

**KWAME NKRUMAH UNIVERSITY OF SCIENCE AND
TECHNOLOGY**

**ASSESSING THE IMPACT OF ICT ON INFORMATION MANAGEMENT
AT THE OUT-PATIENT DEPARTMENT: A MULTIPLE CASE STUDY OF
FIVE HOSPITALS WITHIN THE KUMASI METROPOLIS**

KNUST
by

Ewoenam Akpene Puplampu
BSc Building Technology (Hons.)

**A Thesis submitted to the KNUST School of Business,
Kwame Nkrumah University of Science and
Technology
in partial fulfillment of the requirements for the degree
of**

MASTER OF BUSINESS ADMINISTRATION
KNUST School of Business,
College of Art and Social Sciences

May 2009

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CERTIFICATION

I hereby declare that this submission is my own work towards the MBA and that, to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the Kwame Nkrumah University of Science and Technology, except where due acknowledgment has been made in the text.

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ABSTRACT

Managing information in healthcare institutions in Ghana has become a challenge over the past few years as hospital attendance rates continue to increase. This research is concerned with Out-Patient Departments (OPDs) adopting ICT, particularly electronic medical records (EMRs), in their work environment. The aim was to identify OPD functions that can best utilise ICT to manage information. The research also sought to explore the benefits and challenges associated with implementing information management systems within the Ghanaian context. The research setting was a multiple case study using five health institutions within the Kumasi Metropolis and involved soliciting views from practitioners and non-practitioners through a survey instrument. It was found that the cases in the study were at varying degrees in a shift towards the use of electronic record keeping systems. The major benefits derived from the use of EMRs were found to be easy retrieval of data and interoperability. Easy retrieval was found to have a significant relationship with outcomes such as efficiency, effectiveness, innovation and job satisfaction. Lack of constant supply of electricity and the lack of up-to-date equipment ranked highest among other challenges. The main barriers to adoption were found to be organisational culture and a lack of IT policy. The significant relationships suggest that health institutions that adopt ICT are likely to improve on efficiency and effectiveness. Healthcare institutions that do not use EMRs are therefore encouraged to make use of this essential information management tool. It is expected that an awareness creation of the potential uses of electronic record keeping among health professionals will spread its positive impact to a wider audience and improve on the management of information within the healthcare sector.

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LIST OF ABBREVIATIONS

DHIMS	District Health Information Management System
EHR	Electronic Health Record
EMR	Electronic Medical Record
HAMS	Hospital Administration Management System
HIS	Hospital Information System
ICT	Information and Communication Technology
IT	Information Technology
MIS	Medical Information System
NHIS	National Health Insurance Scheme
OPD	Out-Patient Department
WHO	World Health Organisation

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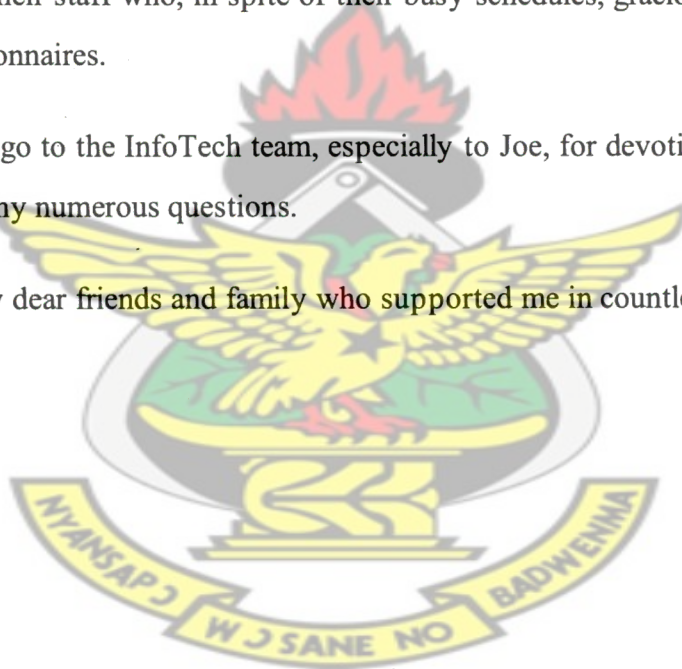
“To Him who is able to do exceedingly abundantly above all that we ask or think, to Him be glory forever and ever”

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In loving memory of

Albert

CHAPTER ONE

INTRODUCTION

The purpose of this research project is to explore how ICT can be used to manage information at the Out-Patient Departments (OPDs) of health institutions with respect to the challenges and benefits associated with adopting computerised record keeping systems. Being custodians of almost all records pertaining to patients, Out-Patient Departments face a number of challenges that ICT may potentially be able to address. This first chapter gives a background to the study, the statement of the problem, the research questions and objectives, the relevance of the study, the organisation of the subsequent chapters included in the work, the scope and limitations encountered in the research.

1.1 Background

Information and Communication Technology (ICT), also referred to as Information Technology (IT), has become an important tool used by many organisations to successfully manage large volumes of information. Considered to be a business enabler, ICT is revolutionizing the operations of firms, industries and markets today. Laudon and Laudon (2006) point out that without the extensive use of ICT systems, the survival or even existence of many industries would be inconceivable. This fact is widely demonstrated in the way information-intensive organisations like banks, insurance companies, telecommunications companies, the airline industry, giant super-markets etc. have been able to manage their information systems quite effectively thereby improving efficiency and quality of service delivery.

Just as many information-intensive institutions are utilising ICT to organize and improve their work environment, the healthcare industry is likewise adopting ICT in order to bring about improvements in the way information is managed and to deliver quality care to patients. For instance, one promising application of ICT in the healthcare industry is the Electronic Medical Record (EMR). EMR is a software for managing overall practice and patient documentation and provides instant access to necessary patient information at the time care is delivered. Substantial potential benefits include the minimisation of adverse events such as errors caused by lack of information about the client at the point of care, reduced duplication of tests and greater coordination and integration through increased exchange of information between service providers. In addition, time is also saved in retrieving information.

(NHIMAC, 2001)

According to von Knoop *et al.* (2001), in a survey of US-based doctors who use EMRs, at least 92 per cent reported that EMRs helped improve overall efficiency, 88 per cent reported that they had improved the quality of care, and 29 per cent reported significant time and cost savings. In Ghana, ICT in the healthcare sector has begun to receive some measure of attention. For example, in 1998 a National ICT Roundtable was organised by the Internet Society of Ghana (ISOG), the Ministry of Communication and Development, and the International Institute for Communication and Development (IICD) as facilitator with representatives from the Ministry of Health to formulate a national ICT policy document (IICD, 2003). Out of the five project proposal topics effectuated, Hospital Information Systems was one of them. It proposed to develop a framework for the implementation of an information system that enables health institutions in Ghana to keep records electronically. It envisaged the use of ICT to support the activities and operations of the healthcare

delivery system throughout the country. It was proposed to network all healthcare institutions in order to collate information and share data among all healthcare professionals. Furthermore, according to a report by the IICD, provision was to be made for the establishment of a national databank to support online national healthcare information administration and management (IICD, 2003).

A recent development in this direction is the 'Pan African e-network' project, which seeks to connect all the African Union states via satellite and a fibre optic network. Among other things, the network is expected to support telemedicine where doctors can access the expertise of other medical experts in other parts of the world or offer their services in remote parts of the country (Daily Graphic, 2009).

Dr. Darkwa, a columnist for the ICT-World Features Column of the *Ghanaian Times*, advocates strongly for the use of ICT in healthcare delivery. He believes ICT has an important role to play in addressing many of the healthcare challenges faced by the sector in Africa (Darkwa, 2007a; 2007b; 2008). The World Health Organisation (WHO) has also identified ICT's role in healthcare delivery as a key issue for the African continent and not surprisingly has made 'ICT and Healthcare' the main theme for its 2009 Annual Regional Meeting for Africa (WHO, 2009).

1.2 Statement of the Problem

With an increase in the rate of hospital attendance, hospitals in Ghana are faced with the challenge of effectively managing the constant flow of patient data that has to be processed daily. Inability to promptly retrieve and provide timely information to stakeholders often results in delays. Delays in healthcare delivery can

have grave consequences and even result in the loss of lives, especially in emergency cases, where it is necessary to act swiftly.

Traditionally, most hospitals and clinics in Ghana keep medical records manually using the card system or folders. Obviously there are challenges with the manual methods. For instance, difficulty in retrieving relevant medical information or illegibility of hand-written requests of doctors, which can lead to errors like administering the wrong drug to a patient.

The Out-Patient Departments of large hospitals are characterized by long bureaucratic procedures and operations. To make matters even more complex, since the launching of the National Health Insurance Scheme (NHIS), our hospitals have seen a dramatic increase in the number of patients accessing healthcare service. Relying solely on manual methods to manage information is becoming increasingly difficult, inadequate, inappropriate and burdensome for the staff.

Experience demonstrated that patient records were sometimes misfiled, misplaced or lost. In such cases new folders had to be opened for the patient meaning that valuable information about the patient's past history, which is important for good clinical decision-making, is lost. The lengthy and cumbersome procedures can be frustrating when patients have to spend several hours at the hospital in order to receive needed care. Some individuals can afford to pay to go to private hospitals but even there, when specialist care is needed, they have no choice but to go to the main hospitals. In other instances, rather than avail themselves of the healthcare they deserve, people resort to self-medication or alternative means of treatment, which sometimes have negative repercussions.

1.3 Research Questions

From the premise that ICT offers valuable tools for managing large volumes of information, it becomes necessary to raise certain questions:

1. Which OPD functions of Ghanaian hospitals best utilise ICT to improve on their information management systems?
2. What benefits are associated with the use of ICT applications within the various OPD functions?
3. What barriers and challenges are involved in getting information management systems implemented at the OPD within the Ghanaian context?

1.4 Research Objectives

The objectives of the study were:

1. To identify the various aspects of OPD functions that utilise ICT applications to effectively manage information.
2. To identify the benefits associated with the use of electronic medical record systems at the OPD.
3. To find out the barriers and challenges involved in getting information management systems implemented at the OPD within the Ghanaian context.

1.5 Relevance of the Study

As mentioned in the problem statement, a delay in gaining quick access to healthcare information generates inconveniences and can lead to grave consequences. Just as the lawyers say ‘justice delayed is justice denied’ it can similarly be said that ‘healthcare delayed is health denied’. In an information age,

where the management of data becomes a crucial issue for all organisations including healthcare service organisations, attention needs to be directed to the study of such matters. It is acknowledged by the WHO that most countries face the problem of generating, analysing, summarising, and reporting health information (Darkwa, 2007b). Health data in a nations databank would reduce these problems and provide information for research as well as allow easy monitoring of changes in demographics and disease patterns as well as the emergence of new infectious diseases. Health information is also vital for the planning and decision-making processes of the healthcare service. With Ghana embracing the information revolution, this study should shed some light on the manifestations and implications of ICT for healthcare institutions in Ghana. Lessons learnt can benefit other institutions. ICT also comes with high start-up costs vis-à-vis acquiring computers, software, connectivity and training. It is important that organisations know whether their IT investment is making any impact on their business. IT consultants and marketers also need to be looking at this new area for potential business opportunities.

1.6 Scope of Study

The scope of the study covered the Out-Patient Departments of five hospitals within the Kumasi metropolis – those with ICT use and those with minimum or no ICT use in their work processes. The focus was on the area of documentation and record keeping and the processes involved at the various points of care within the Out-Patient Departments of the case institutions selected. The points of care included: the records section, the consulting room, laboratory, the dispensary and the billing section.

1.7 Organisation of Study

After the introduction to the study given in Chapter 1, the remaining chapters are organised in the following way. Chapter 2 presents a review of literature related to the topic and examines previous studies conducted in the area of ICT in healthcare. Chapter 3 is concerned with the research methodology adopted for the study. It discusses the specific methods and instruments used to obtain answers to the research questions. Chapter 4 presents the results and findings from the research and a discussion of the findings. Chapter 5 is the concluding chapter. It includes a summary of the findings, conclusions and recommendations based on the research findings.

1.8 Limitations of Study

Generally, in order to assess impact, it would be necessary to have historical data that dates back to some time before a system is implemented. However, most institutions in Ghana do not have good data keeping practices, making access to historical data almost impossible.

Time was also a major constraint to the study. The respondents were difficult to get due to the fact that health care personnel often have tight schedules. Because of the nature of their work it was difficult to fix appointments for interviews and the completion of questionnaires. The researcher also had a limited time frame within which to conduct the research coupled with limited financial resources. Time and financial constraints therefore made it easier to work with a small sample size.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter seeks to review related and relevant articles and papers written about the topic of interest based on previous research. The review covers areas such as ICT, information management, the role of ICT in healthcare, the use of Electronic Medical Records (EMRs), the potential benefits of using EMRs and the barriers, challenges and risks associated with their use. Finally, there is a representation of the conceptual framework used in this research.

2.2 Definition of Terms

An **Out-Patient Department (OPD)** is that section of a hospital that offers treatment to patients without admitting them into the wards. **Healthcare professionals** include doctors, nurses, medical assistants, pharmacists, and a wide variety of other individuals regulated and/or licensed to provide some type of health care.

Information and Communication Technologies (ICT) is the use of computer-based information and communications systems used for “gathering, storing, retrieving, processing, analyzing, transmitting and receiving information” (The Royal Society, 2006, p 5). ICT includes software applications to capture and give access to information, computer hardware to run these applications and networks to facilitate transfer of information within an organization (Chaffey and Wood, 2005). An **Information System** is the set of interrelated components used by organisations to collect, process, store and distribute information. It includes both

technology and people and comprises the hardware, software and the brain-ware plus the supporting network infrastructure (Zeleny, 2000). **Hospital Information Systems (HIS)** are electronic information systems, which provide support for information processing within a hospital.

Input is the capture or collection of raw data from within an organisation or from its external environment for processing in an information system.

Processing is the conversion, manipulation, and analysis of raw input into a more meaningful form.

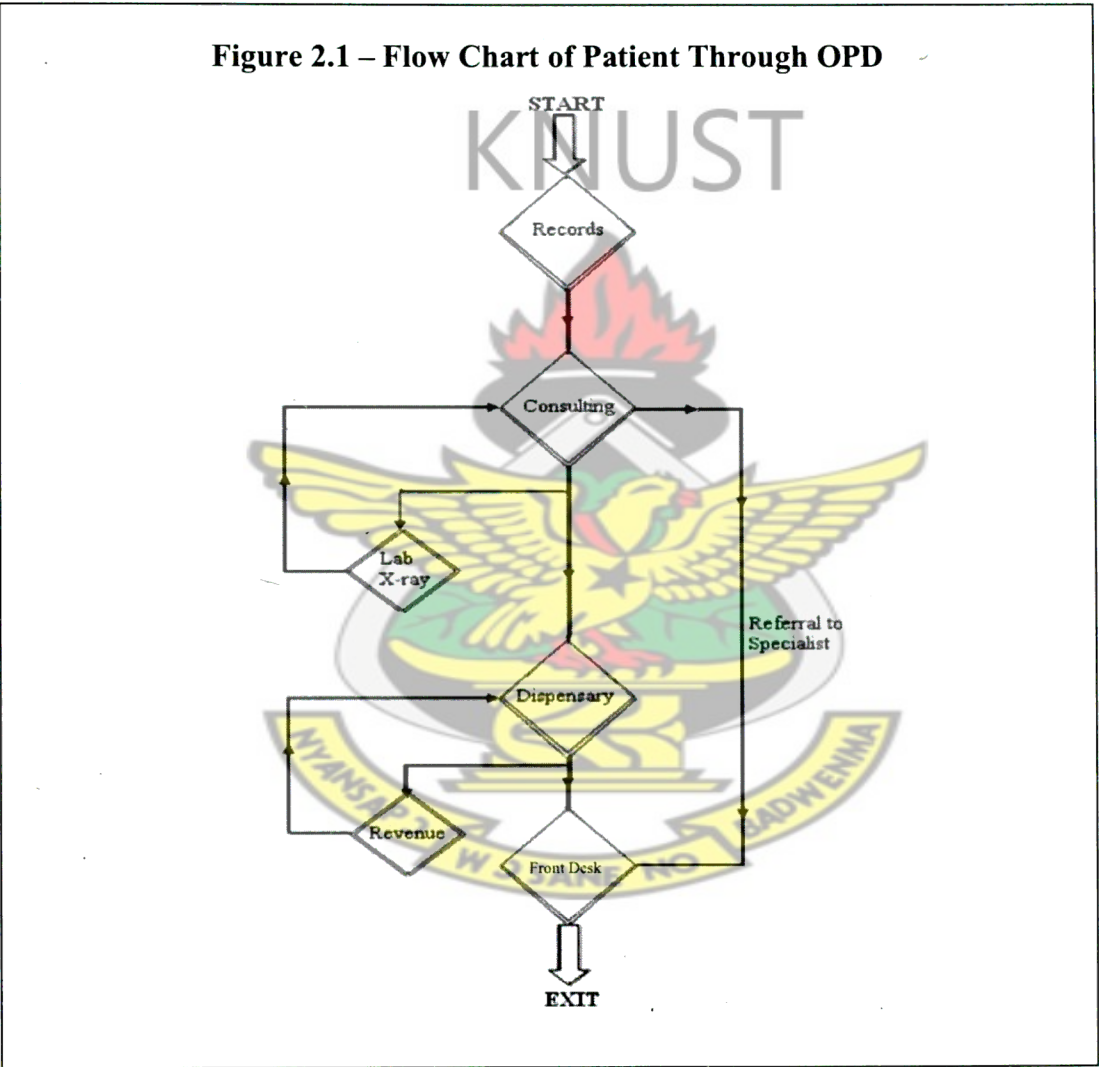
Output is the processed information, which can be distributed to users or stored in a database to be accessed by users.

