghanaian hospitals, and enhance better resource allocation. The data an EHR will primarily capture will be patients' demographics, care plans, laboratory results, billing and NHIS claims information.

The Ministry of Health of Ghana is aware of the potential of an EHR system as a solution to the data collection and management challenges, but there has not been any political commitment yet. Probably it is the cost involved that has hindered the implementation of an EHR system so far, given the fact that the Ministry still has other pressing issues to deal with, with its limited budget, salaries of health professionals and medical consumables constitute a greater percentage of ministry's annual budget. Participants at a consultative stakeholders meeting in Accra discussing "the role of ICT in health care delivery" in February 2009 made a strong case for computerization and internet

connectivity system to exist among hospitals in the country for efficient health care delivery (GHANA NEWS AGENCY). There is a general awareness among health professionals of the benefits of implementing an electronic records system in our hospitals. This will however require some commitment from the policy makers as well as institutional patience; the benefits may not be evident immediately.

This thesis has some limitations and should be treated as an academic quest and not be considered as a feasibility study for an EHR implementation, even though it can serve as a basis for one. The scope of this study was limited to only two units within a Ghanaian hospital and the focus was on data collection/management processes and the challenges of the present data collection/management processes. Further studies should be carried out in the trials of computerized data management tools that is beginning to 'proliferate' in the Ghanaian health service; the Korle Bu Teaching Hospital's Laboratory information system, the Ghana health Information systems Development (a pilot project for the use of mobile phones for data collection – a partnership programme between Dodowa Research Center, Ghana and Columbia University, USA) starting this year will be some interesting areas to begin with.

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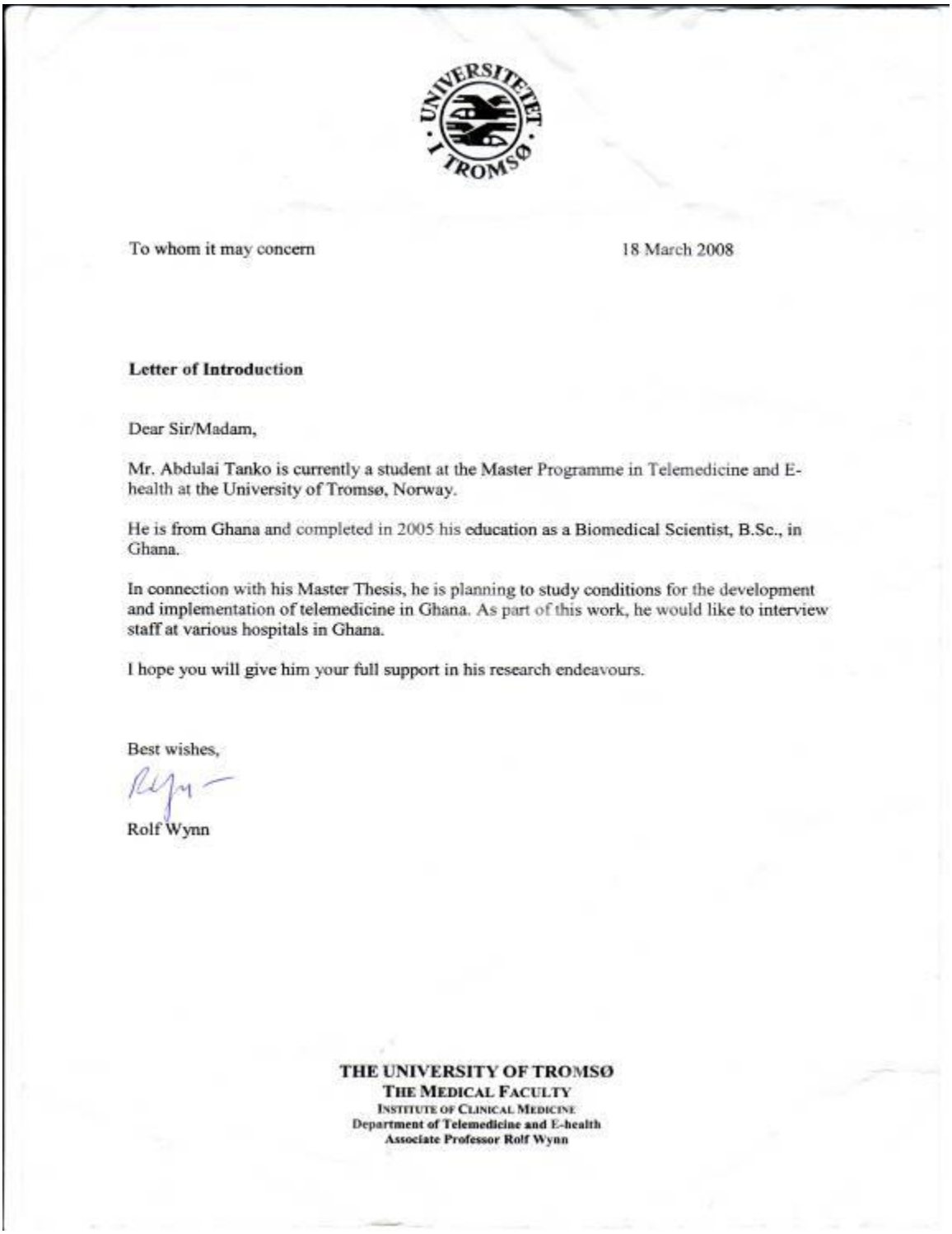
Appendices

