

**IMPLEMENTING ELECTRONIC MEDICAL RECORD (EMR) SYSTEM IN
TEMA GENERAL HOSPITAL: POTENTIAL BENEFITS AND CHALLENGES**

By

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DECLARATION

I hereby declare that this submission is my own work towards the Masters of Science in Health Informatics and that, to the best to 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 University, except where due acknowledgement has been made in the text.

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ABSTRACT

Healthcare in Ghana is going through immense change, and concerns regarding the quality of patient's medical records and patient's safety continue to be expressed in many national forums.

Furthermore, there have been several initiatives for healthcare records to transition from paper-based data management to electronic-based data management. These trends are influencing healthcare organizations in some countries to transition from paper-based to electronic-based documentation system.

The purpose of the study is to establish the potential benefits of Electronic Medical Record (EMR) system, challenges and its ultimate contribution to improving healthcare delivery in Ghana. The objectives are: To examine benefits and disadvantages of using EMR; To examine the factors militating against EMR implementation in TGH.

This is a quantitative, qualitative, explorative, and descriptive study using survey questionnaires with a sample size of 100 at TGH in Tema, Ghana. Findings from the research indicate strong importance of EMR system in TGH in facilitating effective and efficient data collection, data entry, information retrieval and report generation for research. It also shows that Ghana must pass laws to back EMR before TGH can implement it.

The result will help stakeholders and the hospital management design and implement patient's electronic record system that is suitable to their environment and help achieve the Millennium Development Goals by 2015 to transform and improve care delivery in the country.

DEDICATION

This project is affectionately dedicated to my family, friends and my lovely Parents; Mr. Oggah Gmagna Peter and Mrs. Gmagna Mary Nlumba whose patience, sacrifices and encouragement helped in making it possible.

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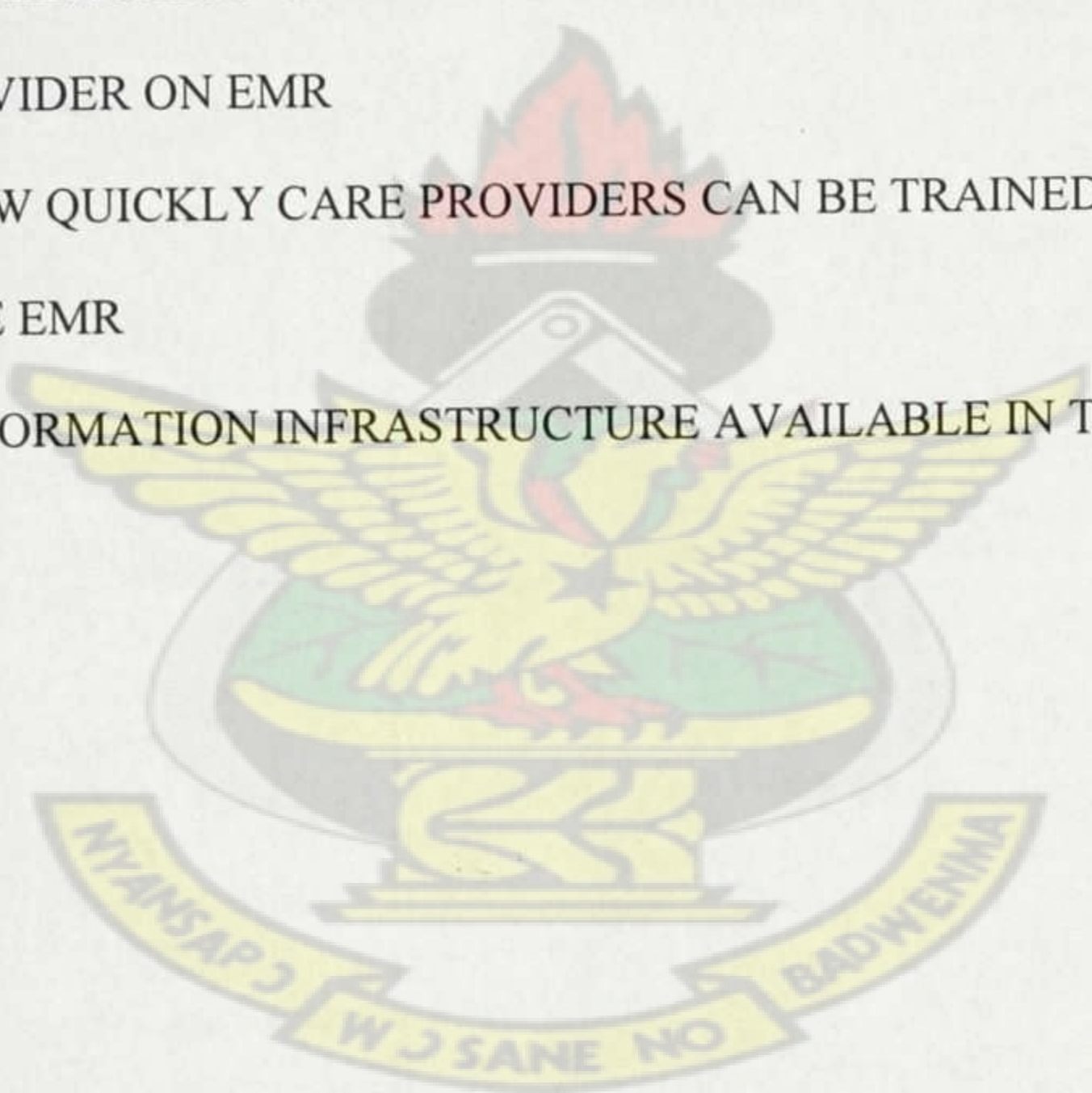
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ABBREVIATIONS

AIDS	-- Acquired Immune deficiency Syndrome
AMPTH	-- Academic Model for Prevention and Treatment of HIV
CDSS	-- Clinical Decision Support System
CHPS	-- Community Health Planning Service
CIS	-- Clinical Information System
CPOE	-- Computerised Provider Order Entry
EMR	-- Electronic Medical Records
EPI	-- Expanded Program on Immunization
HAART	-- Highly Active Antiretroviral
HIPAA	-- Health Insurance Portability and Accountability Act
HIS	-- Health Information System
HIT	-- Health Information Technology
HIV	-- Human Immune Virus
HMIS	-- Health Management Information System
ICPC	-- International Classification for Primary Care
ICT	-- Information and Communication Technology
IGF	-- Internal Generated Funds
IOM	-- Institute of Medicine
KATH	-- Komfo Anokye Teaching Hospital
MDGs	-- Millennium Development Goals
MMRS	-- Mosoriot Medical Record System
MOH	-- Ministry of Health

NAHIT	-- National Alliance for Health Information Technology
NGO	-- Non-Governmental Organizations
NHIS	-- National Health Insurance Scheme
NIST	-- National Institute of Standard and Technology
OCED	-- Organization for Economic Cooperation Development
PDA	-- Personal Digital Assistance
PHC	-- Primary Health Care
PIH	-- Partners in Health
PPE	-- Provider-Patient Encounter
SPSS	-- Statistical Package For Social Science
SSNIT	-- Social Security National Insurance Trust
TAM	-- Technology Acceptance Model
TGH	-- Tema General Hospital
UNDP	-- United Nation Development Program
UNICEF	-- United Nation Children Education Fund
UTAUT	-- Unified Theory of Acceptance and Use of Technology
VB	-- Visual Basic
VTC	-- Video Teleconferencing
WHO	-- World Health Organization

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Health information systems (HIS) such as electronic medical records (EMR) are becoming essential tools for managing the complex demands facing today's modern health care system. The National Alliance for Health Information Technology (NAHIT) defines an EMR as "an electronic record of health related information on an individual that can be created, gathered, managed, and consulted by authorized clinicians and staff within one health care organization" (NAHIT, 2008). In addition to their functional capacity to integrate electronic prescriptions, test ordering and decision-making systems (Gagnon *et al.*, 2009), the potential benefits of adopting EMRs include: enhanced clinical productivity, facilitating coordination of care, improved health outcomes and patient safety, reduced costs and better access to care (Byrne *et al.*, 2010; Car *et al.*, 2008; Chaudry, 2006; Wang *et al.*, 2006; Hillestad *et al.*, 2005; Lau *et al.*, 2011; Ontario, 2010). Systematic review which examined the impact of health information technology (HIT) on the costs, efficiency and quality of health care identified three major actual benefits: 1) improved monitoring and surveillance 2) a decrease in prescription errors and 3) better adherence to clinical guidelines (Chaudry *et al.*, 2006). Since ambulatory care is considered by many as patients' first point-of-contact with the health care system, the potential benefits of using EMRs at the primary care level are innumerable and far-reaching (Torda, 2010).

Ghana is one of the peaceful countries in West Africa and for that matter Africa. It has a population of 24.7 million on an area of 238,537 square kilometers with an annual growth rate of 2.2 % (World Health Statistics, 2012). It has a telephone landline network capacity of 376,500 and 650,000 internet Users (World Health Statistics, 2009)

Unfortunately although information and communications technology (ICT) such as Telemedicine can improve health care delivery to the poor by reducing cost and hardship of travel to seek medical attention, telephone line penetration is biased toward the urban areas with the capital city Accra accounting for over 70 % of the total lines (Cecchini, 2003). The country also has the best health institutions such as Korle-Bu Teaching Hospital, Komfo Anokye Teaching Hospital (KATH) and the Social Society and National Insurance Trust Hospital (SSNIT). For instance, Tema General Hospital located in Greater Accra region; Accra performs a lot of medical activities and serves as an attachment hospital for students from Nanh Bitu, Nyaniba and other health institutions in Greater Accra. Due to the quality of treatment outcome, it now receives referrals from most parts of the country. Despite its exemplary performance, the hospital has no Electronic Medical Record (EMR) system which can help improve care delivery in the region.

However some developed nations have implemented different types of health information systems in the form of electronic health record (EHR), Computerized Provider Order Entry (CPOE) and Clinical Decision Support Systems tools (CDSS) for

effective health planning and assessing the population health needs therefore leading to improvements in care delivery in those countries.

Sadly, Africa like the rest of the developing world is faced with overwhelming health problem such as malaria, HIV/AIDS and tuberculosis that threaten the lives of millions of people (Fraser *et al.*, 2005). Yet most of the worst affected countries lack infrastructure in the form ICT which many researchers consider life saving resources.

The Central government and Christian missions (private non-profit agencies) are the principal health care providers in Ghana (Ghana, 2006). Sources of health services financing include internally generated fund (IGF) or user fees, central government allocations, funding from non-governmental organizations (NGOs) and other donors. User fees for instance started in the early 1970s with the aim “to reduce unnecessary use of services rather than to generate revenue” (Agyepong, 1999,). However, in 1990 the law was amended asking hospitals to retain 100% of fees; revolving funds for drugs known as Cash and Carry. Cash and Carry also allows institutions to keep revenue for drugs separate and use it for the purchase of only more drugs. Although the law made provision for the poor and treatment during emergencies, people are sometimes denied the necessary care needed because costs are to be borne by the facility in question (Agyepong, 1999).

In addition, over the years, a number of policies have been adopted by the Ministry of Health (MOH) to improve health care services in the country. Among them is the

Expanded Program on Immunization (EPI) and Primary Health Care (PHC) policies.

The aims of these policies are;

1. Improve accessibility of health services at the village or rural level
2. Improve the quality of care at the point where it is most needed
3. Improve and strengthen the management capacity to support the system (Agyepong, 1999; Oppong, 1994).

However, due to unavailability of accurate data in terms of efficient information systems the objectives of these programs are yet to be fully realized

With globalization – human interaction across the globe where boundaries do not matter anymore, many developing countries are beginning to introduce National Health Insurance Scheme (NHIS) to make health care accessible to citizens after many years of deregulation and removal of subsidies on health care. In the light of this, NHIS is being pioneered in Ghana to aid financial access to health care and the establishment of Health Insurance Fund in order to make health care affordable to all especially those in the rural areas. In spite of these interventions adequate health information systems are needed to keep track of patients for evidence based decision making to improve health service delivery. Although EMR systems are complex and vary depending on the developer and implementing health care system, an understanding of what EMR is, how it works and how to implement it are all necessary.

1.2 Problem Statement

Currently TGH uses paper-based patient record. However, this system of keeping patient record in Tema General Hospital has its disadvantages. These include: paper-record can be easily lost, misplaced and so patients stay longer waiting for their folders to be recovered, paper folders can easily be burnt by fire outbreaks, thus past patient record cannot be recovered for effective diagnosis. Illegible handwriting of medical practitioners, administration among clinicians is poor in the manual healthcare system. Multiple tests are being ordered, and adverse drug reactions are happening because clinicians are not aware of drugs prescribed. Hospital staff and patients are receiving conflicting treatment information and advice from doctors as a result of the usage of paper record system.

Electronic medical record (EMR) is not only being welcomed by health care providers as a way to improve care delivery, but also serves as a catalyst and gold standard for development (Reifsteck *et al.*, 2006). After Hurricane Katrina in US the importance of EMR has been re-emphasized, since it destroyed or left inaccessible the medical records of untold number of people. This focused new attention on the need for computerized medical records - health records that follow patients, even if their doctors' offices no longer exist. Unfortunately, Tema General Hospital lacks robust healthcare infrastructure in the form of information and communications technology (ICT) to ensure the recovery of patients' clinical data which many researches considered a life saving resource. Notwithstanding the changes that may occur, the aim of the study is to

examine EMR benefits to the patients, physicians, other care providers as well as its ultimate contribution to development of health care delivery in TGH.

1.3 Main Objective

To establish the potential benefits of Electronic Medical Record (EMR) system and its ultimate contribution to improving healthcare delivery in Ghana

1.4 Research Questions

The research will address the following questions:

1. What will be the benefits and disadvantages of using Electronic Medical Records system in TGH?
2. What factors militate against the implementation of an Electronic Medical Record system in TGH?
3. To what extent does infrastructure and IT staffs available for the implementation of Electronic Medical Record system in Tema General Hospital?

1.5 Definition of Terms

1.5.1 Electronic Medical Record (EMR)

An electronic medical/health record (E/HMR) is the compilation of patient medical information in a computer-based format that allows the collection, storage, retrieval and communication of this data (Dick, 1997).

1.5.2 Computerized Physician Order Entry (CPOE)

CPOE is a process of electronically entering physician instructions for the treatment of patients. These orders are communicated over a computer network to the medical staff. CPOE decreases delay in order completion, reduces errors related to handwriting or transcription. It also allows order entry at point-of-care or off-site, provides error-checking for duplicate or incorrect doses or tests, and simplifies inventory and posting of charges (Wikipedia, 2006).

1.5.3 Clinical Decision Support System

Also called CDSS is a computer-based system that enables health care physicians in making decisions about patients (Shortliffe *et al*, 2001).

1.5.4 Information and Communications Technology

For the purposes of this study, ICTs are defined as tools that facilitate communication and the processing and transmission of information and the sharing of knowledge by electronic means. ICTs are also the set of activities that facilitate the capturing, storage, processing, transmission and display of information by electronic means (Cecchini, 2003).

This encompasses the full range of electronic digital and analog ICTs, from radio and television to telephones (fixed and mobile), computers, electronic-based media such as digital text and audio-video recording, and the Internet, but excludes the non-electronic technologies. This does not lessen the importance of non-electronic technologies such

as paper-based text for sharing information and knowledge or communicating about health, but merely draws a boundary around the field addressed by this document.

