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Evaluating Electronic Health Record Systems in Ghana: the case of Effia Nkwanta Regional Hospital

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DEDICATION

To God be the glory, without him I could not have made it through this program.

I dedicate this thesis to my dad and Chief of Bamianko, Awulea Angama Tu-Agan II, my mom, Miss Paulina Essel, my siblings and Enock Mathapoly-Codjoe for their enormous support and encouragement throughout my stay in Norway.

Love you all, you are indeed the best.

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ABSTRACT

The adoption and promotion of Information and Communication Technology (ICT), including Electronic Health Records (EHR) system, in healthcare delivery is growing rapidly in most developing countries including Ghana. Notwithstanding this tremendous growth in the implementation of ICTs in healthcare delivery, most of these projects have been recorded to have survived partially or fully at the pilot phase or have been repealed at the full implementation phase (Adjorlolo & Ellingsen, 2013), hence the need for system evaluation to assuage some of the challenges faced by most system implementation. The current study evaluates the implemented EHR at Effia Nkwanta Regional Hospital (ENRH) by assessing the preparations made prior to the systems introduction as well as the factors that impede or promote the systems usability and satisfaction among the users of the system. The study also examined the impact of the EHR to healthcare delivery by identifying the benefits and challenges of the implemented system. With an interpretive case study research approach, data was gathered from the users of the system and the system administrators using in-depth semi-structured interviews, open-ended questionnaires, observations and focused group discussions. Results indicate sufficient preparations made by the hospital prior to the systems introduction through thorough understudying of other implemented systems in other hospitals, the establishment of an Information Technology (IT) department, provision of infrastructure and network connections, and the training of staff. In spite of these, the study revealed some drawbacks in the preparations to include; inadequate computers, inadequate training and the non-involvement of users in the design and configuration of the system. Majority of the users recorded their satisfaction with the system although the attitudes of some users were perceived to be underserved. Benefits realised from the implemented EHR included; reduced errors and missing files, reduced work task, reduced expenditure on paper logistics and the retrieval of absconded bills. Challenges to the implemented system were recorded to include; poor network connections, illegible handwriting of some doctors, unstable power supply and increased work task. The study also revealed that inadequate funds which hinders EHR implementation in most developing countries was not a major challenge to the systems implementation as adequate budgetary allocations as well as payment plans were initiated with the vendors to reduce this challenge. The findings from the study were discussed and the necessary recommendations made towards the sustainability of the implemented EHR.

Keywords: Electronic Health Records, Information Infrastructure, Usability, Users satisfaction, initial assessment

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LIST OF ABBREVIATIONS

ICTs	Information and Communication Technologies
MDGs	Millennium Development Goal
EHR	Electronic Health Records
DHIMS	District Health Information Management System
ANT	Actor Network Theory
II	Information Infrastructure
ENRH	Effia Nkwanta Regional Hospital
US	United State of America
HAMS	Hospital Administration and Management System
OPD	Out-patient Department
IT	Information Technology
NHIA	National Health Insurance Authority
NHIS	National Health Insurance Scheme
IICD	International Institute for Communication and Development
ISMP	Institute for Medication Practices
MOH	Ministry of Health
GHS	Ghana Health Service
ICD	International Statistical Classification of Disease

CHAPTER ONE

INTRODUCTION

1.1 BACKGROUND TO THE STUDY

Health information is one of the key factors that contribute to the strengthening of health care delivery in every country. Reliable health information leads to timely health policies and planning, which improves the general health status of a country, as well as, serving as a vital element for individual health facilities in managing and improving healthcare delivery (Teviu, Aikins, Abdulia, et al., 2012). The role of Information and Communication Technologies (ICTs) in improving the general management of health information cannot be downplayed. This is affirmed by the ability of ICTs to capture, store, retrieve, analyse and transmit large volumes of health information across various locations (Norman, Aikens & Binka, 2011). The adoption of ICTs in healthcare delivery, which could generally be referred to as *e-health*, has not only been crowed generally as eminent in improving the reliability and effectiveness of health information, but it has also been gloated for strengthening healthcare delivery systems through its various tailor-made innovative applications and program such as the electronic health records (Yusif & Soar, 2014). Although the introduction of ICTs in healthcare delivery is not a new global paradigm, its adoption and promotion has particularly become relevant in resource-constraint developing countries whose healthcare systems are characterised by severe financial, infrastructural, technical and human resource constrictions (Yusif & Soar, 2014). Studies conducted in various developing countries report that the use of ICTs in healthcare delivery leads to better access to healthcare facilities on the part of both patients and healthcare professionals and improved quality of healthcare delivery, which consequently translates into productive labour and the development of the country as a whole (Khan, Shahid, Hedstrom & Anderson, 2012; Cecchini & Scott, 2003; Oyeyemi & Wynn, 2014). Governments and various policy makers across developing countries have also recognised the essence of ICT in improving the general healthcare of their countrymen, and particularly so, as many developing countries are striving to meet the Millennium Development Goals (MDGs).

For that matter, the Ghanaian government is investing hugely in ICT-based health information systems in an attempt to improve healthcare and the general performance of public healthcare facilities (Yusif & Soar, 2012). The adoption of ICT applications in the Ghanaian health sector has seen huge financial injections not only from government but also other private individuals and institutions as well as other international organisations. These count for the numerous pilot

ICT projects (albeit other fully matured projects) across a range of government health facilities in Ghana, some of which are Effia Nkwanta Regional Hospital, Korle bu Teaching Hospital, Komfo Anokye Teaching Hospital, Tamale Teaching Hospital, Ridge Hospital and Tema General Hospital. In July 2010, the Government of Ghana through its Ministry of Health showed an added commitment to the use of ICTs in its health sector by launching a national E-health strategy. The vision of the Ghanaian Government is to ensure the delivery of quality, affordable and up-to-date health services in an equitable and timely manner through the enhancement of communication and the use of information for planning, managing, and delivering health services (Ghana e-Health strategy, 2010). The implementation of the strategy is, however, perceived to be stagnant (International Institute for Communication and Development, IICD report, 2014).

A recent study conducted by Afrikumah (2014) identified 22 e-health projects at various levels of implementation in Ghana. These projects include the use of mobile phones, personal Digital Assistants (PDAs), web-based applications and other e-health or telemedicine applications to facilitate public health activities, data management, e-learning, information management and communication to improve health care delivery (Afrikumah, 2014; IICD, 2014). Projects such as the Sene PDA, Millennium Villages and Mobile Telemedicine, Mobile Technology for Community Health (MOTTECH), ONETOUCH Medicareline (ML) and Vodaphone Healthline Project, among others, use ICT technologies such mobile phones and personal digital assistants (PDAs) to improve service delivery and communication of health information in Ghana (Afrikumah, 2014). Other projects, such as the PAN AFRICA eNETWORK, the Ghana Consultation Network, Mobile Tele dermatology, Moorfields/ Korlebu Eye Centre, the eHealth Initiative and Mahiri Mobile, among others, also use the World Wide Web and other applications to provide online consultations and advice to both patients and healthcare professionals, either through synchronous or asynchronous technologies (Afrikumah, 2014).

Electronic health record (EHR) systems, which have the potential of improving the quality and reliability of health information and communication and the overall quality of healthcare services, are also not left out in the ICT implementation in the Ghanaian healthcare system. EHR systems such as GHS IHOST, Health Administration Management System (HAMS) provided by Infotech Ghana, District Health Information System (DHIS), District Health Information Management System (DHIMS), Health Information Management systems (HIMS) and Hospital administration Management Systems are some of the implemented electronic health records system in Ghana (Afrikumah, 2014; IICD, 2014). Although, some of these

systems such as the DHIS and DHIMS are implemented nationwide to generate health information to facilitate health policies and interventions, systems such as HAMS, Healthfore and IHOST; most of them are locally produced, are implemented in individual health institutions in the country to help improve their health records and address some of the challenges faced with the paper-based records (IICD, 2014). Currently, about six out of the ten identified regional hospitals in Ghana and other tertiary and districts hospitals have introduced the HAMS software in their respective hospitals for the management of their health records (IICD, 2014; www.infotechsystemsonline.com). IHOST, a Hospital information management system, is also being piloted in about 47 health facilities across the country.

1.2 STATEMENT OF PROBLEM

The use of Information and Communication Technology (ICT) and its associated facilities have grown rapidly in the provision and delivery of healthcare services over the last few decades. Paper-based records are fast giving way to electronic health records (EHR) in most developed countries and crawling gradually into the developing countries. The EHR is designed to alleviate the limitations associated with the paper record system and help improve the quality of care delivered (Tang & McDonald, 2006; Meum, Wangenstein, Soleng, & Wynn, 2011). Notwithstanding the tremendous growth in the adoptions or implementation of electronic health records, most of these projects have been recorded to have survived partially or fully at the pilot phase and have been repealed at the full implementation phase (Adjorlolo & Ellingsen, 2013). A study conducted by More (1990) revealed that, the implementation of large-scale information technology projects such as EHRs were associated with a 30% or higher failure rate. This challenge can be said to be even higher in developing countries (Vargneses & Scotte, 2004). Organizational and human factors are noted to contribute immensely to this challenge and not limited to technological factors (Gagnon, Duplantie, Fortin, & Landry, 2006; Obstfelder, Engeseth, & Wynn, 2007). In a study conducted on an EHR trail in Cameroon, insufficient training of personnel, lack of funding, insufficient leadership, and organizational issues, among others, were identified to have led to the failure of the system (Kamadjeu, Tapang & Moluh, 2005).

In view of these issues, studies on the evaluation of ICT applications and their implementation have gained dominance in the healthcare industry. This dominance is to advocate the successes and failures of implemented projects so as to prevent the re-invention of some of the factors

contributing to the failure of these projects (Stoop & Berg, 2003). In some of these studies, performing an initial or pre-evaluation of the ICT applications as well as considering the institutions' readiness before the adoption and implementation of ICT-related projects were proposed as measures to reduce the risk of failure (Adjorlolo & Ellingsen, 2013; Demaris, Oliver, Parock, & Courtney, 2004). However, most healthcare institutions in Africa are noted to have failed to conduct an initial assessment of the institutions' readiness before the implementation of ICT applications, which contributes to the failure rate recorded (Adjorlolo & Ellingsen, 2013). Lack of readiness assessment coupled with other factors such as lack of users' participation in the design and adaption of ICT applications has heightened the challenge of 'Usability' during the implementation phase of the ICT-projects. Usability, which is described as "the characteristics of human-computer interaction in a system" (Tang, Johnson, Tindall & Zhang, 2006), is often unattained in the implementation of most ICT systems. Some healthcare professionals have often discontinued the use of some of these ICT applications for reasons such as insufficient training, difficulty in using, and prolonged working time (Kamadjeu et al., 2005).

The implementation of EHR is on the ascendancy in the health care system of Ghana, as some major hospitals have resorted to the implementation of EHR to help improve their record keeping systems as well as their healthcare delivery systems. However, the challenges of ICT implementation as recorded in the literature are likely to be realised if appropriate measures are not adopted in such implementations. Hence, the need for an evaluation of such implemented systems in Ghana.

1.3 PURPOSE OF THE STUDY

The purpose of this study is to evaluate the implementation of the EHR at Effia Nkwanta Regional hospital in order to reveal the benefits and challenges associated with the system, as well as recommend, where necessary, measures to ensure the successful implementation of the system in the entire hospital, based on the information gathered. The evaluation of the implemented system also seeks to serve as guide to other health facilities. As a Regional hospital, the successful implementation of the EHR would encourage its likely implementation in other health facilities in the region and other regions alike.

The study is also to be conducted in partial fulfilment of the researcher's master's degree programme in Telemedicine and E-health.

The objectives of the research are to:

- Examine the prior assessment made by the Hospital before the implementation of the system
- Examine the factors that impede or promote the usability of the system by health professionals
- Examine the impact derived from the installation of the system and how it influences healthcare delivery

1.4 RESEARCH QUESTIONS

The study sought to address the following research questions;

1. What was the initial (preparation) assessment conducted prior to the acquisition and implementation of the EHR?
2. What are the factors that impede or promote the usability of the system?
3. What is the impact of the EHR on healthcare delivery?

1.5 MOTIVATION FOR THE STUDY

The purpose of evaluation research as described by Robson (2011: 176) is to “*assess the effects and effectiveness of something, typically some innovations, policy, practice or service*”. With this at the back of my mind, I was motivated to evaluate the growing trend of the implementation of electronic health records system in Ghana.

During my internships and training as a hospital administrator, I encountered diverse challenges pertaining to the paper-based records keeping system that forms the majority of records keeping in Ghanaian hospitals. Challenges such as double issue of folders, misfiling of patient folders, missing folders, and lack of storage space, were constantly reported by the health information units in the various hospitals worked. Some of these challenges were difficult to solve as they involved huge financial commitments and attitudes of the personnel that was sometimes difficult to influence. Coming to Norway and getting an in-depth understanding of telemedicine and ICT in healthcare, I have come to realise the benefits and how the full implementation of such systems like the electronic health records can help reduce these identified challenges of the paper record keeping systems; although the attitudes of the personnel could still be a challenge. This encouraged me to search for hospitals in Ghana that have implemented such

systems and to examine how these systems are being perceived by their users. Like any ICT systems, numerous challenges have been identified with the implementation of electronic health records systems in developing countries, some of which include but not limited to; poor telecommunication infrastructure, limited infrastructural and financial resources (Kifle, Mbarika, Tsuma, Wilkerson & Tan, 2008), organisational and human factors such as insufficient training, difficulty in using, and prolonged working time (Kamadjeu et al., 2005). Although the magnitude of such challenges varies among countries of implementation, I was motivated to evaluate an implemented electronic health records system in a health facility in Ghana, as few studies have been conducted in this field. The evaluation of such a system would reveal the benefits and challenges of the electronic health system implementation to a health facility in the Ghanaian context, which could influence the nationwide implementation of such systems, if one could learn from facilities that have implemented the systems.

1.6 EXPECTED CONTRIBUTION OF THE STUDY

As one of the few studies on the evaluation of implemented large scale information infrastructures (EHR) in the Ghanaian context; if not the first of its kind, this study is expected to reveal the challenges, benefits and impact of an implemented electronic health record in a healthcare institution in Ghana, and how such findings correlate to findings of other studies conducted in other developed and developing countries. This study also serves enormous contributions as it explores records keeping in the Ghanaian healthcare sector from another dimension (electronic health records), which paves the way for further studies in the area of large-scale information infrastructure implementation (EHR) in Ghana. It also contributes to knowledge on the deployment and implementation of electronic health records in developing countries, which is noted to be limited (Sood, Nwabueze, Mbarika, et al., 2008).

The study is expected to guide hospital managers, health professionals and information system developers who are interested and involved in the implementation of EHR in the assessment, design, and implementation of EHR systems in their health facilities. The findings of the study may also be valuable for the purpose of policy formulation, implementation and implication for electronic health records and other electronic health applications in the Ghanaian health sector.

1.7 CHAPTER DISPOSITION

The study is presented under six chapters. Chapter one introduces the study by giving a brief background to the study, which elaborates on the need for the study. It also presents the statement of research problem, the objectives of the study, the research questions, the motivation for the study and the expected contributions of the study. Chapter two elaborates on the theories underpinning the study and some relevant literature in the field of study. Chapter three presents the methodology used in the conduct of the study as well as the detailed description of the study country and study site. Chapter four provides the presentation and interpretation of the research findings. This consists of data recorded from the interviews, observations, informal discussions and open-ended questions posed to research respondents. Chapter five discusses the findings of the study in relation to theories and literature on the topic. Chapter six summarises the study, presents the overall study findings, recommendations for further research, and the study's conclusions.

CHAPTER TWO

THEORETICAL FRAMEWORK AND LITERATURE REVIEW

2.0 INTRODUCTION

The proper management of data storage and retrieval of records are imperative in any organization. In this vein, the system used in keeping records in any healthcare organisation should possess the ability to provide smart search functions, instantaneous and multi-location access, and ability to virtually integrate data elements stored in geographically disperse databases (Berg & Toussaint, 2003), as this is the only sure way to ensure better healthcare delivery. The introduction of EHR in healthcare delivery in recent time is therefore aimed to achieve these functional aims highlighted above. In spite of these functionalities, EHR in the healthcare sector is also aimed to trounce the inherent problems associated with paper-based record management systems that have been used in the healthcare industry for over a century.

In this section, a review of other relevant studies relating specifically to the objectivities of this study is presented. This section firstly brings to bear the theories that underpin the study, as it reviews EHR as an Information Infrastructure and as also an actor-network within the lenses of Actor-Network Theory. It then proceeds to a review of record keeping (paper and electronic record keeping) in various health facilities. With the understanding of EHR as an Information Infrastructure and an Actor-Network, a review of EHR is presented in this section. Other studies relating to the readiness assessment of EHR implementation in other hospitals are also reviewed. This section also highlights the benefits and challenges associated with the implementation of EHR as accounted for by other studies. It then concludes with a summary and the rationale for the present study.

2.1 THEORETICAL FRAMEWORK

This study is underpinned by the concept of Information Infrastructure (II) and the Actor-Network theory (ANT). The researcher chose the concept of II and ANT because they complement each other well and provide a good theoretical basis for the study (Gammon, Johannsen, Sørensen, Wynn & Whitten, 2008). Some previous studies have adopted these theories in order to determine the relationship between information systems and organisational issues (Hanseth & Monteiro, 1998). ANT thus provides an enlightening expression, which

describes information infrastructure. Thus, it depicts how, where and to which extent technology influences human behaviour (Ibid). Furthermore, in his work titled “*Actor Network Theory and Information Infrastructure*” Monteiro justified why it is suitable to compliment the ANT with an information infrastructure perspective in an organisational study of a complex organization (such as Effia Nkwanta Regional Hospital, ENRH) (Monteiro, 2000). According to Monteiro (2000:147), “*ANT provides an effective platform from which to critically assess and unravel a set of problematic set of explicit and implicit assumptions made from the management perspective on information infrastructures*”. This implies that ANT does not only provide a language with respect to elucidating Information Infrastructure, it also provides an understanding of the relationships between information technology and its various usages (Akrich, 1992; Akrich & Latour, 1992; Hanseth & Monteiro, 1998). Again, Lee (2001) fiercely recommends that research work relating to the field of information systems should endeavour to examine more than just the technological system, or just the social system, or even the two systems side by side; but rather the researcher ought to strive to investigate the phenomena that emerge when the two interact. Hence, the present work takes strong inspiration from Lee and thus strives to understand not only the implementation of the EHR in Effia Nkwanta but also how the EHR is shaped and reshaped by the staff and within the hospital’s environment in general. In accomplishing this aim, the concept of II and ANT is considered the most apt as ANT provides the interpretative framework of analysis, while the concept of Information Infrastructure may be applied to focus on the actual EHR being implemented in the Effia Nkwanta Regional Hospital.