Appendix A: Introductory letter from Supervisor



To whom it may concern 18 March 2008

Letter of Introduction

Dear Sir/Madam,

Mr. Abdulai Tanko is currently a student at the Master Programme in Telemedicine and E-health at the University of Tromsø, Norway.

He is from Ghana and completed in 2005 his education as a Biomedical Scientist, B.Sc., in Ghana.

In connection with his Master Thesis, he is planning to study conditions for the development and implementation of telemedicine in Ghana. As part of this work, he would like to interview staff at various hospitals in Ghana.

I hope you will give him your full support in his research endeavours.

Best wishes,

Rolf Wynn

THE UNIVERSITY OF TROMSØ
THE MEDICAL FACULTY
INSTITUTE OF CLINICAL MEDICINE
Department of Telemedicine and E-health
Associate Professor Rolf Wynn

Appendix B: Country Profile (Ghana)

General Statistics:	
Total population:	23,008,000 (2007 estimate)
Gross national income per capita (PPP international $):	1,240
Life expectancy at birth m/f (years):	56/58
Healthy life expectancy at birth m/f (years, 2003):	49/50
Probability of dying under five (per 1 000 live births):	120
Probability of dying between 15 and 60 years m/f (per 1 000 population):	350/311
Total expenditure on health per capita (Intl $, 2006):	100
Total expenditure on health as % of GDP (2006):	6.2
Dentistry personnel density (per 10 000 population):	<1 (2004)
Number of dentistry personnel:	393 (2004)
Number of nursing and midwifery personnel:	19,707 (2004)
Number of other health service providers:	7,132 (2004)
Number of Pharmaceutical personnel:	1,388 (2004)
Number of Physicians:	3,240 (2004)
Nursing and midwifery personnel density (per 10 000 population):	9.00 (2004)
Other health service providers density (per 10 000 population):	3.00 (2004)
Pharmaceutical personnel density (per 10 000 population):	<1 (2004)
Physicians density (per 10 000 population):	2.00 (2004)

Source: World health organization (WHO) 2008 country profile

Appendix B continued……

Health Expenditure

External resources for health as percentage of total expenditure on health: 26.0 (2005)

General government expenditure on health as percentage of total expenditure on health: 34.1 (2005)

General government expenditure on health as percentage of total government expenditure: 6.9 (2005)

Out-of-pocket expenditure as percentage of private expenditure on health: 79.10 (2005)

Per capita government expenditure on health at average exchange rate (US$): 10.0 (2005)

Per capita government expenditure on health (PPP int. $): 32.0 (2005)

Per capita total expenditure on health (PPP int. $): 93.0 (2005)

Per capita total expenditure on health at average exchange rate (US$): 30.0 (2005)

Private expenditure on health as percentage of total expenditure on health: 65.9 **(2005) Private prepaid plans as percentage of private expenditure on health:** 6.2 (**2005) Total expenditure on health as percentage of gross domestic product:** 6.2 (2005)