Health informatics or **medical informatics** is the study and application of methods to improve the management of patient data, medical knowledge, population data and other information relevant to patient care and community health. It is the intersection of information science, computer science and healthcare and deals with the resources, devices, and methods required to optimize the acquisition, storage, retrieval, and use of information in health and biomedicine (Wikipedia, 2009). **E-health** can mean using computer-based technologies in healthcare practice (Oh *et al.*, 2005). In a broader sense it can be thought of as “a way of thinking, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally, and worldwide by using information and communication technology” (Eysenbach, 2001).

Interoperability refers to the capability of different computers, being able to exchange information in standard ways and work together on tasks irrespective of different operating systems and different networks.

2.3 Flow Chart of a Patient’s Journey Through the OPD

Upon entering a hospital outpatients follow a process from registration at the clients’ desk through to the consulting room and other points of care until they exit the facility. Figure 2.1 shows a simple flow chart of a patient’s journey through the OPD.



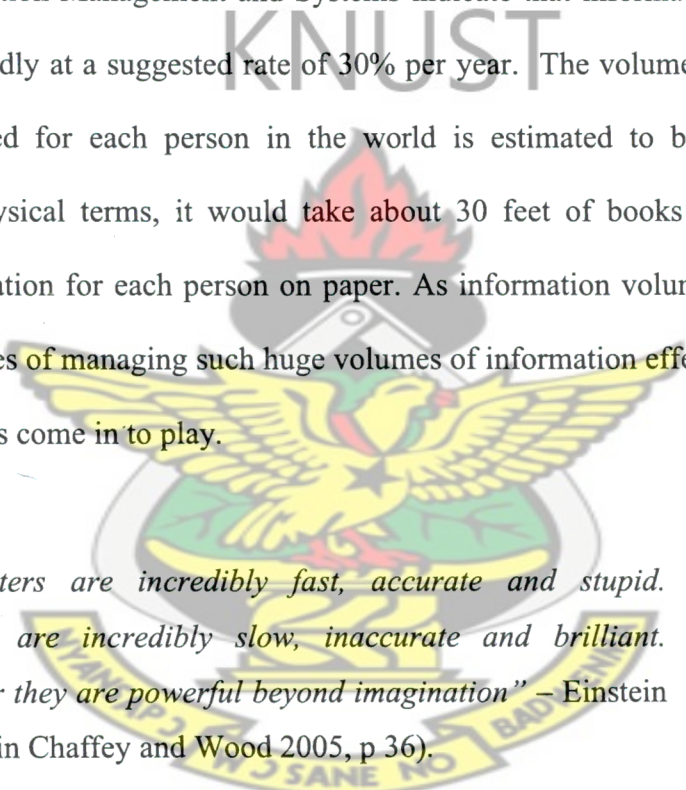
Source: Researcher’s Construct

At every point of care and upon each encounter of the patient with the healthcare professional, information about the patient is generated. Patient data is information about an individual patient, which is relevant to decisions about that

individual's current or future health or illness. This information needs to be captured and stored for future use. The types of information generated include patient demographics, medical history, medicine and allergy lists (including immunization status), laboratory test results, radiology images and billing records.

2.4 The Information Age

According to Lyman and Varian (2003), estimates from researchers at the School of Information Management and Systems indicate that information volumes are increasing rapidly at a suggested rate of 30% per year. The volume of recorded information created for each person in the world is estimated to be about 800 megabytes. In physical terms, it would take about 30 feet of books to store the equivalent information for each person on paper. As information volumes increase, so do the challenges of managing such huge volumes of information effectively. This is where computers come in to play.



*“Computers are incredibly fast, accurate and stupid.
Humans are incredibly slow, inaccurate and brilliant.
Together they are powerful beyond imagination” – Einstein
(quoted in Chaffey and Wood 2005, p 36).*

This quote by Einstein highlights the advantages of using computers in managing information and how human thought processes can be complemented by the strengths of electronic tools. The benefits derived from IT relate to the fact that the technology allows more tasks to be completed with greater accuracy and quality in less time and for lower cost.

2.4.1 ICT in the Business World

Information has become a key strategic resource, which is used by organisations to improve organisational performance and to deliver better quality products or services. Through ICT, businesses now communicate electronically, transfer multimedia files and access information instantly at the touch of a button. These facilitate decision-making processes and permit real-time working (McNurlin and Sprague Jr., 2006). Individual performance also stands to improve when employees are provided with timely information to support their decisions. In theory, a decision can only be as good as the information available to the decision maker.

2.4.2 Qualities of Good Information

For information to be effective in supporting organisational processes, it must be relevant, accurate, and timely as well as user friendly so as to support the tasks performed by individuals and the decisions they make. If information quality is poor, then tasks will be performed inefficiently and erroneous decisions will be made which may result in poor organizational performance, loss of jobs, or even loss of life. Furthermore, information must be made accessible and available for sharing between employees and business partners (Chaffey and Wood, 2005).

2.5 The Role of ICT in Healthcare

Information plays a major role in the practice of health at all levels. Because of this it is believed that health informatics will help doctors with their decisions and actions, dramatically upgrade the healthcare delivery process and improve patient outcomes. Improved ways of handling patient data and the way medical knowledge is captured processed, communicated and applied is likely to contribute to improved

effectiveness and efficiency in the delivery of healthcare. Khalil and Jones (2007) perceive e-health as the future of health practice, which sooner or later, will become a mandatory partner in health systems all over the world.

2.5.1 Electronic Medical Records (EMR)

This is the most often discussed clinical application of ICT. Electronic archiving is now replacing traditional paper based systems in many industrialized countries. Electronic Medical Records, also called Electronic Health Records (EHR), is a longitudinal record of personal health and healthcare from “cradle to grave”. It combines information about patient’s contacts with primary health care as well as subsets of information about hospitalization. It is a comprehensive record of a person’s health history. An EMR is able to electronically collect and store data about patients, supply that information to providers on request and permits physicians to enter patient care orders on the computer. One benefit of the EMR is easy access to data. Electronic Medical Records should allow healthcare professionals access to patients’ data wherever they are potentially worldwide. The many different healthcare professionals with whom an individual interacts during treatment can share information and make better-informed healthcare decisions (The Royal Society, 2006).

Any hospital typically is made up of the following departments: laboratories, blood bank, pharmacy, kitchen, radiology, stores, accounts, purchase and research centre. There are also many doctors, nurses, specialists and patients present in the hospital. Considering that one patient could have interaction with any one or more departments and doctors, it is very important to have a system that links the different departments. Bhushan (2002) illustrates the use of an EMR system in a hospital

setting. The moment a patient enters the hospital all his details are captured and updated in an existing history database. He then is assigned to a relevant doctor, who would check up and feed the details against the patient's case data. The doctor can assign the patient to take certain tests. This data automatically is updated and accessed at different test laboratories, whether internally or externally. Further appointments can be scheduled electronically and the pharmacy is updated as to what medicines to supply to the patient. Finally the billing department can access the whole case and find out how much is to be billed to the customer. Various research departments can also link up to the integrated system and doctors can share knowledge through this medium (Bhushan, 2002).

2.6 Potential Benefits of Using Electronic Medical Records

EMRs have the potential to impact the information environment of the healthcare sector. With the growing importance on providing the right information to the right person anywhere at any time in our world today, it is becoming obvious that the paper record system is incapable of supplying caregivers with all the patient information they need in a way that they can best utilize (Thakkar and Davis, 2006). EMR offers several potential benefits and a range of opportunities to consumers and health care providers, which can lead to significant service enhancements.

2.6.1 Easy Retrieval of Data

One key feature of electronic records systems is their ability to furnish information about patients with just a click of the button. It comes with many advantages. For example, time saved in retrieving information can result in efficiency gains. Besides, data will be collected and made available more quickly,

thereby increasing the time available for direct patient care. Apart from reduction in the duplication of diagnostic tests, which is usually the case in the absence of previous test results, EMRs can also enhance the exchange of information between service providers (NHIMAC, 2001). Reports from the implementation of a computer-based patient record system in a rural Kenyan health centre indicated that patient visits were 22% shorter. Patients spent 58% less time with providers and 38% less time waiting. Clinic personnel spent 50% less time interacting with patients, two thirds less time interacting with each other, and more time in personal activities (Rotich *et al.*, 2003).

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2.6.2 Interoperability

EMRs have the potential to enhance interoperability and reduce medical care fragmentation. Interoperability is when computers work together to exchange information across networks. The goal is not a single coherent network but rather interfacing dissimilar networks into a coherent system whereby information can be exchanged in a standard form (McNurlin and Sprague Jr., 2006).

Medical care fragmentation is largely the result of patients receiving different types of care at multiple facilities from various providers. For example, a primary care physician may treat a certain condition while a specialist treats another. The same patient may also have received treatment at an outpatient centre or in an emergency room. Every care encounter generates patient data that remain with the respective provider within each individual facility because physicians do not routinely communicate with one another and share pertinent clinical information about common patients. In other cases, people change their locations and do not move with the paper based medical records. This wastes time and increases costs

since more tests have to be repeated. Moreover, in case of emergencies patients do not usually have medical records at hand. A system that can serve patients irrespective of the changes in patient's location becomes beneficial (Novak, 2005; DePhillips III, 2007).

2.6.3 Reduced Administrative Costs

It is believed that electronic records systems have the potential to reduce administrative costs and improve quality of service. Houghton (2002) considers that by using electronic records systems, payers will be able to manage and better account for expenditures, manage the flow of funds and contain costs. They will enable payers to track expenditures and exercise control over the processes of referrals and prescription. Besides insurers, healthcare providers, financial institutions and consumers can link into claiming and payment systems and as a result reduce significantly administrative costs and improve quality of service.

2.6.4 Public Health Benefits

There are considerable public health benefits to sharing data contained in a nation-wide EHR system as highlighted by The Royal Society (2006). Health researchers can mine health records to learn about areas such as drug interactions, unexpected side effects of treatment or to determine the efficacy of particular treatments and preventative measures. This sort of analysis could allow for more thorough evidence-based decision-making by healthcare professionals. It can also be a useful source for detecting trends worthy of further study. Government policy makers could use data to understand trends in epidemiology and also to make informed decisions about which drugs to approve.

2.7 Challenges of Implementing Electronic Medical Records System

Implementing electronic medical records comes with its own challenges and implementation may fail if necessary precautions are not taken. It is important to recognise that education of users and computer staff is an essential precursor because Information Systems initially increase the workload of staff, hence the need to educate adequately before introducing the system. Besides, the routine clinical and managerial processes in healthcare are complex but more often than not, they tend to be underestimated. Most healthcare interactions occur in the context of apprehension, anxiety, and time pressure meaning that even the most basic administrative tasks have more complex dimensions than equivalent tasks in the non-health sector. This constitutes a very challenging environment for anyone implementing a hospital information system. Developers therefore need to look for and learn lessons from past projects so as to avoid any further waste of scarce health resources (Littlejohns *et al.*, 2003).

2.7.1 Change Management

Change management is a very important aspect of ICT implementation. Change management is the process of assisting people to make major changes in their working environment. People resist change, especially technological change when they feel vulnerable. Remenyi *et al.* (1991) suggest that drawbacks of adopting IT applications can be caused by the way individuals react to change. Staff frequently mistrust management motives. People fear loss of their jobs, as the new system will presumably be more efficient than the old. Some may also see sophisticated computerisation as giving management more information, and more

control, about the day-to-day work. Others whilst trying to come to grips with the new system will be under more pressure and snap at each other or at customers. Some older staff may not be retrained because they are close to retirement. This can lead to loss of morale on the job. The transformation to an electronic system does not take place by purchasing information technology machines and installing them in hospitals but involves a cultural transformation. It requires providing a solid foundation through preparation and education of the staff that would use these machines and systems (Giaedi, 2008; McNurlin and Sprague Jr., 2006). It is therefore important that the people side of the system is handled correctly in order to guarantee success.

2.7.2 Transition from Paper to Electronic Records

Transition from traditional paper record-keeping systems to electronic systems can be a challenge for some users. In an evaluation study, Lium *et al.* (2008) concluded that the implementation of electronic medical records and the withdrawal of the paper-based medical record is feasible, but represents a drastic change in the information environment of hospital physicians. In their study, they found that many physicians using electronic medical records perceived benefits from the EMR systems, but the legacy of the old paper-based routines and structures still prevailed. The challenge at this point, in their opinion, is to remove paper not just physically, but also to overcome the paper shadow of the past, which slows down the pace of organizational change.

2.7.3 Barriers to Adopting Healthcare IT Applications

When implementing electronic medical records systems, institutions are likely to face certain barriers that can undermine the adoption process. Barriers hinder or prevent an action from being taken. Barriers that were assessed in a study by Thakkar and Davis (2006) included software cost, hardware cost, participation from doctors, participation from nursing staff, inability to find the software that meets the requirements of the true EHR system, organizational culture, and personnel cost among others. For developing countries however the list is more extensive and their existence can render implementation most difficult. A technology assessment carried out in Kenya by researchers Ouma and Herselman (2008) reported several barriers to effective realization of ICT benefits for the healthcare sector. The barriers identified were as follows: lack of computer equipment, lack of computer skills, lack of Internet connection, out-dated and unreliable equipment, lack of broadband connection, working style not suited to the use of computers, cost of computer equipment, fear of computers, and lack of information. Others included training and technical support, lack of professionals, lack of electric power supply, distance and geographic barrier, and lack of service providers.

2.7.4 Risks

There are risks that are associated with ICT implementation. Usually these risks have to do with confidentiality, privacy and data protection. Other risks include inaccurate patient information due to periodic rather than real-time updates; EHR systems being unavailable due to technical problems, software systems becoming

obsolete, software vendors going out of business, computer viruses, computer crashes, data capture anomalies, and programming errors (Goldschmidt, 2005).

2.8 The Future of Healthcare IT

Despite the constraints and barriers encountered in implementing Healthcare IT, the benefits have been shown to outweigh the disadvantages. Chandrasekhar and Ghosh (2001) are of the view that focusing on educating health professionals in the possible uses of ICTs, and providing them with access and connectivity, would spread the benefits to a much wider set of final beneficiaries. DePhillips III (2007) in his article 'Initiatives and Barriers to Adopting Health Information Technology: A US Perspective' suggests that, as with most other major reforms, HIT will continue to have its own set of challenges and barriers until its full implementation can be felt. He is of the view that the benefits clearly justify persevering through the initial complications and that by observing and documenting smaller successes, enthusiasm will be generated for larger-scale implementation. The bottom-line is that "IT offers the healthcare industry tremendous potential for addressing and rectifying some of its greatest concerns" (DePhillips III, 2007, p 5).

2.9 Conceptual Framework for the Study

The framework for the study is that ICT combines with users to form an IT System (see Figure 2.2). The focus of an IT System is to use technology in the best possible way in order to enhance information flow within an organisation. Raw data gathered from routine day to day operations are processed into information and stored in a database. Users then access the database as and when they need to. The use of the systems is expected to produce benefits to users (Figure 2.2), which can

INFORMATION SYSTEM (ICT + USERS)

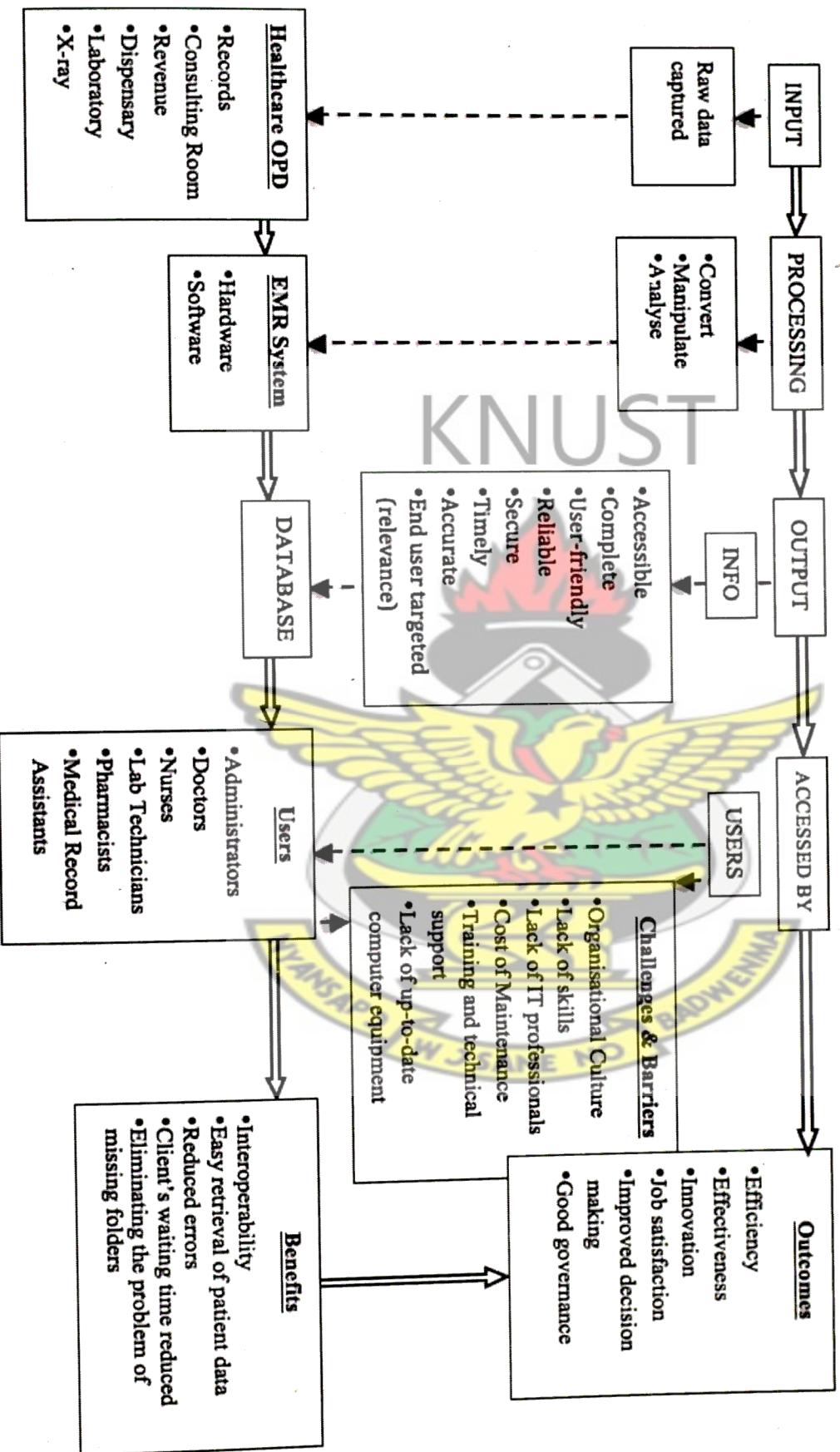


Figure 2.2 Conceptual Framework for the Study (Source: researcher's construct)

lead to the achievement of outcomes such as efficiency, effectiveness, job satisfaction and innovation. Efficiency is a performance measure that indicates how well resources are being used in terms of doing things faster (speed) or doing more within a specified time period (productivity). Effectiveness is the ability to perform tasks right or according to the required standards. It has to do with how well process objectives are being met and delivering quality services. Quality in this context is about technical quality, which relates to the core element of a service that is provided by a professional and which reflects the accuracy with which tasks are performed. Job satisfaction has to do with work environment and improvement in work morale. Innovation is about introducing new ways of working. ICT's impact can therefore be assessed in terms of the benefits derived from its use and the achievement of these outcomes.