2.1.0 THE CONCEPT OF INFORMATION INFRASTRUCTURE (II)

Information Infrastructure started as a political initiative in Bill Clinton’s administration after the adoption of the Bangemann Commission’s report (Bangemann et al., 1994). It became even more prominent after the commencement of the US plan for National Information Infrastructures (NII), which was followed up by the European Union’s plan for Pan-European II (Hanseth & Monteiro, 1998). As a concept, II has generally acquired substantial attention in studies relating to the use of ICT in organisations, and in spite of the mushrooming amount of research dedicated to it, information infrastructure is yet to be ascribed with a univocal overtone (Iannacci, 2010). Perusal of literature hints at a lack of consistency and uniformity regarding the nature and scope of II as a concept, and this could imply a difficulty in surely answering the

question: what is an information infrastructure? For example, in a much more limited nuance, Graham (2000) like Shin, Kim and Lee (2006), imputed II to mean technological networks of advanced telecommunication systems for local communities, which is used to provide them with advanced telecommunication services like multimedia applications (Iannacci, 2010). Yet, other writers have also explained II within a much broader perceptivity. For instance, Bowker and Star (1999); Bowker (2005); Braa, Hanseth, and Heywood (2007); Hanseth and Monteiro, (1998) have all explained II to engulf technological and human elements, networks, systems and processes, users' communicative behaviours and 'taken-for-granted practices' (Iannacci, 2010) that contribute to the functioning of an organisation.

This study conceives the EHR in Effia Nkwanta Regional Hospital as an II, which could then be understood as it was defined by Hanseth and Monteiro, (1998). This definition was, however, extended in Hanseth and Lyytinen (2010). According to Hanseth and Monteiro (1998), II personifies information systems or communication networks together with their associated software that shore up the interaction among individuals and organizations by bringing together different systems such as information processing applications, communication networks, physical and software elements in networks and end systems that are usually integrated through standard interface. Squaring the adopted definition of Information infrastructure by Hanseth and Monteiro, (1998) within the perceptivity of this study, EHR in Effia Nkwanta is seen to involve not only a computer software program but also involves a complex array of information systems including basic support systems like operating systems, file servers, communication protocols, printers, etc. Consequently, this study defines an II as *“a shared, open (and unbounded), heterogeneous and evolving socio-technical system (which we call installed base) consisting of a set of IT capabilities and their user, operations and design communities”* (Hanseth & Lyytinen, 2010:4). Structurally, therefore, the EHR in Effia Nkwanta Regional Hospital is an II which recursively consists of other infrastructures, platforms, application and IT capabilities (Ibid).

2.1.1 Essence of Information Infrastructure to EHR

The essence of II to the understanding of EHR rests on its unique functions and, accordingly, these characteristics of II make it functional as a framework for this study. Therefore, the adoption, sustainability and the actual benefits to be derived from EHRs could be easily achieved when EHRs are seen within the characteristics or function of II. According to Hanseth and Monteiro (1998), information infrastructure possesses some inherent functions or

characteristics and these make them different from other information systems. These functions are: *enabling, shared, open, socio-technical, heterogeneous and installed base*. The highlights of these characteristics are presented below.

2.1.1.1 The Enabling Function of II

IIs possess an ‘enabling’ function, which allows them to support a wide range of activities in an organisation. IIs do not therefore subsist merely as technologies used for just recuperating or automating an already existing activity, rather IIs exist to open up fields of new activities in an organisation. Hence, the EHR in Effia Nkwanta as an II has an ‘enabling’ function which transcends the single function of the automation of health records in the Hospital. The EHRs in the Hospital should also be able to support new fields of activities like alerts systems or reminders, easy and concurrent record retrieval by health professionals, single access points for patient records, and rapid access to patient records both within the organization and across organizations as well as other new activities like the continuing education of practitioners.

2.1.1.2 The Shared function of II

II allow for the sharing of information by members of a community or collection of users as they serve as a communication channel or resource base for the purposes of its users. That is, it becomes an object used by all to achieve an overall goal, although it might appear differently to each user (Hanseth & Monteiro, 1998). Owing to this *shared* function, II are irreducible and the irreducibility of II, according Hanseth and Monteiro (1998), implies that all the various users use the same infrastructure as the system cannot be split or divided into separate parts that are independent of different groups. The authors, however, were quick to add that even if infrastructures are disintegrated into separate units for investigative or design purposes, each fragmented unit must be integrated through a standardized interface. EHR as a *shared* functionality therefore is to assist collaborative work in a health facility by “*enlarging and enriching the area of shared information, providing actors with an overview of information distributed space and time, supporting the negotiation of norms and rules, facilitating the coordination of effort, and helping to establish a certain degree of discipline and rigor*” (Schneider & Wager, 1993 in Vikkello, 2005). This means that the EHR system in Effia Nkwanta should be able to be used by various workers in the facility to achieve a desired goal. The pharmacist and the medical doctor must all be able to access the health information of the patient at any time to make health decisions. Thus, the EHR in Effia Nkwanta will facilitate data sharing among health professionals and various departments and institutions.

2.1.1.3 The Open Function of II

IIs do not limit the number of users, vendors and stakeholders who are involved in the development, implementation and the use of the system. Hence, *openness* as a function of II refers to its lack of boundaries. This arrangement does not, however, mean that everything is included in IIs but rather it emphasizes the fact that, drawing a stringent boundary between what is on one side of an II and what is at the other side of it could be undesirable (Hanseth & Monteiro, 1998). Again, IIs are *open* in the sense that they are dynamic and always shifting, thus there is the need for every II to be flexible to some extent in order to enjoy stability over a period of time (Ibid). In what seems to be a more technical argument, Hanseth, (2002) intimated that the *openness* of an II indicates a characteristic, where there is no beginning and ending in the development of an II and where there is no perceptible limit to the number of individuals involved in the design and implementation of the system. Hence, EHRs in this study could be construed as an II that is *open* or unlimited to many users, who are mostly health care professionals in various departments in the Effia Nkwanta Regional Hospital. The EHR could also be construed as *open* as it also involves different stakeholders as well as human and non-human actors in its design and implementation. The *openness* of EHR in Effia Nkwanta Regional Hospital in this study can again be understood in the light of the flexibility of the EHR to adapt to changes, as there is no beginning and ending its implementation.

2.1.1.4 The Socio-Technical Network Function of II

IIs consist of more than just the various individual components (Hanseth & Monteiro, 1998). IIs cover a broad spectrum of both technological and social components like human and organizational elements. According to Hughes (1994), technology defines every organisation and they are also in turn redefined by it. Thus IIs, as socio-technical networks, pose an emphasis on both the technological aspect of the infrastructure and the social dynamics that are brought to bear on the infrastructure from the organisation, its members and even the community at large (Hanseth & Monteiro, 1998). In this study, therefore, the EHR in Effia Nkwanta Regional Hospital is understood as an II that cannot work properly without the support of the staff and other social elements. This leads the researcher to make the point that, the users and other social elements should be seen as key factors in the implementation of the EHR in the hospital, thus, it is not just a matter of ‘pure technology’ which determines the success or otherwise of the EHR. As Coeira, (2003) observes, the triumph of any system (and in this regards the EHR) in

healthcare delivery, is partly determined by how well the users are able to interact with the system.

2.1.1.5 The heterogeneous function of II

In view of the fact that IIs have a broad socio-technical network and are also open to different activities, relationships and alliances, together with changeable conditions for development, IIs are heterogeneous (Hanseth & Monteiro, 1998). As heterogeneous, IIs also connect various components and assimilate them into interdependent networks – an ecology of networks. This implies that within Effia Nkwanta Regional Hospital, when the EHR malfunctions, all the rest of the infrastructure could also run into huge problems.

2.1.1.6 II as an Installed base

According to Hanseth and Monteiro, (1998), IIs are developed from an already existing or continuously evolving infrastructure, hence it stands to reason that IIs cannot be a novelty but rather they are always inspired by or brought forth on the back of an already existing system. Like many authors, Hanseth and Monteiro (1998) made the observation that technological advancement and the changing circumstances of the world often trigger the institutionalization of newer technologies or replacement of some parts of the already existing technology. But, they were quick to add that developing completely a new system that is not based on any existing system often becomes difficult, particularly within a healthcare sector that is highly fragmented. So, they agreed that both the old and new systems ought to be connected together, to aid interoperability. Hanseth (2002) made the point that when designing a ‘new’ component of infrastructure, it should be kept in mind that the new component will only be accepted and also work well in the organisation if it can be integrated or substitute a part of an existing infrastructure. This implies that the implementation of the EHR in Effia Nkwanta Regional Hospital ought to be seen as something that is not new but rather it ought to be conceived of as an II, which was installed based on the paper-based record system. Further, for a successful implementation of the EHR in the Hospital, one ought to consider the installed based (paper record) as very relevant as it influenced (and continues to influence) the way the EHR system was planned and designed.

2.1.2 The Actor Network Theory (ANT)

ANT seeks to conceptualize the relationship between technology and societies and this has gained prominence in much research involving information systems, since it provides new concepts and ideas for the understanding of the socio-technical nature of information systems (Walsham, 1997). Thus, ANT is seen as an approach taken by social scientists to investigate the social and technical aspects of an organisation that include people, organizations and technology -all enmeshed in a network (Monteiro, 2000; Walsham, 1997). The theory is credited to the writings of Michel Callon, Bruno Latour, and John Law. ANT asserts that the use of technologies in organisations (like Effia Nkwanta Regional Hospital) does not come as a result of any scientific inference. Rather, technologies themselves evolve because of an inherent social momentum that the technologies themselves possess. The theory again contends that, the only way of ensuring order and efficiency in an organisation (Effia Nkwanta Regional Hospital, in this regards) rest on the ability of the organisation to establish networks that will shape social interaction within the organisation (Callon & Law, 1995; Hanseth & Monteiro, 1998; Latour, 1991). ANT views an information infrastructure (EHR) as both an actor in the organisation and also as a tool for establishing a network that links all other actors. Therefore, the actors within a network consist of both human and non-human factors that are heterogeneous to the extent that they are treated in the same way and are even given the collective name of hybrid *collectif* (Aanestad & Hanseth, 2000; Callon & Law, 1995; Latour, 1991; Walsham, 1997). As an Actor-Network, the EHR in Effia Nkwanta consists of various social and technical actors that play specific roles within a network, which the EHR itself establishes. In this vein, the activities of an actor (both human and non-human) are conceived within a network, but not as acting independently (Aanestad & Hanseth, 2000). Hence, establishing the EHR system and ensuring its effectiveness demands the detection of plausible actors that directly or indirectly affect the continuation of the system. Thus ANT offers a language for explaining the many small, concrete technical and non-technical mechanisms that go into the building and use of EHR in the facility. ANT would aid in recognising key actors who are involved in the implementation of the EHR in the hospital as well as explain the necessary elements required for developing a stable EHR in the facility.

2.1.2.1 Translation and Inscription

Monteiro, (2000) identified 'translation' and 'inscription' as the two major means of conceptualizing what actually occur within the Actor-networks.

Translation

Translation involves “*creating convergences and homologies by relating things that were previously different*” (Callon 1981; 211). Actors within the network might have various requirements, needs, interests, expectations and even their way of perceiving a problem might differ; thus there is the need to build synergies between these various actors within the network in order to ensure its stability. *Translation* is favoured as a process of aligning each ‘actants’ interests in order to ensure the stability of the network (Monteiro, 2000). To Brown, translation “*appears as the process of making connections, or forging a passage between two domains, or simply as establishing communication*” (Brown, 2002: 3). He further perceived translation to be “*an act of invention brought about through combination and mixing varied elements*” (Brown, 2002: 6). In ANT, *translation* is simply understood to mean languages that are used to unite the varied aspects (actors) that are combined in technology (Cressman, 2009). Hence in developing any EHR, it becomes indispensable for the organisation to ascertain and know the various needs, role and interest of each user, so as to develop the system such that the essential needs are well provided for to prevent any encumbrance to normal flow of work.

Translation can take four main stages and these according to Callon (1986), are “*problematization, interressement (Interposition), enrolment and mobilisation*”. At the *problematization* stage, a core or a main actor is defined, after this other minor actors whose goals and interests are consistent or in line with the main actor’s, are then identified in an established obligatory or mandatory passage point. Thus, the main actor’s interest becomes compulsory for all. The *Interressement or Interposition* stage entails the process of persuading other actors in the system to agree to the definitions initially provided by the main actor. The aim of this stage is to stabilize the actors’ identities and connection to the network from any outside influences. At the *Enrolment stage*, there are negotiations with actor to willingly acceptance the main actor’s interests. A successful negotiation locks the actors into place and defines their roles and identities in the network. In the *Mobilisation* stage, the whole network finally is represented by the main actor, who becomes a macro actor (Callon & Latour, 1986). In simple terms, all the actors within the network unite behind a single powerful voice.

Inscription

Inscription concerns the relationship between various parts of the technical artefacts and its pattern of use (Monteiro, 2000). Inscription provides information on the how various kinds of

materials (artefacts, work routines, legal documents, prevailing norms and habits, written manuals, institutional and organizational arrangements and procedures) can be applied within the network in a more successful manner (Monteiro, 2000). Again, by means of inscribing programs of action into a piece of technology, the technology is seen to be an actor imposing inscribed instructions on its users. Hence, Inscription is seen as a process of creating technical artefacts that would ensure the protection of an actor's interests (Latour, 1991). Inscription therefore provides implicit and explicit assumption about the competencies that is required by the users and the system to function and maintain the network system (Monteiro, 2000). Latour (1991) however noted that, problems are bound to occur in the system if the users do not follow the assigned program of action and use the system in an unanticipated way.

2.2 LITERATURE REVIEW

2.2.0 Record Keeping in Healthcare Delivery

There are two major means of keeping medical or health records of patients in any healthcare delivery facility. These are paper-based record keeping systems and EHR keeping systems. These record systems (whether paper-based or electronic) accomplish two crucial functions (Berg, 1999). Firstly, health record systems helps in the accumulation of data gathered during the course of a patient trajectory, which in turn help create an ‘external memory’ for future use (Berg & Toussaint, 2003). Secondly, health record helps in coordinating activities and events at various departments and even other geographical locations (Berg & Toussaint, 2003).The following sub-section further throws light on these categorisations.

2.2.1 Paper Base Record Keeping in Healthcare Delivery

The healthcare industry has widely made use of paper based record system as a means of keeping patient’s medical information for the past two hundred decades (Scott, 2006). Although, it has helped the entire healthcare delivery system a great deal from antiquity to date, Coeira (2003) observes that, paper based record inherently pose some corporeal and informational challenges that makes it difficult for it to be sustained as a proper means of record keeping in healthcare delivery. Thus according to many practitioners, paper-based system alone is just not good enough anymore and they justify this by citing various challenges of the paper record which include;

Difficulty in accessing and sharing medical history of patients: Paper based record system makes it extremely knotty for medical professionals at different geographical location to access previous medical information of patients for proper diagnosis or treatment regimes. It is true that paper-based medical information of patients can be conveyed with the aid of fax machine, telephone conversation, and even via courier services or through the post, but these modes of transmitting medical information have the potential for the misreading or mishearing of data, loss of information and delay (Institute for Medication practices, ISMP, 2000). Even in cases where health professionals at various geographical locations get hold to previous medical information of patients, it is intimates that reconciling the medical data could still be impossible (Coeira, 2003). According to Coeira (2003), different interpretations are sometimes given to the same medical records as making sense from the medical data often vary among professionals due to illegibility or improper spelling of a medical terminology.

Improper Organisation of Patient Records: Following from the preceding point, paper based records could lead to improper certification of medical records. With paper based records there is high risk of assigning wrong codes or symbols to medical files, which in turn makes it extremely difficult to locate these same files in a future date. Again, retrieval of medical file from a pile of health records according to Warshawsky, Pliskin, Urkin, et al., (1994) can also be daunting and time consuming. These improper classifications of medical records impede access to data and sharing data for proper healthcare delivery.

Error in Prescriptions and Medications: With paper based record systems, prescriptions are usually written completely by hand. This could lead to a pharmacist making mistakes in filling prescriptions because of an illegible handwriting, or may have to spend extra time calling the doctor's office to get clarification about a prescription. The Institute for Safe Medication Practices in a report estimated that pharmacists make more than 150 million calls to physicians each year to clarify what was written on prescription forms in order to avoid error of medication (ISMP, 2000). Another report by the institute calculated approximately 39% of medication errors; which occurs at the time of prescribers order medications, occurring due to the illegibility of prescribers' handwritings which is often misinterpreted by pharmacists (ISMP, 2002). According to the report, handwritten prescriptions or paper-based prescriptions serve as a major source of medication error which occurs at the very beginning of the medication use process (ISMP, 2002).

No guarantee for information backup. Paper-based records could be ruined by fire, flood, or other natural catastrophe, like Hurricane or they could be damaged or stolen completely. Unless a copy of every paper in the filing cabinet was made, that part of a patient's medical history would be lost forever and this could be detrimental to assessing the progress of a recovering patient or an old patient of the facility (ISMP, 2000).

Breach of Patients' Privacy: With paper based records there is little room of keeping track of who sees paper records or completely preventing unauthorized people from seeing the medical records of a patient. Medical records of patients can be accessed without any traces of who accessed them or when it was accessed or copied. Thus patients, especially those with serious illnesses or those who have confided compromising secrets to their doctors, risk irreparable damages like loss of job, embarrassment at home or work, bias, and the inability to even get insurance coverage (ISMP, 2000).

2.2.2 Electronic Health Record (EHR) In Healthcare Delivery

2.2.2.1 Meaning of EHR and its components

There exist numerous names with its accompanying acronyms for describing the use of computer systems or ICTs in healthcare delivery. Some of the names could be mentioned as Electronic medical record (EMR), electronic patient record (EPR), computerized medical record (CMR), computer-based patient record (CPR), and electronic health record (EHR). These lexicons are often used to mean the same thing but there could still be some minor differences in the meanings depending on the defining country of origin, health sector, professional discipline, and period of time (Nøhr, 2006). In giving meaning to consistency, this study prefers to adopt electronic health record (EHR) to describe the ICT implemented in the hospital. Again, Nøhr (2006) noted that the term ‘health’ in EHR refers to a person’s vital data independent of any specific periods of being a patient, therefore the use of EHR is deemed as most suitable for this study.