1.5.5 Telemedicine, Health Telematics

Telemedicine is the delivery of health care services, where distance is a critical factor, by health care professionals using information and communication technologies for the exchange of vital information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interest of advancing the health of individuals and their communities (WHO, 2004). WHO also describes health telematics as a composite term for health-related activities, services and systems, carried out over a distance by means of ICTs, for the purposes of global health promotion, disease control, and health care, as well as education, management and research for health. More restrictive terms that are part of telemedicine include: teleconsultation, teleradiology, telesurgery, telecare, teleeducation and teletraining.

Assumptions

The main assumptions of the study were;

1. Healthcare professionals in TGH know about electronic medical record (EMR)
2. Hospital management and care providers in TGH recognize the importance of EMR and are open to its implementation.

1.6 Significance of the Study

We live in a world where two-thirds of the population lives in so called “developing countries” under conditions grossly different from those in the richer industrialized countries. With globalization and liberalization of the economy health care and ICT policies are spreading fast across the globe. As a result, we are observing explosion of health information systems infrastructures especially in the developed world with the believe that such technology implementations improve quality of life, lengthening life, lowering the burden of illness, and above all general improvement in disease management an patient centered care (McDonald, 2006). Since good health is not only an important concern for individuals, but policy makers as it plays a central role in achieving sustainable development and effective use of scarce resources (Godal, 2005). Information and Telecommunications Technologies (ICTs) have continued to shape the world in diverse ways. The Okinawa Charter on the Global information Society, adopted by leaders of the G8 countries at their Summit in 2000 re-emphasized the importance of ICTs in the global development agenda (United Nations ICT Task Force, 2003).

Most countries are at some stage of health sector reform to try to provide expanded and equitable access to quality services while reducing or at least controlling the rising cost of healthcare. Health reform processes have many facets and there is no single model being adopted by all countries (PAHO, 1998). However, ICTs have the potential to make a major contribution to improving access and quality of services while containing costs. Improving health involves improving public health and medical programmes

designed to provide elective, emergency and long-term clinical care, educating people, improving nutrition and hygiene, and providing more sanitary living conditions. These in turn ultimately involve massive social and economic changes, as many health challenges go well beyond the health sector.

The health sector has always relied on technologies. According to WHO (2004), they form the backbone of the services to prevent, diagnose and treat illness and disease. ICTs are only one category of the vast array of technologies that may be of use. Given the right policies, organisation, resources and institutions, ICTs can be powerful tools in the hands of those working to improve health (Daly, 2003).

Advances in information and computer technology in the last quarter of the 20th century have led to the ability to more accurately profile individual health risk (Watson, 2003), to understand better basic physiologic and pathologic processes (Laufman, 2002) and to revolutionise diagnosis through new imaging and scanning technologies. Such technological development, however, demands an increased responsibility of practitioners, managers, and policy-makers for assessing the appropriateness of new technologies (Hofmann, 2002).

The methods people use to communicate with each other have also changed significantly. Mobile telephony, electronic mail and videoconferencing offer new options for sharing perspectives. Digital technologies are making visual images and the voices of people more accessible through radio, TV, video, portable disk players and the

Internet, that change the opportunities for people to share opinions, experience and knowledge. This has been coupled with steps to deregulate the telecommunications and broadcast systems in many countries, which open up spaces and platforms, such as community radio, for increased communication.

Reliable information and effective communication are crucial elements in public health practices. The use of appropriate technologies can increase the quality and the reach of both information and communication. On one hand, the knowledge base is about information, which enables people to produce their own health. On the other hand, social organizations help people to achieve health through health care systems and public health processes. The ability of impoverished communities to access services and engages with and demand a health sector that responds to their priorities and needs, is importantly influenced by wider information and communication processes, mediated by ICTs.

1.7 ICTs and the health-related MDGs

Health is at the heart of the Millennium Development Goals (MDGs) - recognition that health is central to the global agenda of reducing poverty as well as an important measure of human development (WHO, 2005). Three of the eight MDGs are directly health-related:

- reduce child mortality (goal 4)
- improve maternal health (goal 5)
- Combat HIV and AIDS, malaria and other diseases (goal 6)

The other MDGs include health related targets and reflect many of the social, economic, environmental and gender-related determinants that have an impact on people's health. Achieving them will also contribute to improvements in the health status of thousands of millions of people around the world:

- eradicate extreme poverty and hunger (goal 1)
- improve education (goal 2)
- empower and educate women (goal 3)
- improve water and sanitation systems (a key component of goal 7)
- improve international partnerships (among other things to improve access to affordable, essential drugs on a sustainable basis – goal 8)

The eight MDGs do not work in isolation and therefore cannot be treated in isolation. Policy efforts and discussions need to consider the broader health determinants that impact upon people's lives (WHO, 2005). UNICEF (1998), for example, has developed a conceptual model for child morbidity and mortality that considers the political, economic and social systems that determine how resources are used and controlled. This helps to identify the number and distribution of children who do not have sufficient access to food, child care, clean water, sanitation and health services. Analysis such as this is applicable to other public health issues, such as HIV and AIDS or women's health (Global Health Watch, 2005). Unless resources are also devoted to tackling the broader determinants of health, more health spending does not necessarily mean better health (Clemens, 2005).

A comprehensive approach is required, both in terms of looking at issues that cut across different areas and also having private, government and non-governmental organizations working together to achieve the same objectives (WHO, 2005). ICTs need to work in synergy with any other policy initiatives or strategies, such as national poverty reduction strategies (Danida, 2005) or as part of national health policies.

The MDG number 8 as noted by the Socialist International (SI) explicitly stated – that eradicating poverty and its underlying causes requires a global partnership for development (Socialist International, 2005).

Like most countries in sub-Saharan Africa, the major health problems in Ghana are child mortality, maternal death and HIV/AIDS. These health problems are mostly bigger in rural areas where more than half of the country's population reside especially the three northern regions (Upper West, Upper East, Northern and Central Region in the southern part of the country (ITDP, 2005). In line with the millennium development goal (MDG) targets and indicators the government of Ghana has identified a core set of "Top 10-Diseases" to work with health providers on all levels of the country through Community based Health Planning and Services (CHPS).

HIV/AIDS, Malaria, Tuberculosis, Guinea Worm, Poliomyelitis, Maternal & Child Health, Accidents & emergencies, Non-communicable diseases, Oral health & eye care and Specialists services including psychiatric care (ITDP, 2005).

According to Godal (2005), good health is not only important for individuals, but also governments because it plays a central role in achieving sustainable economic

development and growth as well as effective use of resource. It is a good thing that the government of Ghana has identified health issues that should be a priority as part of her effort in achieving the MDGs. Despite the progress being made, information and communication technology divide between Africa and the rest of the world remains wide, and the MDGs will only be a mirage without the partnership and assistance from the advanced countries.

To ensure the MDGs are achieved by 2015, the Socialist International challenged Organization for Economic Cooperation and Development (OCED) countries to focus first on delivering Goal 8 – i.e., with more additional and more effective aid, directed mainly to poor countries and also more sustainable debt relief and more trade and technology opportunities for these countries. Again the Socialist International pointed out that for poor countries to realize the MDGs, an additional 50 billion US \$ is needed in aid from OCED countries. Further urgent measures must be taken to fix the problems in the international trade systems that continue to prevent the world's poor countries from trading themselves out of poverty (Socialist International, 2005). However, care must be taken to avoid the situation where “traditional aid programs have seen donors ‘push’ recipient countries, usually those with which the donor nation has some form of historical connection or vested interest, into improvements using aid disbursements to influence specific program activities” (Godal, 2005).

1.8 Organization of the Study

This research work will be organized into five chapters. The first chapter will be introduction. Chapter two will focus on the literature review and theoretical framework of Electronic Medical Record. The third Chapter will be based on the methodology stating the sample design and the sampling method to be used. Chapter four would comprise the interpretation and analysis of responses from the questionnaire that would be collected using the right statistical tool while the final chapter, which is chapter five, comprises the summary of findings, conclusion, and recommendation.



CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter discusses the current literature and research pertaining to medical information technology (electronic medical record systems) and its potential benefit in the medical field. Furthermore, this chapter discusses the current methods used to store and transition from paper based records to electronic records. It also underscore the various theories that measure how successful the implementation of a technology is and its acceptability. As discussed in Chapter 1, the potential to lose access to a patient's medical history exists as more healthcare facilities migrate from paper records to electronic records.

2.2 Theoretical Framework

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

care, measure quality, and reduce medical errors. Core issues such as the people's interactions with technology, and their acceptance of it should be critically examined during the implementation of an EMR system. For this thesis, Technology Acceptance Model (TAM) theory is used to aid in the implementation of EMR as a cooperative tool and its acceptance in TGH.

2.2.1 The Technology Acceptance Model (TAM)

Top most on the minds of those who implement new technologies in an organization is the success of this implementation. The key measure of how successful the implementation of a technology, is its acceptability (Broens *et al.*, 2007). The technology acceptance model (TAM) is an Information system and a behavioural theory that models how users accept and use technology. This theory models the acceptability of a technology based on two behavioural premises; the *perceived usefulness* (PU) and the *perceived ease of use* (PEU) of the technology. TAM has been useful in predicting how acceptable a technology will be. TAM considered as an extension of Ajzen and Fishbein's theory of reasoned action (TRA) was developed by Fred Davis and Richard Bagozzi ((Davis 1989; Bagozzi *et al.* 1992). There have been several studies to validate TAM (Adams *et al.* 1992; Hendrickson *et al.* 1993; Segars 1993; Subramanian 1994). Other researchers, notably Venkatesh & Morris have worked to broaden the scope of TAM and this has culminated in the development of the *Unified Theory of Acceptance and Use of Technology* (UTAUT) (Venkatesh 2000; Venkatesh *et al.* 2003; Venkatesh, 2008). They sought to address the perceived inadequacy and simplistic nature of TAM. UTAUT has added four dimensions (*performance expectancy, effort expectancy, social*

influence, and facilitating conditions) to help broaden the understanding of determinants of usage intention and behavior posited in TAM.

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

2.2.2 Application in Clinical Information Systems Research

Technology adoption research has been performed for nearly 30 years with well-tested models attempting to predict or validate the use of IT; in 2002, there were a scarce number of published studies relating to healthcare and technology acceptance (Chismar, 2002). Today however, numerous studies have been conducted specifically targeting technology acceptance within the medical profession. Common reasons cited within the research as to why technology falls into disuse were those such as the amount of time it takes to learn the new system (ease of use) and the users' perceptions as to whether or not the technology actually assisted or hindered their ability to accomplish tasks (*perceived usefulness*). "Practitioners have often regarded technology as costly, cumbersome, and offering little help for tasks at hand"

Considering the fact that health workers are constantly under time constraints, it is not surprising that a change impacting their hectic, daily regimes would meet resistance (Goldschmidt, 2005).

One particular study conducted by (Hu *et al.*, 1999) examined physician acceptance of telemedicine, using the technology acceptance model (TAM). Telemedicine is best described as “the transportation of medical advice or procedures using telephone lines or internet as the medium” (Chau *et al.*, 2004). Based on the study’s findings, the most significant factor affecting Doctors’ decisions to use telemedicine technology was their perceptions as to how useful they found the technology (Hu *et al.*, 1999).

The further concluded that attitudes might also affect a physician’s acceptance of technology. Physicians, more so than non-professionals, tended to focus on the technology’s usefulness versus its ease of use (Hu *et al.*, 2002). This might help to explain the slower adoption rate that plagues many hospital chief information officers (CIO) and administrators (Middleton, 2005). Even though adoption rates for technology tapered off, improvements to the technology as well as benefits through its use have really ignited a desire for more implementation (Chow, 2007)

2.3 Medical Technology use Increases

While the types of technology employed in the medical field vary greatly, much of the present talk in the medical community is centered on the use of electronic medical records and their sub-systems (Tang *et al.*, 2006). In 1991, the National Institute of

Medicine declared the computer-based records essential for health care (“Institute of medicine,” 1991). Nearly two decades later, the medical community has begun widespread use of this technology. As previously mentioned, the first systems were designed and used in the late 1960s (Goldschmidt, 2005); however, the newer systems of today provide computing power that far surpasses the startup systems of 40 years earlier, and are catapulting the medical field toward a new frontier.

Today, geographically separated medical personnel share incredible amounts of patient-related information within seconds without ever physically handling it. Physicians and their staff no longer need to be present in order to address the changing needs of their patients (Bush, 2007). They are linked electronically to their work whether through E-mail, personal digital assistants (PDA), or video teleconferencing (VTC). The ability to rapidly share information through the increased usage of technology gives doctors, nurses, and hospital administrators access to critical and relevant clinical information as well as fostering communication amongst colleagues (Bobb *et al.*, 2007; Glaser, 2007). Patient health information is among the most shared thanks to the enabling characteristics of EMR systems.

2.4 Importance of Electronic Medical Records

Most developed countries in Europe and the United States of America (USA) are increasingly using EMR due to the belief that it can help improve health care quality. It has also been realized that decision support tools like computerized physician order entry (CPOE) helps in medical errors reduction (Fraser *et al.*, 2005). This is possible

due to the advances in IT which allows for an in-built mechanism into all the clinical information systems (CIS) to check for drug allergies, drug doses and appropriateness of medication, thereby eliminating the need for physicians to write orders by hand in the patient's chart. According to Tang *et al* (2006) "every time someone in practice or hospital touches a chart, it costs the organization nearly \$3". Therefore one main advantage of EMR is that care givers never have to worry about finding a chart since every data or information concerning the patient is already input into the computer.

Another important element of EMR is legibility of clinical notes (Fraser *et al*, 2005; Tang *et al*, 2006; Powsner *et al.*, 1998). EMR provides documentation in a computerized format that allows for data or records to be printed in text form rather than hand written. Also the computer checks for spelling, validity and range checks which prompt users when data entry error is detected. In addition, records in the EMR serve as a legal document since alteration cannot be made to the document without having to enter a new date and time. Electronic medical record increases efficiency of health care providers' workflow (Tang *et al*, 2006). Thus data entered into the hospital information system (HIS) can be used to refer a patient to a specialist. Also, epidemiologists, researchers, physicians and other clinicians can extract information from HIS to protect and promote the health of the population through efficient surveillance, investigation, prevention and control of communicable diseases of public health importance. Especially, identification of risk factors among patients and the obtainment of care quality indicators (Tomasi *et al.*, 2004). Further, EMR allows care providers an opportunity to be abreast of the patient health status. For instance, by

creating shortcuts to documents warning about abnormal laboratory examination results, prescriptions and drugs administration, physicians are able to quickly provide feedback to patients without any difficulties.

Other benefits of EMR include data accessibility by multiple users and continuous data processing. Multiple users can use the record at the same time from different locations simultaneously without any problem. Finally, data can be backed up automatically and stored at different locations outside the hospital or clinics so that in case of disaster access to the record will not be denied (Fraser *et al*, 2005; Powsner *et al.*, 1998).