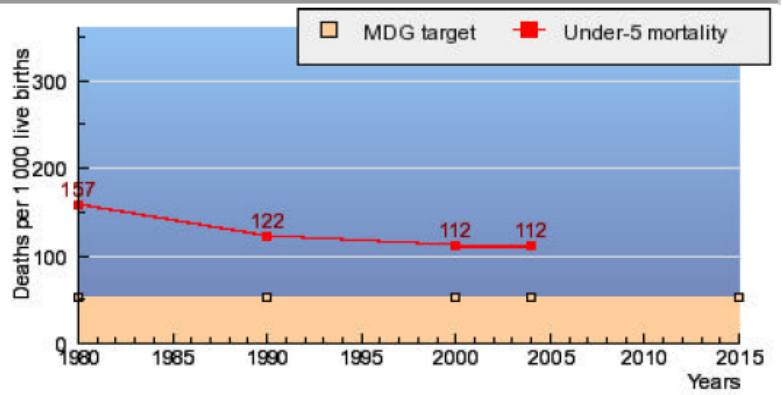
Source: World health organization (WHO) 2008

Appendix B continued…..

(Pages 80-81)

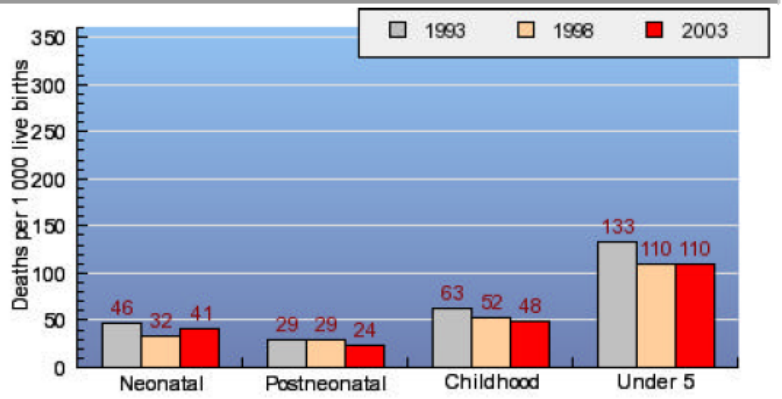
Under-5 mortality

Under-5 mortality: Estimated trend and MDG goal
Ghana, 1980-2004



Source: i) WHO mortality database ii) World Health Statistics 2006

Under-5 mortality: Age-specific mortality rates
Ghana , DHS 1988, DHS 1993, DHS 1998



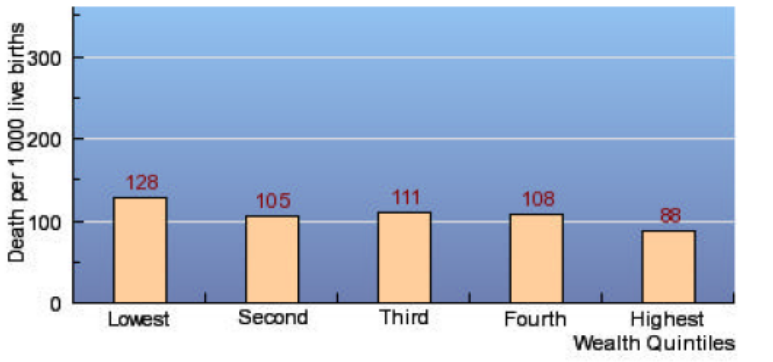
Note: rate for 5 years preceding the survey
Source: DHS 1988 , DHS 1993 DHS 1998

Under-5 mortality: for highest and lowest quintiles
Ghana, DHS 2003

Wealth/assets quintiles	Lowest	Highest	Ratio
	128	88	1.5
Sex	Males	Females	Ratio
	111	108	1.0
Urban/Rural	Rural	Urban	Ratio
	118	93	1.3
Mother's education quintiles	None	Higher	Ratio
	125	85	1.5

Note: rate per 1 000 live births for 10-year period preceding the survey
Source: DHS 2003

Under-5 mortality rates by wealth quintile
Ghana, DHS 2003



Note: rate for 10-year period preceding the survey
Source: DHS 2003

Source: World health organization (WHO) 2008

Causes of death in children under-5

Distribution of causes of death among children under 5 years of age Ghana, 2000-2003

Causes	Deaths[b] (%)	Regional average (%)
Total neonatal deaths	100	100
Neonatal causes[a]	28	26
HIV/AIDS	6	7
Diarrhoeal diseases	12	17
Measles	3	4
Malaria	33	17
Pneumonia	15	21
Injuries	3	2
Others	0	6

a. Includes diarrhoea during neonatal period
b. Sum of individual proportions may not add up to 100% due to rounding.