Meaning

Many writers have ascribed various definitions to EHRs; however the internationally recognized definition of EHRs was given by the International Standard Organization (ISO). ISO (2005) defined EHRs as “a repository of information regarding the health of a subject of care, in computer processable form”. This definition narrowly focuses on only the structure of EHR systems, therefore Hayrinen, Saranto and Nykanen (2008) sought to explain EHRs by broadening the focus given to EHRs in the ISO definition. According to Hayrinen et al. (2008), EHRs should be construed as comprising of retrospective, concurrent as well as prospective information which has the primary objective of supporting continuous, efficient and quality integrated healthcare delivery. Luo (2006) also asserts that EHRs go beyond just the electronic version of the paper based record to encompass the whole management of data required for patients’ care. Thus Bernstein, Bruun-Rasmussen, Vingtoft, Andersen and Nøhr (2005) agreed to the point that EHRs play a many-sided role in healthcare delivery than just being a computer system.

Components of EHR

Tang (2003), has noted that an effective EHR system: should have the capacity of storing patient health information and data longitudinally; should enable results generated from the

system to be managed proper; also enables the facilitation of electronic communication and connectivity; it should provide patient support and help in administrative processes and report. Nøhr (2006), also highlights the common components of EHR as:

Clinical Documentation: EHR should enables health professionals to better handle progress notes of their patients either as free text directly entered into the system or by predefined structured notes.

Physician Order Entry (POE): EHR should also allow for ordering diagnostic test and medication in a standardized and formalized way. Other EHR systems provides for checking drug interactions and alert for patient allergy.

Booking service: An EHR system allows for patients to book appointments with their medical professionals be it face to face or online.

Communication/Messaging: EHR systems should also enable the exchange communication between various hospitals, General Practitioners, pharmacies, and laboratories.

Results Management: EHR systems also facilitate the assaying of medical results. The system is should be able to show some warnings to abnormal results. The system should also depict trends of a particular result.

Charge Capture/Billing: EHR makes it easier to track expenses owed to the facility by virtue of the health service provided to the patient.

Disease Management: EHR also help in management of chronic diseases, by allowing health professionals to access data to assess whether or not disease is been managed properly.

Management of security issues: All EHR systems have special features that help manage authentication and authorization of users.

Further, Coeira (2003) also provides various components of EHR, which could be illuminated, graphically from Fig.1 below:

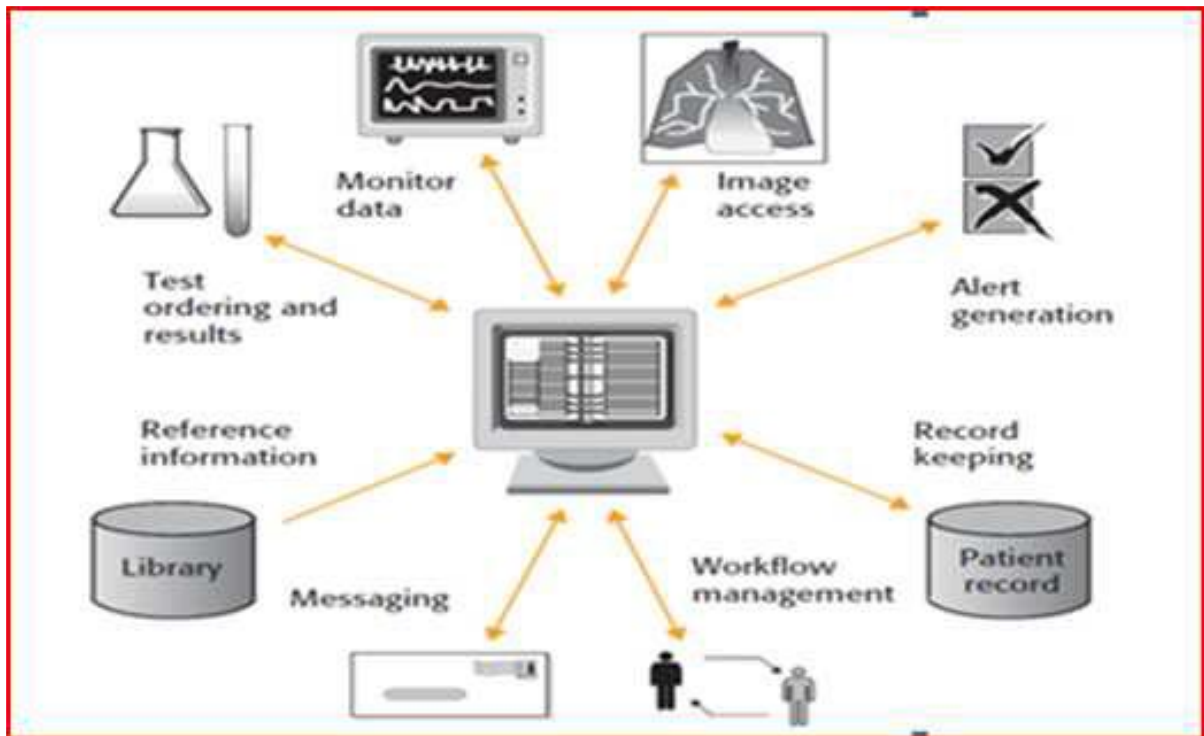


Figure 1: Diagram of EHR and its Components

Source: Coeira, 2003.

2.2.2.2. Structure of EHR

In explaining the structure on EHR system, this study will adopt the structure of EHR system in Dickinson, Fischetti and Heard (2004). The writers identified three (3) structures or functions of every effective EHR system and they classified these structures as direct care functions, supportive requirement and Information Infrastructure. This could further be explained by the aid of Figure 2 below.

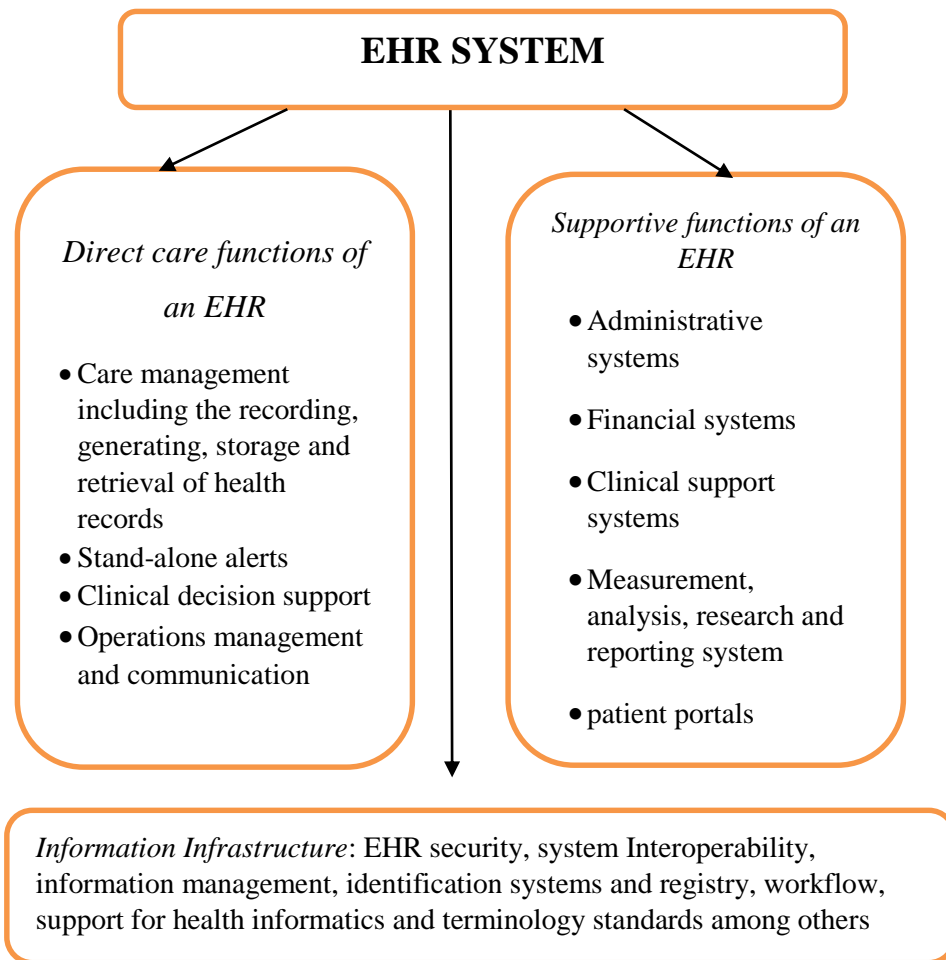


Figure 2: The Structure of an EHR based on Dickinson et al. (2004)

The Direct care functions of an EHR

The direct care function of every EHR system according to the writers, concerns itself with the carrying out the functions associated with general clinical tasks. And it involves the capturing or generation, storage, management, retrieval and communication of health information that are directly definable with the provision of healthcare. As Dickinson et al. (2004) opine, the direct care function of EHR ensures the delivery of everyday healthcare to patients. These include functions such as diagnosis, goal setting on patient management, planning and carrying out interventions, examination and evaluation of results (Bernstein et al., 2005). It also includes stand-alone reminders or alerts which provide prompts for contraindications and wrong prescription of medication to patients (Vesely, Zvárová, Peleška, Buchtela & Anger, 2006).

The direct care function of an EHR also provide task tracking to ensure timeliness in the provision of care (Dickinson et al., 2004). Hayrinen et al. (2008), however, were of the view that referral; patient present complaint and past medical history; physical examination; diagnosis; tests; procedures; treatment; medication and discharge are some of the commonly known Direct care functions of an EHR.

The supportive function

The supportive functions of EHR systems are those functions that are not directly related to the provision of healthcare but are subsidiary direct provision of healthcare though relevant for the overall delivery of health care (Dickinson et al., 2004). The supportive functions seek to improve quality healthcare delivery through the provision of inputs for medical researches and promotion of public health. It also provides assistance for general administrative and financial management (Dickinson et al., 2004). Examples of these supportive functions are optimizing patient bed assignments, provision of health guidelines and resources available, administrative and financial coding assignments as well as the provision of providers' location in the facility.

The Information Infrastructure Function

The function of EHR as an Information infrastructure, relates to the provision of technical groundwork for the successful achievement of the direct care functions and the supportive functions. EHR thus becomes the force which propels the well-functioning of both direct and supportive functions. According to Coeira and Clarke (2004), it involves *security*, which entails controlling access and privacy of data. It also involves *interoperability* or the exchange of clinical and administrative information through standard-based solutions as well as the sharing of information and records across management and various units (Dickinson et al., 2004).

2.3 THE HYBRID HEALTH RECORD SYSTEM

In an empirical study conducted in the US by Varga (2011), it was noted that although EHR is needed to aid in the automation of paper based health records, the complete migration to EHR system; and thus the consequent elimination of the cosmic majority of paper in the delivery of healthcare, will take at a minimum of 10-15 years or potentially many years longer. The study again noted that high percentage of healthcare professionals will continue to receive health information from patients in the form of paper documents for some long time to come, even if

healthcare professionals themselves convert to an EHR system. Therefore many healthcare facilities are now combining the use of both EHR systems and the paper based records systems. This is nonetheless, not exclusive to Varga's study amongst US medical professionals but the same phenomenon of combining paper based health records with EHR has been observed by some writers in the implementation of EHR systems (Adjorlolo & Ellingsen, 2013). Kalra and Ingram (2006:135) sum it all up by instigating that; "*Clinical care increasingly requires healthcare professionals to access patient record information that may be distributed across multiple sites, held in a variety of paper and electronic formats, and represented as mixtures of narrative, structured, coded and multimedia entries*".

2.4 FRAMEWORKS FOR EVALUATING EHR

Studies tilting towards evaluating health IS (of which EHR is a part), has been embarked upon for the past 40 years (van der Loo, 1995). And this is because, evaluating the success or effectiveness of EHR is crucial to the understanding of the value and efficacy of IS management actions and IS investments in various health facilities (William & Ephraim, 2003). Telemedicine in general is fluid and evolving, and owing to this an evaluation of a telemedicine application requires careful specifications (Grigsby, Brega & Devore, 2005). In existence is an array of methods for the evaluation of Telemedicine application. These arrays of method however fall in two major categories: formative or summative evaluations (Friedman & Wyatt, 1997; Grigsby et al., 2005; Wills, EL-Gayer & Sarnikar, 2011).

Formative evaluation draws attention to the implementation as well as the measurement of changes in the process of implementation or the intermediate-term effect/outcomes (Grigsby et al., 2005). Thus the aim of formative evaluations is to improve the EHR under evaluation by the means of providing feedback to users and system designers (Wills et al., 2011).

Summative evaluations on the other hand stress the need to measure outcomes, which includes changes in health status, quality of life, and functional performance (Grigsby et al., 2005). The major aim of summative evaluation is to make obvious, the various impact on clinical routine.

In addition to the two major types of evaluations generally acknowledged in modern EHR evaluation studies, Bashshur (1980) proposed a three-tiered approach to telemedicine evaluation. This three tier approach had '*evaluability assessment*' as the first step of an

evaluation process into EHR systems. According to him, the evaluability assessment forms the first stage of an empirical study and it frames the evaluation issues, which in turn sets the stage for the systematic formative and summative evaluations to be carried out (Bashshur, 1980).

Frameworks for evaluating telemedicine application like EHR are indeed nuanced. In their work titled “*Health systems evaluation of telemedicine: A staged approach*” DeChant, Tohme, Mun, Hayes and Schulman (1996), develop a three staged approach or a framework for assessing telemedicine applications. However, the approach seems to be grounded rather narrowly in technology assessment methods. At stage I, an assessment of technical efficacy of the EHR system at various end points is done. This involves finding out whether or not the EHR system is accurate and produce reliable data that are transmitted in real time. Having completed stage I, the next stage (II), involves assessing the cost, quality and access to specific applications. Stage III, which is the last stage involves a much broader evaluation. The evaluation here takes into account the various multiple end points and the overall costs incurred, all in an attempt to understand the effects of telemedicine on the larger health system (Ibid). However, it should be stressed that Ohinmaa et al., (2001) like Grigsby (1997) notably emphasised the complications in undertaking cost-effectiveness or cost-utility analysis of telemedicine applications.

In a report edited by Fields (1996), the need to include a business or project management plan focusing on the sustainability of the EHR system was amply highlighted. The report further suggested that evaluations of telemedicine applications like EHR should be compared with conventional care delivery systems from the varied perspectives of patients, providers, and society in general (Ibid). This makes any evaluation process a complex one. Therefore a successful evaluation of any telemedicine applications must reflect concerns in and around the healthcare facility. In what they technically termed as ‘*domain*’, Stoop & Berg (2003) identified *Technical; Professional; Organisational; Economic; Ethical and Legal* as the various viewpoints which evaluation could take. Thus according to them, all question generated while evaluating a telemedicine application like EHR ought to find expression in one of the six main domains highlighted. This nonetheless is not exhaustive as the writers themselves admitted in no uncertain terms. Therefore, other questions regarding evaluation deals with usability and the patients who are impacted the most in healthcare delivery (Ammenwerth, Eichstadter, Haux, et al., 2001; Buerkle, Kuch, Prokosch & Dudeck, 1999).

2.5 PHASES OF EVALUATING EHR

Stoop & Berg (2003) identified three (3) phases or stages of conducting an evaluative research in EHR system (which they generally termed Patient Care Information in their original study). The various phases or stages in the life of an EHR, where an evaluation could be done are *Pre-implementation, Implementation (during) and Post-Implementation*.

At the *Pre-implementation stage*, an evaluative assessment is done before an EHR system is implemented and is anticipated, among other things, to give a course for decision-making with respect to successive development or implementation of future responsibilities (Brender, 2006). Pre-implementation or readiness assessment is often thought of as a pivotal measure, which is conducted before rolling out any useful EHR system (Adjorlolo & Ellingsen, 2013; Demiris et al., 2004; Jennett, Jackson, Healy, et al., 2003). And this affords any health facility the opportunity to identifying failure factors associated with the actual implementation of EHR system and the mitigating factors to be deployed in order to address these failures. Hence a health facility which shows a noticeable lack of readiness invariably lacks the ability to undergo transformation for successful implementation of a useful EHR (Brender, 2006). The pre-implementation stage therefore allows for proper planning and management in an attempt to test the feasibility of the EHR system (Stoop & Berg 2003) or to access whether or not to implement the EHR system in the whole healthcare delivery facility (Vretveit, 1998).

At the actual *Implementation stage*, an evaluation of EHR system is carried out which aims to provide feedback (Stoop & Berg (2003) so that the optimum level of utilization could be realised in real time. This is akin to the *formative evaluation*, which also provides responses or feedback to users and system designers (Wills et al., 2011). According to Stoop & Berg, at the implementation stage, questions generated in the evaluation process “*are often concerned with the first consequences of real time use and with tentative results*” (Stoop & Berg, 2003: 459) Thus questions like; is the system easy to use or what are the benefits compared to the old situation, according to them suffices at this stage of evaluation.

During post-implementation phase, the evaluation process is focused on the impact or the spill-over effect of the system. Again, this is in semblance with the ‘*summative evaluation*’. Hence it is directed towards accounting for the decisions taken at the previous stages as well as the possible lessons to be learnt in organisation’s going forward.

These phases or stages of evaluation are not quite exact or they simply could be irregular. For instance, a trajectory pertaining to the acceptance of EHR system could be difficult to categorise as either 'before', 'during' or 'after' (Stoop & Berg, 2003). Nonetheless it has been stressed by Southon (1999) and Stoop and Berg (2003) that categorising the evaluation process into phases or stage helps in bringing some order to the massive amount of potential evaluation questions. This according to them also helps the various decision makers that have to decide on evaluation a proper place to place a particular evaluation query.

2.6 BENEFITS OF EHR

EHR are highly configurable, and may be adjusted rather comprehensively for different groups of staff and departments (Bossen, Jensen & Udsen, 2013). These set of characteristics are itself important contributing factor to the success of EHR implementation (Ibid). But previous studies conducted by Nah, Lau and Kuang (2001) as well as Ludwick and Doucette (2009) in seven different countries illustrate that successful implementation of EHR largely depend on a wide range of contextual and organizational factors (Bossen et al., 2013). And for this reason, other merits of EHR deserve further elaborations. From the perusal of literatures, benefits of EHR could be largely grouped under the following headings; Improve quality of care, Enhance productivity and efficiency, Improved Care Coordination and Communication, Reduction of cost, and Protection of Privacy of patient records.