2.5 Challenges of Electronic Medical Record

Electronic medical record has great potentials to improve the quality of care delivery. However, despite its importance there are some challenges that must be considered when designing and implementing EMR systems. One limitation is lack of hardware and software standardization. According to Shortliffe (2001) although standards “reduces development costs, increases integration, and facilitates the collection of meaningful aggregate data for quality improvement and health-policy development”, due to the complexity and different needs of each of the units/departments within the health care industry, maintaining technological standards is always difficult. As a result, each department usually implements its own technology pertaining to the needs of that unit which makes it impossible for all systems within the hospital system to communicate. Also lack such standardization reduces importance of automatically generating indicators which are necessary for decision making (Tomasi *et al*, 2005).

Similarly, Fraser *et al*, (2005) noted that a survey of US primary care physicians identified 264 different EMRs in use. Consequently EMR systems development has been dogged by problems of proprietary and incompatibility.

Another major limitation to EMRs implementation is too many data sources (McDonald, 2005). Thus, the sources of EMR information that do exist (e.g. laboratory data, pharmacy data, and physician dictation) reside on many isolated islands that have been very difficult to bridge. Further, each of these sources contains different data and uses variety of methods to capture, structure, and code the needed information. Unfortunately as noted by McDonald, despite these difficulties professionals have not been able to find out how to capture the data from the physician in a structured and computer understandable form.

In addition to these problems, privacy, confidentiality and security issues cannot be achieved using EMR (Shortliffe *et al*, 2001; Tomasi *et al*, 2004). Only computers can manage the large amount of clinical information generated in this information age; however careful action must be taken to ensure that access to this information is made available to only valid and authorized users of the system to protect the privacy and confidentiality rights of patients. There is therefore the need for government and organizations to adopt strict policies and regulations to protect this information. Privacy and confidentiality protections are necessary for public health promotion since people will feel more comfortable to disclose personal information to health professionals decreasing the risks of spreading infectious diseases.

According to Jha *et al.*, 2009, the uses of computerized EMRs have a negative effect on patient privacy. He said Physicians doubt whether EMR are secure in storing patient results and fear that they may be accessible by unauthorized users.

Security is a very important issue, but it is essential that the appropriate people are able to access information when they need it. According to Goedert (2004), He explains how a medical center in Washington created a virtual private network (VPN) to secure data sent within the facility and other external sources. However, too many VPN's were created and the network became too secure, which caused appropriate users to have to go through many authentication procedures before they could log into various applications. Physicians were not able to do two tasks at once during a single session, to resolve this problem they had to bring in a vendor to re-modify the security settings.

Shachak, 2009 said that 92 % of the Physicians felt that EMR use disrupts communication with their patients especially when Physicians lack typing skills.

The costs of implementing and maintaining EMR is another challenge (Bates *et al.*, 2003; Miller, 2004; Powsner *et al.*, 1998; Shortliffe *et al.*, 2001). It is true that hospitals need robust ICT infrastructure especially in terms of hardware and software, but the cost of such technology is highly capital intensive, therefore small hospitals and developing countries especially find it difficult to embark on. However, the long term benefits associated with such technology definitely far outweigh the investment cost (Lorenzi, 1995). Also, due to the heavy cost involved, any decision to implement an EMR should be a strategic one involving all leaders from every segment of the health

care institution to facilitate the design, implementation and maintenance of the system. Further, due to fear, change is often considered a threat which means without adequate involvement of the users of the system, the project can never be developed, implemented and maintained successfully (Leonard, 2004). In conclusion, ICT promotes greater efficiency and error reduction in the management of diseases. But review of the literature revealed that the numerous varieties in technology applications within the same environment hamper evaluation. As concluded by (Tomasi *et al*, 2004) the most important lesson is the adoption of a single national information systems.

2.6 The Traditional Paper-Based Patient Record (PBPR)

For many centuries, the traditional paper-based patient record (PBPR) has been the main source of compiling information about patients' illness, diagnosis and treatment (Miller, 2004). As with any other record system, it provided a means of communication between health care providers and the patient. With advances in technology leading to information overload, care delivery has become more complex for clinicians as a result of medical knowledge explosion and increasing importance of communications between health professionals and other care delivers (Tange, 1995). In addition to the complexity, most patients are not seen by only one physician, but a group of care givers. Therefore to ensure continuity of care and medication error reduction as reported in the Institute of Medicine (IOM) Committee on improving the patient record report, the traditional paper-based system proves woefully inadequate, inefficient and ineffective in this information age to meet the needs of modern medicine (Tange, 1995).

2.7 Challenges of Paper-Based Patient Record

One of the main drawbacks of paper-based patient record is inaccessibility (Shortliffe *et al.*, 2001). The IOM committee report (1991) and a noted in their study that about 30 percent of patient visits in traditional records were not accessible. The reasons attributed were “patients being seen in two or more clinics on the same day, charts not being forwarded, physicians keeping records in their offices or removing them from their offices and records being misfiled in the file room” (Dick, 1991,). Even when the records are readily available, because paper records become bulky with time, it requires a lot of time to access and retrieve appropriate information relating to care management, and especially in real time situations, such as an emergency, this can be frustrating to care providers. In addition, paper records are not portable; therefore do not follow the patient when he or she moves or changes care providers to ensure continuity of care. Consequently, the patient has to repeat the same information and diagnostic examinations over and over again which may lead to vital information being left out. Ignorance of the patient’s medical history, however, can easily cause adverse effects which might even lead to death.

Information content and organization in PBPR are normally illegible or inaccurate (Bates *et al.*, 2003). Data in medical records are usually not legible and there is no mechanism to check for spellings, validity and completeness of details in the record. Moreover, each provider has his or her method of recording information and what looks clear to one may not be for the other. According to Dick (1991) other issues related to medical record content include lack of standardization regarding definition of medical

terms, inability to capture the rationale of health care providers, among others. The paper-based record is also location bound and consists mainly of unstructured free text (Bates *et al*, 2003; Dickk, 1991). The traditional medical record does not support either multi-tasking or remote access, therefore, can only be accessed at a particular place and time. Thus, care providers at different locations cannot easily access and review patients' records and medical histories to promote effective and efficient clinical problem solving and disease management. Many researches have shown that data captured in computer can be reused and easily stored, accessed, and retrieved. Although medical records are organized in chronological order, unlike structured data in computer-based medical record, information are four times faster to find (Fries, 1974).

Other notable problems with paper-based medical record include lack of coordination, data linkages, integration and cost (Dick, 1991). Traditional paper medical records cannot be shared between different care providers since access is limited to one person at a time. Moreover paper-based record increases administrative, storage and retrieval expenses of healthcare institutions.

2.8 Strength of Paper-Based Patient Record

As already noted traditional medical records have been in use for centuries and continue to serve as the major source of information for clinicians in disease management and treatment. In spite of the difficulties and challenges associated with its use, there are a number of benefits users derived from it. The IOM committee on improving the patient record in (1991) identified five strengths of the system from users' perspectives:

Paper records are familiar to users who do not want to acquire new skills.

Paper records can easily be carried to the point of care.

Once in hand, paper records do not experience downtime as computer systems do

Paper records allow flexibility in recording data

Records can be browsed through and scanned (if not too large). This feature allows users to organize data in various ways and to look for patterns or trends that are not explicitly stated.

2.9 Transition from Paper-Based to EMR

Converting from paper-based to EMR is complex and difficult because it represents a paradigm shift not only in the work of physicians, but other staff. Therefore, the transition requires a systematic activity and must be managed from many aspects ...”clinically, administratively, culturally, and organizationally. The transition must include not only the process changes inherent in the use of a new tool, but also the technical and procedural training, and the resultant changes to physician and staff roles within the office” (Dick, 1991). Subsequently, it requires a strong management commitment and motivation (Smith *et al.*, 2005). Secondly, involvement of all stakeholders, care providers and other users of the system right from the beginning is necessary for survival and sustenance of the project. Involving those help to have a clear understanding of why the organization is making the change. Involvement and understanding also help users (care providers) to identify themselves with activities that will make the transition very smooth to achieve desirable outcome. As noted in the CPSA guideline, during this process care must be taken not to impact the patient-physician relationship or the integrity of the clinical processes covered be impaired.

The following must be considered during the transition process:

- ✦ Cost of training, hardware and software
 - ✦ Type of hardware and software
 - ✦ Security of patient information
 - ✦ Maintenance of patient privacy and confidentiality
 - ✦ Maintenance and integrity of medical record content
 - ✦ Integrity of the clinical workflow supported by the medical record must be maintained
 - ✦ Continuity and quality of care must be maintained through the transition period
- (CPSA Guideline, 2004).

To conclude, health care delivery has become more evidence-based and information intensive and ...”much of the process of medicine involves information retrieval, integration, processing and transmission” (CPSA, 2004). Only ICT tools such as EMR implementation can handle the large volume of health care information to provide greater opportunity for improvement in workflow of clinicians and staff. Unfortunately change is often feared. Such technological transition therefore requires strong managerial strategy, motivation, commitment and leadership that can identify and seek support from change agents within the organization to bring about the cultural and behavioral transformation needed for success and survival of the system.

2.10 EMR Opportunities in Developing Countries

Developed countries are embracing the potentials of technology to liberate their economies from traditional constraints of time and space (Entsua-Mensah, 1996). Telemedicine, for instance, is increasing access to improve treatment and quality of care by rural populations by diminishing transport of patients to other facilities. While diseases, disorders and environmental conditions threaten the lives of the developing world, lack of adequate ICT infrastructure is undermining the development of efficient Health Information System (HIS) in these countries where more than half of the population reside in rural areas without access to health care (Tomasí *et al*, 2004).

Meanwhile without reliable, relevant Health Information System health care providers cannot effectively plan, assess health needs of populations and groups, or make decisions to allocate scarce resources to implement programs, improve the quality of health or address the numerous health issues facing them especially HIV-AIDS, tuberculosis, malaria, civil wars etc. The hindrances could be attributed to a number of factors.

2.11 Challenges

Although the need for EMR systems are felt in most third world countries, they lack financial and human resources vital for strategic policy making to either acquire, train, or accommodate informatics professionals to handle the design and implementation of systems to meet their needs (Simba, 2004). Lack of computers/hardware facilities is another challenge in implementing EMR (Fraser *et al.*, 2005). Facilities like telephone lines and internet connectivity play a critical role when introducing EMR. This means

that the cost associated with setting up of EMR will be more than the resources needed to manage other aspects of the hospital (Faxyang, 2001). Again due to funds and high costs of repair, developing countries are not able to draw up maintenance plans to sustain the few computers and other equipment donated by philanthropies. Some authors believe data collected in developing countries are incomplete, inaccurate, unreliable and not timely, therefore the potentials of EMR may not be realized (Simba, 2004). It is also suggested that the use of EMR might expedite the dissemination of wrong or poor data which does not represent the truth, hence the slow pace of development (Simba, 2004). Further, it is assumed that technology architectures designed for developed countries are appropriate and can easily fit into developing countries' environments. However, considering the differing cultural, organizational and environmental factors, it is essential for systems analysts and designers to research into these areas to design equipment pertaining to the needs of these countries. Finally, EMR implementation in developing countries requires human resources, funds, systematic collection of data, and effective monitoring of the existing system. Governments, health managers and administrators have to exercise strong commitment, and invest in HIS to improve the health delivery status of their citizens. To bridge the digital divide between the North and South, it is essential for international agencies and co-operations to assist developing countries in the areas of technology and manpower developments in order to meet the demand of twenty-first century health care delivery. Finally, as concluded by Jayasuriya (1995), in his study, it is necessary for donors to invest more in "developing capacity rather than in outsourcing IT projects to expatriate

firms and vendors, as in the long-run, the survival of the systems depend on capabilities within the organization”.

2.12 Implementation of EMR in Developing Countries

Availability of good quality data for continuity of care, decision making and allocation of limited resources in most developing countries, and especially in Africa, remains a mirage. This section reviews the process of the design and implementation of some EMR projects.

1. CAREWARE, UGANDA

Background: A team at the US Department of Health and Human Services has developed a medical record system to support HIV treatment via the Careware system.

Design: Stand-alone database built with MS Access.

Functions: Provides comprehensive tools for tracking HIV patients and their treatment, including clinical assessment, medications and billing data. It is widely used in health centres and hospitals in the US, and has recently been internationalised and deployed in Uganda in October 2003.

Significance: Careware is an example of a US-based stand-alone EMR that is being adapted to developing country environments. An internet-accessible version that is under development will allow local data entry offline but provide networked communications and back-up.

2. MEDCAB, CAMEROON

Background: MEDCAB is a locally designed electronic health record (EHR) system for primary health care (PHC) practitioners in Cameroon and released at the beginning of 2003. It is important to note that as with any other place in sub-Saharan Africa, the public sector is the principal health care provider (Kamadjeu *et al*, 2005).

Design: MEDCAB was designed after in-depth observations and interviews, and modeling of the provider-patient encounters (PPE). Using the International Classification for Primary Care (ICPC-2) disease classification, and Visual Basic 6 (VB) programming language, the system development platform was Microsoft Windows i.e. MS-Access and MySQL as the system's databases.

Functions: The system consisted of many user interfaces with multiple functionalities including; users' administration, medical encounter, patient registration, appointment management, report generation, patient card generator, diagnosis, etc.

Implication/Significance: After four months of implementation, there was a significant decrease in coding time, consultation and better management of patients. Also there was significant increase in best practices, that is "system prompting for measurement of parameters and checking for unusual values (temperatures, blood pressures), reminders for conditions requiring special attention and making data from previous contacts readily available" (Kamadjeu *et al*, 2005).

3. LILONGWE EMR, MALAWI

Background: Kamuzu Central Hospital located in Lilongwe, Malawi has made extensive use of a touchscreen patient management information system for a wide range of clinical problems in the 216-bed paediatric department since 2001.

Design: Runs over a local area network built on Linux/ MySQL with Visual Basic™ for the client programs.

Functions: Data are collected on patient demographics, medication, laboratory tests and X-rays. A potential limitation of the touch screen approach is that it is difficult to enter free text, though an 'on-screen' keyboard is available and has been used by local staff to enter all the patients' names.

Significance: The extensive use of this system directly by healthcare workers in a poor country with limited IT skills is a convincing demonstration of the potential of EMRs with user-friendly data entry mechanisms.

4. HIV-EMR, HAITI

Background: Non-governmental organizations Partners In Health (PHI) and Zanmi Lasante have collaborated to launch a community-based HIV treatment program in Haiti's impoverished area (Fraser *et al*, 2004).

Design: It is a web-based satellite system hosted on a server in Boston, USA. It is bilingual (English and French) with an open source system backed by an Oracle database. Categories of data collected in the HIV-EMR are patient demographics, previous treatment and any adverse effects, symptoms, physical examination, laboratory investigations, drugs etc.

Functions: Health care professionals enter all clinical and drug information using a standard patient registration form. The system checks for drug and their doses, administration procedures, allergies. It also has in-built mechanism to detect errors such as prescribing zidovudine and stavudine together.

Implication/Significance: Successful implementation and use of the system has proved the importance of EMR in rural impoverished areas.

5. MMRS, KENYA

Background: The Mosoriot Rural Health Center comprises six separate clinics: Adult Medicine, Pediatrics, Well Children (infants and children < 5 years of age), Antenatal Care, Family Planning and Sexually Transmitted Infections (STI) Clinics. Through collaboration between Indiana University School of Medicine and Moi University School of Medicine led to Mosoriot Medical Record Systems (MMRS) in 2001 (Tierney *et al*, 2002).

Design: MMRS consists of a paper encounter form, based on IBM-compatible microcomputer powered by a UPS with solar battery back-up and programmed in Microsoft Access using the following modules; Registration, Encounter Data, Reports and Data Dictionary.