Annual estimated proportions of death by cause for neonates Ghana, 2000

Causes	Deaths[c] (%)	Regional average[c] (%)
Total neonatal deaths	100	100
Neonatal tetanus	2	9
Severe infection[a]	29	27
Birth asphyxia	26	24
Diarrhoeal diseases	2	3
Congenital anomalies	8	6
Preterm birth[b]	25	23
Others	8	7

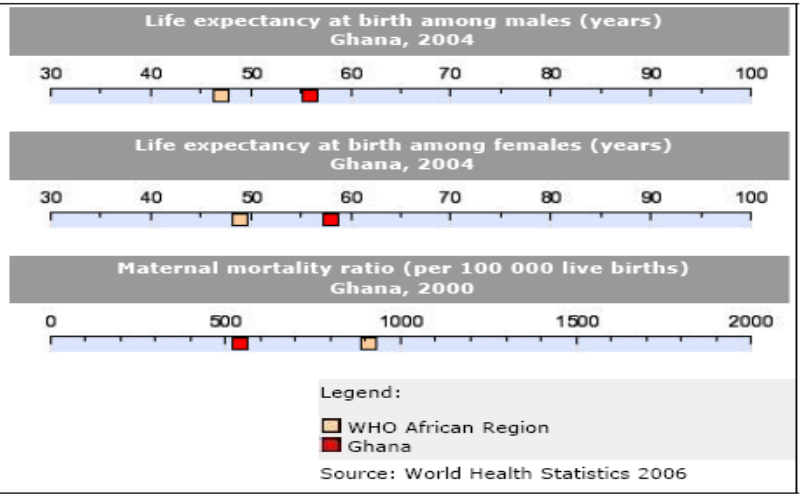
a. Includes deaths from pneumonia, meningitis, sepsis/septicaemia and other infections during the neonatal period.
b. Includes only deaths directly attributed to prematurity and to specific complications of preterm birth such as surfactant deficiency, but not all deaths in preterm infants.
c. Sum of individual proportions may not equal 100% due to rounding.

Causes of Death

Top ten causes of death, all ages Ghana, 2002

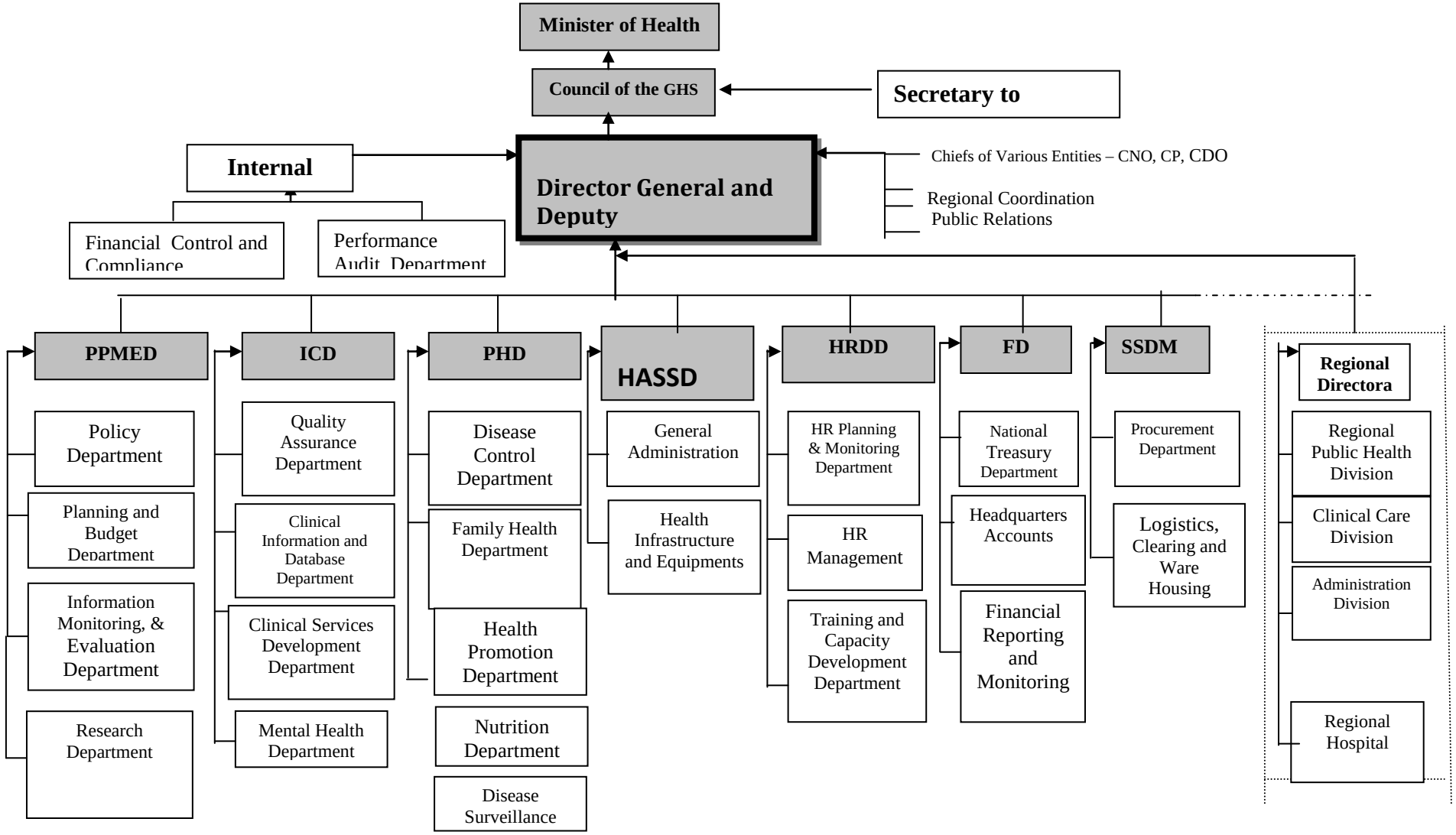
Causes	Deaths (000)	Deaths (%)	Years of Life Lost (%)
All causes	207	100	100
HIV/AIDS	30	15	17
Malaria	23	11	16
Lower respiratory infections	16	8	10
Perinatal conditions	16	8	12
Cerebrovascular disease	11	6	2
Ischaemic heart disease	10	5	2
Diarrhoeal diseases	9	5	6
Tuberculosis	8	4	4
Road traffic accidents	5	3	3
Chronic obstructive pulmonary disease	3	2	1