2.6.1 Improve quality of care

The EHR system, when successfully implemented advances and improve the access to precise and up-to-date health records thereby strengthening the quality of care given to patients (Bossen et al., 2013; Boyer, Samuelian, Fieschi & Lancon, 2010; Khalifehsoltani & Geremi, 2010; Randeree, 2007; Sood et al., 2008). EHR systems are able to improve quality of patient care through greater access to health information, which leads to the reduction of medical errors which were largely associated with the paper-based record systems. Quality of patient care is also reflected in reduction of test result wait times and the general reduction in patient wait times in the health facility. In an empirical study conducted by DesRoches et al. (2008) a mammoth majority of 97% of respondents indicated that EHRs add to timely access to health records while about 82% reported that EHRs positively affected the quality of clinical decisions. Again, a systematic review of the impact of health IT on quality of care by Chaudhry

Wang, Wu, et al. (2006), revealed an increase in care delivery in the ranges of 5 to 66 percentage points. Further, findings from a recent study by Jarvis, Johnson, Butler, et al. (2013) suggest that EHR use is associated with higher clinical process quality of care in U.S. hospitals

2.6.2 Enhance productivity and efficiency

Anecdotally, health professionals who operate the paper-based records, habitually spend most of their time completing paperwork at the expense fulfilling their core duties of giving care. So a lot of time is spent in sorting out duplicate records, and finding records that are not available for days or weeks. The implementation of EHR systems in most health facilities has largely decreased the paperwork for clinicians. This has in turn reduced record-keeping time thus leading to the optimization of workflow efficiency and increase in the general productivity of health professionals (Erstad, 2003). As a result, health professionals turn out to be more productive as they do not now have to defer or reschedule their own duties while waiting for other colleagues to complete their duties (Essex, 2000; Menachemi & Brooks, 2006). By ensuring improved utilization of resources and minimizing duplication of efforts, EHR systems are able to improve productivity and efficiency in any healthcare delivery facility (Agrawal, 2002). This is attested to by a study conducted in Bangladesh by Khan, Shahid, Hedstrom and Andersson (2012), where a 25 year old female doctor said, using an EHR makes her more efficient and 'make her work easier'. These improved efficiencies have the likelihood to result in improved employee morale and maintenance. Similarly, evidence abound that e-health tools and for that matter EHR have positive effect on users (Bedeley & Palvia, 2014). Thus users of EHR are more inclined to become well-informed, better supported, and have improved behavioural outcomes, as compared to non-users of EHR (Murray, Burns, See, Lai, & Nazareth, 2005), in the same health facility.

2.6.3 Improved care coordination and communication

In a study by Smith et al. (2005), it was reported that one out of every seven hospitalizations is as a result of missing clinical or health information. This is because health records of patients; like test or diagnosis results and other significant data, are often not available when needed, or are often mislaid, and even in some cases, completely missing (Ibid). EHR thus reduces the likelihood of misplaced and lost records, which ensure that health records of patients and other vital patient data are readily available when needed. This enables health professionals to have access to better information at the various healthcare delivery points and departments. Furthermore as observed by Burton, Anderson and Kues (2004), EHR advances an improved

level of communication and facilitates overall improved coordination of care, over and across different health facilities. The coordination of care across various facilities made possible by the use of EHR is very paramount in the management of chronic disease or chronic care management (Bodenheimer, Wagner & Grumbach, 2002).

That said, the built-in email feature of many EHRs also result in enhancing communication by allowing staff of various hospitals the ability to communicate with each other from any department or work station (Erstad, 2003; Menachemi & Brooks, 2006). Again, these email feature also allows for instantaneous and real-time communication amongst health professional (Menachemi & Brooks, 2006) and this provides the ability to concurrently complete tasks by clinicians at various locations thus leading to saving of time. Again, and empirically, DesRoches et al. (2008) found majority of respondent in their study (72%), saying EHR does not only improve care coordination but also improve communication with patients.

2.6.4 Reduction of cost and enhanced revenue

The general cost of providing healthcare is on the increase partly because of the inefficiencies of paper-based work. Manual processes such as expenses incurred for the transcription of physicians' dictated notes, pulling, filing, and maintaining charts together with the cost of maintaining the storage of health records are some of the identified cost associated with the paper-based records (Cisco Systems Inc, 2005). The introduction of EHR in many health facilities has however resulted in the reduction of supply and printing cost (Menachemi & Brooks, 2006). Hence the cost incurred in initiating and maintaining paper health records including clerical supplies, cost of paper, and printing costs are squashed or reduced when EHRs are used (Ibid; Sandrick, 1998). In a work done by Ewing and Cusick (2004), a health facility reported a sketchy 90% reduction in the paper backlog after a few months of implementing an EHR system (Menachemi & Brooks, 2006), which resulted in the reduction in paper and supply costs. Remlex (2007) has also agreed that using ICT in health sector largely reduces the cost of running hospitals. The implementation of EHRs does not only help reduce cost but also lead to increased revenues by ensuring timely and accurate capture of charges for medications, medical supplies, and clinical services. EHR is hence seen as a measure to increase the cash flow of health facilities (Menachemi & Brooks, 2006). Incorrect coding of health records according to Mildon and Cohen (2001) and Erstad (2003) results in a loss of between 3–15% of the total estimated revenues of healthcare providers. Furthermore, a studies by

Agrawal (2002) pointed to the role played by EHRs is increasing the cash flows of health facilities that implement them.

2.6.5 Privacy of patient records

EHRs ensure that maximum protection is given to patients' information, which may be very sensitive. Health records contain immense quantity of sensitive information, such as fertility and abortions, emotional problems, sexual behaviours and diseases, substance abuse, and physical abuse (Rindfleisch, 1997; Palvia, Lowe, Nemati & Jacks, 2012). Hence when access to this kind of information are uncontrolled, it can be injurious and detrimental to the wellbeing of a patient. EHRs, however, ensure that patient's records are electronically kept behind log-in passwords or even biometric sensors. It also ensures the tracking of providers that accesses patient information in the system. Thus EHR does not only ensure compliance with privacy regulations but also provides pliant security measures to protect patient information across the entire wired and wireless environment (Cisco, 2005).

2.7 CHALLENGES OF EHR IMPLEMENTATION

The progression and sequence of EHR, particularly in developing countries' health facilities has never been an easy undertaking as there are many peculiar factors impeding the progression and diffusion of such technologies (Bra, Monteiro & Sahay, 2004; Sood et al., 2008). But the point ought to be made fiercely that challenges of EHR implementation in developed countries, somewhat differ from the challenges of EHR implementation in developing countries. The works of Sood et al. (2008) titled "*Electronic Medical Records: A Review Comparing the Challenges in Developed and Developing Countries*" is a clearer manifestation of the differing challenges of EHR implementation in developed and developing countries. This section of the work thus, would be much more interested in the challenges of EHR implementation in developing countries owing to the research objectives.

Khalifehsoltani and Gerami (2010), in their study obtained a model, which considers the challenges facing E-Health in Developing Countries. This model included challenges relating to six areas of Technology and Operational; Social and Cultural; Native Environment; Legal; Policymaking; and Financial. However, their model had a general outlook of e-Health, which EHR is just a fraction. Therefore upon a further review of other works regarding the challenges

of EHR implementation in developing countries, some peculiar issues that affront EHR implementation in developing countries were discovered. Inadequate Electric Power Supply; Lack of ICT Infrastructure; lack of basic ICT knowledge/skills; Poor Internet connectivity; financial issues; and Resistance to New Technology were identified broadly (albeit others) as the major challenges that hinder the successful implementation of EHR in developing countries like Ghana.

2.7.1 Inadequate electric power supply

Most developing countries, particularly in sub-Saharan Africa, find it difficult to provide Uninterrupted Power Supply (UPS) to their citizens. This invariably affects any good ICT service provision like EHR (Achampong, 2012). The Ghanaian experience is even worse with the current ongoing load shedding exercise. Thus a health facility operating an EHR cannot safely depend on the flow of electricity supplied by the Electricity Company of Ghana (ECG) since at any time without prior notice power can go off (Ibid). In touring some health facilities in Accra (the capital city of Ghana) in order to ascertain how these facilities have been dealing with the electricity shortages, Beatrice Adu, a Joy News (a leading private news TV station in Ghana) reporter, described the erratic power supply as “worrying” to the general healthcare delivery system (Adu, 2013). From the reportage and particularly “*at the Adabraka Polyclinic, officials told Joy News that electricity goes off at least five times a day, making the sterilization of equipment used during each day difficult. They also reported that the low current affecting the entire hospital has made work unbearable.*” (Ibid) Further, the Assistant-in-charge of the Princess Marie St. Louise Children’s Hospital enlightened the reporter that “*because of the erratic power supply, the facility has been digging into its scarce resources to repair equipment*” (Ibid). This means that the erratic supply of power does not only affect the well-functioning of EHR systems but goes to the extent of damaging the system. This brings an additional cost of repairs. Even in some cases these damaged EHR systems, goes beyond repairs and are totally replaced.

2.7.2 Lack of ICT Infrastructure

In most developed countries like United State, United Kingdom, Norway, Denmark and Australia, there is a growing and robust healthcare infrastructure that receives ample financial support from its governments (Sood et al., 2008). This is however not the situation in most developing countries. In particular, professionals in various health facilities who implement healthcare information technology based solutions like EHR systems in developing countries

are overwhelmed with the lack of ICT resources (such as unavailability of computers) and weak healthcare infrastructure (Ibid). Again, infrastructure such as those that support the operation of EHRs remains a constraint (WHO, 2010). And this is consistent with the finding from a current empirical studies conducted by Bedeley & Palvia (2014), which rates *Lack of ICT Infrastructure* as the major challenge of e-Health. According to Bedeley & Palvia (2014), “*The ICT infrastructures that are currently in place are not enough to support the new system*” (p.7). For example health facilities that are equipped with computers or ICT infrastructures are often not in good conditions. Again other essential IT accessories that are basic element for successful implementation of EHR systems are just not available in most health institution in developing countries, particularly Ghana (Ibid). Thus limited access to computers and other ICT facilities remain a challenge to the successful implementation of EHR (Martinez, Villarroel, Seoane & del Pozo, 2005).

2.7.3 Lack of basic ICT knowledge/skills

The majority of health professionals in developing countries lack the basic ICT knowledge or skills that are needed to effectively use the EHR systems (Alverson et al., 2009; Bedeley & Palvia, 2014; Martinez et al., 2005; Pradhan, 2004; Sood & Bhatia, 2005; Xue & Liang, 2007). This hampers the full utilization of the system by health professions. As confirmed by interview response gathered from the healthcare professionals in Bedeley & Palvia (2014), it was observed that the “*...majority of the current generation of Ghanaians grew up in the rural areas without computers or even common electricity. Such people therefore exhibit negative attitudes towards computers due to their ignorance as they rather prefer someone do their work for them with the computer than doing stuff by themselves.*” They further opined that the “*lack of enthusiasm... has slowed down implementation efforts as it raises the debate of whether the time is right or not.*” (p.6). As a result there are various training programs arranged by various health institutions themselves to boost the knowledge and skills of health professions regarding basic computer skills. But, the period made available for these computer illiterate health professionals to acquire and master the rudimental operations of the computer and to transfer the skills acquired to particular project might themselves also hinder the effectiveness of EHR (Sood & Bhatia, 2005; Xue & Liang, 2007). In some situations the period of time for the training is too short and this result is trainees acquiring limited computer skills or nothing at all. Again when the period of time is too long, it often create a vacuum for manpower needed to operate the system at critical moments.

2.7.4 Poor Internet connectivity

Another major problem that affronts the successful implementation of many EHR projects in developing countries is the lack of access to the Internet (Achampong, 2012; Idowu, Adagunodo, Aderounmu & Ogunbodede, 2005; Seini, Abdulai, & Asenso-Okyere, 1998). An important function of the Internet is that it makes available enormous amounts of health related information that may be very useful for individuals as well as organizations such as hospitals (Andreassen et al., 2007; Santana, Lausen, Bujnowska-Fedak, et al., 2011; Kummervold & Wynn, 2012). This functionality may also be accessible through or integrated in the EHR (Griffiths et al., 2006 in Bedeley & Palvia, 2014). Although the access to the Internet is improving in many parts of Africa (Oyeyemi, Gabarron & Wynn, 2014), the problem of Internet connectivity and Internet services is still a major challenge in many developing countries like Ghana. Even if there is Internet connectivity available in a particular health institution, low speed, and high utility cost (Bedeley & Palvia, 2014) often makes the use of EHR unreliable and expensive (Swinfen & Swinfen, 2002). Computer viruses, spams together with limited bandwidth (Doarn, Adilova & Lam, 2005; Geissbuhler, Bagayoko & Ly, 2007; Swinfen & Swinfen, 2002) also impede the use of EHR system even in cases where Internet services are intermittently available. Thus the issue of poor Internet connectivity and limited bandwidth often brings about Internet congestion that in turn affects image retrieval and image resolution (Durrani, & Khoja, 2009) as well as other non-image files. This largely can affect negatively, the effectiveness of diagnosis and treatment regimens (Stutchfield, Jagilly & Tulloh, 2007; Zhao, Nakajima & Juzoji, 2002).

2.7.5 Financial issues

Another major challenge, which encumbers the implementing of health-related ICT projects like EHR in developing countries, is the issue relating to financial cost (Pal, Mbarika, Cobb-Payton, Datta & McCoy, 2005; Xue & Liang, 2007). The cost incurred in purchasing the necessary software and hardware together with the cost of transport and installation, the cost of maintenance, the cost of training of the hospital staff (al Shorbaji, 2008; Alverson et al., 2009; Durrani, & Khoja, 2009; Martinez et al., 2005) as well as other unanticipated costs might be too high to deter governmental and institutional commitment towards the implementation of EHR. Hence the implementation of EHR comes with huge financial responsibilities and commitments that often worsen already existing financial predicament of health institutions in developing countries (Bedeley & Palvia, 2014).

2.7.6 Resistance to new technologies

Health care professionals (like their counterpart in other sectors) often harbour a fear that integration of new EHR systems into existing work practice might alter existing work practices, or interrupt workflow (WHO, 2010). Thus healthcare professionals turn to defy new technological developments like EHR that may threaten their job particularly in cases where the organisation introducing new EHR anticipates reducing staff strength and cost of operation (Achampong, 2012). This greatly affects the acceptability of such EHRs.

2.8 USABILITY AND USER SATISFACTION

Generally, the effective use and the general satisfaction with respect to EHR on the part of users is a prerequisite for a successful implementation of EHR systems in any healthcare facility (Coeira, 2003; Vikkelsø, 2005). Usability of EHRs has also been identified as one of the key barricades to the adoption of EHRs (Gans et al., 2005). Hence Perednia and Allen (1995), in what could be described as a much detailed review of telemedicine applications, emphasised that the definitive success of EHR hinges on the ability of health facilities to address managerial challenges, which include user technology acceptance (Chau & Hu, 2002). Again, in a study of three interconnected organizational EHR systems, Payton (2000) also concluded with a clear emphasis on the significant role played by physicians in the process of implementing an EHR. These conclusions invariably led Chau & Hu (2002) to assert “*given the potential impact of telemedicine technology, it is therefore important to investigate factors essential to its acceptance by individual physicians*” (p.298). Usability testing should therefore be an unambiguous element in the pre-purchase assessment of EHR (Walker et al., 2005). Usability as a term connotes the characteristics of human–computer dealings or interactions in a system (Tang et al., 2006). Therefore, to describe an EHR system as having good usability means that the system is easy to learn and remember, efficient to use, generates very few errors, and leads to great satisfaction on the part of users (Nielsen, 1994; Tang et al., 2006).

2.8.1 Factors That Impede Usability

Empirical studies abound in ascertaining the relationship between individual’s perception to use a technology sufficiently and his or her actual use. Hence, Chau & Hu (2002), in their study, which seeks to probe healthcare professionals’ decisions to accept telemedicine, the authors

aimed to find out how perception affects the actual use of EHR. The study found out that the perception of health workers of the degree to which telemedicine technology is easy to use, affects both their attitude toward using the technology as well as perception of usefulness of the system itself. In other words, attitude of health professionals are influenced by the usefulness of EHRs, as they perceived it. From a skewed technology management standpoint, however, their findings made known the substance of attitude cultivation and management.

Various studies on user satisfaction in connection with the implementation of EHRs in various health facilities (Bonner et al., 2010; Christensen & Grimsmo, 2008) have all suggested the possibility to realize a general level of satisfaction among health professionals. However these studies observed that usability of EHRs and the satisfactions thereof by the users are often thwarted with apprehension emanating from shift from paper based records to EHR. Users' reluctance to adapt to new technology (Fitzgerald, Piris & Serrano, 2008) has led to the poor usage or in some situation the complete neglect of EHR systems in most health facilities.

Schumacher, Berkowitz, Abramson and Liebovitz (2010) identified 'failure to use human factors design principles' as a major factor that impede usability and user satisfaction in their use of EHR. According to them, management, designers and vendors of EHR systems often fail to apply human and social factors when designing the system, rather they just concentrate on the technological aspect. These results in little time dedicated to appreciating the context of use. Designers of the system thus focus on workflow (for instance, click here to fill a data or open here to access this file) at the neglect of what Schumacher et al. (2010) described as "*less obvious, but often more important, 'thought flow' - the review and thinking which physicians inherently do before finishing a task*" (p. 818). They also identified other barriers to the use of EHRs as

"Physician's attitudes that they want a computer system to mimic a paper system as closely as possible as well as IT staff's attitudes that technology solutions are more important than the purpose of the solution and the problem it was intended to solve" (p. 818)

The process of entering and retrieving information from EHR systems itself may contribute adversely to usability and thereby user satisfaction (Bonner et al., 2010). This is particularly the case where the system interface is complicated to decipher or go around it. Again, the case is made worse where there is lack of interpersonal communication mechanism in various health facilities.

2.8.2 Measure to increase usability

In the opinion of Chau and Hu (2002:308), to foster users' acceptance of EHR, management in the health facility needs to work out a plan for cultivating positive attitudes toward using the technology. Management must robustly '*emphasize, demonstrate and communicate* the usefulness of the system regularly to not only the users but also the entire organisation. This is the only way to reinvent the negative attitude or perceptions of users towards the use of the system.