Functions: MMRS assign a unique registration number to patients. The Report module generates monthly reports required by the Kenyan Ministry of Health. The Data Dictionary provides information on all diagnosis necessary for treatments.

Implication/Significance: Despite the digital divide, logistical and cultural problems, this simple inexpensive system is serving the needs of the Kenyan rural population by

improving on the quality of care, research and training for the local medical school (Tierney *et al*, 2002).

These projects illustrated the potentials of implementing EMR system in developing countries despite the challenges. To facilitate effective and efficient data collection for policy making, evaluation, disease management and quality care delivery and development, in Africa and other developing countries, it requires collaboration and involvement of the developed world.

2.13 Developments of Health Information Management in Ghana

There have been reforms in the health information management systems recently aimed at improving the quality of health information, and this has largely been in response to requests from donor agents like the UNDP and also as a commitment to meeting the Millennium Development Goals (MDGs) (MOH 2006). The National Health Insurance Scheme (NHIS) of Ghana, which was passed by an act of parliament in 2003, promises to be a lead promoter for the introduction of ICT in the Ghanaian health service. NHIS has introduced electronic identification cards to help minimize fraudulent claims and also for easy identification of NHIS clients at health facilities throughout the country. Of the various interventions in Health Management Information Systems (HMIS), the UNDP supported Maternal and Child Health Information System is the most extensive and significant. Piloted between 1987 and 1993 in three out of the ten administrative regions of Ghana, it focused on organized collection of data and reporting at the departmental level (MOH 2006). Little is mentioned of the success of this intervention

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

2.14 Use of EMR in Developed Countries

Countries such as the United States, United Kingdom and Australia have mature and advanced healthcare infrastructures that receive substantial funding and support from their governments. Although significant failures still exist in these systems, there is strong support and motivation to accomplish goals associated with comprehensive development of successful medical information technology systems (Avison, 2007)

These countries are able to make significant investments in research to develop information systems that would meet the need of their particular healthcare system. This

is in sharp contrast to the healthcare infrastructure of many developing countries. For many of these countries the delivery and management of healthcare services alone comes with many challenges. In many of these countries, implementers of healthcare information technology based solutions are faced with complex challenges such as inadequate funding, lack of resources and weak healthcare infrastructure. When EMR systems were first introduced, it was widely believed that their broad adoption will lead to major health care savings, reduce medical errors, and improve health (Fonkych, 2005). But there has been little progress toward attaining these benefits. The United States trails a number of other countries in the use of EMR systems. Only 15–20 percent of U.S. physicians' offices and 20–25 percent of hospitals have adopted such systems. Barriers to adoption include high costs, lack of certification and standardization, concerns about privacy, and a disconnection between who pays for EMR systems and who profits from them (Fonkych, 2005).

Despite the appeal of EMR, available data suggest that the majority of office practices in the United States, especially smaller offices, do not have this technology (Fonkych, 2005). For example, using 2003 data from the National Ambulatory Medical Care Survey, Burt and Sisk reported that an average of 17.6 % doctors used EMRs in their office-based practices (Fonkych, 2005). In contrast, other countries, such as Australia and the United Kingdom, are nearing universal adoption of EMRs (Fonkych, 2005). In Massachusetts in 2005, only 18 % of medical and surgical office practices reported using EMRs (Simon et al)

Larger practices that provided primary care and those with other computerized systems were more likely to have adopted EMRs. Among practices with EMRs, most systems did not include advanced functionalities, such as order entry for medications, laboratory tests and diagnostic imaging. While 58 % of practices with EMRs had electronic clinical decision support available, more than 1 in 4 practices indicated that a majority of their clinicians were not actively using that support. In 1995, Newton performed a study titled "The first implementation of a computerized care planning system in the UK". The implementation included both a new way of structuring work, using the nursing process and a new technology which was the use of computers. The results showed that it took more than a year after implementation until the nurses' negative attitudes towards the system shifted to positive attitudes. The study also showed a significant improvement in the quality of care planning (Smith *et al.*, 2005). In their review on the use of computers in a health care setting, Smith *et al.* (2005) found no conclusive evidence that could provide the foundation for an effective computer implementation strategy. However, more common use of computers in society today has increased the use of computers in nursing and also made it possible to implement standardized care plans in EMR (Smith *et al.*, 2005).

Attention to problems associated with the design of structures in EMR suggested that there is a risk that such structures will be difficult to work with in practice (Gagnon, 2009). Timmons described nurses' resistance to using computerized systems for planning nursing care; their resistance did not entail direct refusal, but was instead quite subtle. They tended to minimize use of the system or postpone it to another time or to

the next work shift. Timmons considered that the nurses' behavior was characterized by resistance to changes in the nursing process and to the technology (Dahm, 2008).

Smith and others investigated charting time before and after computer implementation and found that no change had occurred. The advantage of using the software was observed when the technology and the concept brought together the care plans and subsequent documentation. This shows that use of the system improved the function and meaning of the care plan process (Smith *et al.*, 2005).

2.15 Use of EMR in Developing Countries and Sub-Saharan Africa

In Africa millions of people die every year, and Sub-Saharan Africa, in particular, shows little progress towards achieving five of the six health-related Millennium Development Goals (MDG) targets (WHO, 2009). Countries in this region require health information systems that will enable them to generate the data needed to monitor progress towards the achievement of the targets. The health information systems in most African countries currently are primarily paper based and are woefully insufficient to meet both patient and reporting needs. On the other hand, information and communication technologies (ICTs) offer unparalleled opportunities to respond adequately to this challenge (WHO, 2009).

Just five years ago, the use of electronic medical records (EMRs) in resource-poor countries in the Global South was, at best, experimental. Few organizations thought their usage was realistic, and fewer still had deployed such systems. The handful of projects that used an EMR system fell mainly into two groups: those that used

expensive commercial software in specialist projects and private hospitals and those that developed the software in-house, usually to manage a specific disease (Fraser *et al.*, 2004).

Since then, several successful medical information systems and EMRs have been implemented in developing countries and information technology is much more widely available in resource-poor areas. These factors, along with recognition of the benefits of EMRs in improving quality of care in developed countries, have created a broad interest in the use of health information technology systems (HIT) in the management of diseases such as HIV and drug-resistant TB (Fraser *et al.*, 2004).

In 2001, the Departments of Medicine and Child Health and Pediatrics at Moi University, Eldoret and the Department of General Internal Medicine and Geriatrics at the Indiana University School of Medicine, in collaboration with the Moi Teaching and Referral Hospital in Eldoret, Kenya, established the Academic Model for Prevention and Treatment of HIV/AIDS (AMPATH) (Siika *et al.*, 2005). The AMPATH Medical Record System (AMRS) was the first functioning comprehensive electronic medical record system committed to managing and improving the quality and efficiency of care for patients with HIV/AIDS in sub-Saharan Africa. It has played a significant role in patient care in all AMPATH sites. It has standardized patient data collection and made data retrieval much faster than the traditional paper-based record. It has enabled evidence-based decision-making for patient encounters and for the health system. The AMRS is affordable and represents a model system for recording critical HIV/AIDS

data in resource poor settings that will be delivering an increasing amount of HIV care. This model will also allow those funding the rapid increase in the provision of HAART to know the return they are getting on their investment and hopefully encourage continued treatment of the worst medical disaster to ever befall humanity.

While most sophisticated EMRs in low-income regions are in large cities, where infrastructure and staffing needs are more easily met, Partners in Health (PIH) pioneered web-based EMRs for HIV and TB treatment in rural areas (Allen et al, 2006). The HIV-EMR, developed in Haiti, was deployed in two Rwandan health districts starting in August 2005. In less than six months (August 2005 through January 2006), the EMR tracked over 800 patients on ARV treatment. The addition of new features and adaptation to local needs was happening concurrently with the rapid scale-up and evolution of the medical program itself. The EMR in Rwanda provides support for patient monitoring, program monitoring, and research. Patient monitoring includes information for care of individuals, such as historical medical summaries and alerts. This is especially useful given the large distances between the clinics. The EMR in Rwanda also has an instrument to predict drug requirements and aid pharmacists in packing.

PIH in Rwanda learnt that well-trained data entry persons are required to maintain an EMR system; the team also learnt that at least 4 months of on job-training is needed to properly train data entry persons. Data entry persons must have the ability to solve

problems and follow up ambiguous or suspect data, and IT support persons must be available. Care providers must also be trained to properly report changes in treatment.

2.16 Implementing EMR in Ghana

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

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

The primary purpose of the EMR is to provide a documented record of care that supports present and future care by the same or other clinicians. This documentation provides a means of communication among clinicians contributing to the patient's care. The primary beneficiaries are the patient and the clinician(s) (ISO 2003). Implementing

a new technology (such as EMR), especially in complex work environments such as in the health sector requires a careful thought out plan and strategy, not only to ensure a successful implementation but also to strike a balance between conflicting important goals. Important goals such patient safety/privacy, healthcare quality, process efficiency, the organization's business plans and goals and the EMR usability all need to be balanced (Watson, 2003). Implementation of EMR should not be a mere automation of existing workflows, but rather it should be geared towards the development of new and efficient workflow.



CHAPTER THREE

METHODOLOGY

This chapter highlights the design, sample, and procedures involved in this research. Choosing an appropriate research method can be very challenging; initially I was not sure of which research method(s) to employ for this work, given a myriad of research methods available. Reviewing other master students' approaches and given the research questions and the expected impact of this research, I decided using an exploratory study conducted in Kumasi, Ghana to examine the potential benefits of EMR and its contribution to improving health care delivery, it is largely descriptive, and categorized as a non-experimental qualitative study.

3.1 Study Area

The Tema General Hospital established in the 1950s as the only centre to attend to the health needs of workers in the Port City, has diligently served its purpose and was among the best hospitals in the country in its hey days second only to the two main teaching hospitals in Accra and Kumasi. The Tema General Hospital aside from catering for patients from the Harbour city, also serves as the referral centre for other health posts in the South-Eastern part of Greater Accra, and provides emergency services to both victims of industrial and road traffic accidents, especially on the Tema Motorway. It has been the health sanctuary for residents of Ada, Dodowa, Ashaiman, Teshie-Nungua and beyond.

3.6 Representativeness: Because the study was conducted in one hospital, and taken into account the total number of professionals in the participating departments and the difficulty in getting volunteers, a sample size of 100 was reasonable enough for the study.

3.7 Instrumentation

Based on the focus of the research and systematic review of the literature, the content of the instrument designed was open-ended questions considering issues on the following areas;

- Knowledge of EMR
- Transition from paper-based
- Benefits and Challenges of EMR
- Transition from paper-based system to EMR
- Demographic details based on profession, length of practice, age and sex.

The hospital Administrator was contacted at the time of visit and an individual selected from the biostatistics Department to help distribute the questionnaires and the consent letter to all participants. Participants were requested to fill out the attached survey and return it in a sealed envelope to this person from the biostatistics Department. After 2 week, a first reminder was sent through a text message asking for their cooperation and the importance of returning the survey. A final reminder was sent after the third week period to those who might have forgotten to return the completed survey.

3.8 Pre-Test or Pilot Survey

In order to identify any problem with the survey instrument or its deployment, a pilot test was performed (date) in St. Joseph's hospital in Nkwanta in the Volta Region before conducting the final study. Pilot testing was also necessary to determine the average length of time needed to complete the survey, as well as how to manage and analyze the data collected. Pilot survey was also conducted to identify questions that may be misinterpreted, so that the questionnaire could be revised before it was administered to the larger population and possible coding system and themes to use. In all ten questionnaires were administered to selected health care professionals in this Hospital.

3.9 Data Collection

Questionnaires were distributed to workers who deal directly with patients were used to collect data. At every point the investigator was immersed in the setting, acting as an unobtrusive observer. Field notes of what was being experienced, learned through interaction with other people and what was being observed was documented and expanded into a more descriptive and narrative form. Feedback from workers during observation and discussions were recorded. Data collection tools were pretested for validity and feasibility and appropriate corrections were made before the actual study was conducted.

3.10 Data Management Analysis

This section describes data management and analysis method and tools used to analyze the data.

3.10.1 Data Analysis

Open-ended survey responses were coded and organized into themes to determine result interpretation and recommendation

Quantitative data of the closed-ended questions were analyzed using SPSS version 16.0

Graphs and charts were created using Microsoft Excel.

3.10.2 Data Quality Control

The following measures were taken to ensure reliability and validity of survey instrument

A second coder was identified who assisted with coding the questionnaires using SPSS and MS-Excel for an accurate data analysis.

3.11 Ethical Consideration

A special informed consent letter was written to the hospital management in Tema General Hospital after which each was attached to each questionnaire for the respondents. Cognizance of the right to privacy, confidentiality and anonymity of research participants was greatly considered by the Researcher. The right to equality, justice, human dignity/life and protection against harm during administering of the questionnaires was ensured. The participants' right to freedom of choice of expression during the completion of the questionnaire was not interfered.

3.12 Data Gathered

Some data obtained from the subjects regarding the number of years they worked in their departments, Length of time of paper records usage, accuracy of reports generated using EMR and paper Records and the security, Privacy and confidential issues of EMR are represented on Table 1, 2, 3 and 4 respectively.

Table 1 Number of years worked by respondents in their present unit/department

Year	Frequency	Percentages (%)
Less than 1	14	14.0
1-5	75	75.0
6-10	10	10.0
11-15	1	1.0
Total	100	100

Table 2 Length of time (months) participants uses paper records

Month	Period used paperbased records (%)
>6	6%
6-12	34%
13-18	2%
19-24	1%
24 and above	57%
Total	100%

Table 3 Accuracy of reports generated by EMR and the paper based records

Reports generated	percentage of respondents (%)
The EMR-generated report will be significantly more accurate	93%
The EMR-generated report will be slightly more accurate	4%
Paper will be significantly more accurate	2%
The accuracy of both reports will be about the same	1%
TOTAL	100%

Table 4 Security, privacy and confidential issues of EMR

Patient security	Percentage response (%)
Password	84%
Access restriction to user	8%
Data encryption	5%
Hippocratic Oath	3%
TOTAL	100%

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

The preceding chapter discussed the research design and the methodology used in the current study. This chapter discusses how the collected data was prepared for analysis, description of the data, and its presentation.

Based on the research and the methodology, the survey was made up 100 participants at the Tema General Hospital in Accra. All surveys from 100 respondents were received. To begin with data analysis, all 100 responses were coded, typed and organized into data. The results from the 100 participants are as follows:

4.2 Demographics

Majority of the respondents (65 %) were females with 35 % being males. More than half (85 %) of the respondents have been in practice for 1-10 years, with the next largest group (13 %) reporting between 11-20 years of experience and only 2 % of the respondents worked between 21-30 years. The various professions of the respondents as well as the number of years they worked in their present departments are shown on figure 1 and table 1.