Source: Death and DALY estimates by cause, 2002
http://www.who.int/entity/healthinfo/statistics/bodgbddeathdalyestimates.xls



Source: World health organization (WHO) 2008

Appendix C: Organizational Chart for Ghana Health Service (*source: www.ghanahealthservice.org*)



Appendix D: ICT uptake in Ghana

Description	Year(s)					Authorised	Operational	Projection
	2000	2001	2002	2003	2004	2005	2005	2006
Fixed Network Operators	3	3	3	3	3	3	3	-
Mobile Cellular Operators	4	4	4	4	4	5	5	-
Teledensity	-	-	-	-	-	13%	13%	20%
Internet Service Providers	29	79	-	112	143	-	-	-
Pagers	7	7	7	10	10	10	10	-
Public/ Corporate Data Providers	9	12	-	-	-	83	23	
VSAT Data Network Operators	14	31	-	96	136	162	57	-
Broadband Operators	-	-	-	4	4	-	-	-
Marine Licences	-	-	-	117	117	-	-	-
TV Stations	3	-	-	-	-	28	7	-
Pay Per View Cable/Satellite	7	-	-	24	28	-	-	-
FM Radio Stations	49	-	-	127	137	140	84	-

Source: Ministry of Communications-Ghana (http://www.moc.gov.gh)

Appendix E: Some Field Questions

Type of data to collect….:

1. GPs (computer in office/internet?), Nurses, Lab Tech computer skills?
2. Present data collection methods at various units in hospitals?
3. for what purpose are data collected at various units?
4. difficulties/limitation of data collection methods?
5. How is data communicated within the various units?
6. Communication infrastructure at the hospitals?
7. How are reports produced (monthly, quarterly, biennially or annually)?
8. How are reports transmitted and for what purpose?
9. Had there been any previous attempts to address the present challenges of data Collection/recording in used presently?
10. If yes, name the approaches/initiatives?

Where to collect data (source)

1. Hospital units (laboratory and Records department
2. GHS (Ghana health service)
3. MOH (Ministry of Health)

Type of data at MOH:

i. IT training at various educational institutions of health professionals… is that part of the current curriculum?
ii. Is data management and continuous education a priority?
iii. How has that been achieved in the past
iv. Funding?

4. Telecommunication policy (vis-à-vis telemecdicine)