In order to increase usability and user satisfaction, the EHR system but be seen to be smarter and add to the overall intellectual value of health professionals after an encounter with a patient (Schumacher et al., 2010). The system should be able to reveal buried content and interrupt or suspend apparent medical mistakes. Users of EHR in various health facilities would likely be more satisfied with the system if it presents inconspicuous assistance with context sensitive reference algorithms and data-sets (Ibid).

To ensure usability and maximum user satisfaction of EHR, there is a need for continuous awareness and training workshops or courses concerning basic ICT skills as well as the actual usage of EHR systems (Walker et al., 2005). The technical intricacies of EHR systems necessitate the need for a high level of technical competence on the part of users (Sahay & Walsham, 2006). These technical competences are achieved largely by organising training and other workshops for users of the system. Further, there is a need for training in order to alleviate or lessen the problems associated with general usage of EHR such as poor preparation of data for use, and low initiative for using the data. This is reflective of empirical findings from a study in Tanzania conducted by Smith et al. (2007).

2.9 SUMMARY OF THE CHAPTER

This chapter began with the theories underpinning the study that viewed the implemented EHR at Effia Nkwanta Regional Hospital (the study site) as an Information Infrastructure that requires the identification of the various actors in its implementation to form a network (Actor Network Theory) to enhance the successful implementation of the EHR.

The second part of the chapter; the literature review, identified some challenges with the use of paper-based records in health care delivery which Electronic health records helps to address.

The literature also indicated that, the implementation of EHR and hence its success is limited by human, organisational and technological factors which varies in both developed and developing countries although some challenges are commonly shared by these countries. In the face of these challenges, evaluating the EHR at the various levels of implementation; pre-implementation, implementation and post-implementation, seemed viable in reducing the failure rates associated with the implementation of such systems. Evaluation of EHR is documented and identified with most system implementation of developed countries such as the EHR implementation in Denmark, however such studies are limited in developing countries such as Ghana. Hence, this study sort to document the evaluation of an implemented EHR implementation in a regional hospital in Ghana by identifying the preparations made by the hospital prior to the systems implementation and the factors that impedes or promotes its usage and overall realisation of the systems benefit to the hospital.

CHAPTER THREE

RESEARCH SETTING AND METHODOLOGY

3.0 INTRODUCTION

The research study has a number of unified objectives set within the context of EHR evaluation that includes to;

- Examine the prior assessment made by the Hospital before the implementation of the system
- Examine the factors that impede or promote the usability of the system by health professionals
- Examine the impact derived from the installation of the system and how it influences healthcare delivery.

In information system development and implementation, like the EHR, evaluation is recommended to be keen in ensuring the functionality and sustainability of the system (Bossen et al., 2013). The literature reviewed in chapter two, identified two forms of evaluation, which is either formative or summative. Formative evaluation is intended to improve the EHR by providing feedbacks to the system providers to initiate appropriate changes to the system while summative evaluation identifies the clinical or economic outcome of the EHR (Ibid). Given the research objectives, a formative evaluation was chosen for this study as the EHR is currently at its initial stages at the hospital of study- Effia Nkwanta Regional Hospital. Formative evaluation also seems necessary and valuable in the implementation process of the system as it aids in identifying the weaknesses and strengths of the system for necessary changes to be effected.

This chapter of the study hence details how the entire research process was planned and executed to achieve the study objectives. A brief profile of the study country, Ghana, as well as the profile of the study site is described under the heading research setting. The chapter also presents the research approach that includes; research design, the data collection method and procedure and the data analysis strategy. The chapter ends with a description of the limitations to the study process and a reflection on the adopted study processes.

3.1 RESEARCH SETTING

This section of the methodology describes the settings in which the study was conducted and takes account of a profile of the study country and the study site. The study site was however chosen by the researcher because it is the third largest hospital in Ghana and as a regional hospital the successful implementation of the EHR system would encourage its replication in other health facilities in the region and the country at large. The study site was also selected because of its proximity to the researcher's residence of stay thereby reducing the expenditure of the researcher. The researcher was also an intern at the facility during her undergraduate studies and this goes to give the researcher a proper appreciation and understanding of the changes in the study site.

3.1.1 Profile of the study country- Ghana

The study was conducted at Effia Nkwanta Regional Hospital in Ghana. Ghana, formerly known as Gold Coast, lies on the coast of West Africa and share borders with Togo on the east, Cote d'Ivoire on the west, Burkina Faso on the north and the Gulf of Guinea on the south. Ghana was the first sub-Saharan country in colonial Africa to gain independence in 1957, 6th March. As a former British colony, Ghana adopted English as her official language although there are about 46 different languages spoken in the country.

Geographically, Ghana occupies an area of 238,533 square kilometres and is naturally endowed with resources such as Gold, timber, Industrial diamond, bauxite, petroleum, rubber and manganese among other natural resources (World Fact book, 2014). Ghana has a population of about 24, 658, 823 people (Ghana Statistical Service, 2012). Administratively, Ghana is divided into 10 regions, 170 districts (including 6 metropolitan assemblies) and 275 constituencies with Accra in the Greater Accra region as her capital.

3.1.1.1 The Ghana Healthcare system

Healthcare in Ghana is mainly provided by two actors; the public institutions and the private institutions (private commercial and faith-based or religious institutions). The Ministry of Health (MOH); with its various departments and agencies, serve as an executive regulatory body that regulates the activities of the various public and private healthcare institutions in Ghana. The MOH does not only earn a seat at the cabinet but also oversees quality and equitable distribution of healthcare in the country. However, by virtue of Act 525 of 1996 (Ghana Health

Services Act), some responsibilities and authority has been shifted from the MOH to a more autonomous and apolitical institution - Ghana Health Service (GHS). The GHS as an institution is responsible for implementing national health policies under MOH, regulate and provide healthcare services (including public health) at all levels of care in Ghana (IICD, 2014). In providing healthcare services, the GHS is also required by law to ensure increase in the access to quality healthcare whiles managing resources available for the provision of healthcare prudently. It is noteworthy to emphasise that the activities of the GHS exclude public Teaching Hospitals, Private Hospitals and Mission Hospitals (GHS, 2014).

There are five major hierarchical public delivery channels of healthcare in Ghana which includes; the community based health facilities, sub-district, district and regional and national level of healthcare delivery. The sub-district level; has health centres, health post and clinics as well as community-based health planning and service facilities. These facilities provide immediate and urgent care to patient before any referral, should the need arise. The activities of the sub-district providers (which include the community-based health services) are coordinated by the district level providers that serve as the first referral point for the sub-district providers. The regional hospitals serve as the second referral points and refer its complex cases to the national care providers. The diagram below gives the organisation of healthcare system in Ghana.

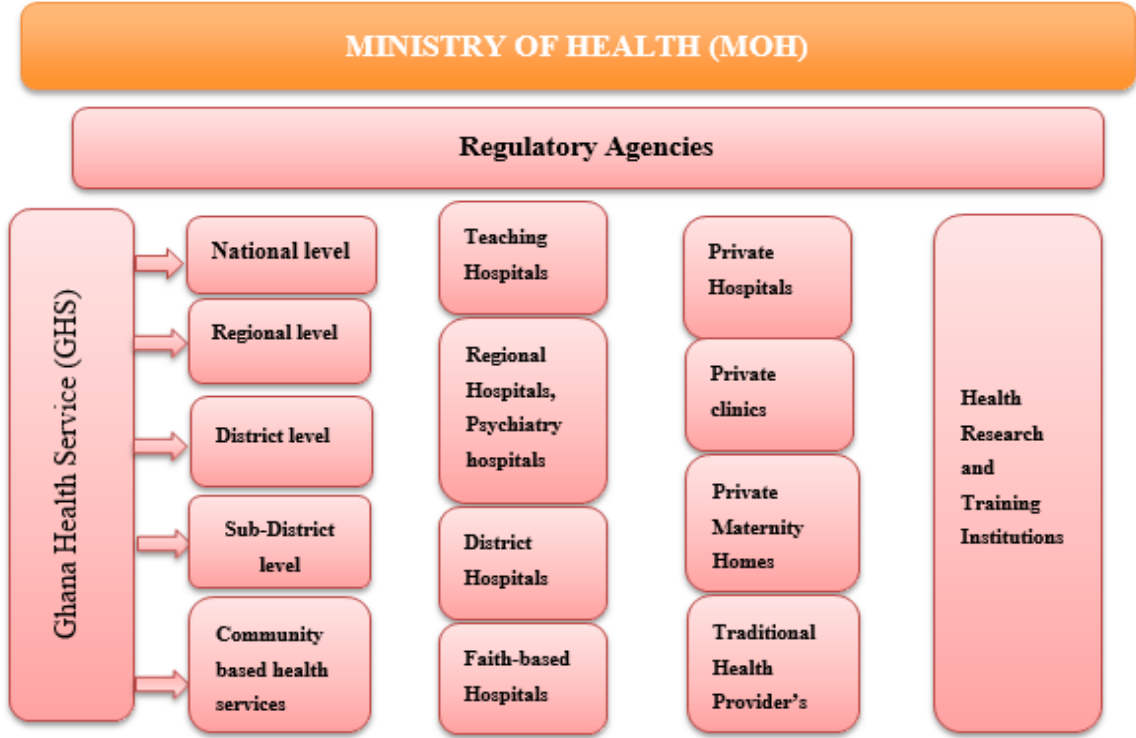


Figure 3: A diagram showing the healthcare delivery system in Ghana

Healthcare financing in Ghana is mainly by the National Health Insurance scheme (NHIS), out-of-pocket payments (cash-and-carry), government and other donor budget support (although funds from the donor support is on the decrease). The NHIS covers about 35% of Ghana's population and requires people to pre-register to enjoy the benefits provided by the scheme (National Health Insurance Authority, NHIA, 2012). Most hospitals; both private and public facilities, are accredited by the scheme to provide services to pre-registered clients. However, not all medical procedures and treatment are covered by the scheme and hence require clients to pay for the uncovered treatments and procedures. People who are not registered under the scheme pay upfront for services rendered to them by the healthcare providers. Whereas most public institutions provide services under the scheme, most private commercial institutions have either ceased to provide their services under the scheme or operate solely on "cash and carry system" due to the delays in claims processing and reimbursement, although measures are taken by the scheme to reduce its impact on clients (IICD, 2014).

Inadequate staff numbers and the inequitable distribution of health workers amongst the various levels of care delivery are some of the challenges faced by the Ghana Healthcare system. Most skilled health personnel and equipment are concentrated in the urban areas than the rural areas. As a result people in rural areas have to travel to urban areas to access specialist care that have a tolling effect on the health of people living in rural areas (Saleh, 2012). As at 2010, the ratio of doctors and nurses per 1000 population in Ghana, was 0.11 and 1.14 (Bedeley & Palvia, 2014). This low physician to population ratio coupled with the inequitable distribution of healthcare personnel and equipment in the country has partly brought about the growing trend of e-health in the country.

3.1.1.2 E-Health in Ghana

Ghana like most African countries is revolutionising its healthcare system to include ICT and its applications to improve care delivery and facilitate the access to quality health by its citizenry. Ghana, which hitherto could not boast of a nationwide e-health project, now has a nationwide health information system called DHMIS2 (District Health Management Information System). This has helped in generating a nationwide health monitoring and evaluation data for public health issues. Information is now generated electronically from all districts through the DHMIS2, which is based on the International Statistical Classification of Disease and Related Health problems (ICD10) (IICD, 2014). Although the systems' reliability and completeness is still a challenge due to the late entry and incompleteness of information

from some facilities (Ibid), the effort made by the country to use ICT in improving its healthcare system cannot be overlooked.

In July 2010, the National e-health strategy was launched to provide a framework for the design and rolling out of e-health projects in the Ghanaian health sector (Ghana e-Health strategy, 2010). The four main strategies that were outlined in the National strategy includes to; Streamline the regulatory framework for health data and information management, Build sector capacity for a wider application of e-health solutions in the health sector, Increase access and bridge the equity gap in the health sector through the use of ICT and to Achieve a paperless records and reporting system in the health sector of the country (Ghana e-Health strategy, 2010; pp. 38).

Although the e-health strategy has been launched, the rolling out of the strategy is faced with some challenges that make its implementation somehow stagnate. A key challenge is the fragmentation of the health sector and the incapacity to use the available technologies in daily care activities which is attributed to materials, human practices, work ethics and culture (IICD, 2014). E-health in Ghana is also faced with the challenge of interoperability due to the use of ICT from different manufacturers and vendors by the various health facilities. Again, the country lacks regulatory bodies to monitor the progress and development of various e-health applications that makes it even more difficulty to achieve interoperability. The health sector in general suffers a shortage of ICT skilled personnel required to deliver large-scale e-health projects (Ghana e-Health strategy, 2010).

A scan through the various e-health projects in Ghana revealed about 23 projects at different stages of implementation in Ghana (IICD, 2014; Afarikumah, 2014). These projects can be classified into five categories which include data management, hospital management information systems, public health systems, telemedicine and eLearning systems which are all with the aim of improving healthcare delivery in Ghana (IICD, 2014).

3.1.2 The study site – Effia Nkwanta Regional Hospital (ENRH)

ENRH was established in 1938 as a military hospital in the Second World War by the then British West African Royal Frontier Force based in Takoradi; the regional capital of the Western region of Ghana. After the Second World War, the hospital was handed over to the Ministry of Health of Ghana; the then Gold Coast, in 1948 by the military authorities.

The hospital, which is the third largest hospital in the country, is situated on a hill and covers an area of about 202 hectares. At the foot of the hill are the outpatient department, OPD, (which comprises 6 consulting rooms), laboratory, casualty, Health insurance unit and the records department. Leading to the top of the hill is a stairway that connects the outpatient department to the main buildings of the hospital. On both sides of the staircase is the Ear, Nose and Throat (ENT) department, Psychiatry department, Dental unit, main Dispensary, Injection/Dressing unit, Public health research laboratory, Physiotherapy department and the Adolescent health office. The main buildings (the tower and service blocks) on the hill contribute to the beautiful view of the hospital although the departments in the hospital seem disperse. It comprises of eight (8) wards for in-patient admissions (Female surgical ward, Male surgical ward, Obstetrics and Gynaecology ward, lying-in ward/Neonatal Intensive care unit, paediatrics-ward B, Male medical- ward C, Male orthopaedics-ward D, Female Medical-ward A), Accident and Emergency unit, Theatres for surgical procedures, Drug Information centres, Mortuary, Communication Disease Unit (CDU), Doctors' offices, Health Information unit and other service units (Radiology or X-ray, Pharmacy, Administration, Maintenance/Laundry, Kitchen, Revenue unit, Staff canteen, Snack bar and the procurement unit). Also on the top of the hill is a Nurses/Midwifery training school and Bungalows/Flats for some staff of the hospital.



Figure 4: View of ENRH showing the OPD and the Tower building

(Source: www.gbcghana.com assessed 18/12/14)



Figure 5: Directional Chart of ENRH

ENRH has a bed capacity of 350 beds distributed among the eight wards. The hospital provides services to a population of about 365,000 people in the Shama/Ahanta East Metropolis in the Western Region. The hospital also serves as a referral centre for other facilities in both the

Western region in Ghana; which has a population of about 2,376,021 (Ghana Statistical Service, 2012), and the Central region in Ghana.

Table 1: The Staff composition of the hospital as at the time of data collection

Staff Category	Number Represented
Medical Director	1
Hospital Administrator	2
Doctors including specialists	37
House Officers - Doctors	24
Paramedics	74
Nurses	134
Midwives	55
Auxiliary Nurse – Community Health Nurses and Enrolled Nurses	120
Support Staff - Non-clinical staff	216
Casual workers	144
TOTAL	807

Administratively, Effia Nkwanta Regional Hospital, like most hospitals in Ghana, is headed by the Medical Director who has oversight of the daily operations in the hospital. The Medical Director is supported by the Deputy Director of Nursing Services (DDNS) and the Hospital Administrators who together form the core management of the hospital. The DDNS has the responsibility of managing the wards, Theatres, consulting rooms and the overall directions of the nursing division of the hospital. The Hospital Administrator on the other hand oversees the day to day running of the hospital including the manpower planning, budgeting and expenditure control and reports directly to the Medical Director. The three core managers of the hospital are assisted by other two line managers, that is, the Head of Finance and the Head of Pharmacy who together form the management team of the hospital.

3.2 RESEARCH APPROACH

The main goal of the study was to evaluate the EHR implemented in ENRH. To achieve this objective, the study sought to identify the initial assessment made by the facility before the adoption and implementation of the system, the usability and satisfaction of the users of the system and to identify the benefits of the system to healthcare delivery. Data was hence collected from key actors of the hospital to meet the set goals of the study. A diagrammatic representation of the study approach is presented below;

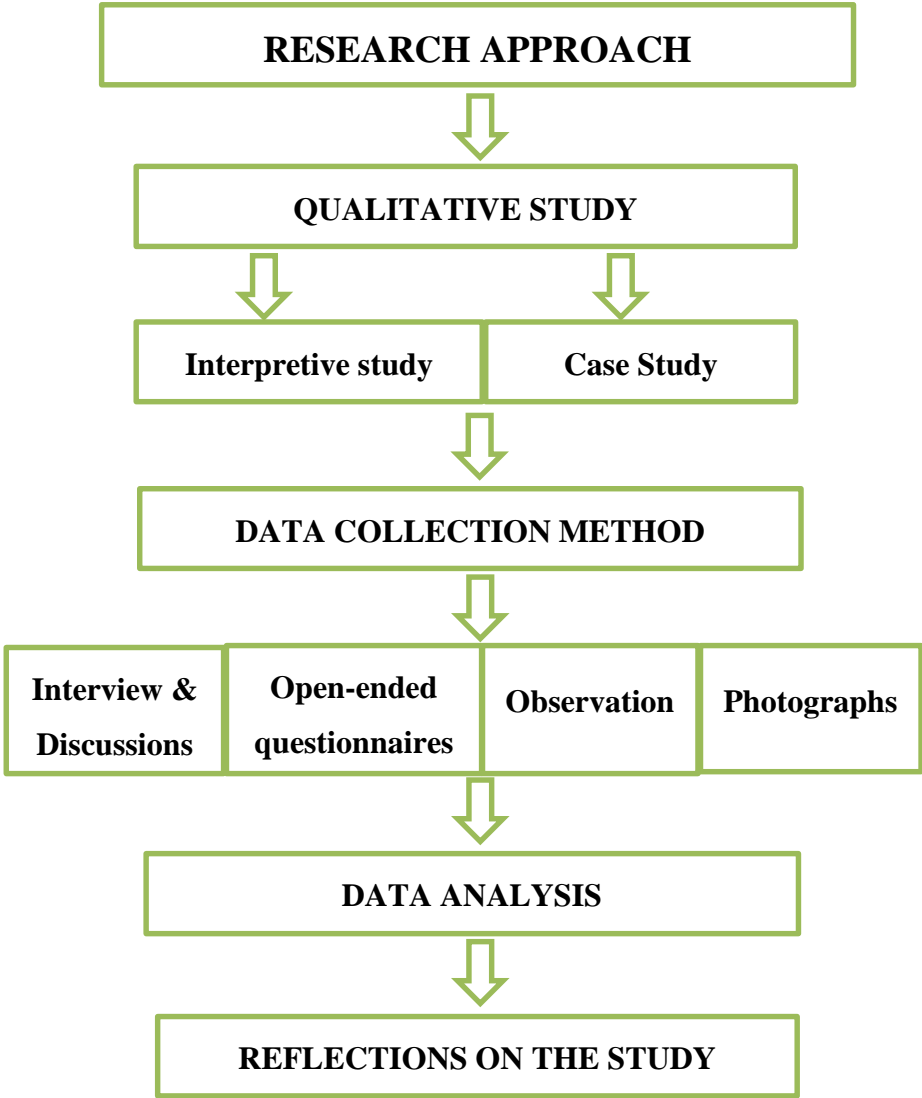


Figure 6: Diagrammatic representation of Study Approach

3.2.1 Study Design

Researches in information systems usually dwell on qualitative research methods, although some studies adopts the quantitative or the triangulation approach which combines both quantitative and qualitative research approach. However, this study adopted a qualitative research design with an interpretative case study approach in the conduct of the study.