In the process of using these systems, or in their implementation, various challenges and barriers also arise. A barrier hinders or prevents one from achieving a desired goal and for health institutions may include organisational culture and a lack of IT policy, software and hardware costs as well as participation from doctors and nurses. Other challenges may include a lack of up to date computer equipment, lack of computer skills, the fear of computers, training and technical support, lack of IT professionals and a lack of constant supply of electricity.

2.10 Propositions

It had been suggested in the problem statement that the number of patients accessing care in health institutions is on the increase and this has made the management of information a challenge especially when it comes to data retrieval. Based on the premise represented in the conceptual framework that ICT is a tool with

potential to impact positively on healthcare delivery, and based on the literature that has been reviewed, the following propositions will be explored:

PROPOSITION 1: The use of Electronic Medical Records (EMRs) at the Out-Patient Department facilitates retrieval of patient data.

PROPOSITION 2: The use EMRs enables the flow and exchange of information (interoperability) within the various sections of the OPD.

PROPOSITION 3: The use of EMRs at the OPD helps eliminate the problem of missing folders.

PROPOSITION 4: Errors are minimized when electronic medical records are kept.

PROPOSITION 5: The use of electronic medical records at the OPD reduces clients' waiting time.

PROPOSITION 6: Organisational culture and a lack of IT policy, software and hardware cost as well as participation from doctors and nurses constitute barriers to adopting electronic medical record systems.

PROPOSITION 7: A lack of up-to-date computer equipment, lack of computer skills, the fear of computers, training and technical support, lack of IT professionals and a lack of constant supply of electricity constitute challenges to the use of electronic medical records system.

PROPOSITION 8: The benefits of easy retrieval of patient data and interoperability would enable institutions (and the staff) achieve efficiency, effectiveness, job satisfaction, and bring about innovation in the work environment.

This research work sought to assess the impact of ICT on healthcare delivery along the lines of these propositions.

2.11 Previous Studies

The work of Ouma and Herselman (2008) 'E-health in Rural Areas: Case of Developing Countries' has inspired and informed the approach to the methodology adopted by the researcher in this study. In their work they carried out a technology assessment in the rural areas of Kenya to investigate the current ICT infrastructure and e-health solutions provided. They also sought participants' knowledge on benefits gained from ICT implementations and the challenges that exist towards ICT implementations within selected hospitals. By the use of multiple case studies on five rural hospitals they conducted a qualitative research using participants that included hospital managers, hospital staff and patients. These participants were selected through purposive sampling. Data collection tools used included interviews, observations and questionnaires. Similarly, the work of Thakkar and Davis (2006) 'Risks, Barriers, and Benefits of EHR Systems: A Comparative Study Based on Size of Hospital' has informed some of the content of the survey questionnaire especially the list of benefits, barriers and risks.

2.12 Conclusion

This concludes the chapter on the review of related literature. The next chapter is concerned with the methods adopted by the researcher in order to find answers to the research questions raised in Chapter One and to explore the propositions that were formulated.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter is concerned with the various methods that were used to obtain answers to the research questions and to achieve the research objectives. It describes the population selected for the study, the sampling scheme used and the research instruments employed to collect data from the respondents as well as the data analysis procedures utilized.

3.2 Research Design

The purpose for conducting research is often threefold and can be classified as exploratory, descriptive and explanatory. This research was mainly descriptive and exploratory in nature – descriptive as regards the objective of identifying OPD functions that require computerization; exploratory in terms of finding out benefits derived from and challenges associated with the implementation of information systems. There was also an explanatory aspect that sought to determine whether there was any association between benefits derived and outcomes achieved.

A multiple case study was adopted for this research. This approach helps to establish whether the findings of a first case occur in other cases and if there is need to generalize. They allow for comparison to be made regarding the outcomes. For this reason, it is argued that multiple case studies are preferable to single case studies (Yin, 2003 cited in Saunders *et al.*, 2007). Case studies can illuminate the general by looking at the particular, and so allow researchers to study in detail the relationship of individuals and small groups in their natural settings (Opoku-Amankwa, 2002).

3.3 Sample Population and Data Collection Methods

For the purposes of this research it was necessary to collect primary data in order to be able to answer the research questions that were posed.

3.3.1 Population and Sample

All research requires the selection of individuals who will provide the needed information. This set of individuals is called the sample (Remenyi *et al.*, 1991), and is selected from a chosen population.

The population chosen for this research comprised health facilities within the Kumasi Metropolis. A list, which formed the sampling frame, was obtained from the Kumasi Metro Health Directorate. Five health institutions were then selected from the list using purposive sampling technique. A sample size of 50 was then chosen from the selected health institutions.

These hospitals were selected purposively based on the following criteria:

3.3.2 The Cases

The five hospitals selected were:

- 1) The SDA Mission Hospital, Kwadaso under the Bantama Sub-metro.
- 2) The Aninwah Medical Centre situated at Emina in the Asokwa Sub-metro.
- 3) The KNUST Hospital of the Kwame Nkrumah University of Science and Technology.
- 4) The Kumasi South Hospital, located at Chirapatre, under the Asokwa Sub-metro.
- 5) The fifth institution is assigned the name "X Hospital" for the sake of anonymity.

These hospitals were selected purposively based on the following criteria:

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- The SDA Mission Hospital is private and is one of the health institutions within the metropolis that has implemented a Hospital Administration Management System (HAMS), which has been in use for the past five years. Their experience can give substantial insight into the achievements and challenges of implementing an Electronic Record System.
- The Aninwah Medical Centre is also private and was selected for the same reasons as above even though they have been using the software system for three years.
- The KNUST Hospital, being in the university environment and with the future goal of being transformed into a teaching hospital, becomes an important institution to be considered in this study.
- The Kumasi South Hospital is a public institution and has been designated as the Regional Hospital for Ashanti and therefore plays a key role. The findings from here would be significant as they are likely to reflect what may be happening in other public health institutions within the Kumasi District and can provide a basis for some generalizations to be made.
- The “X Hospital”, which is private, has been selected because patients’ records are kept only in electronic format and can provide a real example of using electronic medical records.

3.3.3 Methods of Data Collection

Mixed methods were adopted in the data collection process. Mixed methods of collecting data enable triangulation and lead to greater confidence in the conclusions (Saunders *et al.*, 2007). The methods used included structured and unstructured interviews, hospital visits, and observations. Unstructured interviews

were used with top management (administrators and directors) in order to obtain an in-depth opinion, since they are often the decision-makers. Many of these methods served as preliminary investigations, which helped in the design of the main data collection tool – a survey questionnaire.

3.3.4 Questionnaire Design

A questionnaire was designed for two different groups of respondents:

- Practitioners
- Non-practitioners

This was necessary so as to address specific issues pertinent to each group. Close-ended questions were adopted throughout the questionnaire except the part for the final comments, which was open-ended. Since health professionals are very busy people, the use of closed questions was considered appropriate. Closed questions are easier and quicker to answer, as they require minimal writing. Closed questions also facilitate comparison and statistical analysis (Saunders *et al.*, 2007). The questionnaires were first pilot-tested to ensure that the questions were addressing the key issues and to ascertain that the questions were soliciting the right responses. Where necessary, the questions were revised accordingly. The work of Remenyi *et al.* (1991) 'A Guide to Measuring and Managing IT Benefits' has been instrumental in shaping the design of the survey instrument adopted. Sample of questionnaires can be found in Appendix B.

3.3.5 Respondents

Fifty respondents were selected from the two categories practitioners and non-practitioners. The practitioners' group included doctors, medical assistants

nurses, pharmacists and laboratory technicians. The non-practitioners' group comprised medical record assistants, administrators, accounts clerks and IT managers. These respondents were all selected on the basis that they had the ability to supply the needed responses that were to provide answers to the research questions.

3.3.6 Mode of Administration

Questionnaires were hand-delivered to ensure that the exact respondent received the questionnaire. Some questionnaires were self-administered but where necessary others were interviewer-administered. Data was collected over a period of six weeks.

3.4 Data Management and Analysis

The responses from the questionnaires were coded in order to facilitate statistical analysis. The coded results were analyzed statistically using the SPSS 16.0 software. The results are presented with tables and charts and discussed in the subsequent chapter.

3.5 Duration of Research

The research was conducted between the months of January and May 2009.

CHAPTER FOUR

RESULTS, FINDINGS AND DISCUSSION

4.1 Introduction

The purpose of this chapter is to present the findings from the research. The findings are organised under the research objectives and propositions that were set at the beginning of the study. It also includes a discussion of the findings as to their implications and possible impacts for stakeholders. Even though a sample size of 50 was originally selected, the actual sample size was 44 due to non-responses. For list of respondents see Table 4.1.

Table 4.1 List of respondents

Medical Practitioners		Non-Practitioners	
Position Held	Freq.	Position Held	Freq.
Doctor	6	Statistician	3
Nurse	8	Administrator	4
Pharmacist	4	Medical Record Assistant	3
Medical Assistant	3	IT Manager	3
Lab Technician	3	Other	4
Medical Director	2	-	-
Biomedical Scientist	1	-	-
Total	27	Total	17

Source: Research Field Work

4.2 Research Objective 1: To Identify the Various Aspects of OPD Functions that Utilise ICT Applications to Effectively Manage Information.

This objective was achieved mainly by investigation through interviews, interrogations and observations. The results are subdivided into three:

- i. Computerised OPD functions
- ii. Existing software in use
- iii. Mode of record keeping

4.2.1 Computerised OPD Functions

In an interview with System Developers (Infotech) it was revealed that several functions of the OPD could be computerized to capture data at the various sections of the OPD. Data captured at the OPD can be categorized as shown in Table 4.2.

Table 4.2 Computerised OPD functions

Records Section	Unique ID number of patient Bio-data Demographic Data NHIS Status of Patient
Nurses' Desk	Vital Signs Height of patient Weight of patient Nurses Remarks and Interventions
Consulting Room	Patients' complaints Physical examinations performed Findings Management of Findings (Referral to Specialists, Lab test requests, X-ray, Ultrasound, Further investigations) Diagnosis Prescription Past Medical History (drugs taken, diagnosis, lab results etc.)
Dispensary	Drugs Prescriptions Inventory control
Revenue Section	Consultation fees Laboratory tests OPD card fee X-ray Ultrasound Cost of drugs supplied

Source: Researcher's field observation

These findings show that computerising OPD functions is feasible even in the Ghanaian context and that information generated about patient at the OPD from the point of entry at the records section through the consulting room to the point of exit

lends itself to computerisation. Computers can therefore become useful partners to healthcare staff by helping to manage the large volumes of data that health institutions have to process daily. The implication for healthcare professionals is that ICTs, when introduced, may revolutionize some aspects of their work processes and therefore the need to create awareness among health personnel regarding the changes that ICT would bring into the sector and what impacts it is likely to have. For IT experts, the situation presents opportunity to design systems that will support the needs of healthcare personnel. This area can become a fertile ground for business opportunities.

4.2.2 Existing Software

From researcher's investigations it was found that there is some existing software in use at the OPDs of the institutions studied. Examples of such software are:

- HAMS – Hospital Administration Management System is a customised software application with a wide range of features that include most of the functions listed in Table 4.2. It is an electronic medical record (EMR) software designed to network various aspects of the healthcare delivery process and to facilitate the flow and exchange of information within a health facility. HAMS was designed by alumni of KNUST.
- DHIMS – District Health Information Management System is a software designed for the Ghana Health Service to collate information from health institutions within the districts to facilitate reporting.
- EXCEL – A spreadsheet program.
- EPI INFO – A Data Management software.

- ORACLE – Database Management System used by the health institutions to ascertain the NHIS status of the patients.
- MEDICAL INFORMATION SYSTEM (MIS) – a customised software used to manage patient data.

Table 4.3 shows the software in use by the respective institutions.

Table 4.3 Existing software

	HAMS	EPI-INFO	ORACLE	DIHMS	MIS
Hospital X	√				
Aninwah Clinic (AN)	√				
Knust hospital (KN)		√	√		√
Kumasi South (KSH)			√	√	
SDA Hospital	√				

Source: Researcher’s field observation

Among the software in use, HAMS is the most comprehensive but the market would demand a wider range of choices to meet the varying needs of the sector.

4.2.3 Mode of Record Keeping

At the various OPDs of the institutions, it was observed that there were different modes of keeping patient information – either manually or electronically or both manually and electronically (see Table 4.4).

Table 4.4 Mode of record keeping by institution

	X	AN	KN	KSH	SDA
Demographics	e	b	b	m	b
Patient Complaint	e	b	m	m	b
Diagnosis	e	b	m	m	b
Doctors' Prescriptions	e	b	m	m	b
Dispensary Drugs	e	e	e	m	b
Billing	e	e	m	m	e
Lab Results	e	b	m	m	b

Source: Researcher's field observation

- m = manually
e = electronically
b = both manually and electronically

When respondents were asked how they kept patients' records, 6.8% indicated they kept records only electronically, 68.2% indicated they kept records both manually and electronically and 25% indicated they kept records only manually (see Table 4.5). The results above show a transition from the manual methods of record keeping to the electronic system. It can be deduced that majority of the health institutions in this study are aware of ICT as an indispensable tool for managing information and efforts are being made to shift to the electronic system.

Table 4.5 Mode of record keeping

Mode of Keeping Records	Freq.	Percent
Manual only	11	25.0
Electronic only	3	6.8
Both	30	68.2
Total	44	100.0

Source: Researcher's field work

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The fact that the dual system seems more prevalent may be because health institutions have had a long tradition of using paper records and are familiar with that system of working for years. The institution 'X', where records are kept only electronically, is barely a year old. It adopted the system right from the start without having to grapple with past tradition of paper records.

4.3 Research Objective 2: To Identify the Benefits Associated With the Use of Electronic Medical Record Systems at the OPD.

Respondents (medical practitioners and non-practitioners) were presented with a number of options and were required to indicate their agreement or disagreement as to the benefits they perceived their institutions derived from the use of electronic medical records. The responses that indicated strong agreement and agreement are grouped into the 'Agree Category' and the rest as 'Not Agree Category'.

4.3.1 Proposition 1: The Use of Electronic Medical Records (EMRs) at the Out-Patient Department Facilitates Retrieval of Patient Data.

Among medical practitioners who use EMRs, about 94% (50 strongly agree and 43.8% Agree) indicated that their institutions have derived the benefits of easy data-retrieval. All the non-practitioners were in total agreement (see Figures 4.1 & 4.2). Respondents from institutions that have not implemented an EMR indicated high optimism as regards an EMR potentially giving the benefits of easy data retrieval (see Figure 4.3 & 4.4).

Fig. 4.1 Easy Patient Data Retrieval (Medical Practitioners)

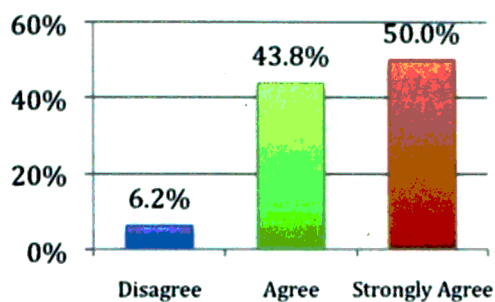


Fig. 4.2 Easy Patient Data Retrieval (Non Practitioners)

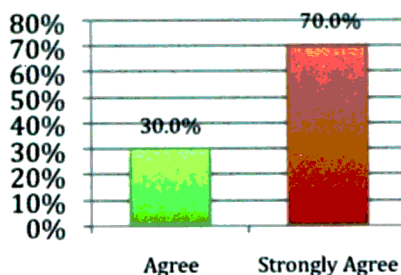


Fig. 4.3 Potential Benefits: Easy Patient Data Retrieval (Medical Practitioners)

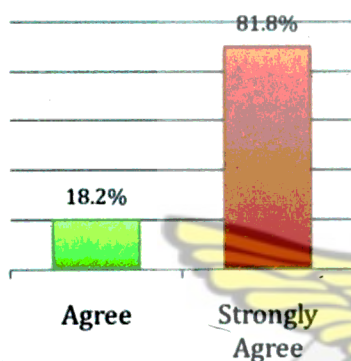
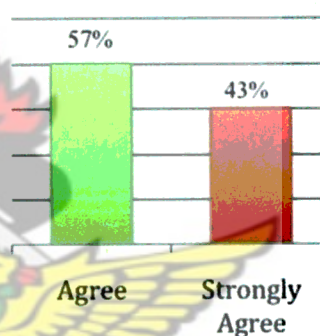


Fig. 4.4 Potential Benefits: Easy Patient Data Retrieval (Non Practitioners)



Source: Researcher's field work

One of the challenges of healthcare institutions as indicated earlier in the problem statement is their inability to promptly retrieve data – a situation that causes delays, inconveniences, and which can have cost implications for stakeholders. The results obtained show that electronic records are enabling health institutions to address and overcome this challenge. A system that makes information readily available to users would speed up work processes and enable informed decisions to be made resulting in better outcomes. The researcher witnessed a scenario in one of the institutions where a notorious patient for the n^{th} time came to the OPD without her ID card and for the n^{th} time was issued with a new folder. The doctor refused to attend to the patient who protested vehemently. The importance of past medical

history cannot be over-emphasised as it helps doctors make right judgments and decisions. Where electronic records are available, should patients forget or lose their ID cards their medical history would still be easily retrievable.