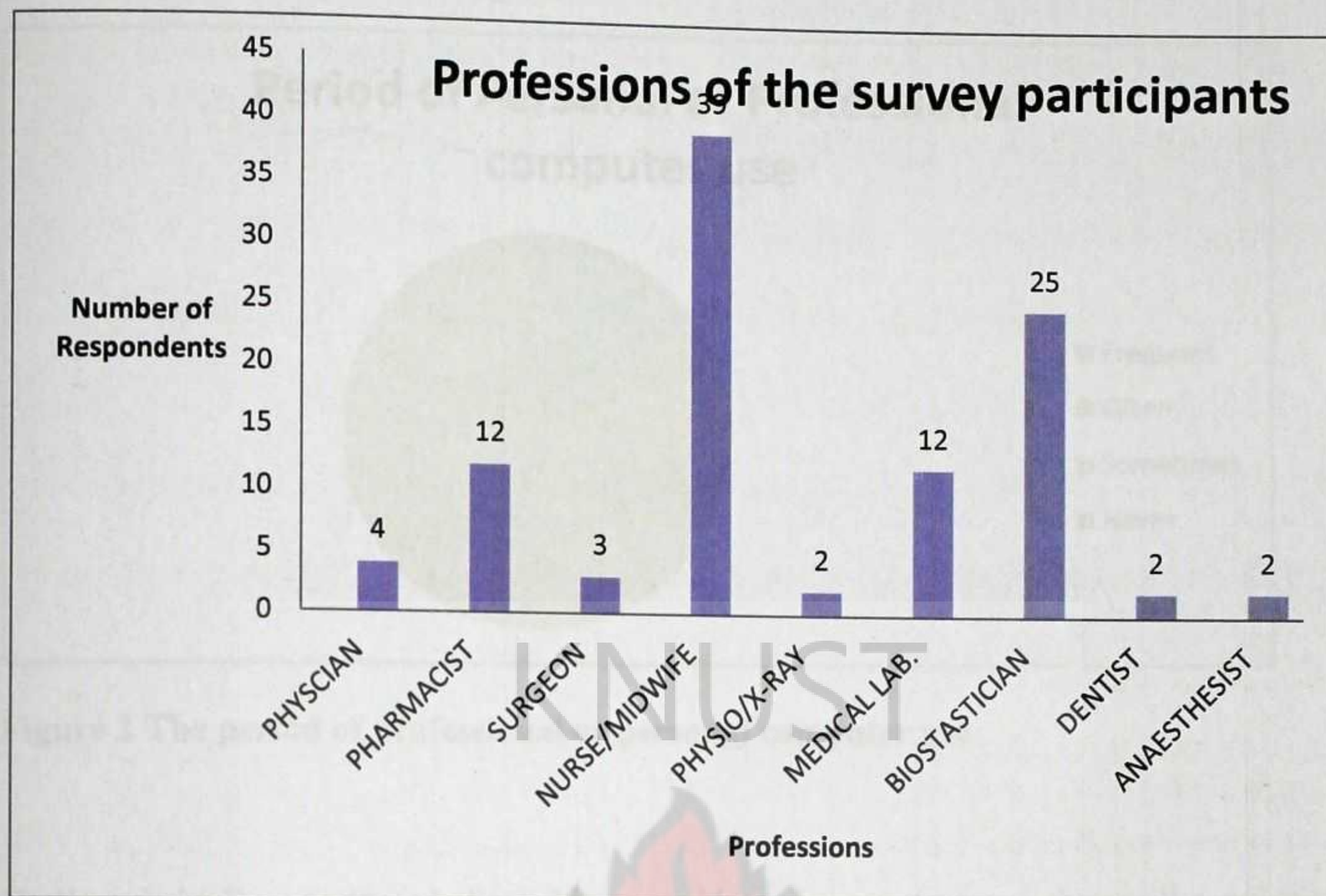


Figure 1 Professions of Survey participants in TGH

4.3 Computer experience of participants

Respondents' knowledge on IT was tested if they had previously used IT for other work functions. Those that have used it occasionally were 74 %, those who responded yes and had used it extensively were 9 % and 17 % said No they had not used it before.

Some of the subjects had used computer for personal or professional purposes. The extent of usage is categorized as either frequent, often, sometimes, rarely or never. The figure 2 indicates the period of computer usage.

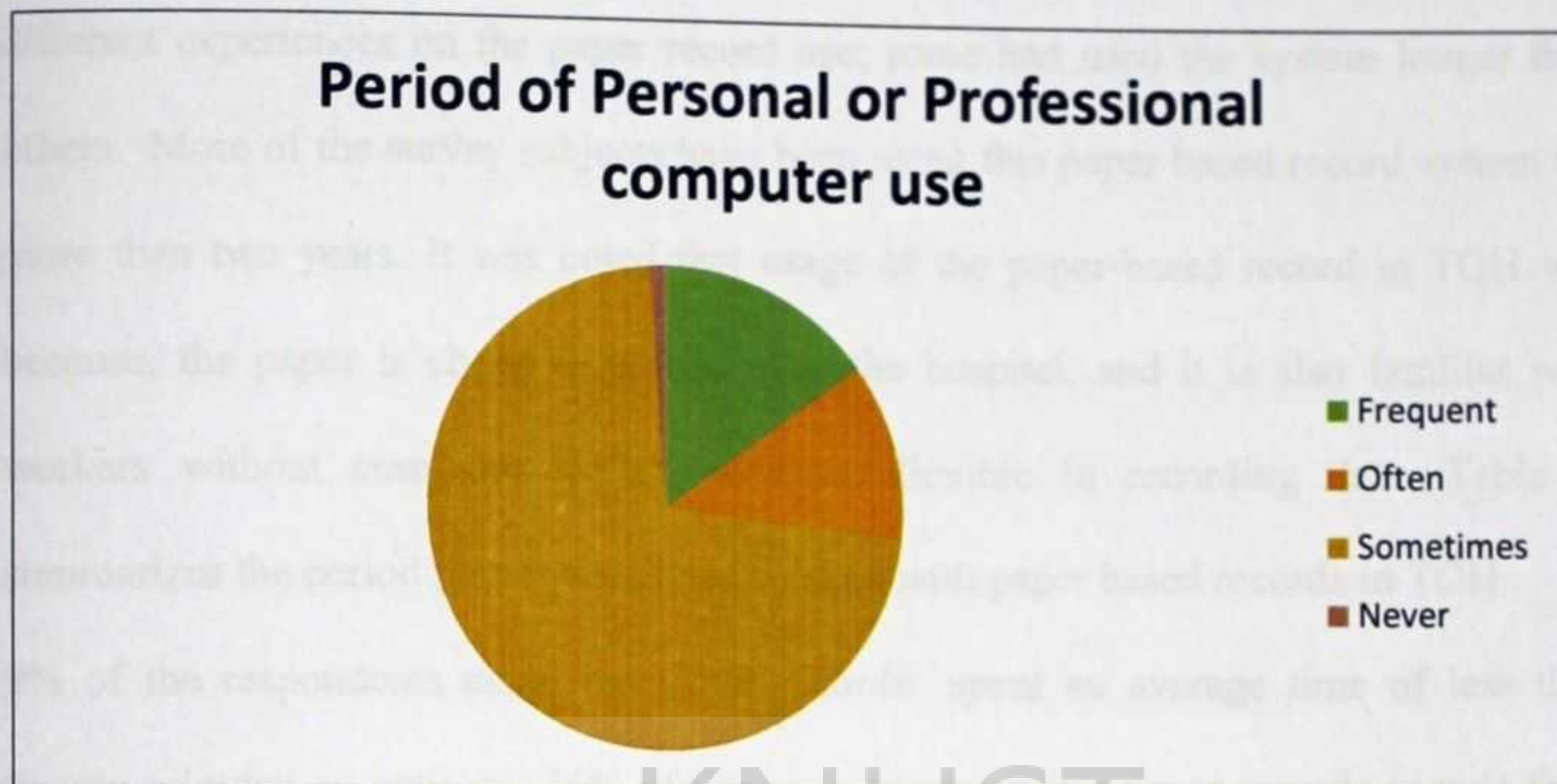


Figure 2 The period of professional or personal computer use

On the whole, Respondents indicated how sophisticated computer users they will consider themselves. 56% were novice - beginner with limited skills and privileges 15% were Technician - advanced beginner; dabbler; starting to function creatively and assist others, but without significant expertise. 21% are generally - starting to become well-rounded, knowledgeable advanced - experienced, able to assist others independently and critically. 8% usually has completed formal training in computer science, medical informatics or related area extra - seasoned; experienced the most accomplished in the field will have completed advanced training in both medicine and medical informatics or related area.

4.4 Paper-Based Records System

Majority of the participants (99%) said they have been using the paper-Based record for compiling patients' clinical information in the Tema General Hospital. This is not different from the results obtained in researches by Roukrma, Los, Bleker, Ginnerken, Lei & Moll, 2006. Only 1% said they have no used before. Participants in the study had

different experiences on the paper record use; some had used the system longer than others. More of the survey subjects have been using this paper based record system for more than two years. It was noted that usage of the paper-based record in TGH was because, the paper is cheap to purchase by the hospital, and it is also familiar with workers without computer skills and more flexible in recording data. Table 2, summarizes the period participants have worked with paper based records in TGH.

9% of the respondents using the paper records spent an average time of less than twenty minutes on patients, 36% of the respondents using paper records spends from 21 to 40 minutes on patients and 42% of the participant spends 41 minutes to 60 minutes. Only 13% of the study participant spends more than 60 minute. The figure 3 depicts the time spent on patient by respondents using the paper based records system.

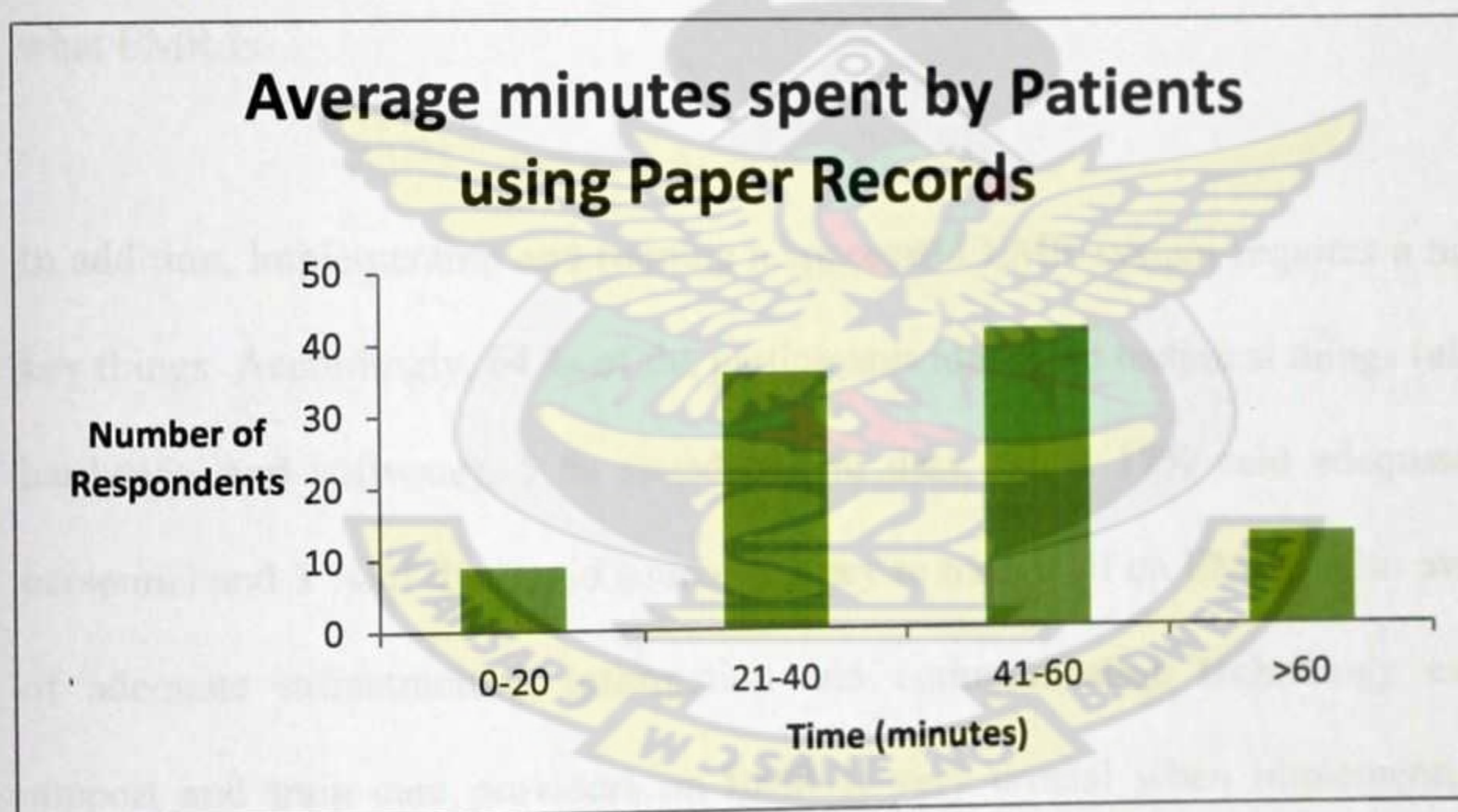


Figure 3 Average time used by patient when using Paper records

4.5 Knowledge of EMR and key requirement for its implementation

According to Dick, 1991; EMR is the compilation of patient medical information in a computer-based format that allows the collection, storage, retrieval and communication

of this data. Therefore to analyze this result, these key words, computerized, storage and retrieval were used to determine respondents understanding of the concept. Subsequently, respondents (51 %) indicated that EMR is Software for collection, storage, retrieval and communication of patient data to reduce medical errors. While 42 people representing 42 % who said it is a mechanism for storing patient medical record on computer and 2 respondents (2 %) indicated as having no idea or understanding of the system. More of the participants suggest that EMR is software for collecting, storing, retrieving and communicating patient medical record to reduce medical errors. This is not different from the publication of Fraser *et al*, 2005 who also stated that EMR help reduces medical errors. However, some of the subjects have no idea or understand what EMR is.

In addition, implementing and running a successful EMR system requires a number of key things. Accordingly, 64 % of the participants identified technical things (electricity, hardware, and software), 5 % stated patient data, while 17% said adequate trained personnel and 3 % of them said source (money to train staff on EMR). Also availability of adequate infrastructure, information and communication technology experts to support and train care providers on EMR is very crucial when implementing EMR system. Only 10 % of the respondents agreed that enough infrastructures are available in Tema General Hospital to support EMR implementation and 1 % had no idea on things that are required for effective implementation of EMR. This result could be so because hardware and software for ICT successful implementation of EMR in Tema General Hospital is not available. Also, this may be due to the frequent power

interruption in the TGH. Some of the participants claim that enough funds is also needed to train Users of EMR, purchase equipments and build infrastructure for the implementation of EMR. However, funds are not allotted for these EMR items by the hospital management.