3.2.1.1 Qualitative vs. quantitative study approach

Quantitative research methods are recognised to be most suitable for “*establishing the size, extent or duration of certain phenomena (how much), or to establish that a specific cause or intervention results in a prespecified effect*” (Stoop & Berg, 2003; 463). By employing statistical or mathematical measurement of variables, quantitative researches ensure the representation of study variables that allows for the generalisation of results or study findings (Robson, 2011). The method uses tools such as questionnaires or surveys, time studies or tracking of clinical outcome to achieve its objectives and has been widely used in information system researches. Despite its wide use in information system researches, the approach is perceived to ignore the interaction or relationship between the context, human behaviour and the technology (Benbasat et al., 1987) by viewing information system within a technological lens (Gallies & Land, 1987). However, with the recent emphasis on user participation and socio-technical approach to system design and implementation to enhance system success, the interaction of the context and the technology is paramount where views and interpretations of the users are allowed. A qualitative approach hence seemed promising in the conduct of this study to understand the system as a network by identifying and understanding the various actors in the network; the interaction between the system and the users from the users and organisational perspective.

Qualitative research is concerned with the “*negotiation and construction of meanings in social interaction*” which focuses on the “*meaning that people attach to experiences, the relationship between knowledge, experiences and action and the social factors that shape these processes*” (Popay & Williams, 1998; 34). Stoop and Berg (2003; 463) have also referred to Qualitative methods as “*optimally suited to understand a phenomenon from the points of view of the participants and in its particular social and institutional context*”. And as a flexible research design, qualitative research allows unpredicted findings obtained from the study to be incorporated into the study framework as it also allows modification to be made to the research

question (Wynn, 1995). In system evaluation, understanding the context or phenomena under study is relevant and thus qualitative research allows the researcher direct contact with the people, situation and the general phenomena under study (Patton, 2002).

In contrast to quantitative researches that present its data statistically or numerically, qualitative researches present its data in the form of words or texts. This captures direct quotations about respondents' experiences thereby giving the researcher a direct insight into how the respondents actually view a phenomenon. One quality of qualitative research, which makes it more convenient for this study, is its ability to also present in quantitative forms although not as statistical as quantitative studies. A typical example is when data collected qualitatively from respondents are analysed quantitatively by grouping similar responds and representing it by the number or percentile of respondents that agreed on such responds. This study uses mainly qualitative methods but adopt quantitative methods in terms of numerical representation of similar statements from the actual users of the EHR.

3.2.1.2 Interpretive Research Approach

In information system research, interpretive research paradigm has gained prominence and has become valid as significant group of studies have adopted interpretative traditional approach as against the use of say positivistic or critical research paradigms (Klein & Myers, 1999; Walsham, 1995; Orlikowski & Baroudi, 2002).

Interpretive research in information system according to Walsham (1993) is "*aimed at producing an understanding of the context of the information system, and the process whereby the information system influences and is influenced by the context*". Interpretive research thus seeks to understand the relationship between the information system and the information technology together with the individual and organisational culture (Walsham, 1995). Trauth (2000; p. 6) has also mentioned that "*Interpretive studies assume that people create and associate their own subjective and inter-subjective meanings as they interact with the world around them... The intent is to understand the deeper structure of a phenomenon ... to increase understanding of the phenomenon within cultural and contextual situations...*" Hence, an interpretative research approach was adopted in the study to elaborate on the system from the perspective of its users and throw a broader light on the system, particularly; how the EHR was introduced, how it is being implemented and its impact it is having on the daily work practice of the hospital.

Notwithstanding the wide use of interpretive philosophy in information system researches and its application in this study, there have been several criticisms about its quality and validity. To this end, Klein and Myers (1999) proposed seven principles to overcome such criticisms, and these principles were held highly in the conduct of this study though not exhaustive. These seven principles are based on the fundamental principles of the hermeneutics circle (that is, the first principle), which proposes that “*we come to understand a complex whole from preconceptions about the meanings of its parts and their interrelationships*” (Klein & Myers, 1999; p 71). The first principle further elaborates that the shared meaning of a context (complex whole) emerges from the interactions between the pre-understanding of the researcher and the participants (its parts) of the context (ibid).

The second principle is “*The principle of Contextualization*”. This principle requires the interpretive researcher to critically reflect on and detail the social and historical background of the research setting in order to depict the emergence of the situation under study to its intended audiences. The principle is with the assumption that, the organisation or context under study is not static but constantly changing hence the study is influenced by such changes and might also influence the organisation. There is therefore the need to detail the historical background of the setting for understanding by its intended audiences (Klein & Myers, 1999).

The third principles which is “*the principle of interaction between the researchers and the subjects*”, requires a social interaction between the researcher and the participants in order to generate facts and deeper insights of the research setting which is concealed when the researcher relies solely on historical secondary data (ibid). The principle of abstraction and generalisation, the fourth principle, inspires an interpretive researcher to relate data generated from the participants and the application of the earlier principles to general theories and concepts that describes the nature of human understanding and actions. This reflects the Actor Network theory and the Information Infrastructure theory adopted in this study.

The fifth principle, “*the principle of dialogical reasoning*”, requires the detailing or sensitivity of possible contractions between the researchers’ pre-conceptions or knowledge and the actual facts or findings generated on the research setting from the users. In doing this however, the sixth principle (*the principle of multiple interpretation*) encourages the researcher to highlight the different perspective and interpretations of the participants whiles the seventh principle (*the principle of suspicion*) caution the researcher against possible biases and systematic distortions in the presentation of the data collected from the participants (Klein & Myers, 1999). Although

not exhaustive, these principles served as a guideline that aided in the collection of relevant data in the evaluation of the EHR at Effia Nkwanta Regional Hospital.

3.2.1.3 Case Study

A *case study*, which is extensively used in the conduct of interpretive research or qualitative research, was adopted in the conduct of this study. Information system researches have recorded a wide use of case study approach owing to its ability to explore the relations and interaction between information technology and the organisational context in a thorough manner (Orlikowski & Baroudi, 1991; Yin, 2003). Yin (2003) defines case study as “*an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident; and in which multiple sources of evidence are used*”. The approach is most suited for the study of a phenomenon in which the researcher has little or no influence of what happens in the context of study but is interested in the understanding of what, why and where the phenomenon is (Bossen et al., 2013). The main goal of this study is to evaluate the EHR in ENRH in order to understand where the system is, in terms of its implementation and user’s acceptance or perceptions to the system, hence adopting the case study approach was appropriate for the conduct of the study to understand the context and the system.

Case study approach uses multiple data collection methods to generate information from few entities such as groups or organisations in a natural setting (Benbasat et al., 1987). According to Yin (1989), case studies can be derived from multiple sources; *documents, archival records, interviews, direct observations, participant observation and physical artefacts*, which helps in capturing as many variables as possible from a homogeneous group or social context under study. The study hence adapted case study approach to help evaluate the study site and system thoroughly by bringing out every details of the system in the context.

3.2.3 Sampling Techniques

The population of this study were health professional at Effia Nkwanta Regional Hospital in Ghana. However, the study was limited to the health professionals working in the department of the EHR implementation, the management of the hospital and the IT manager, who serves

as the main administrators of the system. The study area was studied for a period of seven weeks, where the researcher gathered adequate data on the study area.

3.2.3.1 Sampling method and sample size

To ensure the likelihood of high accuracy in research, there is the need for sampling. Sampling according to Saunders, Lewis and Thornhill (2012) helps to represent a case in a meaningful way by aiding the collection of detailed data or information. The study thence adopted the dimensional, purposive and convenient non-probability sampling techniques in the selection of respondents to represent the study population. The sample size was however determined by the principle of saturations. As a qualitative study, the principle of saturation was used to reduce repetitiveness of respondents' responses and the collection of large responses that does not add up to what had been collected (Mason, 2010).

Dimensional Sampling is a sample technique used in selecting small samples to enhance the representation of members in a population. It involves two steps; to specify all the dimensions or variables that are of relevance to the study, and to choose a sample that includes at least one case to represent each dimension. Its goal is to provide a framework for drawing a purposive sample representative of the population under study (Arnold, 1970). Owing to the fragmentation of the hospital into department or units, dimensional sampling technique was used to identify the actual user departments of the system by enquiring from the Hospital's Administrator. The departments or unit then became the dimensions from which samples were drawn. It included the Pharmacy department, the Revenue unit, the Health Information unit (which includes all records keepers at all service points) and the Health Insurance unit (which is a composite of two units; the Claims office and the Transcribing room). Another dimension of users were also identified which included doctors and nurses although currently they are not functional users of the EHR system. This dimension of users was created because; when the EHR system was first introduced in the hospital some computers were sent to some wards for use and training were also adequately provided. However, the systems were removed from units for reasons which would be presented in the subsequent chapter. Dimensional sampling technique was used by the researcher in order not to overlook some users of the system and include as much users as possible in the study.

In identifying the dimensions of study, *purposive sampling* was used to identify the actual users from the dimensions since not all members within the dimensions are actual users of the system.

Convenient sampling technique was then used to include as much users as possible due to the shift system in the various user departments. The identified departments run a three-shift system where some members work in the morning while others work in the afternoon or evening. As a result not all members were contacted. However, the researcher as much as possible contacted members from the various shifts to ensure representation of the users of the EHR.

3.2.3.3 Selection of Respondents

Based on the pilot text conducted using two members each from the IT department and the Health Insurance office, it was realised that users in the department who have spent less than a year in the facility knew less about the initial preparations or assessment made by the hospital before the system's implementation. Hence, the study included users who have spent more than a year in the facility and excluded all those who did not meet this, 'more than a year in service', criteria. Respondents who were included in the study were also literates, who could read, understand and speak the English language.

3.2.4 Data collection methods

Given a period of one year in which the study was conducted, data was collected in a span of seven weeks. The researcher assumed the role of an intern in the hospital to have a firsthand experience on the use of an EHR and also collect data from the respondents of the study. As contended by many writers on data collection, the data collection method of every research must be appropriate to the type of research being conducted (McNiff, 1995). It must also be able to collect data that answers the research questions to achieve the objectives of the study (ibid). Taking into consideration the research objectives and with the necessary approval from the hospitals' authorities, the multiple data collection strategy was adopted by the researcher in the gathering of research data. Data collection tools for qualitative studies such as interviews, open-ended questionnaires, participant observation and informal discussions were used in the study to generate adequate information from the researched field. The use of the multiple data collection approach was to enable a more nuanced interpretation of findings as well as to validate some of the responses from the two categories of respondents; the system Administrators or implementers and the actual users of the system. An overview of the data collection methods in terms of the purpose, scope and time are illustrated in Table 2 below;

Table 2: OVERVIEW OF DATA COLLECTION METHODS

METHOD	PURPOSE	SCOPE & TIME
Observation	<ul style="list-style-type: none"> • To understand the daily use of the EHR • Inform adjustments in the interview guide and the open-ended questionnaires • Observe the attitude of users in using the EHR 	<ul style="list-style-type: none"> • Two weeks (32 hours) unit rounds with the IT Manager • 15-20 hours: each user department • 2 hours: all users, Medical Director and IT Manager meeting
Semi-Structured Interview	<ul style="list-style-type: none"> • In-depth understanding of EHR evaluation. • To explore the management, IT manager and the user's assessment on the initial evaluation, usability and satisfaction as well as the impact (expected or realized) of the EHR on healthcare delivery at the hospital. 	<ul style="list-style-type: none"> • 4 individual interviews: • Two system Administrators • Two Unit Heads • Total, 185 minutes • Shortest/Longest: 25/80 minutes
Open-ended questionnaire	<ul style="list-style-type: none"> • In-depth understanding of EHR evaluation. • To support interviews • To explore the user's assessment on the initial evaluation, usability and satisfaction as well as the impact (expected or realized) of the EHR on healthcare delivery at the hospital. 	<ul style="list-style-type: none"> • 50 questionnaires distributed • 35 questionnaires received • 25 questions
Informal Discussion	<ul style="list-style-type: none"> • To solicit for users perception of the EHR • Follow-up issues arising from open-ended questionnaires and observations 	<ul style="list-style-type: none"> • 30 minutes : discussion with 4 nurses and a doctor on a ward • 15 minutes: discussion with a doctor on answers provided on open-ended questionnaire and the use of other electronic health applications • 10 minutes discussion at the Health Information unit on the system

The subsequent sub-headings provide a detailed description of the use of the various strategies in the collection of data in the field

3.2.4.1 Observations

Observations constituted the exploratory phase of the data collection (Robson, 2011) that began the entire data collection process. It also served as a supplementary data collection method to complement the primary data collection methods used in this study. On entering the study site, the researcher was assigned to the IT department, which is responsible for the systems functionality, for a period of two weeks. This was to introduce the researcher to the system and also for the researcher to part-take in the daily unit rounds embarked by the IT manager to monitor the use of the system and to address some of the problems that arises with the systems use. The daily unit rounds; which took about 3 to 4 hours each day, was particularly relevant for the researcher to observe and understand the situational issues in terms of users' attitude and perception towards the use of the EHR system. After the first week of observation, some revisions were included in the drafted open-ended questionnaire and the interview guide to include things that the researcher did not know about the system before the data gathering process. In all, three more questions where added to the open-ended questionnaires, bringing the total to 25.

Having completed the two weeks of being assigned to the IT unit, the researcher was rotated among the user Departments for a period of one week each. This was for the researcher to get real world insight into the system. How the system was used and what go into the recording of patients' information onto the system from the first point of contact to their final contact point were studied during this period of rotation. The researcher was also invited to take part in a meeting held between the Medical Director, IT Manager and the users of the system on some issues arising from the use of the system and its problems. This opportunity to partake in a meeting of such a nature (although as an observer), enlightened the researcher even more on some of the challenges of the users and also confirmed some assumptions and reflections made by the researcher regarding the earlier observations.

Observations made were documented in a diary carried by the researcher usually after the observation sessions at the various user Departments. However, some interesting comments that arose on the rounds were transcribed verbatim by the researcher in the diary in order not to overlook them when documenting. This was however done discretely to avoid distracting the users. The meeting attended was recorded with a tape recorder and transcribed verbatim, and also included the researcher's own reflections on the meeting.

3.2.4.2 Interviews

Interviews are, according to Yin (2003; p. 89), “essential sources of case study information”. This is mainly because they provide insight into complex phenomena that in this study involve the interrelation between the EHR system and its users. Robson explains interviewing as a research method which, “*typically involves you, as researcher, asking questions and, hopefully, receiving answers from the people you are interviewing*” (Robson, 2011; p. 278).

From the definition, interviewing sounds as a straightforward approach, but this is not the case. It rather requires considerable skills and experience of the researcher as well as guidelines in good interview practices to make profitable use of the approach (Robson, 2011). Semi-structured interview was mainly used as one of the primary data collection tool in the study. Interview guides were drafted as support for the interview to ensure that all-important issues were discussed to achieve the study objectives. The interview questions were open-ended which encouraged the interaction between the researcher and the respondents as well as ensured that respondents explain their responses in their own words. All interviews conducted were in English language for easy transcription and analysis.

Four interviews were conducted and included two system Administrators and two unit heads of the user departments. The content and duration of the interviews varied depending on the respondent and their position in the systems introduction and implementation. However, the interviews followed the same procedure, main headings (based on the study objectives) and shared some common questions (see Appendix). The duration varied from 25 minutes to about 80 minutes (interview with first system Administrator). The interview with the second Administrator lasted for about 50 minutes where questions pertaining to how the decision was arrived at for the selection of the system, to the realized benefit of the system were asked.

Although the study sought to interview all user departments’ heads, it was limited to the two heads due to the busy schedule of the other units’ heads. Hence, other data collection tools were used amongst such heads of department. All interviews were tape-recorded with the necessary permission from the interviewees, subsequently transcribed and later deleted.

3.2.4.3 Open-ended Questionnaires

Open-ended questionnaires were also used as a supportive primary data collection tool aside the interviews conducted. Questionnaires were distributed to the users of the system in the user department to fill on their perceived satisfaction and impact of the system to their work delivery. The questionnaires were limited to this group of participants because of their busy schedules; due to the high turn up rate at the department, to allow them ample time to give their responses at their leisure time. Interviews amongst this group of participants were also likely to generate similar responses hence the use of open-ended questionnaires to generate possible variations in responses of participants. In total 50 questionnaires were distributed and 35 of the questionnaires received. 25 questions were asked including 14 closed-ended leading questions that were aimed to make respondents as open as possible on the evaluation of the system. The distribution of the respondents is presented in Table 3 below;

Table 3: Distribution of respondents

Role of respondents	Number of Respondents
Health Information officers	12
Pharmacist	4
Pharmacy Technicians	4
Revenue officers	3
Doctors	3
Nurses	3
NHIS Officers	6
Total Number of respondents from the user departments	35

Designing the questionnaire: In developing the questions for the questionnaire, some questions proposed by Stoop and Berg under the domain and phases of system evaluation in their paper “Integrating Quantitative and Qualitative Methods in Patient Care Information System Evaluation” were adopted (Stoop & Berg, 2003). Some questions pertaining to the technical, professional, organizational and economic domains (“*the different viewpoint that an evaluation can take*”) (Stoop & Berg, 2003; pp.459) of system evaluations on the initial assessment,

usability and the impact of the system were adopted in the design of the questionnaire and the interview guide. Although, the three phases; pre-implementation, implementation and post-implementation, of system evaluation were considered the emphasis was not on the post-implementation evaluation since the system is at its early stages of implementation and therefore the net benefit is not fully realized.