One doctor also commented that EMRs enabled him to track the drugs he has prescribed to his patients and it was important for him to know that he could easily retrieve that information at anytime. He adds, "Sooner or later patients are going to start suing doctors for the medications we give them". He wants to be ready should that happen. Thus even from a legal point of view it is beneficial to keep electronic records.

The fact that a database can easily be accessed and data retrieved poses elements of risk related to privacy, unauthorized disclosure, modification or destruction of data. In a multiuser system, users can sign on to the system and browse through files that belong to other users. It is also possible that an unauthorized user can log on, retrieve data or even modify it (Radlow, 1995). Organisations are therefore responsible to protect and to keep data secure. It requires that access to data be controlled and made available only to authorized users. In this regard, important lessons can be learnt from the banking industry, which has been largely successful in providing security in the area of electronic banking.

4.3.2 Proposition 2: The Use EMRs Enables the Flow and Exchange of

Information (Interoperability) Within the Various Sections of the OPD.

Among practitioners from institutions that have implemented EMR, 88% (69% agreed and 19% agreed strongly) indicated they achieved interoperability. All non-practitioners indicated they achieved interoperability (see Figures 4.5 & 4.6). Interoperability is the ability to exchange information electronically with other

Fig. 4.5 Interoperability (Medical Practitioners)

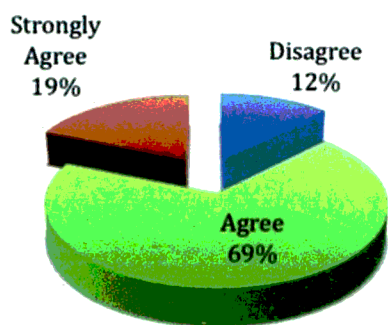
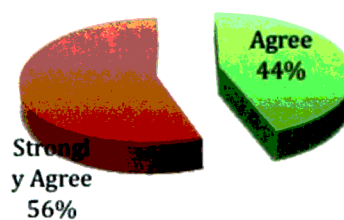


Fig. 4.6 Interoperability (Non Practitioners)



Source: Researcher's field work

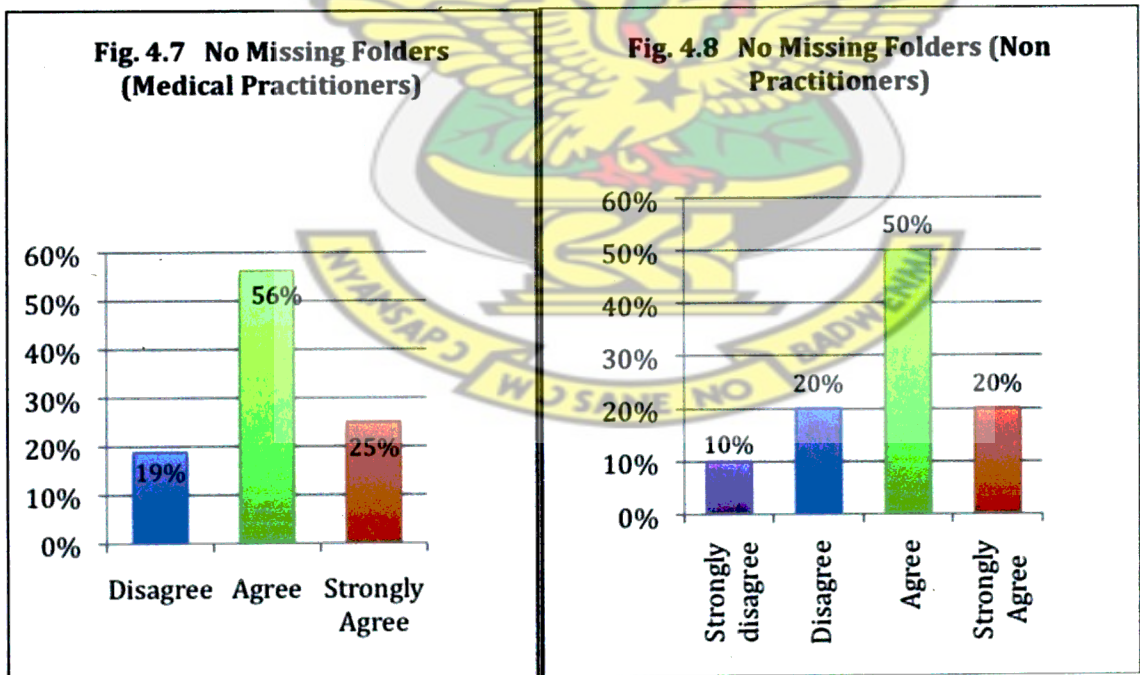
departments within a facility. Interoperability can be achieved when computers in different departments are networked and connected and everybody is using the system and communicating through it. The results indicate that in the institutions that have implemented EMR in this study, information flow and exchange was facilitated among the various OPD sections. Interoperability is also likely to improve planning and administrative processes. Through EMRs, administrators can have access to information from all the departments at a glance on the screen and be able to monitor performance of the various units. EMRs have also been found to facilitate reporting. All the respondents who were involved in writing reports for their organisations indicated that their use of a software system such as EMR has contributed to the speed of preparing quality reports.

When the use of electronic records is restricted to only some departments, interoperability cannot be achieved. For example the KNUST hypertensive clinic keeps records electronically but they are not networked and connected to other sections of the OPD. Connectivity allows users to communicate up, down, across, and out of an organization (McNurlin and Sprague Jr, 2006). Installing systems that are neither networked nor compatible cannot be expected to give the desired benefits

of interoperability. Interoperability must also be seen beyond a single facility. It is when different facilities are able to exchange information that the problem of fragmentation will be addressed. Thus it is necessary for institutions to adopt a long-term view towards EMR implementation, to guarantee that systems are interoperable.

4.3.3 Proposition 3: The Use of EMRs at the OPD Helps Eliminate the Problem of Missing Folders.

Among medical practitioners, 81% (25% + 56%) of EMR users indicated that it has helped eliminate the problem of missing folders while 19% disagreed. Among non-practitioners with EMR, 70% (20% agreed strongly and 50% agreed) indicated that EMRs have helped eliminate the problem of missing folders while 30% disagreed. (see Figures 4.7 & 4.8).



Source: Researcher’s field work

It can be deduced that folders can still get missing even when EMRs have been implemented as in the case of institutions that still use the paper records

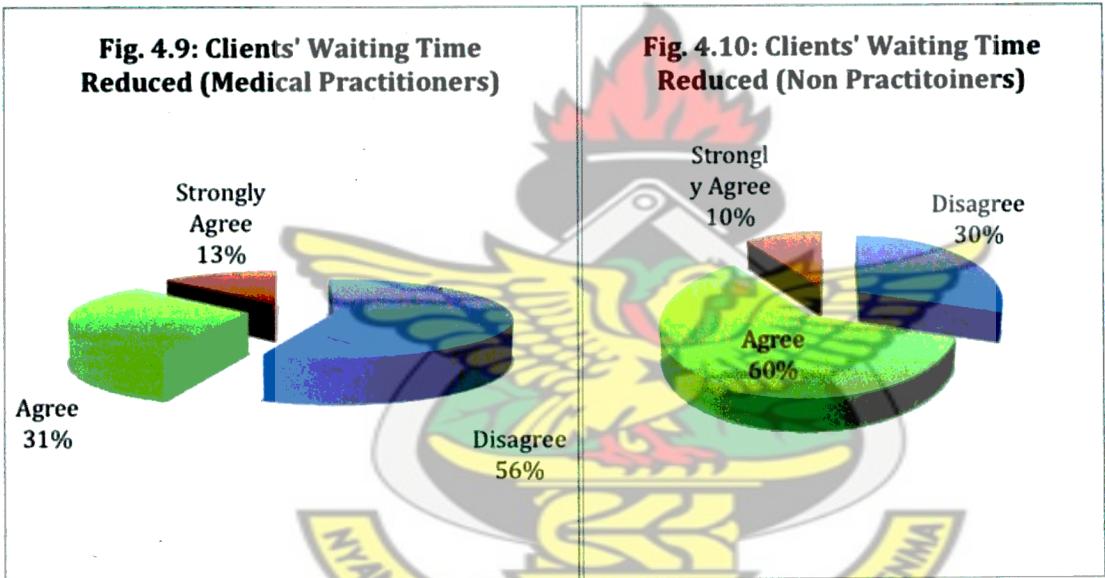
alongside the EMR (the dual system). Folders can still be misfiled or misplaced unless a very rigorous filing system is put in place. The positive side though is that once an electronic record exists, if a paper folder is missing, one can always make printouts from the electronic system. Effectively though, only institutions that exclusively use electronic records can totally eliminate the problem of missing folders. It can also be argued that not only paper records get missing or lost but that files on electronic formats also face the risk of getting lost or damaged either through computer crashes, system failures or virus infections. Hence it is necessary to have a backup system put in place to ensure that records are kept intact and protected.

4.3.4 Proposition 4: Errors are Minimised when Electronic Medical Records are Kept.

Sixty-six percent (20% & 46%) of medical practitioners indicated that EMR use contributed to reducing errors. Among non-practitioners 78% indicated the same (see Figures A.1 & A.2 in Appendix A). When managing large volumes of data it is obvious that computers are more efficient than humans. However it must be noted that computers process whatever input is given them. Thus GIGO (Garbage In, Garbage Out) still holds. If the data that is captured is invalid or if there is a programming error, the automated system will reproduce invalid information. Data quality, especially accuracy, needs to be assured. As was noted, quality information has to be accurate, relevant and complete so as to support evidence-based practice and good decision- making. It must also be noted that the judgment of a qualified professional should always have precedence because computers are only tools to assist professionals do better what they already do and are not meant to replace or de-skill them.

4.3.5 Proposition 5: The Use of Electronic Medical Records at the OPD Reduces Clients' Waiting Time.

Among practitioners with EMR 56% did not consider that EMR reduced clients' waiting time whereas 70% of non-practitioners indicated agreement (see Figure 4.9 & 4.10). These results may be explained by the fact that when practitioners have to key in data at the consulting room, the consulting process can become longer. In fact 36.4% of practitioners indicated that data entry slowed down the consulting process and 54.5% admitted that data entry doubled their work volume and for this reason, they did not enter data themselves (see Table 4.6).



Source: Researcher's field work

Table 4.6 Reasons for not entering Data (Medical Practitioners)

Which of the following apply to you?	Frequency	Valid Percent
I do not consider data entry my job	1	9.1
Data entry doubles my work volume	6	54.5
I do not enter data myself, it slows down the process	4	36.4
Total	11	100

Source: Researcher's field work

Poissant *et al.* (2005), in a review paper highlighted that a goal of decreased documentation time by physicians in EHR projects is not likely to be realized. The explanation being that physicians rarely use standardized templates to write their clinical notes and this can lead to increased documentation time. Non-practitioners (70%) however, indicated that clients' waiting time is reduced with EMR use. It can be deduced that because non-practitioners deal more with standardized and repetitive procedures and tasks (e.g. paying of bills or locating a patient's file), it is possible that they are able to achieve time savings as a result of specialisation setting in. Poissant *et al.* (ibid) suggest that the focus on time efficiency should be oriented toward the overall processes of care delivery rather than toward the potential time gains in performing specific activities.

4.4 Research Objective 3: To Find Out the Barriers and Challenges Involved in Getting Information Management Systems Implemented at the OPD Within the Ghanaian Context.

4.4.1 Proposition 6: Organisational Culture and a Lack of IT Policy, Software and Hardware Cost as Well as Participation from Doctors and Nurses Constitute Barriers to Adopting Electronic Medical Records System.

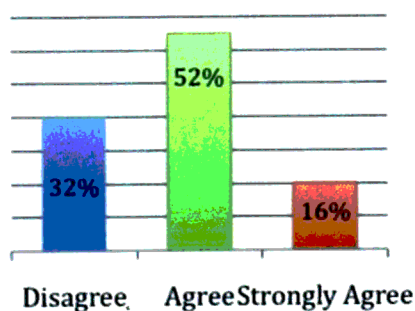
A list of barriers was identified and presented to respondents to indicate agreement or disagreement. The list included software cost, hardware cost, organisational culture, personnel cost, doctors' participation, nurses' participation and a lack of IT policy. As before the responses that indicated strong agreement and agreement are grouped into the 'Agree Category' and likewise the 'Not Agree Category'.

Organisational Culture and Lack of IT Policy

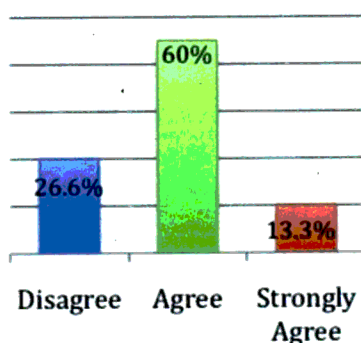
Among medical practitioners and non-practitioners 68% and 73% respectively, considered organisational culture as a barrier to adopting EMRs (see Figures 4.11 & 4.12). A lack of IT policy was also considered a barrier by 72% of medical practitioners and 44% of non-practitioners (see Figures 4.13 & 4.14).

Employees are usually so much accustomed to particular ways of doing things that naturally change can become a challenge. It is a most difficult task to unlearn old habits that have been formed over many years and re-learn new ones. Introducing IT involves change at the organizational level and as with most change processes, it may prove uncomfortable and threatening to some and consequently will tend to be resisted. Lapointe and Rivard (2006) in their case studies reported of varying degrees of resistance, divisiveness and contention during the introduction of an EMR system in some three hospitals. The change to an electronic system would require users to undergo a cultural transformation process because user participation is critical to any successful implementation of IT applications. Leadership and management's role becomes absolutely necessary in providing the right structures in order to encourage change in the desired direction.

**Fig. 4.11 Barriers: Org. Culture
(Medical Practitioners)**



**Fig. 4.12 Barriers: Org. Culture
(Non Practitioners)**



Source: Researcher's field work

Fig. 4.13 Barriers: Lack of an IT Policy (Medical Practitioners)

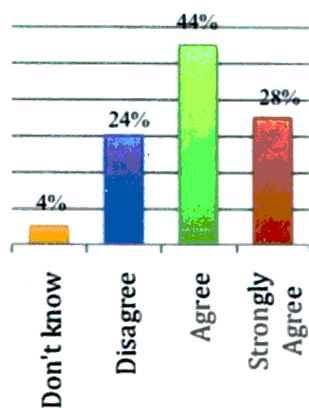
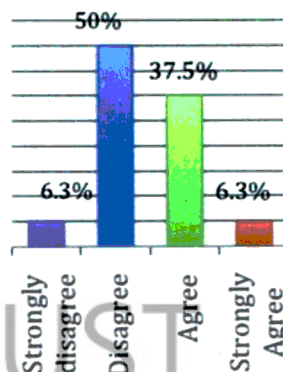


Fig. 4.14 Barriers: Lack of an IT Policy (Non Practitioners)



Source: Researcher's field work

With reference to IT policy, where an IT Policy is lacking, no financial commitment will be made. Policies however, when made, should not remain at the policy level. They must be carried forward and implemented. As mentioned in the introductory chapter, Ghana has had an ICT Policy for health since 1998, and provision was to be made for health institutions to keep records electronically (IICD, 2003). It will be necessary therefore for Government to play a visionary role in the transformation that is required as well as give a strategic direction.

Software/Hardware Costs

Among medical practitioners and non-practitioners 40% (36+4) and 66% (53+13) respectively indicated that software cost was a barrier. As regards hardware costs, 48% and 63% respectively indicated that hardware was a barrier (see Figures 4.15 - 4.18). More non-practitioners than medical practitioners indicated that software and hardware costs constituted barriers to adoption.