4.6 Benefits of using EMR

Most developed nations are implementing EMR and other HIS due to the benefits associated with it. According to the survey results, some benefits of EMR as well as the percentage of the respondents indicating them as the benefits of EMR are; enhances Patients medical history, privacy and confidentiality (15%), saves patients time and cost (4%), EMR improves the workflow of health workers (9%), promote communication consistency among health workers (22%), promotes accessibility and retrieval of patient data at any time (24%), Storing and monitoring patient medical history (26%). As a result of the numerous benefits of the EMR, 100 % of the participants in Tema General Hospital are ready to migrate from paper based results to the electronic one. The importance of EMR in care delivery is shown in figure 4

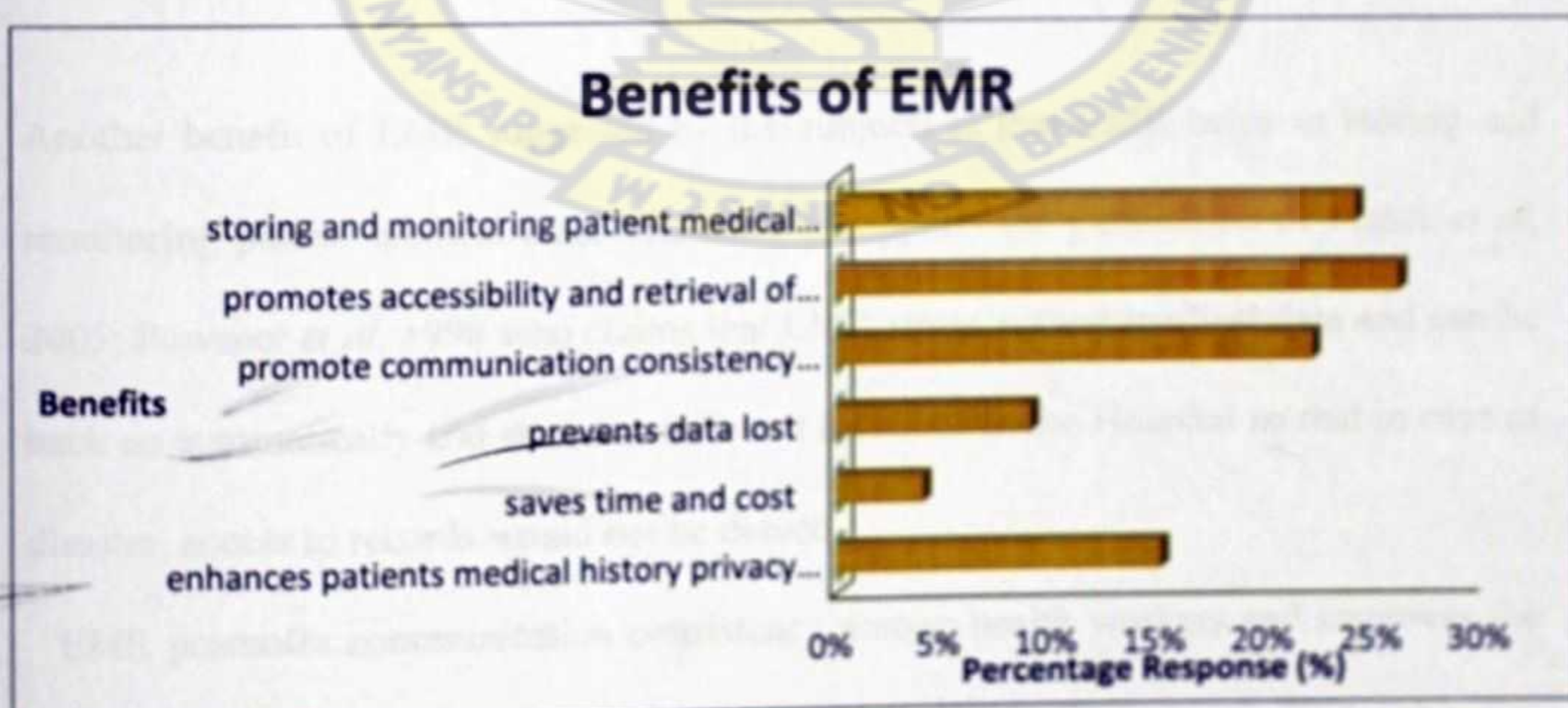


Figure 4 Benefits of EMR in care delivery

Participants suggest that EMR enhance patient medical history, privacy and confidentiality is contrary to the view of Shortliffe *et al*, 2001; Tomasi *et al*, 2004. It could be that the paper based record system currently used to capture patient's health information in TGH is not ensuring enough security, privacy and confidentiality of patient's health information.

Some of the subjects also claim that EMR saves patient time and the costs involved in treating him/her. This finding is contrary to the view of Simba, 2004 who suggests that data collected using EMR in developing countries are incomplete, inaccurate, unreliable and not timely. The respondents feel that that patient will not waste time at the records waiting to collect their folders. The subjects also think that EMR will not be time-consuming in entering patient data as compared to using the paper folder system. The subjects also claim they find it difficult to retrieve patient information easily in the Hospital because they always have to comb through the voluminous folders to be able to retrieve patient information.

Another benefit of EMR suggested by the subjects is that EMR helps in storing and monitoring patient medical data. The finding supports the publication of Fraser *et al*, 2005; Powsner *et al*, 1998 who claims that EMR stores patient medical data and can be back up automatically and stored in different locations in the Hospital so that in case of disaster, access to records would not be denied.

EMR promotes communication consistency among health workers and improves the workflow of health workers. This benefit is affirmed by Tang *et al*, 2006 who also

Benefits of EMR in Care Delivery Development

claimed that EMR increases the efficiency of healthcare providers' workflow. The illegible handwriting of most of the medical practitioners including prescription of allergic drugs to patients by subsequent physicians will be avoided since everything is typed on the designed EMR system. Workflow within the hospital will be improved because of the interoperability of the EMR system.

4.6.1 EMR and care Delivery Development

As shown in Figure 5, from the survey results, it is clear that many participants believed implementation of EMR will tremendously improve upon care delivery in the TGH. For instance as noted by one respondent, "availability of patient past history in electronic format will enable health care workers have information about patients in seconds and with ease which will facilitate quick diagnosis and treatment hence reducing the state of morbidity and mortality, leading to quality health care delivery".

12 % of the participant indicated that EMR ensures confidentiality and privacy of patient's clinical information, 1 % said EMR introduction will improve therapeutic works 6 % of the survey participants noted that EMR will help in researching and planning for the future, 2 % said EMR will save time, 21 % mentioned that EMR will improve communication consistency among workers, 58 % of the participant indicated that EMR will prevent patient data loss.

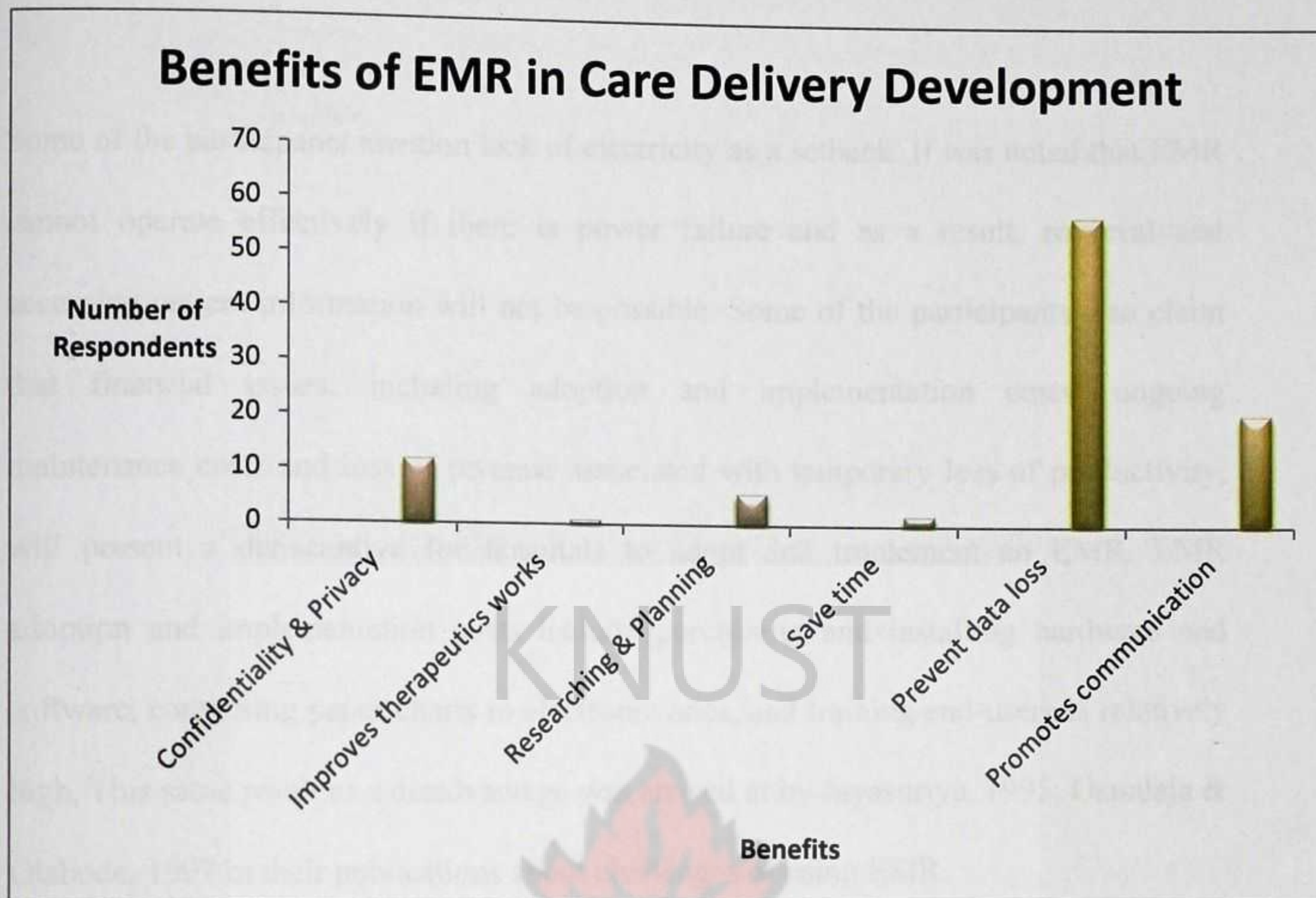


Figure 5 EMR contributions to care delivery development

4.7 Disadvantages associated with EMR usage

Unfortunately, despite the benefits spelt out by the subjects in the survey, Participants have identified some key potential disadvantages associated with this technology. 13 respondents representing 13% mentioned lack of power or electricity. According to participants hospitals cannot operate effectively when there is power failure. As a result, it will be difficult accessing and retrieving patient information for decision making. Sixty-nine respondents (69%) attributed the problem to finance issues. Eighteen respondents (18%) mentioned lack of technical know- how (personnel and education).

Some of the participants mention lack of electricity as a setback. It was noted that EMR cannot operate effectively if there is power failure and as a result, retrieval and accessing patient information will not be possible. Some of the participants also claim that financial issues, including adoption and implementation costs, ongoing maintenance costs and loss of revenue associated with temporary loss of productivity, will present a disincentive for hospitals to adopt and implement an EMR. EMR adoption and implementation costs include purchasing and installing hardware and software, converting paper charts to electronic ones, and training end-users is relatively high. This same result as a disadvantage was arrived at by Jayasuriya, 1995; Osunlaja & Olabode, 1997 in their publications about challenges of using EMR.

4.8 Factors militating against EMR implementation Tema General Hospital

Unfortunately, in spite of the numerous benefits that EMR may bring to the doorstep of TGH, the hospital does not have any EMR to facilitate care delivery. The key issues that were identified by the participants of the survey as to why Tema General Hospital has not adopted the electronic way of keeping patient records are: firstly, 9 % claim that the Hospital lack computers/hardware. This agrees with other researchers who state that some practice lack this basic facilities/hardware needed to support EMR implementation (Kemper, 2006; Fraser *et al*, 2005) and that this issue blocks the widespread adoption of EMRs. This shows that the use of EMR systems requires a sufficient hardware in practices, including computers, phone lines and internet connections. However, subjects claim that these facilities are not enough to support EMR adoption. They also suggested that the start-up costs associated with setting up

EMRs will be higher as more resources are needed to manage other aspects of the hospital. Secondly, 13 % of the respondents indicated that EMR is not in place in TGH because of privacy, confidentiality and security concerns of patients' results. However, this finding does not agree with Jha *et al*, 2009 who concluded that the use of computerized EMRs is an issue that may have a negative effect on patient privacy. They also stated that Physicians doubt whether EMRs are a secure store for patients' information and records, and fear that data in the system may be accessible to those who are not authorized to obtain it. This shows that because TGH do not have enough IT experts, outsiders may gain access patients clinical information which may results to legal problems against the hospital. Also, TGH lacks clear security regulations that could help ensure patient results privacy and confidentiality. This shows that concerns about the privacy and security of patient data will be experienced as a barrier to EMR usage. Thirdly, 4% of the subjects also concluded that EMR interferes with doctor-patient relationship, and so management sees it as a way of creating communication gap between Doctors and patients. A few researchers have considered the possibility of interaction problems between doctors and patients when using EMRs. In Shachak's research (2009), where this issue was considered, 92 % of physicians felt EMR use did disturb communication with their patients. Physicians have to turn to the computer to complete electronic forms during the encounter, and this can be time consuming especially when they suffer from limited computer skills. Some participants reported that they sometimes hunt for menus and buttons during their leisure usage of computers and this may even disrupts the clinical encounter with patients. Fourthly, more than half of the respondents; 74 % attributed the unavailability of EMR in TGH to lack of

leadership initiative and priority. Leaders do not see it necessary adopting a new technology to help in retrieving patient data, because they always complain of funds not available to implement it. Lastly, some also suggest that there are no ICT infrastructures in the hospital to support the implementation of EMR. So therefore, training Users of the technology to kick start EMR in the Hospital will not be possible.