Other validated and reliable system evaluation models such as the DeLone and McLean on Information system success that has received wide acceptance were also referred to in the design of the questionnaire (William & Ephraim, 2003). Questions pertaining to service quality, use, intension to use and user satisfactions were assessed and included to the questions drawn from Stoop and Berg. Although inferences were drawn from these models in the design of the interview guide and questionnaires in order to wholly evaluate the system, some questions were generated based on the observations and the interactions with the users and the system.

3.2.4.4 Informal discussions

Whiles working in the user department, the researcher engaged the participants in some form of informal discussion to attain their perception of the system, taking critical notes of body expressions and tone. The focus of the discussion was to support the data generated from the observation and probe further into some of the issues identified in the observation and the open-ended questionnaires. A discussion was held among 4 nurses and a doctor in one of the wards to solicit their views on the implemented EHR that lasted for about 30 minutes. Responses from the discussion were documented as the discussions were going on. Another informal discussion was held with a doctor to probe into some the answers provided to the open-ended questionnaire. Questions asked during the discussions as well as responses were documented verbatim as part of the respondents' questionnaire. The discussion with the doctor lasted for about 15 minutes although other issues outside the outline headings of the questionnaires were discussed which included issues on other electronic health applications used in their course of duty.

3.2.4.5 Photographs

Photographs were also used as a supportive data collection tool to gather pictorial evidence for study. Pictures on the state of the paper-based records as well as the EHR and how was used in the departments was taken to support the findings of the study.

3.3 DATA ANALYSIS STRATEGY

Analysing qualitative data according to Biggam (2011; p. 236) is “*not a linear activity and requires an iterative approach to capturing and understanding themes and patterns*”. Robson (2011; pp. 468) also contended that, analysing qualitative data requires the “*clear thinking on the part of the analyst*” in order to make meaningful and useful presentation of data generated. This is mainly because qualitative data involves the analysing of words in the form of narratives or accounts from respondents (Ibid).

To easily analyse the data generated from this study, interviews and questionnaires used in study were structured according to themes to reflect the main objectives of the study and aid the easy analysis of data transcribed. The themes; which are a set of inter-related topics all directed at the overall evaluation of the EHR, echoes the areas rose in the review of literatures as well as reflects the objectives of the study. The data generated from the study was hence analysed based on the themes that includes; Initial assessment made, Usability and User satisfaction and Impact of the EHR on healthcare delivery.

The qualitative data analysis in Miles and Huberman (1994) as cited in Robson (2011) was adopted in analysing the data generated from the study field. Data analysis was began by first assigning labels or codes to the words, paragraphs or phrases of interest from the data transcribed from the interviews, observations and the data from the open-ended questionnaires. Again, comments as well as reflections, which are usually referred to as ‘memos’ were added to the labels. The data collected were then focused into small sets of generalisation by identifying similar phrases, patterns, themes, sequence and relationships between the various phrases, paragraphs or words to form a sort of network of data consistency. The sets of generalisation were then linked to a formalised body of knowledge in the form of theories, literatures or constructs.

3.4 REFLECTION ON THE STUDY APPROACH

The successful implementation of information technologies in the healthcare delivery is mostly influenced by organizational, individual and technological factors. An evaluation of such system is therefore recommended by various studies to help reduce the impact of these factors on the implemented system. In the case of this study, the implemented system at Effia Nkwanta

Regional Hospital in Ghana is evaluated to identify the possible factors that hinder the successful implementation of the system. Hence the evaluation was mainly based on the initial assessment made by the hospital as well as the usability and users' satisfaction with the system. To achieve this goal, an interpretive case study, which enables the researcher to gather data from the participants' point of view, was adopted in the study. This approach was most suitable for the study due to its ability to reveal the participants social construction in using the system and the perceived benefit of the system.

3.4.1 Assess to the study site

As identified by Golden-Biddle and Locke (1993), the authenticity of a research finding can be justified by the researcher's presence at the research setting as well as the understanding of the research setting according to the members' construction of the setting. This is to reduce the imposition of the researchers' biases and 'taken-for-granted' assumptions onto the researched field (Ibid). In the conduct of this study therefore, the researcher was present at the study area for a period of seven weeks during which data was collected. The researcher had direct contact with the participants from the research site, conducting the observations and interviews herself. Questionnaires were also administered personally by the researcher as well as subsequent follow up questions.

On arriving at the decision to write on an implemented EHR system in Ghana, a call was made to the Deputy Head of Administration at Effia Nkwanta Regional Hospital for an approval to conduct the study at their facility based on a prior knowledge of an EHR implementation in the hospital. The Administrator requested a proposal to be sent by mail so as to discuss at a management meeting for the full approval from the house. A proposal was drafted with the help of the researcher's supervisor and sent to the facility for approval. After two weeks an approval was granted by the management of the hospital to conduct the study.

Entry into the research area was quite easy as a result of the researcher being a formal intern at the hospital. A formal letter of recommendation written by the researcher's supervisor was taken to the facility to justify the studentship of the researcher as well as the main purpose for the study. Rotating between the various user departments was accompanied by an introductory letter (see appendix) from the Administrator to the unit head for their maximum cooperation and assistance.

3.4.2 Klein & Myers (1999): Principles to Interpretive Research

Reflecting on Klein and Myers seven principles of conducting and evaluating interpretive studies as discussed earlier in this chapter, the study has been consistent in seeking meaning into the social and historical context or background of the research setting (the principle of contextualization). This was particularly relevant in understanding the emergence of the EHR and its impact as compared to the formal record keeping practices in the hospital (which would be discussed in the subsequent chapters). The fieldwork was also characterised by the interaction with the participants through interviewing, informal discussions and observations to understand how the EHR works and its impact on the work practices of its users (in terms of their usability and satisfaction with the system) as well as the hospital.

Following the principle of abstraction and generalisation, the findings of the study (which is discussed in Chapter 4) were limited to the study context, although it could be useful for hospitals with similar characteristics with the hospital of study. Dialogical reasoning (the fifth principle) was done in Chapter 5 based on the findings in Chapter 4, the theoretical preconceptions (Chapter 2) guiding the study as well as the literatures reviewed in chapter 2. As pointed out by the principle of ‘multiple interpretations’ data was collected from different categories of users and the systems Administrator and analysed critically by cross examining their responses on similar issues such as their response on the adequacy of training as well as the usability and users’ satisfaction with the system.

To remove possible biases and distortions in the information from respondents (the principle of Suspicion), the data was gather anonymously from multiple sources such as interviews, distributed open-ended questionnaires, observations and informal discussions.

3.4.3 Ethics and safety

The purpose of the study was to evaluate the implementation of electronic health records at the study hospital. This study was not medical in the sense that it did not involve research on the health or illness of individuals.

The study hospital or the region of study did not have a separate ethical research committee. Research proposals were routinely referred to the hospital management, who evaluated all aspects of research proposals and either accepted or declined such proposals. The proposal for the present study was granted institutional approval.

In addition, the participants of the study were adequately informed about the purpose of the study and that participation in the study was voluntary and that they could withdraw at any time.

The confidentiality of respondents was maintained by ensuring no name was requested from respondents. Except the doctor whose questionnaire was collected individually and follow up questions asked, the other questionnaires were collected in groups and looked through so as not to associate the questionnaires with the respondents for confidentiality purposes. In such instances follow up questions were directed to the whole group in the department and not to a particular person.

3.4.4 Limitations to the study approach

Unlike quantitative studies, the result of this study cannot be generalised. Although the researcher has no intention of generalising the findings of the study, the study can serve as a guide for other studies in hospitals that share a similar background with the current research site. Although a qualitative study approach was adopted in the study, a triangulation approach or the mixed method approach to a study could have been more appropriate for the present study. Similarities in respondents' responses would have been more varied if the study had adopted a more closed ended questionnaire or a quantitative survey, where for instance, respondents are asked to rank on a scale their perceptions of the system. However, that did not limit the researcher in bring out a nuanced findings from the study.

The reliability of the study approach is also questionable especially with the use of interviews and open-ended questionnaires as the main data collection methods. This is because interviews and open-ended questions rely solely on personal opinions of the respondents and are open to bias, poor memory recall, and inaccuracies. However, these issues were in part addressed by interviewing different categories of users and supplementing the interviews and open-ended questions with other data collection methods, like observations and informal discussions. A considerable number of respondents were also contacted to reduce such effects.

Another noted challenge was the use of the open-ended questionnaire. Despite the conversion of the interview questionnaire into an open-ended questionnaire (to be filled by the respondent at their free time) due to the inability of the researcher to schedule an interview appointment with the respondents, the filling of the questionnaire was still faced with some challenges. Due to the high work-load, the respondents were reluctant to answer the interview questionnaires,

which led the researcher to read the questions out for them to respond and the responses were noted by the researcher while they did their work.

CHAPTER FOUR

RESEARCH FINDINGS AND INTERPRETATIONS

4.0 INTRODUCTION

This chapter of the thesis presents the research findings and the interpretations of the data collected with the aid of open-ended questionnaires, interviews, observations and informal discussions. As previously mentioned, data was collected from the system Administrators and other direct users of the implemented EHR system. The data collected are presented in three sub-sections. The first sub-section presents the case, that is, it describes the EHR system implemented in the hospital and the reasons for its implementation. The second sub-section presents the findings generated from the interviews, while the third sub-section presents the findings from the open-ended questionnaire, informal discussions, and the observations. The concluding part of the chapter tries to merge the findings from the interviews and other data collection methods while identifying the variations in the responses from the users of the system and the system Administrators.

4.1 CASE STUDY– THE EHR AT EFFIA NKWANTA REGIONAL HOSPITAL

This sub-section gives a detailed description of the EHR system implemented in the hospital and describes the changes instigated by the system regarding records keeping. This is largely based on the interviews with the system Administrators and the Unit Heads.

4.1.1 The EHR – Hospital Administration and Management System (HAMS™)

According to an Administrator, *“at a point in time there was this general consensus based on a general discussion with the National Health Insurance Authority (NHIA) on the general changes in technology”*. The Administrator recounted how NHIA fiercely bemoaned their continual processing of the hospital’s insurance claim manually. The NHIA according to him intimated that *“the volume of work to be done manually was so much, the risk of losing some forms is there for which reason you would lose a lot of money”*. This essentially informed the Hospital’s decision at management level to procure a solution that *“could be used first of all, to process the health insurance claims and to manage other related activities”*.

Therefore the hospital, Effia Nkwanta Regional Hospital, acquired and installed the Hospital Administration and Management System- HAMS™ to easily manage its ever increasing health insurance claim forms and other generated health and administrative records. Although the system transcends the management of health insurance claims to other administrative usage, it could be said that it was installed primarily to help reduce losses associated with the manual processing of health insurance claims.

The system- HAMS™ which was developed by *InFotech Dot Net System Limited (IDNS) Ghana*, was first introduced in the hospital in 2011 but its actual installation and commencement of use started later in 2012. Technically, the HAMS™ solution installed by the hospital is a client server solution which was designed using a Microsoft Visual Studio and a Microsoft Dot Net framework which serves as the front-end portion of the system. In generating reports from the HAMS™, the developers used the crystal Report Writer, an inherent part of Microsoft Visual Studio, in designing all HAMS™ reports.

When asked the reason and rationale for choosing the HAMS™ solution rather than any other solutions, an Administrator mentioned that, the solution has a “*user friendly interface*” which makes it easier to work with especially among users with differing computing backgrounds.

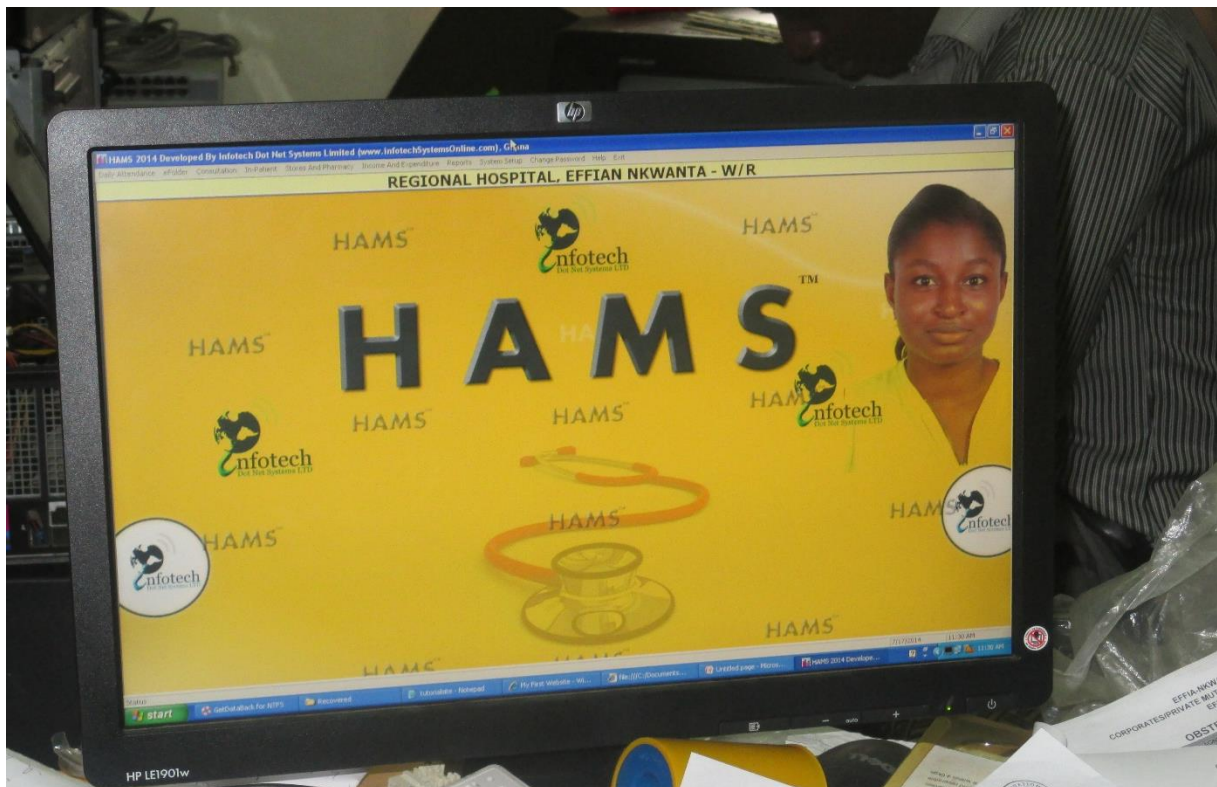


Figure 7: The interface of the HAMS™ Solution

Generally, the HAMS™ solution is grouped into toolsets or modules which reflect the primary needs of its users and can be implemented independently of each other. Its includes but is not limited to; the eFolder Management module, the patient Registration and Record Management module, the Consulting Room Management module, the Investigations Management (Laboratory, X-ray and Ultra Sound Scan) module, the Birth, Death and Referral Management module, the Pharmacy and Dispensary Management module, the Integrated Supply Chain, Inventory and Stores Management module, the Billing Management module, the Pay Group and Service Charge Management (Health Insurance Ready), the Ward Management (Admissions and Discharges Processing), and the Management and other Reports modules.

Currently, and rather unfortunately, the hospital has not activated all the HAMS modules. The hospital has, however, adopted some core modules to limit the challenges in the management of patients' records, particularly at the Records Keeping Department, Pharmacy and the Finance Departments. The eFolder Management module, the Patient Registration and Records management module, the Pharmacy and Dispensary Management module, the Pay group and Service charges Management module and the Billing Management module, are the commonly used modules in the system by the hospital.

The commencement of the system use was marked with the use of the ***eFolder Management module***. This eFolder Management module is to facilitate the ease of filing and retrieval of patients' folders. It is also to help the tracking and management of patients' folders at every stage of their movements. Hence, it aims to help reduce some of the challenges with the manual issuing and handling of patients' folders; such as the duplication in the issuing of folders and the general lack of storage space for folders in the hospital. The module is designed to assign cell units to each patients both on the system and on the shelves in the folder storage room for easy identification, retrieval and filing. In 2012, when the hospital started using the system, all patients who visited the hospital from the 1st of April were entered into the system and assigned a cell unit on the system, which reflected its subsequent filing in the storage room. The refiling of patients' folders were done on the patients' visits and therefore did not include the already back logged folders in the hospital. An old patient's folder is retrieved from the storage room and assigned a new cell unit and number, which is refiled according to the new number issues by the system. An archive was also created by the Hospital to store folders of patients who did not visit the facility within the period of migrating to the eFolder system.



Figure 8: Sample of folder filed with the system

The *Patient Registration and Records management module* of the solution is mainly used by the Records Keeping Unit or the Health Information Unit to capture the bio data of patients; including the patients' demographics, contact addresses and numbers, contact persons' information, and to issue unique OPD numbers or folder numbers for the patients who visit the hospital. The information captured and generated in this module becomes readily available to all valid users of the system in the hospital by entering the unique number generated by the system for the patient. The module is also used by the Hospital to request for services offered by the Hospital for the patient who visits the hospital. This helps in the easy identification of the patient, which further helps in the health insurance claims. The module has other components, such as the vital signs management component, which is to capture the various vital signs of the patients on their visits to the Hospital, such as the temperature and pulse rate. However, some of these components are currently not used by the Hospital.

The *Pharmacy and Dispensary Management module* is used by the pharmacists and dispensing technicians in managing the dispensary of prescribed drugs and expendables. Although the module can serve as an alert to the drug dispensers regarding the stock levels and expiry dates of drugs (based on the reorder level and the expiry dates of the drugs entered into

the system) as well as indicates side effects of drug, the module is currently limited to the recording of drugs and dosage of drugs prescribed by the physicians or doctors to the patient. It is also used to generate the total cost of drugs for insurance reimbursement purposes and the payment of the cost of drugs for the non-insured clients of the hospital.