Fig. 4.15 Barriers: Software Cost (Medical Practitioners)

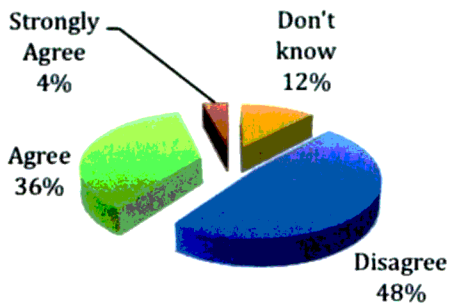
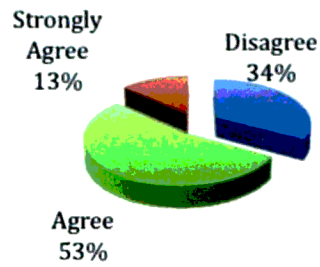


Fig. 4.16 Barriers: Software Cost (Non Practitioners)



Source: Researcher's field work

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Fig. 4.17 Barriers: Hardware Cost (Medical Practitioners)

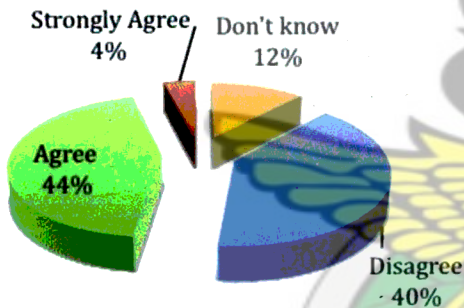
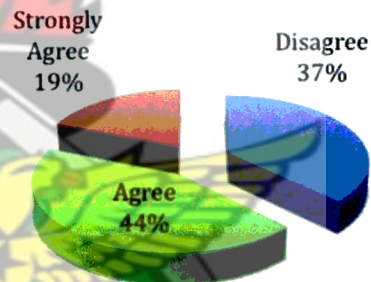


Fig. 4.18 Barriers: Hardware Cost (Non Practitioners)



Source: Researcher's field work

The fact that a percentage of medical practitioners (12%) did not know whether software or hardware cost constituted a barrier may suggest a lack of knowledge on their part when it comes to cost issues seeing that their daily interactions are mainly in clinical activities. Installing EMRs does involve initial capital layout and can prove to be a barrier.

Infrastructure, hardware, software, installation and maintenance of the system on one hand and operating, training and hiring staff on the other hand, contribute to

high costs that may be unaffordable for the limited funding provided for health sectors (Khalil and Jones, 2007). It is true that prices of computers especially hardware, are plunging, as compared to some years back, making computers now affordable for most people.

Another consideration is that by not implementing an EMR system, institutions may be incurring costs other than monetary costs e.g. less productivity, poorer quality of service, etc. Assuming that ten people are employed to keep records, the accumulated salaries of those employees over a period of say two years, may be more than enough to acquire a set of hardware and software system. If such a system enhances work processes by making them easier and faster with less human resource then it can become more profitable. It is therefore necessary to carry out a cost-benefit analysis to ascertain the validity of the notion that software/hardware cost is a barrier. This may be true for small hospitals but questionable for large ones.

Doctors' And Nurses' Participation

Among practitioners, more than half (52%) disagreed that participation from doctors' was a barrier and 60% disagreed about nurses' participation. However among non-practitioners, 67% considered doctors' and nurses' participation to be a barrier to EMR adoption (see Figure 4.19 - 4.22).

Majority of non-practitioners considered medical practitioners' participation to be a barrier to EMR adoption. Majority of medical practitioners however disagreed. The results could be indicating some level of antagonism among health professionals even though they work as a team. As noted, the healthcare environment is quite complex in nature. The view of the non-practitioners can be supported by the fact that practitioners' main tasks are patient-oriented and majority of their time is

spent providing direct care to patients. They may therefore be reluctant to do anything that interferes with the professional-patient relationship (Royal Society, 2006).

Fig. 4.19 Barriers: Doctors' Participation (Medical Practitioners)

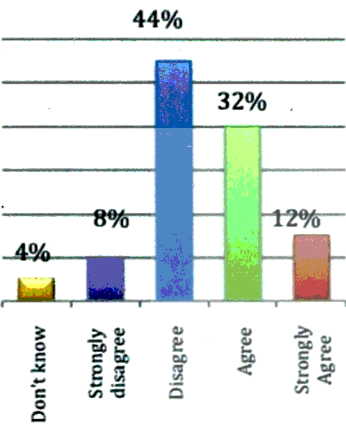


Fig. 4.20 Barriers: Doctors' Participation (Non Practitioners)

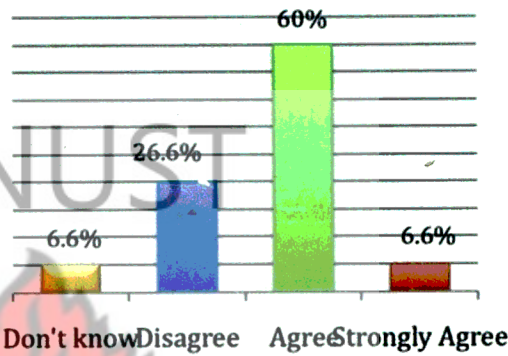


Fig. 4.21 Barriers: Nurses' Participation (Medical Practitioners)

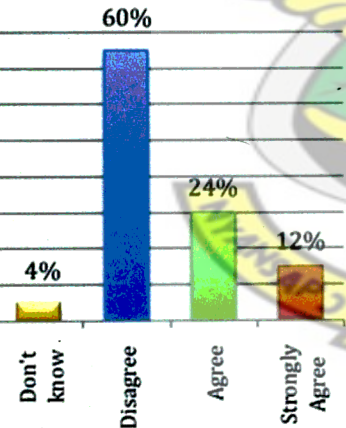
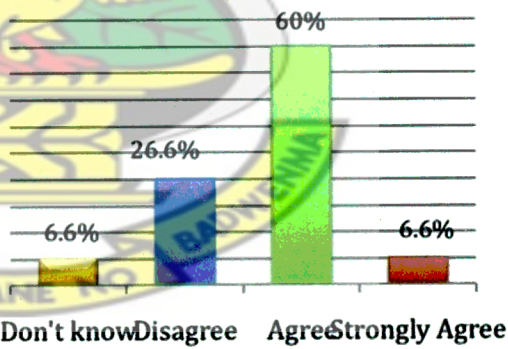


Fig. 4.22 Barriers: Nurses' Participation (Non Practitioners)

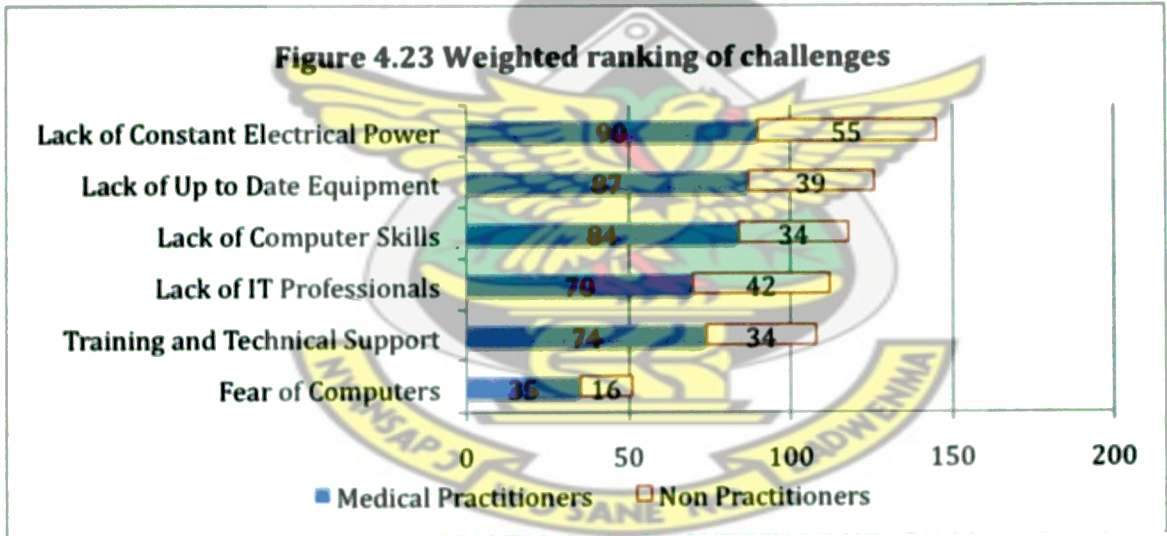


Source: researcher's field work

Another reason in support may be linked to the earlier point given that increased documentation time can discourage doctors from using the system (Poissant *et al.*, 2005). It is necessary that user-friendly systems be created to facilitate practitioners' documentation process so that they will be encouraged to use them.

4.4.2 Proposition 7: A Lack of Up-to-date Computer Equipment, Lack of Computer Skills, the Fear of Computers, Training and Technical Support, Lack of IT Professionals and a Lack of Constant Supply of Electricity Constitute Challenges to the Use of Electronic Medical Records System.

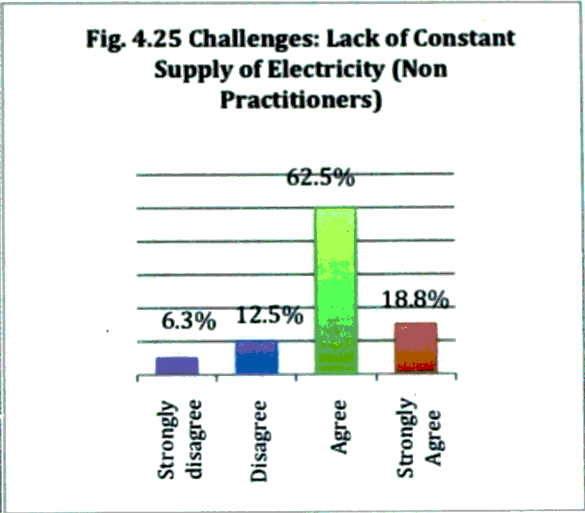
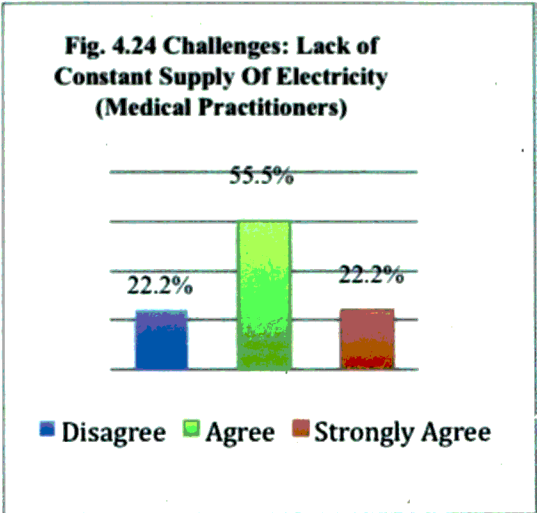
A number of challenges were identified and presented for respondents to indicate their agreement or disagreement as to whether they constituted challenges to adopting ICT applications. The list included lack of skills, lack of training and support, lack of up-to-date computer equipment, lack of constant supply of electricity, lack of IT professionals and fear of computers. The chart below (Figure 4.23) shows the ranking (by weight) of the challenges as perceived by the respondents.



Source: Researcher’s field calculation

Lack of constant supply of electricity

Lack of constant supply of electricity was considered by respondents to be the greatest challenge. Seventy-eight percent (22+56) of medical practitioners and 82% (19+63) of non-practitioners respectively indicated lack of constant supply of electricity as a challenge (see Figures 4.24 & 4.25). Computers run on electricity and

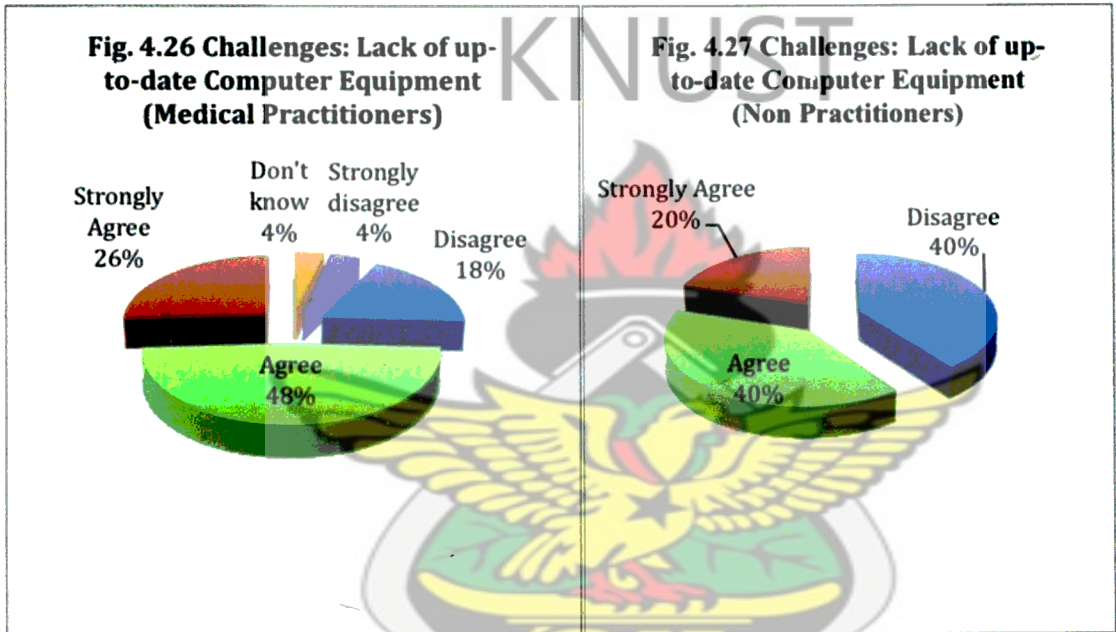


Source: researcher’s field work

so it is understandable that frequent power cuts and fluctuations interrupt smooth running of programs and can even cause damage to equipment. In a hospital where only electronic records are kept, it is important that systems are available for use all the time because not having information available might in some cases jeopardize patient safety. It must be for such reasons that some institutions continue to use the dual system. When there is a power cut, they can record on paper and data can be keyed in at a later time. This approach has the associated risk of data being incomplete or inaccurate unless those keying in data are well trained and meticulous. Littlejohns *et al.* (2003) reported about an EMR implementation in the Limpopo Province of South Africa that had infrastructure problems like unreliable power and damaging power surges. Power supply issues seem to be typical to the African context. For this reason, most institutions are obliged to have standby generators to cater for this problem. Whatever the case, solutions that are more environmentally friendly are required as generators are noisy and pollute the air besides being expensive to run.

Lack of up-to-date computer equipment

Among medical practitioners 64% (48 & 26%) indicated that lack of up-to-date computer equipment was a challenge; among non-practitioners 60% also indicated lack of up-to-date computer equipment as a challenge (see Figures 4.26 & 4.27). This challenge ranked second after power supply. The use of outdated or obsolete computers can make work slow and frustrating. It is important to provide users with current and updated equipment so as to make their work more enjoyable



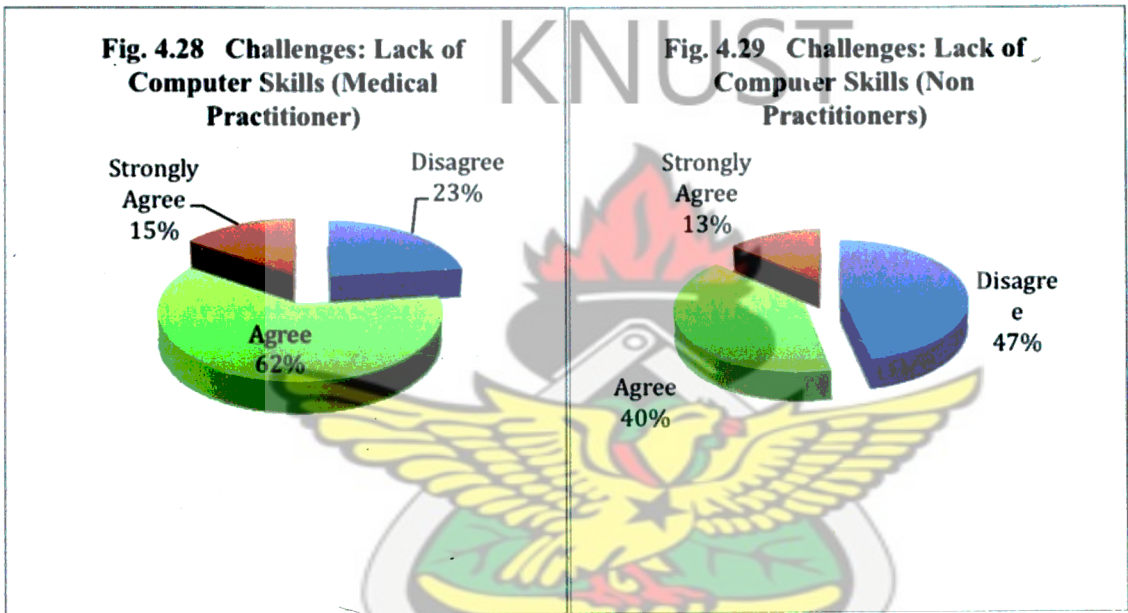
Source: researcher’s field work

and fast. Thankfully, technological advancement today has made the processing speed of computers very powerful as a way of keeping in step with the rate at which information is growing.

Lack of computer skills

Among medical practitioners, 77% indicated that lack of computer skills was a challenge and 53% of non-practitioners indicated lack of skills was a challenge (see Figures 4.28 & 4.29). Skills need to be built and improved and they require both

financial and human resources. In order to optimize the use of systems and derive maximum benefits the users must possess the skills to effectively operate the systems. If users are slow and incompetent it will certainly detract from the potential benefits. The fact that such a large proportion of practitioners felt lack of skills was a challenge may be an indication that practitioners may lack skills and may require additional training.