4.9 Availability of infrastructure and IT experts in Tema General Hospital

.On the issue of availability of infrastructure for the implementation of EMR, 54 % of the participants indicated that there are no infrastructures in TGH, 2 % have no idea as to there are infrastructures whilst 40 % responded yes there were infrastructures in TGH for implementation of EMR and 4 % mentioned that the hospital has few of the infrastructures. The availability of infrastructures in Tema General Hospital to support the implementation of EMR is shown on figure 6 below:

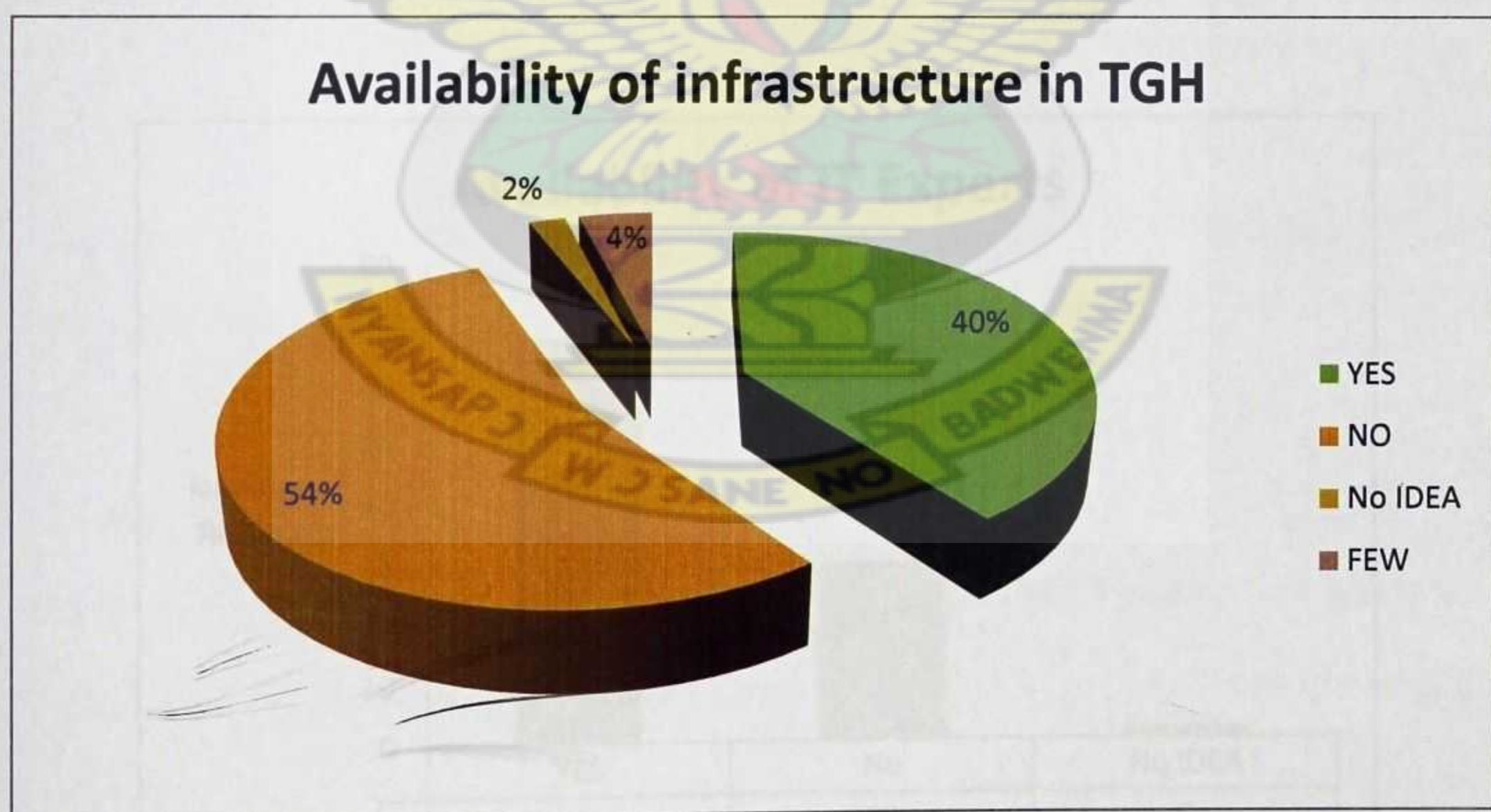


Figure 6 Availability of infrastructures to support EMR implementation

In this study, it is noted that more than half of the subjects said that TGH has no ICT infrastructure to support EMR technology implementation. This finding is not contrary to the view of Tomasi *et al*, 2004, Who suggested that lack of ICT infrastructure can undermine the development of efficient health information system and this can deny more than half a population of an area access to health care. So therefore, its implementation will impede the efficiency of health information and may deny some patients access to health care. Management therefore will have to focus on securing more infrastructures in TGH before thinking of EMR implementation.

On the other hand, 68 % of the respondents reported that there were no experts in TGH to train health care providers to use EMR, 30 % of concluded that there were enough experts to train care providers on EMR usage and 2 % did not have any idea. Figure 7 shows responses on the level of experts available at Tema General Hospital.

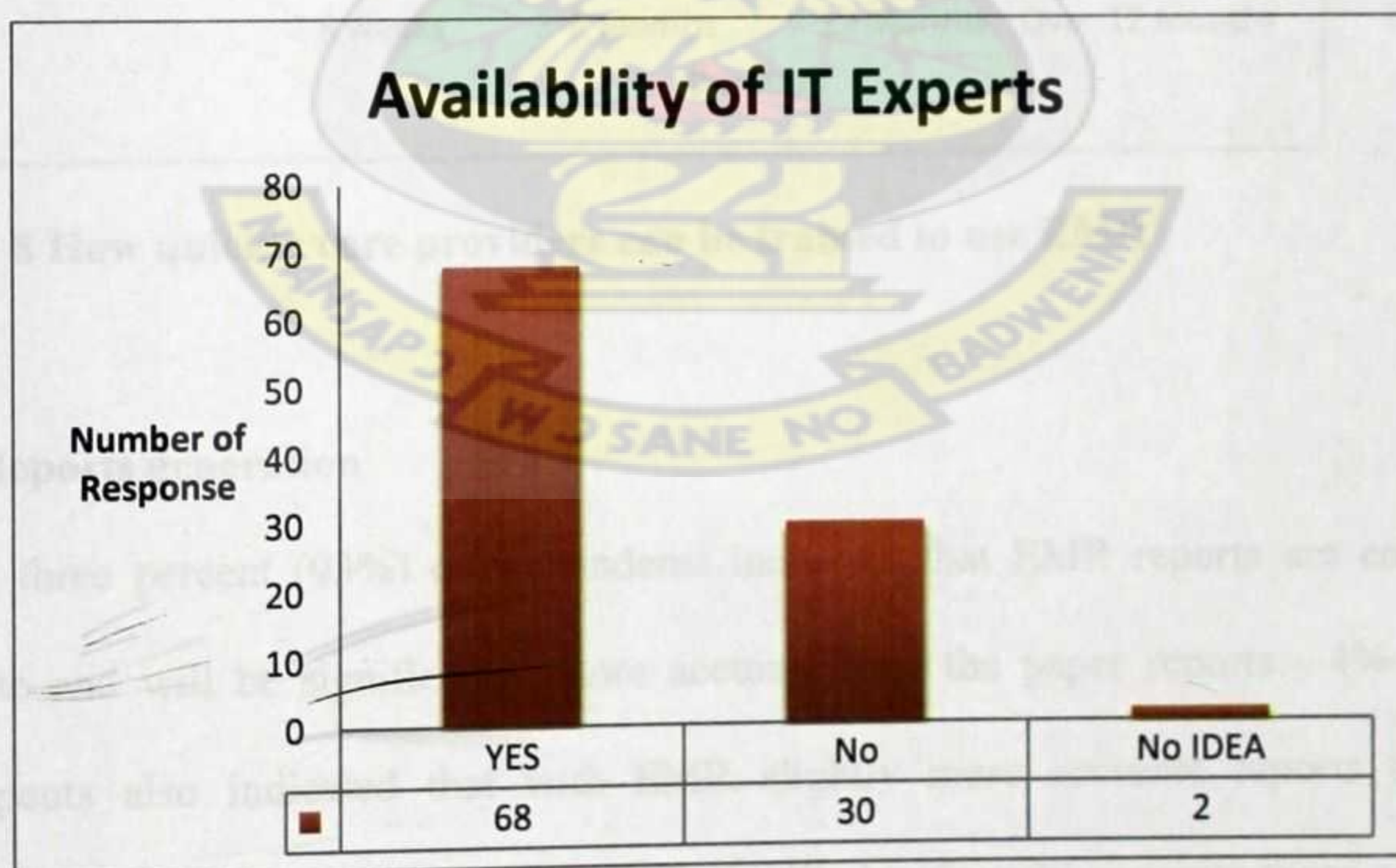


Figure 7 Availability of ICT experts to train care providers on EMR

More than half of the respondents said that there were no IT experts to train care providers on the use of EMR. 8 % cited that it will take 2-8 weeks for care providers to be trained by the Experts on the use of EMR. 56 % of the study participants indicated that care providers will learn to use EMR by 3-6 months, 8 % also noted 7-12 months whilst 28 % said that care providers will over 12 months be trained by these experts. Figure 8 illustrates time require to train health professionals at Tema General Hospital to use EMR.

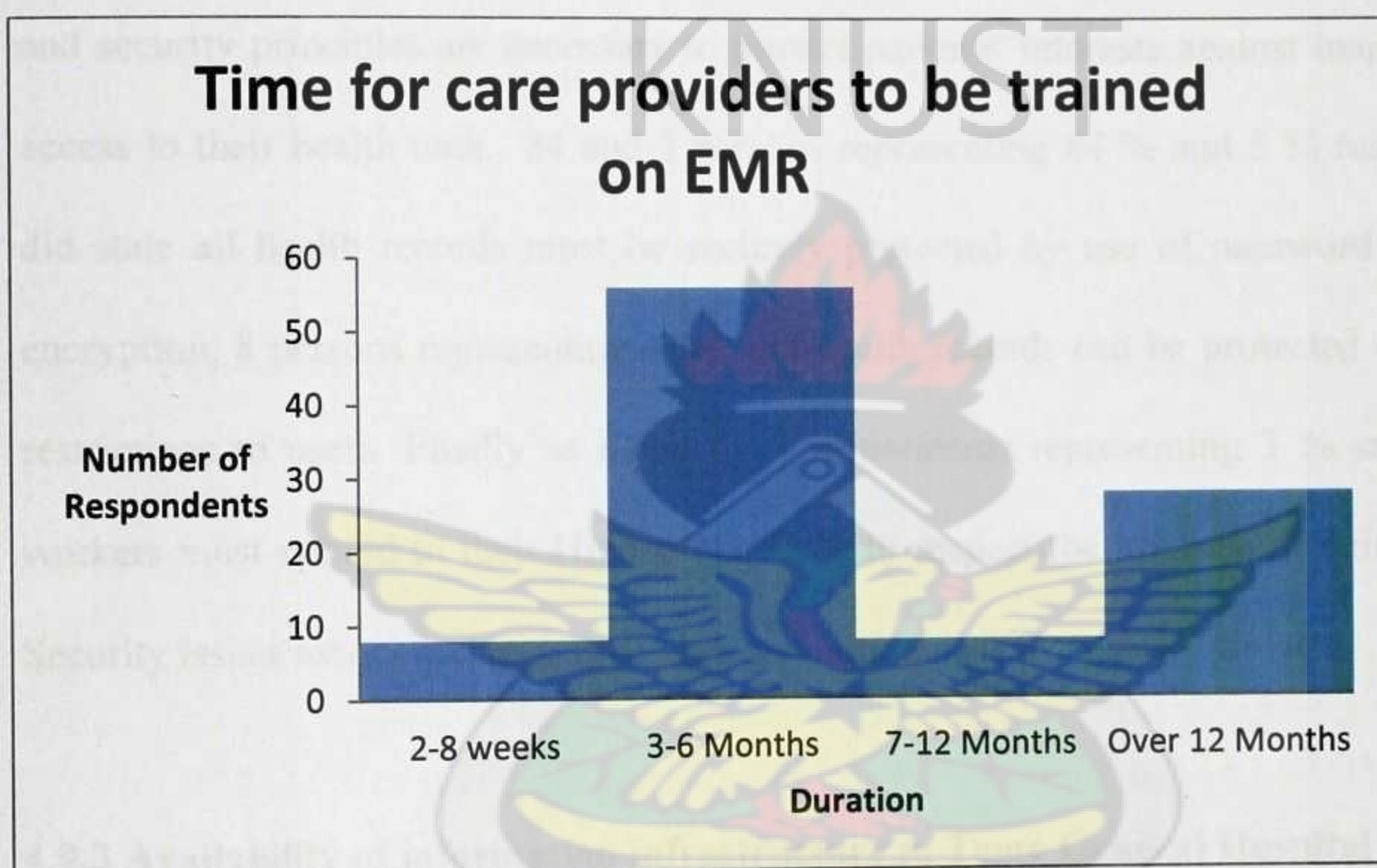


Figure 8 How quickly care providers can be trained to use EMR

4.9.1 Reports generation

Ninety three percent (93%) of respondents indicated that EMR reports are easier to generate and will be significantly more accurate than the paper reports. 4% of the Participants also indicated that with EMR slightly more accurate reports can be generated. 2 % accepted that the paper based will significantly generate more accurate reports than the EMR whiles 1 % said the accuracy of both the EMR and the paper

based reports will be about the same. Table 3 indicates the accuracy of reports generation.

4.9.2 Security, privacy and confidentiality Issues s associated with EMR

The adequate protection of patient health record requires limitations at all levels i.e. collection, use, access and disclosure. Therefore development of privacy, confidentiality and security principles are necessary to protect patients' interests against inappropriate access to their health data. 84 and 5 persons representing 84 % and 5 % respectively did state all health records must be securely protected by use of password and data encryption, 8 persons representing 8 % said health records can be protected by access restrictions to users. Finally as noted by 3 respondents representing 3 % said health workers must uphold to their Hippocratic Oath to respect the privacy of their patients. Security issues associated with EMR is shown on table 4.

4.9.3 Availability of information infrastructure in Tema General Hospital

Information infrastructure at TGH is still very basic, and therefore most of the interactions among the health workers are physical, telephony and computer networked communication systems. These are used frequently for data and information exchange among clinicians. 50 % of the participant attested that the infrastructure available for carrying out this data and information exchange is by telephones, 49 % said this is often carry out by physical interactions and 1 % mentioned that the information exchange and data transfer was always by computer network communication. Figure 9 represents the information infrastructure present in Tema general Hospital:

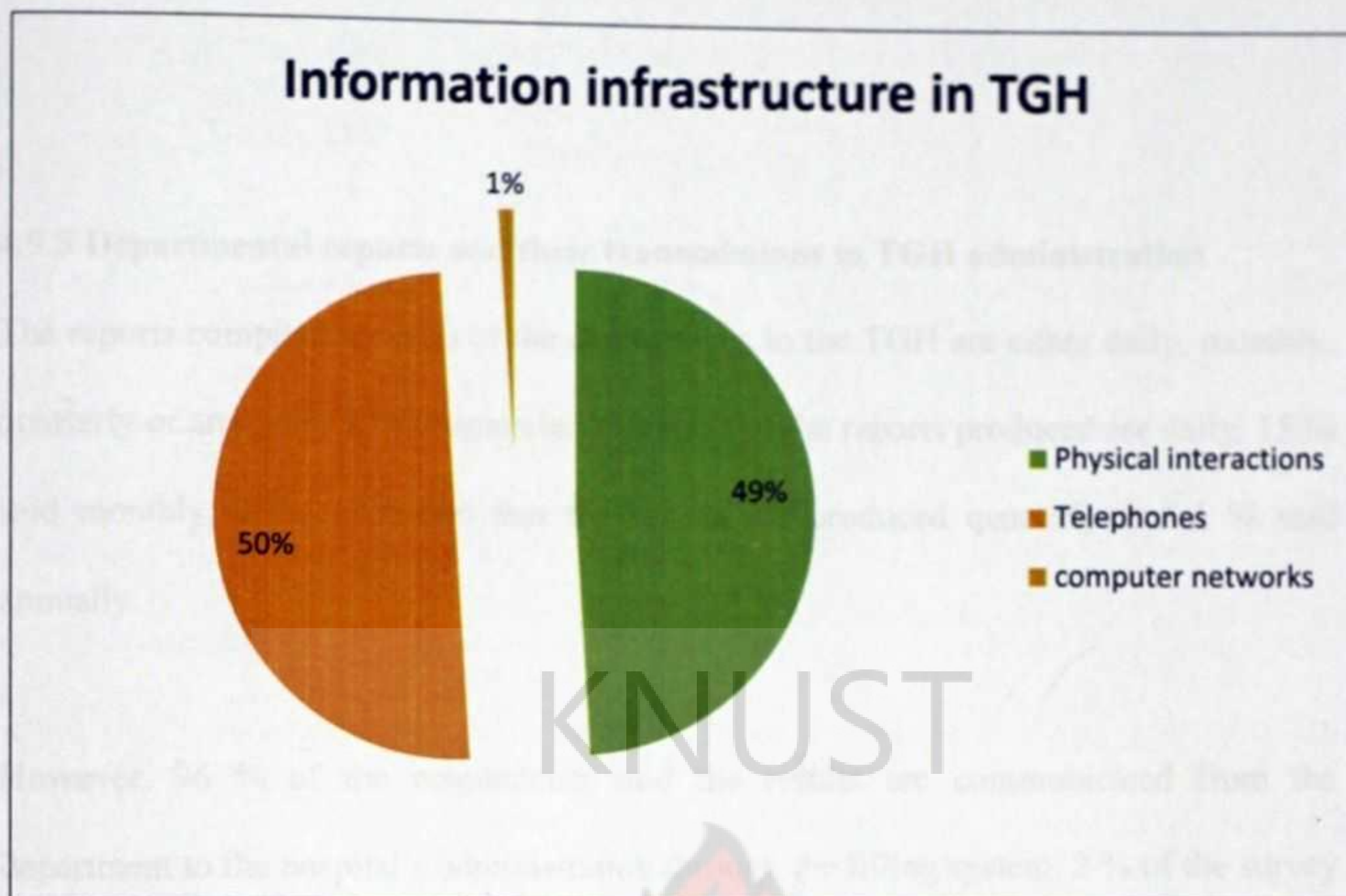


Figure 9 Information Infrastructure available in Tema General Hospital

4.9.4 Patient data communication among units in TGH

The modes of communication of patient's data in Tema General Hospital are often patient folder systems, physical interactions, telephones/mobile phones and computer networked communication systems. 75 participants representing 75 % said that the mode of communicating patient results from department to department was through the folder systems, 23 % mentioned they use phones and 2 % of the respondents use the computer networked systems.