Source: researcher’s field work

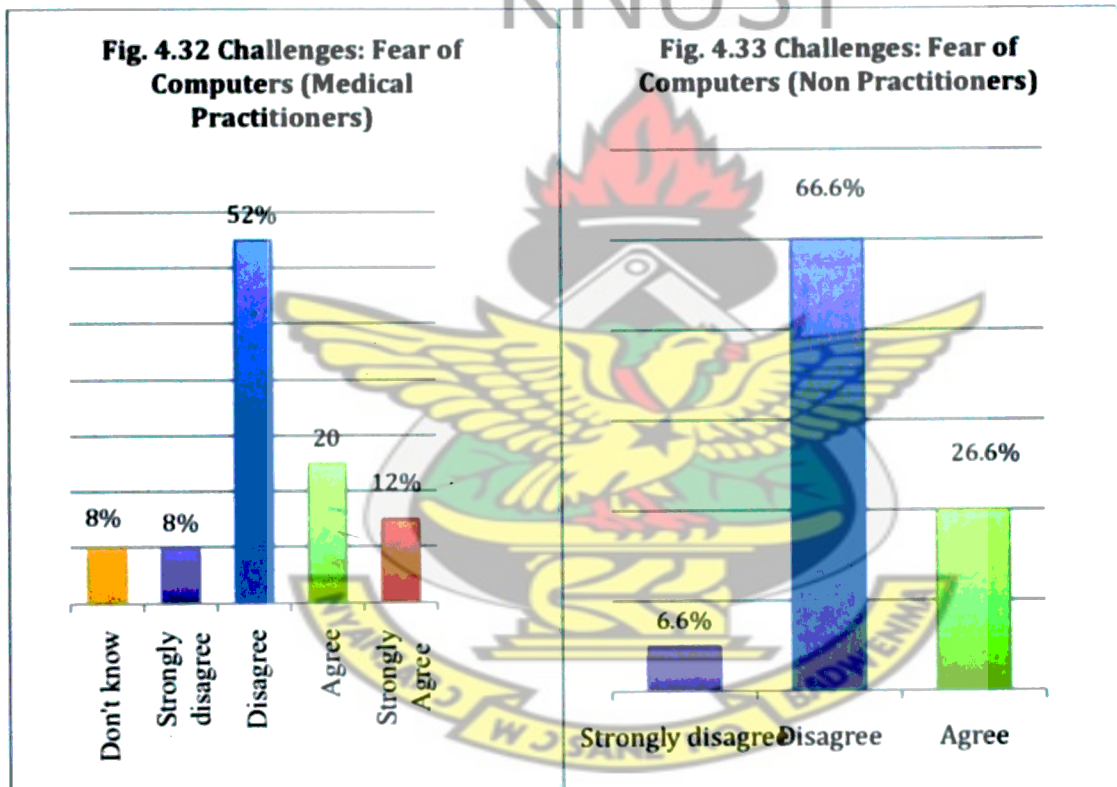
Lack of IT professionals

As regards lack of IT professionals more than 60% percent of respondents indicated that lack of IT professionals was a challenge (see Figures A.3 & A.4 in Appendix A). There is need for IT expertise to provide the necessary support to hospital staff in case of difficulties. There are certain problems that go beyond the users’ ability to resolve and require the intervention of professionals. Problems can come up in network, hardware and software and they come unannounced but need to be resolved. In order to avoid disruptions in workflow, it is necessary to have a

an understanding of the peculiar challenges health professionals face, will enable IT experts to design tailor-made, user-friendly systems for the health personnel whose work must be made as simple and straightforward as possible.

Fear of Computers

Among medical practitioners only 32% indicated that fear of computers was a challenge; among non-practitioners only 27% agreed that fear of computers was a challenge (see Figures 4.32 & 4.33). Majority did not think that fear was a challenge.



Source: researcher's field work

Though we live in an IT-driven world and many young people have the flair for computers, there may be a few people with an aversion for technology. Fear is a handicap that can cripple the victim preventing an individual from attaining a desired goal. Fear however can be overcome when handled carefully even though for some people it would require an extra effort. Such cases call for an understanding of the exact areas that cause frustration to users and providing the appropriate help.

4.5 Proposition 8: The Benefits of Easy Retrieval of Patient Data and

Interoperability Will Enable Institutions Achieve Efficiency, Effectiveness, Job Satisfaction, and Bring About Innovation in the Work Environment.

This section presents bi-variate analysis (cross tabulations) aimed at identifying the existence of associations between benefits of EMR and outcomes of interest. Descriptive analysis indicated that EMRs were most useful in terms of making it easier to access patients' records once they have been filed (easy retrieval of patient data). Moreover, they enable communication across departments, sectors and facilities (interoperability).

In order to verify whether the two variables had any association with outcomes, 'easy retrieval of patient data' and 'interoperability' were cross-tabulated with each of the four outcomes – efficiency, effectiveness, innovation and job satisfaction. Answers to these questions were obtained only from respondents who indicated to have implemented EMR. Again, the five possible responses were grouped into two categories, namely 'Agree' (for those who chose 'Agree strongly' or 'Agree') and 'Not Agree' (those who chose 'Disagree strongly', 'Disagree' or 'Don't know').

4.5.1 Easy Retrieval of Patient Data vs Outcomes

Almost all respondents who used EMRs had said that easy retrieval was a benefit. Approximately 92% of them also said they had achieved efficiency. The p-value was 0.006, indicating that there is a significant relationship between ease of patient data retrieval and efficiency. It can be concluded that 99.4% of the time the relationship between ease of data retrieval and efficiency cannot be explained by chance factors alone (see Table 4.7). Majority of them also said they achieved

effectiveness, innovation and job satisfaction. As shown in Tables 4.8, 4.9 and 4.10, there is more than 95% certainty that ease of patient data retrieval is associated with effectiveness and job satisfaction (p-value of 0.001) as well as innovation (p-value of 0.019).

Easy retrieval enables time savings (delays are minimised), makes the performance of tasks easier and faster, meaning that workers require less effort to retrieve data as opposed to going through dusty heaps of physical paper files to accomplish tasks. Timely, accurate information is readily available, enabling quick and informed decision-making, and possibly, better outcomes.

Table 4.7 Crosstab of easy retrieval by efficiency

			Efficiency		Total
			Not Agree	Agree	
Easy Retrieval	Not Agree	Count	1	0	1
		%	100.00%	0.00%	100.00%
	Agree	Count	2	22	24
		%	8.30%	91.70%	100.00%
Total	Count	3	22	25	
	%	12.00%	88.00%	100.00%	

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	7.639	0.006

Source: Researcher’s field work

Table 4.8 Crosstab of easy retrieval by effectiveness

			Effectiveness		Total
			Not Agree	Agree	
Easy Retrieval	Not Agree	Count	1	0	1
		%	100.00%	0.00%	100.00%
	Agree	Count	1	23	24
		%	4.20%	95.80%	100.00%
Total		Count	2	23	25
		%	8.00%	92.00%	100.00%

Pearson’s Chi-Square		11.979
Asymp. Sig. (2-sided)		0.001

Source: Researcher’s field work

Table 4.9 Crosstab of easy retrieval by innovation

			Innovation		Total
			Not Agree	Agree	
Easy Retrieval	Not Agree	Count	1	0	1
		%	100.00%	0.00%	100.00%
	Agree	Count	3	21	24
		%	12.50%	87.50%	100.00%
Total		Count	4	21	25
		%	16.00%	84.00%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.469	0.019

Source: Researcher's field work

Table 4.10 Crosstab of easy retrieval by job satisfaction

			Job Satisfaction		Total
			Not Agree	Agree	
Easy Retrieval	Not Agree	Count	1	0	1
		%	100.00%	0.00%	100.00%
	Agree	Count	1	23	24
		%	4.20%	95.80%	100.00%
Total		Count	2	23	25
		%	8.00%	92.00%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	11.979	0.001

Source: Researcher's field work

4.5.2 Mode of Record Keeping vs Ease of Generating Patient Lists by

Categories

There is a significant association between the mode of record keeping and ease of generating lists by lab results (p-value of 0.000). The results presented in table 4.11 show that among those who use both manual and electronic records in parallel (dual system), 70% found it easy to compile a list of patients by lab results. Among those who keep records only manually, about 91% found it difficult to generate a list of patients by lab results (see Table 4.11). The analysis of findings showed that the

mode of record keeping had significant associations with ease of generating lists by age group, by medication and by diagnosis (see Tables 4.12 - 4.14). It can be deduced that keeping electronic records facilitates categorisation of data.

Table 4.11 Crosstab of mode of record keeping vs lists by lab results

			List by Lab Results			Total
			Cannot generate	Difficult	Easy	
Mode of Patient Record	Manual only	Count %	0 0.00%	10 90.90%	1 9.10%	11 100.00%
	Electronic only	Count %	1 33.30%	0 0.00%	2 66.70%	3 100.00%
	Both	Count %	5 16.70%	4 13.30%	21 70.00%	30 100.00%
Total		Count %	6 13.60%	14 31.80%	24 54.50%	44 100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.436E1	0.000

Source: Researcher’s field work

Table 4.12 Mode of Patient Record * List by Age group Crosstab

Mode of Patient Record		List by Age group			Total
		Cannot generate	Difficult	Easy	
Manual only	Count	0	5	6	11
	%	0.00%	45.50%	54.50%	100.00%
Electronic only	Count	0	1	2	3
	%	0.00%	33.30%	66.70%	100.00%
Both	Count	3	1	23	27
	%	11.10%	3.70%	85.20%	100.00%
Total		Count	3	7	31
		%	7.30%	17.10%	75.60%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.104E1	0.026

Source: Researcher’s field work

Table 4.13 Mode of Patient Record * List by Diagnosis Crosstab

Mode of Patient Record		List by Diagnosis			Total
		Cannot generate	Difficult	Easy	
Manual only	Count	0	9	2	11
	%	0.0	81.8	18.2%	100.0%
Electronic only	Count	1	0	2	3
	%	33.3%	0.0%	66.7%	100.0%
Both	Count	3	5	21	29
	%	10.3%	17.2%	72.4%	100.0%
Total	Count	4	14	25	43
	%	9.3%	32.6%	58.1%	100.0%

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	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.826E1	0.001

Source: Researcher's field work

Table 4.14 Mode of Patient Record * List by Medication Crosstab

			Gener List by Medicin N/D/E			Total
			Cannot generate	Difficult	Easy	
Mode of Patient Record M/E/B	Manual only	Count	2	6	3	11
		%	18.20%	54.50%	27.30%	100.00%
	Electronic only	Count	1	1	1	3
		%	33.30%	33.30%	33.30%	100.00%
	Both	Count	5	3	21	29
		%	17.20%	10.30%	72.40%	100.00%
Total	Count		8	10	25	43
	%		18.60%	23.30%	58.10%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.036E1	0.035

Source: Researcher's field work

4.5.3 Interoperability vs Outcomes

The ability to exchange information among separate sections of the health facility was expected to enhance speed (efficiency) and quality (effectiveness) of work at all levels, as well as promote new ways of working (innovation) and increase job satisfaction among the staff. The following tables present the results of the analysis (see Tables 4.15 - 4.18).

Only two respondents out of 25 felt that the use of EMR did not enable exchange of information between sections. Among the remaining 23, approximately

Table 4.15 Crosstab of interoperability by efficiency

			Efficiency		Total
			Not Agree	Agree	
Interoperability	Not Agree	Count	1	1	2
		%	50.00%	50.00%	100.00%
	Agree	Count	2	21	23
		%	8.70%	91.30%	100.00%
Total		Count	3	22	25
		%	12.00%	88.00%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	2.973	0.085

Source: Researcher’s field work

Table 4.16 Crosstab of interoperability by effectiveness

			Effectiveness		Total
			Not Agree	Agree	
Interoperability	Not Agree	Count	1	1	2
		%	50.00%	50.00%	100.00%
	Agree	Count	1	22	23
		%	4.30%	95.70%	100.00%
Total		Count	2	23	25
		%	8.00%	92.00%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.210	0.022

Source: Researcher’s field work

Table 4.17 Crosstab of interoperability by innovation

			Innovation		Total
			Not Agree	Agree	
Interoperability	Not Agree	Count	1	1	2
		%	50.00%	50.00%	100.00%
	Agree	Count	3	20	23
		%	13.00%	87.00%	100.00%
Total		Count	4	21	25
		%	16.00%	84.00%	100.00%

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	1.870	0.171

Source: Researcher's field work

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Table 4.18 Crosstab of interoperability by job satisfaction

			Job Satisfaction		Total
			Not Agree	Agree	
Interoperability	Not Agree	Count	1	1	2
		%	50.00%	50.00%	100.00%
	Agree	Count	1	22	23
		%	4.30%	95.70%	100.00%
Total	Count	2	23	25	
	%	8.00%	92.00%	100.00%	

	Value	Asymp. Sig. (2-sided)
Pearson Chi-Square	5.210	0.022

Source: Researcher's field work

91% agreed when asked if interoperability helped work faster or achieve more within a specified time period. The p-value of 0.085 indicates that the relationship between interoperability and efficiency is significant at a 90% level of certainty. Ninety percent of the time interoperability should result in enhanced efficiency. The reason for not being significant at 95% may be because not everyone is using the system the way it ought to be used, perhaps due to inadequate skills, resulting in communication gaps.

Among those who saw interoperability as a benefit of EMR, almost 96% also felt it resulted in better quality of work. The association between interoperability and effectiveness is significant at a 95% level of certainty, with a p-value of 0.022. These results were very similar for the relationship with job satisfaction. The achievement of effectiveness usually brings a sense of accomplishment so there may be a correlation between effectiveness and job satisfaction. Innovation was not found to be significantly associated with interoperability - p-value of 0.171. (See Tables 4.17 and 4.18)

This ends the findings, results and discussion chapter.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

A summary of the findings, conclusions and recommendations are presented in this final chapter.

5.2 Summary

Most aspects of the OPD functions that generate patient data were found to be easily computerised. A comprehensive EMR software, HAMS, is used by some of the institutions even though not all its features are utilised. Majority of the institutions studied use the electronic system alongside the manual records (dual system).

Easy retrieval of patient data and interoperability were found to be major benefits derived by the institutions that used electronic medical records. The benefit of easy retrieval was found to have significant associations with outcomes such as efficiency, effectiveness, job satisfaction and innovation. Interoperability also had a significant relationship with effectiveness and job satisfaction.

Significant associations were also identified between the mode of record keeping and the ease of categorising data. Those who kept records manually found it more difficult to generate categorised data, whereas those who kept electronic records alongside the manual (dual system), found it easier to categorise data about patients. Other benefits derived as indicated by respondents who used EMRs included reduced errors and elimination of the problem of missing folders. Contrary to expectation, majority of medical practitioners did not consider that EMRs would reduce clients' waiting time. Non-practitioners however, thought otherwise.

The study also revealed that there are a number of barriers and challenges involved in the adoption of EMRs. Organisational culture and a lack of IT policy were the main barriers indicated by respondents. Non-practitioners considered doctors' and nurses' participation as a barrier to an EMR project. Software and hardware costs were also identified as barriers.

Lack of constant supply of electricity and lack of up-to-date computer equipment ranked highest in the list of challenges. Other challenges identified were lack of computer skills, lack of IT professionals, lack of training and technical support. A minority indicated that fear of computers was a challenge.

5.3 Conclusions

Since the introduction of the NHIS, hospital attendance rates have increased, placing high demands on the health facilities available within the Kumasi Metropolis. One particular area of challenge that has been identified in this study is the need for health institutions to manage patient related information in an effective manner. The propositions formulated in the study have largely been confirmed. ICT has potential to help health institutions improve on their information management systems. Based on these observations, it is deemed appropriate that health institutions exploit the possibilities offered by this all-important technology so as to derive maximum benefits that lead to better outcomes.

Obviously there are challenges that must be addressed. This requires the involvement of all stakeholders (medical and non-medical practitioners, IT experts, training institutions, patients and the Government). The Government's role is important especially in our system of healthcare where the state, through the National Health Insurance Scheme, is the main payer and provider of healthcare. Government

is also the main policy formulator as is evidenced by Ghana's ICT policy document. ICT projects also require high initial capital layout. Thus careful planning and resource allocation cannot be underestimated.

Technology and skill must go hand in hand because technology requires the acquisition of necessary skills to be able to use them effectively. Technology also requires a stable energy source in order to guarantee its smooth running. Seeing the power situation in Ghana, it becomes necessary that alternative sources of energy be explored. The benefits offered by ICT are enormous, yet as is often the case with most good things, there can be downsides. ICT use comes along with certain elements of risk but steps have to be taken to minimize them.

There is the need to emphasise the establishment of standards and regulations. Standard forms of keeping information enhance information exchange particularly in today's globally interconnected world. Ultimately various countries could actually be networked and exchange health information which is vital to meeting our development goals. It is also important to establish regulations that guide the use of the electronic systems. Easy access to information should not become an excuse to violate privacy and confidentiality. Ethical standards must be upheld and those who misuse the systems need to be held accountable. Prolonged use of computers is known to create health hazards, especially causing damage to eyesight. Users should therefore be protected so that the attempt to solve one problem does not generate another.

In the light of the findings that ICT offers substantial benefits in the management of information, and seeing the important role information plays in the decision making process of healthcare delivery, it is imperative that ICT applications especially electronic medical record systems, be integrated and incorporated into the

routine functions of out-patient departments (OPD) of healthcare institutions. The following recommendations are therefore proposed in order to address the challenges that are associated with the adoption of IT applications in the healthcare sector.

5.4 Recommendations

- It is recommended that training workshops be organized to educate healthcare professionals in the uses of healthcare ICT. Exposure and awareness creation can be achieved through demonstration workshops and trial versions being made available to experiment with.
- Close collaboration between IT experts and practitioners is recommended so that practice will inform technology and vice versa.
- It is also recommended that health informatics be introduced as a discipline in our training institutions. For example at the School of Medical Sciences or in the Computer Engineering Department as an area of specialisation.
- It is recommended that access to information be controlled and managed effectively to ensure data security by giving passwords to authorized users only and by making use of information encryption.
- It is recommended that decision-makers formulate policies that provide the structures for implementation of EMRs in their institution. They should ensure that staff be educated before any change is initiated.
- It is recommended that early implementers share their experience with prospective ones so they can benefit by avoiding past mistakes.
- It is recommended that Government play a supporting role by investing in healthcare ICT, especially since ICT is now high on its agenda as the key to national development.

- It is recommended that healthcare professionals enter data as much as possible in real time rather than periodically so as to ensure accuracy and timeliness of information.
- It is recommended that periodic audits be conducted so as to replace obsolete and outdated equipment with updated ones.
- It is recommended to explore other techniques of documentation, for example a touch screen, voice recognition or using the stylo pen that transcribes directly into the computer rather than the use of a mouse.
- It is recommended that OPDs implement electronic medical record systems for the management of information within their facilities.
- It is recommended that institutions intending to implement EMRs consult with system developers to ensure that systems are compatible and can be networked in order to achieve interoperability.
- It is recommended that the technical characteristics of the systems be upgraded periodically and antivirus software be updated regularly.
- It is recommended that software applications be made more user-friendly by incorporating value-added functions like automated reports, prompts and alerts.
- It is recommended that EMR users regularly provide backup systems to guard against loss of data.
- It is recommended to explore alternative sources of power supply, for example solar or wind power generation.
- Further research is recommended to find out from patients what direct impacts the use of EMR is having on them.

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APPENDICES

Appendix A

Fig. A.1 Derived Benefits: Reduced Errors (Medical Practitioners)

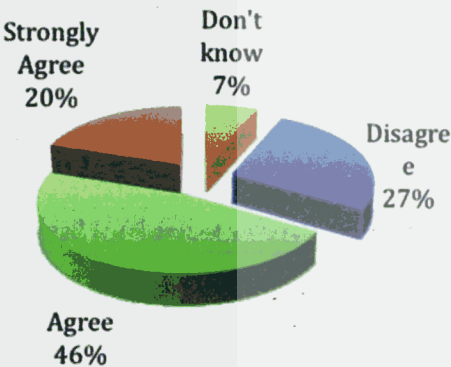


Fig. A.2 Derived Benefits: Reduced Errors (Non Practitioners)

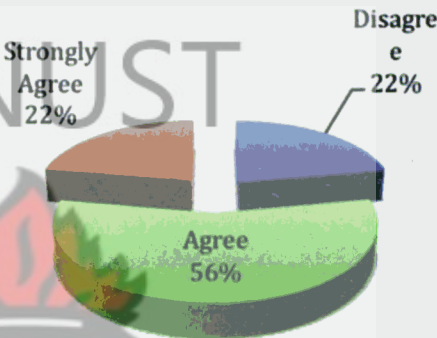


Fig. A.3 Challenges: Lack of IT Professionals (Medical Practitioners)

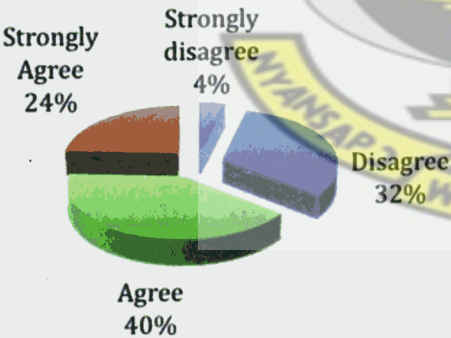
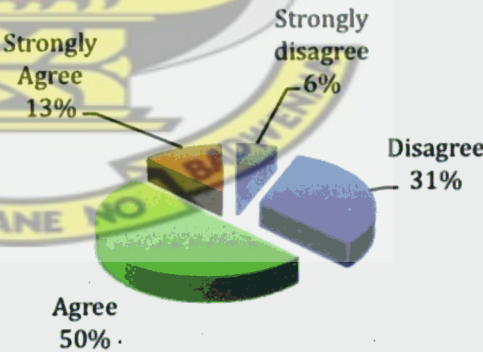


Fig. A.4 Challenges: Lack of IT Professionals (Non Practitioners)



Source: researcher's field work

Appendix B

☐1 ☐2 ☐3 ☐4

☐☐☐

QUESTIONNAIRE FOR MEDICAL PRACTITIONERS

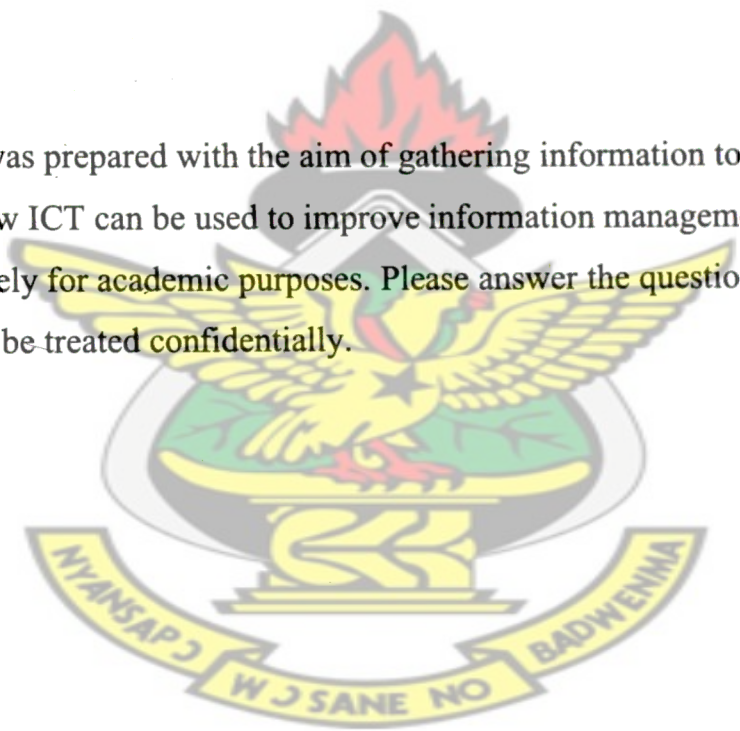
A Questionnaire on assessing the impact of ICT on Information Management at the OPD of Health Institutions in the Kumasi Metropolis

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Dear Respondent,

This questionnaire was prepared with the aim of gathering information to enable the researcher assess how ICT can be used to improve information management in health institutions. It is purely for academic purposes. Please answer the questions freely. Your responses will be treated confidentially.

Thank you



SECTION A:

Identification of OPD functions that require computerisation to manage information better

- 1 Name of Institution: _____
- 2 Position Held
- ☐₁ Doctor
 - ☐₂ Nurse
 - ☐₃ Pharmacist
 - ☐₄ Medical Assistant
 - ☐₅ Lab technician
 - ☐₆ Other Medical (Please specify) _____
- 3 How many years have you been working with this institution?
- ☐₁ Under 1 Year
 - ☐₂ 1 - 3 Years
 - ☐₃ 4 - 6 Years
 - ☐₄ 7 - 9 Years
 - ☐₅ 10 Years or more
- 4 How do you keep patients' records?
- ☐₁ We do not keep Patients Records
 - ☐₂ Only Manually in Paper Folders
 - ☐₃ Only Electronically on our local PC
 - ☐₄ Only Electronically on the Network
 - ☐₅ Both Manually and Electronically on local PC and/or Network
- 5 Do you use the INTERNET or Computers for continuous medical education?
- ☐₁ Not at all
 - ☐₂ Rarely (once or twice a month)
 - ☐₃ Sometimes (once or twice a week)
 - ☐₄ Frequently (once a day)
 - ☐₅ Very Frequently (as often as possible each day)

- 6 Do you use Computers at work for any tasks at all?
- ☐₁ Not at all *** IF NOT AT ALL THEN GO TO SECTION B**
 - ☐₂ Rarely (once or twice a month)
 - ☐₃ Sometimes (once or twice a week)
 - ☐₄ Frequently (once a day)
 - ☐₅ Very Frequently (as often as possible each day)
- 7 Is your section networked and connected with other sections of the OPD?
- ☐₁ Not networked
 - ☐₂ Soon to be networked and connected
 - ☐₃ Networked but connections not working
 - ☐₄ Networked but not connected
 - ☐₅ Networked and connected to all sections of the OPD
- 8 Which software do you use for keeping patients' records?
- ☐₁ Word Processor (e.g. Word)
 - ☐₂ I use software but I do not know what software
 - ☐₃ Office (e.g. Excel or Access)
 - ☐₄ Customized Software (e.g. HAMS)
 - ☐₅ Other (Please Specify) _____
- 9 Have you received proper and adequate training to use the computer effectively?
- ☐₁ No training at all
 - ☐₂ Little training or feeling inadequate
 - ☐₃ Moderately trained, need practice
 - ☐₄ Properly trained but not proficient
 - ☐₅ Well trained, very proficient

- 10 Is data generated about the patient entered immediately into the computer?
- ☐1 No it is entered later (at close of day)
 - ☐2 No it is done periodically when there is time
 - ☐3 No it is entered immediately after the patient is gone
 - ☐4 Yes it is entered by an assistant (while the patient is present)
 - ☐5 Yes I enter the data myself (while the patient is present)

11 – 30 Which of the following functions do you use on the available software?

Please tick all the boxes that apply to your work.

		Yes	No
11	Patient Demographics	<input type="checkbox"/> 1	<input type="checkbox"/> 2
12	Referrals to specialists	<input type="checkbox"/> 1	<input type="checkbox"/> 2
13	Patients complaints	<input type="checkbox"/> 1	<input type="checkbox"/> 2
14	Reports from specialists	<input type="checkbox"/> 1	<input type="checkbox"/> 2
15	Past medical history	<input type="checkbox"/> 1	<input type="checkbox"/> 2
16	Diagnosis	<input type="checkbox"/> 1	<input type="checkbox"/> 2
17	Physical examination results	<input type="checkbox"/> 1	<input type="checkbox"/> 2
18	Prescriptions	<input type="checkbox"/> 1	<input type="checkbox"/> 2
19	Immunisation tracking	<input type="checkbox"/> 1	<input type="checkbox"/> 2
20	Standard Treatment Guide	<input type="checkbox"/> 1	<input type="checkbox"/> 2
21	NHIS status of patients	<input type="checkbox"/> 1	<input type="checkbox"/> 2
22	Lab tests requests	<input type="checkbox"/> 1	<input type="checkbox"/> 2
23	Coding of services	<input type="checkbox"/> 1	<input type="checkbox"/> 2
24	Coding of drugs	<input type="checkbox"/> 1	<input type="checkbox"/> 2
25	Lab results	<input type="checkbox"/> 1	<input type="checkbox"/> 2
26	X-ray results	<input type="checkbox"/> 1	<input type="checkbox"/> 2
27	Writing excuse duty	<input type="checkbox"/> 1	<input type="checkbox"/> 2
28	Ultra sound results	<input type="checkbox"/> 1	<input type="checkbox"/> 2
29	Vital signs	<input type="checkbox"/> 1	<input type="checkbox"/> 2
30	Inventory control	<input type="checkbox"/> 1	<input type="checkbox"/> 2

31 Do you key in the data yourself?

- ☐1 Yes
- ☐2 No

32 Which of the following applies to you?

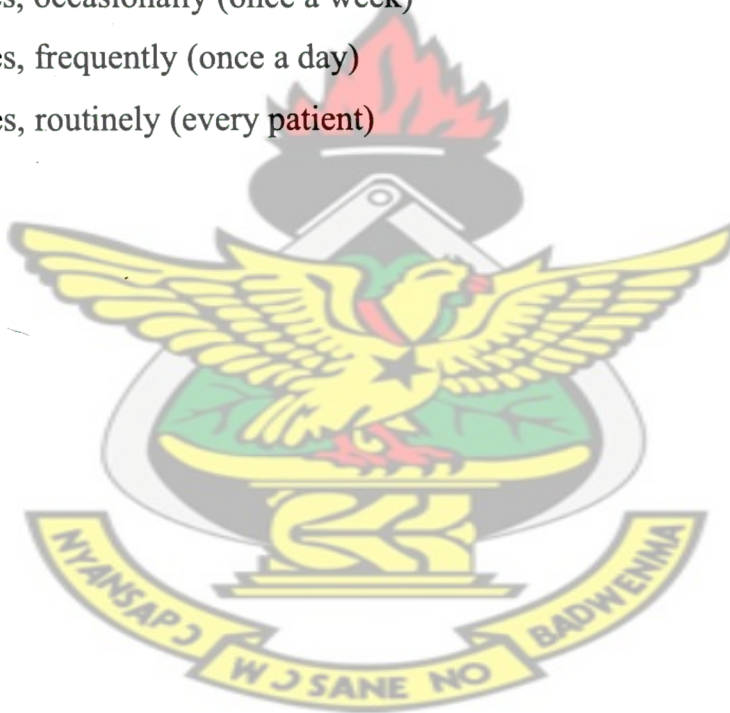
- ☐5 I enter the data myself because I want to be sure of accuracy
- ☐4 I enter the data because data entry is required by management
- ☐3 I enter the data myself because it makes my work easier
- ☐2 It makes no difference to me who enters the data
- ☐1 Other (Please specify)

33 Which of the following applies to you?

- ☐₁ I don't like using computers
- ☐₂ I do not consider data entry my job
- ☐₃ Data entry doubles my work volume
- ☐₄ I do not enter the data myself because it slows down the process
- ☐₅ I do not enter data myself because I am not fast with the keyboard

34 Do you currently access patients' records electronically?

- ☐₁ We do not access patients' records electronically
- ☐₂ Yes but rarely (once a month)
- ☐₃ Yes, occasionally (once a week)
- ☐₄ Yes, frequently (once a day)
- ☐₅ Yes, routinely (every patient)



SECTION B:

Assessing the Benefits of Using Electronic Medical Records Systems.

35-38 With the patient medical records systems you currently have, how easy would it be for you (or staff) to generate the following list of patients?

		1	2	3	4	5
LISTS		Cannot Generate	Very Difficult	Difficult	Easy	Very Easy
35	By Age Groups					
36	By Diagnosis					
37	By Lab Results					
38	By Medication					

- 39 We have implemented an electronic medical record system
- ☐1 No ****IF NO THEN GO TO QUESTION 44***
 - ☐2 Partially – Mainly for OPD data and attendance records
 - ☐3 Partially – Implementation in progress
 - ☐4 Partially – scope limited to some unit
 - ☐5 Fully (software linking all sections)

40-43 Please indicate the impact of the software on your work

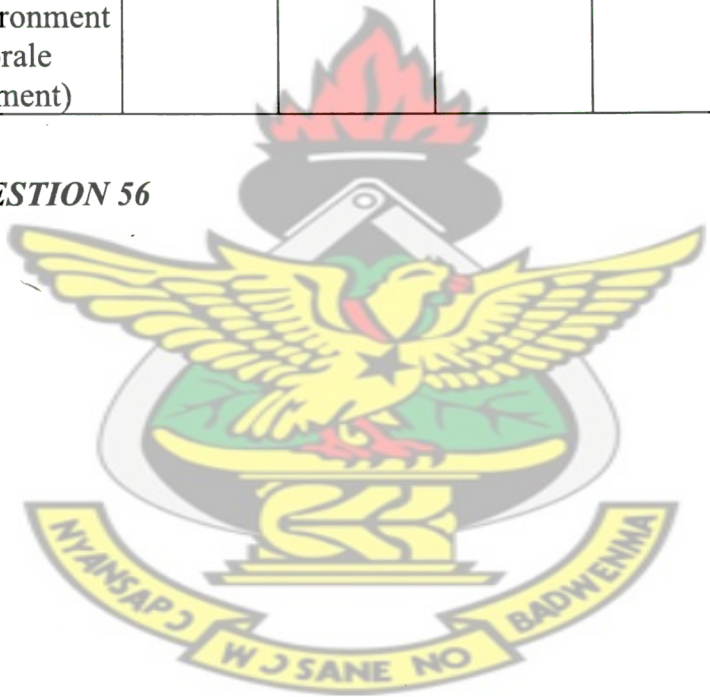
		1	2	3	4	5
IMPACT		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
40	Efficiency (Doing more/doing things faster)					
41	Effectiveness (Doing things right)					
42	Innovation (New ways of working)					
43	Job Satisfaction (Work environment and morale improvement)					

* **GO TO QUESTION 48**

44-47 In your opinion what potential impact is an electronic record keeping system likely to have?

		1	2	3	4	5
LIKELY IMPACT		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
44.	Efficiency (Doing more/doing things faster)					
45	Effectiveness (Doing things right)					
46	Innovation (New ways of working)					
47	Job Satisfaction (Work environment and morale improvement)					

* GO TO QUESTION 56



48-55 What benefits do you perceive your institution has derived from the use of an electronic medical record keeping system?

		1	2	3	4	5
BENEFITS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
48	Interoperability (Patient data available to all departments at once regardless of source)					
49	Easy Patient Data Retrieval					
50	Medical Staff's work and time management improve					
51	Reduced Errors					
52	Eliminating the problem of missing folders					
53	Improved planning and administrative processes					
54	Client's waiting time reduced					
55	Easier to control wastage and pilfering					

*** GO TO QUESTION 64**

56-63 In your opinion, what are the potential benefits of using an electronic medical record system?