Unfortunately, 93 % of the participants agree that problems often occur when communicating patient's results from unit to unit, 3 % strongly agree with this assertion. 2 % respectively said they disagree or neither agrees with this claim.

4.9.5 Departmental reports and their transmissions to TGH administration

The reports compiled by each of the departments in the TGH are either daily, monthly, quarterly or annually. 82 % responded that most of the reports produced are daily, 15 % said monthly, 2 % responded that the results are produced quarterly and 1 % said annually.

However, 96 % of the respondents said the results are communicated from the department to the hospital's administration through the filling system. 2 % of the survey participants said the results are communicated through telephones and the computer networked system respectively.



CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Results

The study focuses on the role of EMR in care delivery, development. Using survey methodology developed, I analyzed 100 people at the Tema General Hospital in Accra, about the benefits of EMR and how it can contribute to care delivery development. Results from the research indicates strong importance of EMR system in TGH to facilitate effective and efficient data collection, data entry, information retrieval, report generation and research. It will also improve health care planning and decision making and disease management. Furthermore, due to the absence of legislative body such as HIPAA, NIST and so on, in Ghana to enforce regulations against breach of privacy, confidentiality and security of electronic patient record, findings indicates that Ghana must pass laws to back the implementation of the system before it implementation.

Considering hydro power as the main source of electricity in Ghana, and due to the low level of water in the Dams and other technical problems leading to power rationing in the country, more than half of respondents suggested constant electricity supply is the most important thing to take into account when implementing EMR due to the inability of the hospital stand-by generator to kick in immediately during power outage.. In spite of this problem, study results also revealed that funding from the Government is inadequate to acquire computers and train users of EMR to facilitate care delivery in TGH.

5.2 Conclusions

The potential of EMR system to transform medical care practice has been recognized over the past decades to enhance health care delivery and facilitates decision making process. Subsequently, EMR and other clinical decision support system tools are currently used in both primary and secondary health care facilities in most developed nations. However, implementing an EMR system or any HIS in a clinical practice is a daunting task. It requires good planning, strong management and physician leadership and supportive staff. The most immediate benefits of EMR system include accurate medication lists, legible notes and prescriptions, immediately available charts, decreased chart pulls, lower transcription costs, medical errors reduction and improve quality care and standard in patient safety.

In view of the benefits of EMR and its faster way of attending to patients, findings from the result indicate that TGH workers are ready to embrace this technology. They believe that the security, privacy and confidentiality of the patients' results will be greatly assured more than the ordinary Paper Folder system. Because system use under this technology can be pass-worded and encrypted, so access to unauthorized users can be restricted. Unfortunately the hospital lacks the experts, funds and ICT infrastructure necessary to implement such modern health care technology to ensure continuity of care.

5.3 Recommendations

Research indicates that ICT interventions are contributing to improved efficiency of health service deliveries in the first world. At the same time many scholars believe one

possible area of ICT intervention in the health domain is the automation of medical record system. Further due to medical knowledge explosion, appropriate decision making and plan demands accurate, timely, relevant, and appropriately formatted information. Unfortunately Ghana as a nation lacks ICT infrastructure, fund and experts to facilitate modern health care delivery. Therefore to achieve the MDG numbers 3,4 and 8, bridging the digital divide between the north and south by the year 2015, and to significantly improve patient care, reduce paperwork and speed the operations of facilities to promote quality health care, it needs enough funding, develop human capacity and work effectively with the local experts to design and implement information systems that will strengthen the health systems performance, because in the absence of continuity of care, continuity of information is essential to optimize healthcare delivery.

5.4 Limitations of the Study

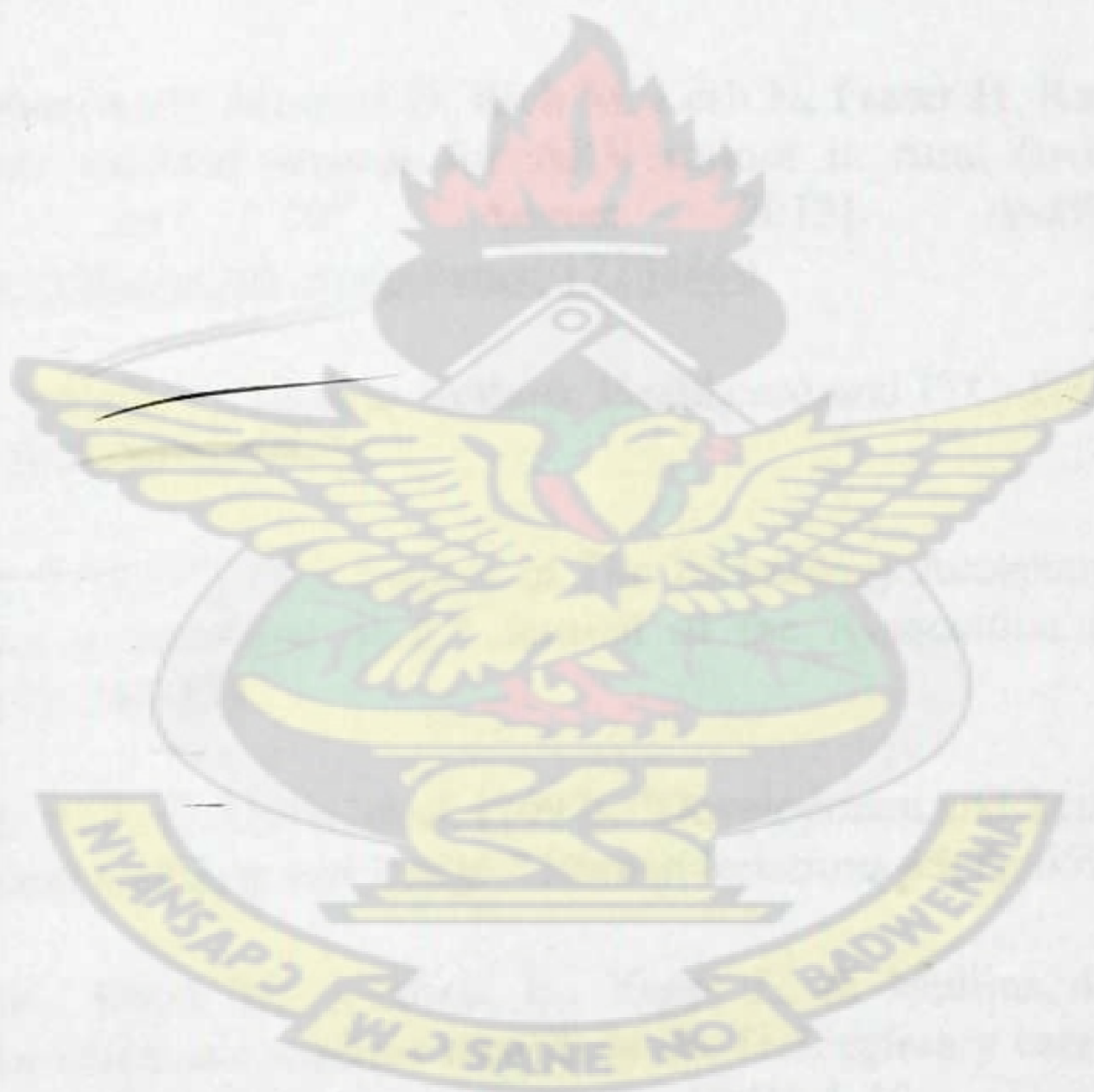
In the first place, the time allotted for this project is not enough, therefore the study was limited to only TGH; hence findings represented the views of Tema General Hospital alone. However, the research could be more interesting, challenging and results more generalized if professionals (subjects) from other hospitals are involved in the study.

5.5 Direction for future research

Automating the paper-based health record system can have a lot of importance for practitioners (clinicians), patients, administrators and managers. Therefore, I hope this study will serve as a baseline for funding organizations to help health workers explore and collaborate with any of the universities in Ghana to design and implement EMR and other

clinical decision support systems to actually access the level of care delivery development in most of our hospitals.

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APPENDIX A

ELECTRONIC MEDICAL RECORD SURVEY QUESTIONNAIRE IMPLEMENTING ELECTRONIC MEDICAL RECORD (EMR) SYSTEM IN TEMA GENERAL HOSPITAL: POTENTIAL BENEFITS AND IMPLEMENTATION CHALLENGES

My name is Donkor Emmanuel Gmagna and I am undertaking this research as part of my Masters of Science Degree (Msc) at the Kwame Nkrumah University of Science and Technology, under the supervision of Dr. Ben Okon Inemesit of the department of Pharmacy, KNUST. The aim of this survey is to **verify the potential benefits of Electronic Medical Record (EMR) system and its ultimate contribution to improving healthcare delivery in Tema General Hospital (TGH).**

The survey information indicated by each participant will be anonymous. Please answer all questions to the best of your ability by putting a cross (X) in the appropriate circle. Choose only one answer per question.

SECTION A: DEMOGRAPHICS

1. Gender
☐ Male ☐ Female
2. What is your main profession?

☐ Surgeon	☐ Anaesthetics	☐ Physician
☐ Pharmacist	☐ Midwife/Nurse	☐ Dentist
☐ Laboratory technologist	☐ Physiotherapist/Radiography	☐
☐ Biostatistian		
3. How long have you been practicing?

☐ 1-10 years	☐ 11-20 years	☐ 21-30years
☐ 31-40years	☐ 41-Above	
4. How long have you worked in your current unit/Department?

☐ Less than 1 year	☐ 1-5 years	☐ 6-10 years
☐ 11-15 years	☐ 16-20 years	☐ 21 years or

SECTION B: COMPUTER KNOWLEDGE

5. I use computers for personal or professional purposes

☐ Frequent	☐ Often	☐ Sometimes	☐ Rarely	☐
Never				

6. Have you previously used IT systems for other work functions/processes?
☐ Yes, extensively ☐ Yes, occasionally ☐ No
7. On the whole, how sophisticated a computer user do you consider yourself? (select one)
☐ Novice - beginner with limited skills and privileges
☐ Technician - advanced beginner; dabbler; starting to function creatively and assist others, but without significant expertise.
☐ General - starting to become well-rounded, knowledgeable
☐ Advanced - experienced, able to assist others independently, critically. Usually has completed formal training in computer science, medical informatics or related area
☐ Extra - seasoned, experienced, the most accomplished in the field. Will have completed advanced training in both medicine and medical informatics or related area.
8. Have you used paper based (patients' mastercards) medical records before?
☐ Yes ☐ No
9. If yes, for how long have you been using paper based (patients' mastercards) medical records?
☐ Less than 6 months ☐ 6-12 months ☐ 13-18 months
☐ 19-24 months ☐ Above 24 months
10. How long (on average) is the wait on line for patients in your unit?
☐ 0-20 minutes ☐ 21-40 minutes ☐ 41-60 minutes ☐ More than 60 minutes

SECTION C KNOWLEDGE OF EMR, BENEFITS AND DISADVANTAGES

11. What is your understanding of electronic medical record (EMR)?
12. What do you think are some of the benefits associated with EMR use?
13. Which ways can EMR contribute to healthcare development in TGH?
☐ EMR ensures Confidentiality and privacy ☐ Improve therapeutic
☐ EMR helps in researching and planning for the future ☐ EMR will save time
☐ Improve communication consistency among workers ☐ Save cost
☐ Prevent patient data loss

14. How will EMR change the quality of care to your patients?
- ☐ Decreased significantly ☐ Decreased a little ☐ Not changed
- ☐ Improved a little ☐ Improved significantly
15. Which are the things needed to implement Electronic Medical Record system, in TGH?
16. What disadvantages may be associated with EMR use?
17. In your opinion, what comparison will you draw in terms of accuracy between the manually generated reports to that of the EMR-generated report should EMR be introduced in TGH?
- ☐ Paper will be significantly more accurate ☐ Paper will be slightly more accurate
- ☐ The accuracy of both reports will be about the same
- ☐ The EMR-generated report will be slightly more accurate
- ☐ The EMR-generated report will be significantly more accurate

SECTION C: FACTORS MILITATING AGAINST EMR IMPLEMENTATION IN TGH

18. What are the reasons why Electronic Medical Record software is not being used at TGH in place of patient's folder?
19. What challenges are associated with the move from traditional paper-based system to computer-based patient record?

SECTION D: AVAILABILITY OF INFRASTRUCTURE AND ICT EXPERT MTO TRAIN CARE PROVIDERS IN TGH

20. Are there enough infrastructures in TGH to support EMR and ICT implementation?
- ☐ Yes ☐ No
21. Are there available information and communications technology experts in TGH to train care providers on EMR?
- ☐ Yes ☐ No

22. How quickly do you think health care providers can be trained by these experts on the use of EMR?
- ☐ 2- 8 Week ☐ 3-6 Months ☐ 7-12 Months ☐ Over 12 Months
23. What technologies does TGH use for backup and recovery of patients data?
- ☐ Database replication ☐ File replication ☐ Online disk backup
- ☐ Tape backup ☐ Other
24. As healthcare provider, are you ready to accept the changes necessary to implement EMR software?
- ☐ Yes ☐ No
25. What would be the ideal approach necessary in TGH to maintain patient's security, privacy and confidentiality when using EMR?
- ☐ Passwords ☐ Health workers upholding to their oath of patients privacy
- ☐ Access restriction to users ☐ Data encryption
26. What information infrastructure is available in TGH?
- ☐ Telephone ☐ Physical interaction ☐ Internets
- ☐ Computerized networked communication system
27. How is a patient data communicated among the various units in TGH?
- ☐ Telephone/Mobile phones ☐ Communication through networked computer
- ☐ Internet ☐ Physical interaction through the usage of patients' folders
28. How are these reports transmitted from your unit to the Hospital administration?
- ☐ By using file system ☐ By telephoning
- ☐ By using computerized networking systems ☐ By the use of the internet