		1	2	3	4	5
	POTENTIAL BENEFITS	Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
56	Interoperability (Patient data available to all departments at once regardless of source)					
57	Easy Patient Data Retrieval					
58	Medical Staff's work and time management improve					
59	Reduced Errors					
60	Eliminating the problem of missing folders					
61	Improved planning and administrative processes					
62	Client's waiting time reduced					
63	Easier to control wastage and pilfering					

64 I feel the software will make a strong impact on the way the institution does business

- ☐1 Don't know
- ☐2 Disagree Strongly
- ☐3 Disagree
- ☐4 Agree
- ☐5 Agree Strongly

65 Are you involved in preparing reports for your institution?

☐₁ Yes

☐₂ No *** IF NO GO TO SECTION C**

66 Do you have software for preparing reports for your institutions?

☐₁ Yes

☐₂ No *** IF NO GO TO SECTION C**

67 My use of the software has contributed to the speed with which I can prepare reports

☐₁ Don't know

☐₂ Disagree Strongly

☐₃ Disagree

☐₄ Agree

☐₅ Agree Strongly

68 My use of the software has contributed to my ability to produce better quality reports

☐₁ Don't know

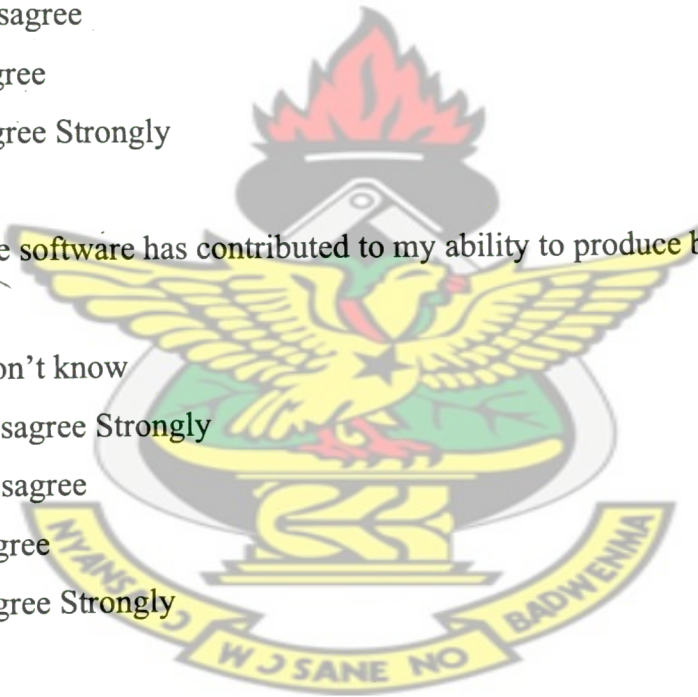
☐₂ Disagree Strongly

☐₃ Disagree

☐₄ Agree

☐₅ Agree Strongly

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SECTION C

Barriers, Challenges and Risks of Using an electronic record system

69-76 Which of the following do you consider as barriers to adopting an electronic medical records system?

		1	2	3	4	5
BARRIERS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
69	Software Costs					
70	Hardware Costs					
71	Organisational Culture (The way we do things here)					
72	Personnel Costs					
73	Doctors' Participation					
74	Nurses' Participation					
75	Lack of IT Policy					
76	Other (Please Specify)					

77-84 Which of the following do you consider as challenges to adopting an electronic medical records system?

		1	2	3	4	5
CHALLENGES		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
77	Lack of up-to-date computer equipment					
78	Lack of computer skills					
79	Fear of computers					
80	Training and Technical support					
81	Lack of IT Professionals					
82	Lack of constant supply of electricity					
83	Other (Please Specify)					

84-90 Which of the following constitute risks in the use of an electronic medical records system?

		1	2	3	4	5
RISKS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
84	Privacy of data (access control)					
85	Incomplete patient information due to periodic rather than real-time data entry					
86	System being unavailable due to down time					
87	Security of data (protection from Intruders)					
88	Loss of Data (computer crashes)					
89	Computer Viruses					
90	Other (Please Specify)					

91 Please briefly recommend ways that you think any of the above challenges can be addressed

SECTION D

Demographic Data

This is to assist in clarifying and interpreting the responses to the questionnaire

92 Please indicate your gender

- ☐₁ Male
- ☐₂ Female

93 Please indicate your age range

- ☐₁ 18 - 24
- ☐₂ 25 - 34
- ☐₃ 35 - 44
- ☐₄ 45 - 54
- ☐₅ 55 - 60
- ☐₆ 60 Plus

94 Please indicate the highest level of your education

- ☐₁ Secondary School Certificates or Equivalent
- ☐₂ HNC/HND or Equivalent
- ☐₃ Bachelors Degree or Equivalent
- ☐₄ Post Graduate Diploma/Masters or Equivalent
- ☐₅ PhD or Equivalent
- Other (Please Specify) _____

QUESTIONNAIRE FOR NON-PRACTITIONERS

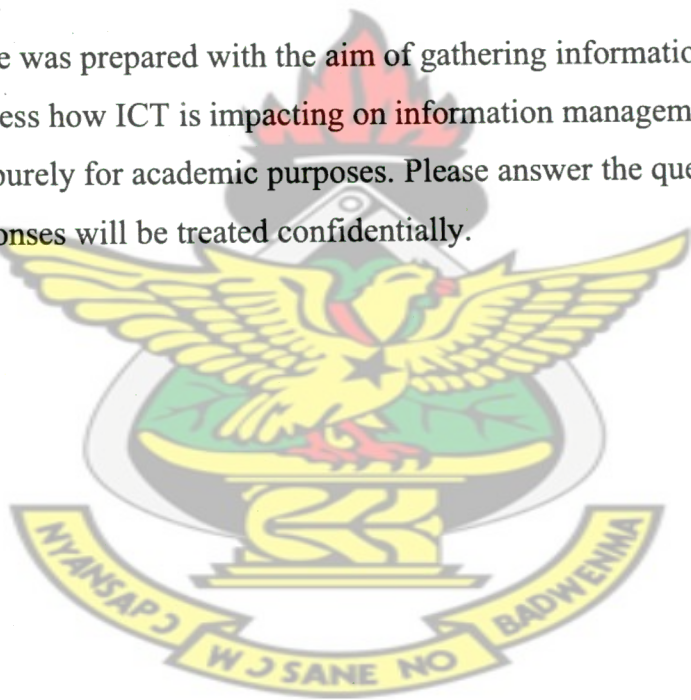
A Questionnaire on assessing the impact of ICT on Information Management at the OPD of Health Institutions in the Kumasi Metropolis

KNUST

Dear Respondent,

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Thank you



SECTION A:

Identification of OPD functions that require computerisation to better manage information

1 Name of Institution:.....

2 Position Held (Please tick):

- ☐1 Statistician
- ☐2 Administrator
- ☐3 Lab Technician
- ☐4 Medical Record Assistant
- ☐5 IT Manager
- ☐6 Other (Please

specify).....

3 How many years have you been working with your present institution?

- ☐1 under 1 year
- ☐2 1-3 years
- ☐3 4-6 years
- ☐4 7-9 years
- ☐5 10 or more

4 How do you keep patients' records?

- ☐1 We do not keep Patients Records
- ☐2 Only Manually in Paper Folders
- ☐3 Only Electronically on our local PC
- ☐4 Only Electronically on the Network
- ☐5 Both Manually and Electronically on local PC and/or Network

The following services are billed electronically (please tick the appropriate column):

		Yes	No
		(1)	(2)
5	Consultation fees	<input type="checkbox"/>	<input type="checkbox"/>
6	Laboratory test	<input type="checkbox"/>	<input type="checkbox"/>
7	OPD card fee	<input type="checkbox"/>	<input type="checkbox"/>
8	X-ray	<input type="checkbox"/>	<input type="checkbox"/>
9	Ultra sound	<input type="checkbox"/>	<input type="checkbox"/>
10	Drugs	<input type="checkbox"/>	<input type="checkbox"/>
11	Spendables	<input type="checkbox"/>	<input type="checkbox"/>
12	NHIS sponsored items	<input type="checkbox"/>	<input type="checkbox"/>

13 Do you have an IT manager?

☐₁ Yes

☐₂ No

14 Which software do you use?

☐₁ HAMS

☐₂ Don't know

☐₃ No software

☐₈ Other software (please specify).....

If No software, please go to Section B

15 Is your section networked with the other sections of the OPD?

☐₁ Yes

☐₂ No

16 I have received adequate training to use the software effectively (please tick one):

☐₁ No training at all

☐₂ Little training or feeling inadequate

☐₃ Moderately trained, need practice

☐₄ Properly trained but not proficient

☐₅ Well trained, very proficient

- 17 The software is user-friendly.
- ☐₁ Don't know
 - ☐₂ Disagree Strongly
 - ☐₃ Disagree
 - ☐₄ Agree
 - ☐₅ Agree Strongly
- 18 We can easily resolve network problems internally.
- ☐₁ Don't know
 - ☐₂ Disagree Strongly
 - ☐₃ Disagree
 - ☐₄ Agree
 - ☐₅ Agree Strongly
- 19 We receive prompt technical support whenever it is needed.
- ☐₁ Don't know
 - ☐₂ Disagree Strongly
 - ☐₃ Disagree
 - ☐₄ Agree
 - ☐₅ Agree Strongly
- 20 On the average, how many patients are attended to daily at the OPD?
- ☐₁ Less than 100
 - ☐₂ 100-199
 - ☐₃ 200-299
 - ☐₄ 300-399
 - ☐₅ 400 or more
 - ☐₆ Don't know
- 21 What percentage of OPD patients are NHIS sponsored?
- ☐₁ Less than 50%
 - ☐₂ 50-70%
 - ☐₃ 71-80%
 - ☐₄ 81-90%
 - ☐₅ More than 90%

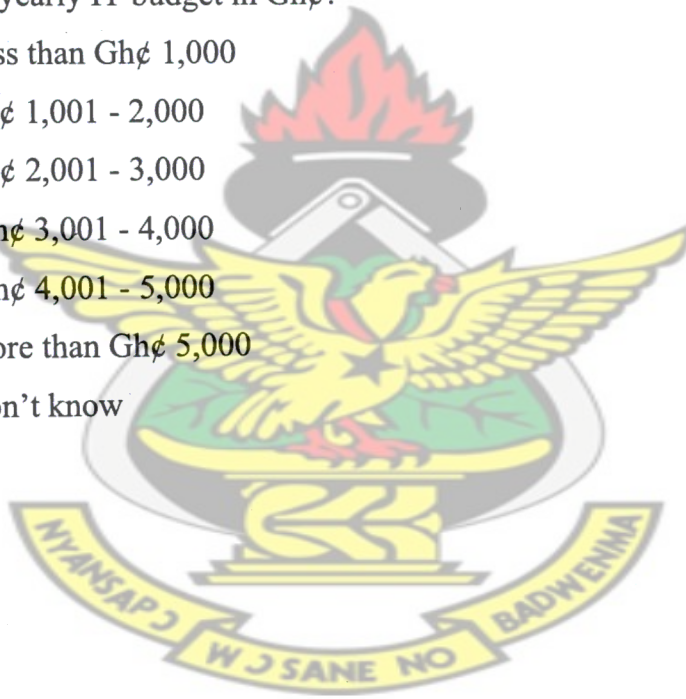
- 22 Our NHIS claims are
- ☐₁ Up to date
 - ☐₂ Less than 1 month behind
 - ☐₃ 1-2 months behind
 - ☐₄ 3-4 months behind
 - ☐₅ More than 4 months behind

- 23 Our OPD staff strength is: ☐☐☐

- 24 Our hospital's bed size is: ☐☐☐

- 25 What is your yearly IT budget in Gh¢?

- ☐₁ Less than Gh¢ 1,000
- ☐₂ Gh¢ 1,001 - 2,000
- ☐₃ Gh¢ 2,001 - 3,000
- ☐₄ Gh¢ 3,001 - 4,000
- ☐₅ Gh¢ 4,001 - 5,000
- ☐₆ More than Gh¢ 5,000
- ☐₇ Don't know



SECTION B:

Assessing the Benefits of Using Electronic Medical Records Systems.

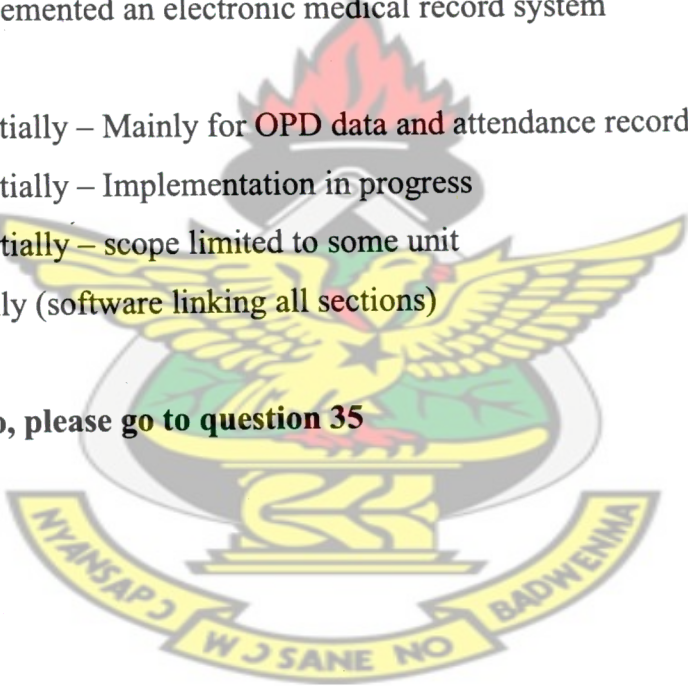
26 – 29 With the patient medical records systems you currently have, how easy would it be for you (or staff) to generate the following list of patients?

		1	2	3	4	5
LISTS		Cannot Generate	Very Difficult	Difficult	Easy	Very Easy
26	By Age Groups					
27	By Diagnosis					
28	By Lab Results					
29	By Medication					

30 We have implemented an electronic medical record system

- ☐1 No
- ☐2 Partially – Mainly for OPD data and attendance records
- ☐3 Partially – Implementation in progress
- ☐4 Partially – scope limited to some unit
- ☐5 Fully (software linking all sections)

If your answer is No, please go to question 35



31 – 34 If you have implemented an electronic medical record system, please indicate impact of the software on your work. Please tick one answer for each impact provided in the table below and then **go to question 36**

		1	2	3	4	5
	IMPACT	Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
31	Efficiency (Doing more/doing things faster)					
32	Effectiveness (Doing things right)					
33	Innovation (New ways of working)					
34	Job Satisfaction (Work environment and morale improvement)					

*** GO TO QUESTION 39**

35 – 38 In your opinion what is the potential impact that an electronic record keeping system is likely to have?

		1	2	3	4	5
	LIKELY IMPACT	Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
35	Efficiency (Doing more/doing things faster)					
36	Effectiveness (Doing things right)					
37	Innovation (New ways of working)					
38	Job Satisfaction (Work environment and morale improvement)					

*** GO TO QUESTION 47**

39-46 What benefits do you perceive your institution has derived from the use of an electronic medical record keeping system?

		1	2	3	4	5
BENEFITS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
39	Interoperability (Patient data available to all departments at once regardless of source)					
40	Easy Patient Data Retrieval					
41	Medical Staff's work and time management improve					
42	Reduced Errors					
43	Eliminating the problem of missing folders					
44	Improved planning and administrative processes					
45	Client's waiting time reduced					
46	Easier to control wastage and pilfering					

*** GO TO QUESTION 55**

47 – 54 In your opinion, what are the potential benefits of using an electronic medical recordsystem?

		1	2	3	4	5
	POTENTIAL BENEFITS	Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
47	Interoperability (Patient data available to all departments at once regardless of source)					
48	Easy Patient Data Retrieval					
49	Medical Staff's work and time management improve					
50	Reduced Errors					
51	Eliminating the problem of missing folders					
52	Improved planning and administrative processes					
53	Client's waiting time reduced					
54	Easier to control wastage and pilfering					

* CONTINUE WITH QUESTION 55

55 I feel the software will make a strong impact on the way that the institution does business

- ☐₁ Don't know
- ☐₂ Disagree Strongly
- ☐₃ Disagree
- ☐₄ Agree
- ☐₅ Agree Strongly

56 Are you involved in preparing reports/claims for your institution?

- ☐₁ Yes
- ☐₂ No *** IF NO, GO TO SECTION C**

57 Do you have software for preparing reports/claims for your institutions?

- ☐₁ Yes
- ☐₂ No *** IF NO, GO TO SECTION C**

58 My use of the software has contributed to the speed with which I can prepare a report/claims (tick one).

- ☐₁ Don't know
- ☐₂ Disagree Strongly
- ☐₃ Disagree
- ☐₄ Agree
- ☐₅ Agree Strongly

59 My use of the software has contributed to my ability to produce better quality report/ claims (tick one):

- ☐₁ Don't know
- ☐₂ Disagree Strongly
- ☐₃ Disagree
- ☐₄ Agree
- ☐₅ Agree Strongly

SECTION C

Barriers, Challenges and Risks of Using an Electronic Record System

60 – 67 Which of the following do you consider as **barriers** to adopting an electronic medical records system?

		1	2	3	4	5
BARRIERS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
60	Software Costs					
61	Hardware Costs					
62	Organisational Culture (The way we do things here)					
63	Personnel Costs					
64	Doctors' Participation					
65	Nurses' Participation					
66	Lack of IT Policy					
67	Other (Please Specify) _____ _____ _____ _____ _____					

68 – 75 Which of the following do you consider as **challenges** to adopting an electronic medical records system?

		1	2	3	4	5
CHALLENGES		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
68	Lack of up-to-date computer equipment					
69	Lack of computer skills					
70	Fear of computers					
71	Training and Technical support					
72	Lack of IT Professionals					
73	Lack of constant supply of electricity					
74	Other (Please Specify)					

75 – 81 Which of the following constitute **risks** in the use of an electronic medical records system?

		1	2	3	4	5
RISKS		Don't Know	Strongly Disagree	Disagree	Agree	Strongly Agree
75	Privacy of data (access control)					
76	Incomplete patient information due to periodic rather than real-time data entry					
77	System being unavailable due to down time					
78	Security of data (protection from Intruders)					
79	Loss of Data (computer crashes)					
80	Computer Viruses					
81	Other (Please Specify)					

SECTION D

Demographic Data

This is to assist in clarifying and interpreting the responses to the questionnaire

82 Please indicate your gender

- ☐₁ Male
- ☐₂ Female

83 Please indicate your age range

- ☐₁ Under 18
- ☐₂ 18 - 24
- ☐₃ 25 - 34
- ☐₄ 35 - 44
- ☐₅ 45 - 54
- ☐₆ 55 - 60
- ☐₇ 60 Plus

84 Please indicate the highest level of your education

- ☐₁ Secondary School Certificates or Equivalent
- ☐₂ HNC/HND or Equivalent
- ☐₃ Bachelors Degree or Equivalent
- ☐₄ Post Graduate Diploma/Masters or Equivalent
- ☐₅ PhD or Equivalent

Other (Please Specify) _____