The *Pay group and Service charges Management module* is an insurance module used in the capturing of services rendered to patients who are registered and sponsored by medical sponsors registered with the hospital. The medical sponsors include private insurance companies, private companies and the public insurance scheme (NHIS). The module is also used to ensure the validity of sponsored period and validate the clients who fall under the various medical sponsors using their unique identifications issues by the sponsors.

The *Billing Management module* is used by the finance or revenue unit of the facility to process the financial proceeds of the facility. This module is used in generating patients' bills invoices and payments. The module is also used in generating the amount due the facility from services rendered to sponsors clients as well as the amount generated by the hospital from the non-insured clients. Like the other modules used under the solution, not all component of this module are used but limited to the components whose benefits can easily be realised in improving the work practices of its users.

4.1.2 The Patient flow in the hospital prior to the EHR implementation

The provision of healthcare services (with the exception of emergency services) in ENRH; like every hospital in Ghana, starts at the registration points (OPD) and ends at the pharmacy department on every visit of an out-patient. The first point of call is the Records Department where the patient is registered as a user of the facility. At the Records Department a folder; which contains the patients' bio data as well as other medical records, is created and issued or retrieved for the patient depending on whether the patient is a new patient or an old patient. On the issue of the folder, the patient is directed to a consulting room for a medical consultation or diagnosis, dependent on the service requested (that is either general medical service, dental, ENT, physiotherapy, psychology, among others) with the folder. For a non-insured patient, payment is made at the revenue collection point which is attached to the records unit before sending the patient to the consulting room.

From the consulting rooms, a patient who requires a further examination is requested to move to the point of investigation or examination room which can either be the x-ray Department or the laboratory. A patient for whom investigation is not requested or required, moves directly from the consultation room to the Pharmacy for their medications which ends the visit of the patient.

Like the outpatients', the inpatients' care seeking path also usually starts from the OPD where their information are captured and folders issued. They are then directed to a consulting room for consultation where they are put on admission. On their admission, the patient is sent to one of the eight wards of admission. When the patient gets to the ward, the folder of the patient is sent to the pharmacy for their medications and back to the ward for further record taking. However, in the case of emergencies or life threatening instances demanding immediate and urgent medical care, the patient is admitted at the emergency unit first and resuscitated before the retrieval of the patients' folder for subsequent information recording and admission to a ward.

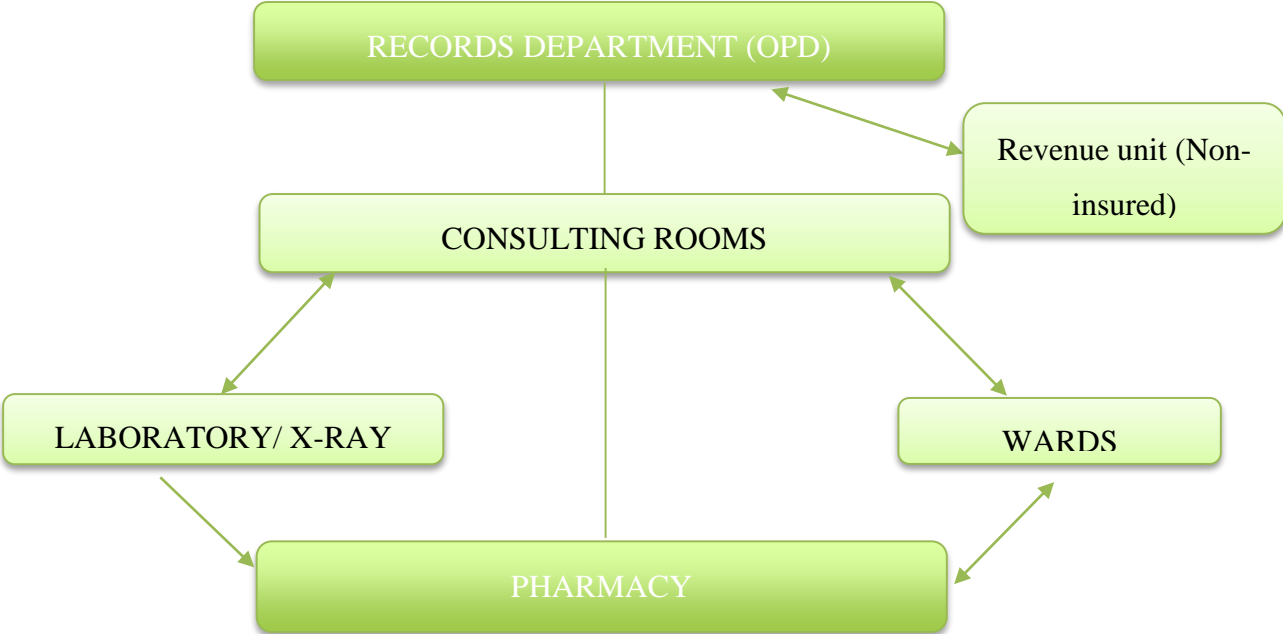


Figure 9: Patients' flow in ENRH before the implementation of the EHR

4.1.3 The Patient flow in the hospital after the EHR implementation

The flow of the patient in the hospital as well as the channel for healthcare delivery in ENRH has seen some changes after introduction of the EHR. A step each has been added to the patient path of accessing healthcare both for the in-patient and the out-patient. Hitherto, the outpatient after consultation moves to the Pharmacy for his drugs when no investigation is requested or to the investigation department when an investigation is demanded. However with the introduction of the system, the patient from the consulting room moves to another room called the Data Transcribing room (Room 5); which is part of the Health Insurance Office of the hospital, for their records from the consultation to be recorded into the system before going to the next point of service. An admitted patient is also to submit the folder to the records unit closer to the wards for admissions and discharges to be done electronically for insurance purposes. A diagrammatic presentation of the care delivery path after the systems' introduction is presented below;

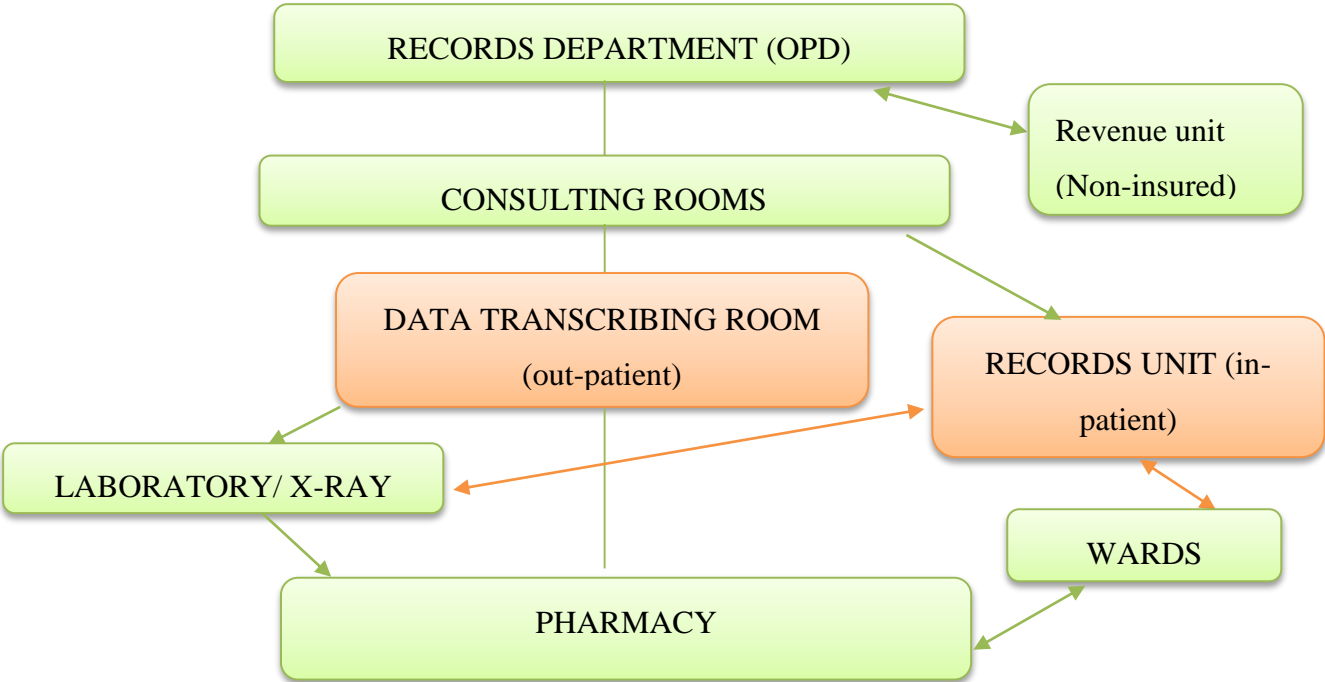


Figure 10: The Patient flow in the hospital after the implementation of the EHR

4.1.4 Records Keeping at ENRH

Record keeping in ENRH like the care delivery path has seen some changes with the implementation of the EHR. However, the old procedure for recording patients' information is kept together with the electronic recording of patients' information. The changes in record keeping starts from the Records Department which is the centre of all record keepings in the hospital. Upon the introduction of the system, the bio data or demographics of the patients are now recorded electronically and a unique number issued to the patients. This is to be used throughout the care delivery process. For a first time visitor to the hospital, the bio data and other records which was recorded electronically is similarly recorded in the folder and the books kept at the unit. Here, there is no need for such information to be recorded for the old patients since their information already existed in the system and in the patients' folder. However, changes in the bio data is updated regularly to reflect what is entered in the system. After the recording of the patients' information, service is requested for the patient in the system, for the patient to proceed to the next point of care, which is the consulting room. Prior to the systems' introduction, the insured patients were issued a claim sheet (see appendix) which is used by all health professionals in the clinical pathway to keep records of all medical proceeds (including clients information, type of services provided, procedures performed, investigations and medicines provided) to be submitted to the NHIA for reimbursement purposes. However, with the introduction of the system, the claim form is generated and submitted electronically to the National Health Insurance Authority.

Record taking at the consulting rooms has however not changed even with the implementation of the HAMS. As at the time data was being gathered, the documentation of patients' consultation were done in the patient's folder which were then submitted to the Data transcribing room for electronic recording. Likewise, the documentation of patients' examinations and diagnosis are also recorded in a paper based records at the various examination units. The revenue collection points however has the system which is used to keep records of all payments made by the patients to the facility. On the entry of the unique number generated by the system, the type of service requested and the amount to be paid is generated for payment. The revenue collectors however also keep paper records of all the payment made and issue paper-based receipts accordingly.

Records keeping at the Pharmacy which is the last point of contact for the out-patient is similar to that of the Records Unit. The medications written by the doctor in the patients' folder is

recorded into the system and their books kept at the pharmacy department. Costing or billing of drug issued is however done electronically and recorded in the patient folder for payment. Should the patient skip the data transcribing room and moves to the pharmacy, his or her information may not appear in their system for the diagnosis hence would be turn back to go to the transcribing room for their information to be entered. This prevents the issue of prescriptions made by unauthorised prescribers. Again, this is to ensure the easy generation of claims for the insured patients. Currently, the EHR used in the hospital does not help the pharmacist or the pharmacy technicians to detect any form of incongruities associated with prescription such as the drug dosages and contra-indications. In an informal discussion at the pharmacy, it was indicated that any anomalies in the drug prescription is sent back to the physician or doctors for clarity before any action is taken. However, it was mentioned that the system is able to detect under dosage of drugs prescribed.

“... for instance if the doctor mistakenly write 250mg of Paracetamol drugs for an adult which should be for children, then the system looking at the age entered in the system would indicate that the dosage is wrong and ask you to provide the right dosage before completing the form for drugs in the system for the patient..”(Respondent).

All other departments and wards in the hospital keep their records of patients and services provided in the folders of the patients and their individual unit books.

4.1.4.1 Reasons for keeping both paper-based records and electronic records after the implementation of the EHR in the hospital

During the daily unit runs, it was observed that the introduction of the EHR has rather doubled the task of its users. This was as a result of keeping both electronic paper-based record of all medical information generated. When asked the reasons for keeping both records, an Administrator cited two reasons primarily for the double documentation. The first reason for keeping both records according to him is the statutory regulations from the Ghana Health Service in providing documentation for services delivered. He mentioned that no statutory policy permits them to stop keeping the paper-based records hence such records must be kept for auditing purposes. The second reason he mentioned was the lack of reliable and adequate backup for the system hence the use of the paper records as a backup for entries made in the system.

4.2 FINDINGS FROM THE INTERVIEWS, OBSERVATIONS AND DISCUSSIONS

This sub-section presents the findings from the interviews conducted based on a thematic representation of the research objectives; Initial preparations made by the hospital prior to the systems' implementation, System usability and Users satisfaction and Impact of the EHR on the hospitals healthcare delivery. It also includes findings from the observations made and other informal discussions. As mentioned earlier, four interviews were conducted including two unit heads and two system Administrators at the facility. In order to ensure privacy and confidentiality of the respondents, roman numerals would be used to represent respondents based on where such comments appear in the presentation.

4.2.1 Initial preparation made by ENRH before the EHR implementation

From the interviews conducted, the data pointed towards adequate preparations by the hospital prior to the introduction of the systems. Although there seem to be gaps in the preparations made; such as inadequate computers to support the various user departments, measures were taken by management of the hospital to ensure the smooth running of the system. This section highlights the views of participants interviewed on the preparedness of the hospital and this includes; how the decision to adopt the system was arrived at, the funding of the system; the establishment of the ICT department, Internet and Internet facilities and Training of staff among others.

4.2.1.1 Arriving on HAMS

Before management of the hospital arrived at the decision to procure an EHR system for the hospital, a team, including the medical director was formed to visit and understudy a facility, which had implemented a similar EHR system. This according to an Administrator was due to the difficulty in choosing a reliable vendor (hence a reliable system) since a couple of vendors were available at the time of purchase. The team visited a hospital in Koforidua (in the Eastern Region of Ghana) to assess how the system is run and the easiness with its usage by its users. A decision was then arrived to go in for the HAMS solution from InfoTech. The direct users of the system were not included in the decision making process by management to procure the system. The decision was taken by management and communicated to the various heads of department. According to the Administrator, engaging the unit heads to a larger extent indicates the engagement of users in the decision since most changes are advocated by the unit heads.

However, staff durbars were subsequently held to communicate managements' intention to procure the system and its relevance to the healthcare delivery in the hospital.

The decision was spearhead by an adequate budgetary allocations to procure the system. The solution is perceived to be quite expensive and since financing it was solely the hospitals' responsibility from its internal generated funds, a payment plan had to be made by the hospital with the vendors. Budgetary plans were also made by management for the provision of computers and other logistics for the systems implementation as well as the networking of the facility and future maintenance of the system in the hospital.

“I would say we were adequately prepared in terms of funding. In the sense that, our problem with the implementation has not been that there is no money....we have always had some computers to use. And the good news is that usually we don't pay cash before the upgrade. We have a contract with the vendors and they have agreed to do it. So for me in terms of funding at our level, I think we were ok” (Respondent I).

4.2.1.2 IT Department

A well-functioning IT department is a 'sine quo non' for a successful implementation of an EHR system. The management of the hospital shares in this belief and on such realisation, the hospital created an IT department with the role of ensuring that the necessary infrastructure were provided for the operation of the EHR. The IT department prior to the introduction of the system was charged with the responsibility of contacting experts in networking the whole facility to support the system and the provision of computers to support the solution. The department was also to organise training and understudy the system to ensure its support to the work practices of the hospital. Since the solution was not built in-house, the IT department was to receive adequate training and insight into the system from the vendors so as to train and address the difficulties faced by the users in the use of the system. The department was also to ensure the configuration of the system to support the work task of the user departments. This was achieved by engaging the heads of the user departments and the users in the re-configuration of the system to include essential practices, which were not included by the vendors. The IT department prior to the systems implementation was manned by only one person. This according to the respondents was part of the challenges faced at the initial stages of the system's introduction, owing to the numerous workloads on the department. At the time

of the data collection, their number of IT staff had increased to three people with one intern to oversee the system but this was still not adequate.

4.2.1.3 Internet and Internet facilities

Before the implementation of the EHR system, most department consigned to use the EHR system were already networked to support the use of Internet services. The other department or units including the operating theatres were later networked to support the Internet and other telemedicine applications. As at the time the researcher was gathering the data, all departments or units in the facility had Internet connections. However, the access to Internet services was suspended in some departments by the Internet providers due to the huge financial implications on the Hospital's account.

The EHR runs on a Local Area Network where all computers in the hospital communicate to a server located close to the IT office. This means that the suspension of Internet services at some user departments does not necessarily affect the use of the EHR. However, in the interview conducted, it was revealed that the suspension of Internet services has affected their ability to update the antivirus installed on the computers on the affected areas in the hospital. Other ICT infrastructure existing in the hospital is presented in Table 4 below;

Table 4; ICT infrastructure in the Hospital

Network /Hardware	Number represented
Desktops	64 (54 in active use)
Laptops	11 (9 in active use)
Monitors	65
Printers	25
Photocopier machine	3
Television	All unit except newly created units
Department with Internet connectivity	All departments
TV based Video conferencing system	0
PC based Video conferencing system	0
Inter-connected communication system (Telephones)	All departments

4.2.1.4 Training of Staff

For every EHR implementation, the knowledge of health workers in computing and their attitude towards the EHR is pertinent to, its adoption and the overall success of the EHR system. Hence, there was the need for the researcher to evaluate the computer literacy of the health workers as well as the adequacy of training provided them, prior to the systems' implementation. In all the interviews conducted, the respondents asserted to the differences in the computer knowledge of the various users. One respondent mentioned that;

“.....some of the users were quite poor in computing while some were average because the users are made up of the aged (when I say the aged I mean those who are in their middle ages; 40 years and above) and the young. With those that are young, most of them already know the computer knowledge and are ok with it but most of those who are in their middle ages do not know the computer, which was quite challenging” (Respondent II).

One of the system Administrators interviewed also mentioned that, due to the difference in the computer knowledge of the users, training was provided in groups where the various professionals were sought and trained on what is to be done with the system. In all about 200 staff were selected and trained from all the units in the hospital. Two representatives each were selected from each department to be trained and in turn train the other users of their respective units. Nonetheless, training was provided for all the health professionals from the Health Information Unit (Records Unit), Pharmacy and Revenue Unit because to their daily use of the system.

When asked about the adequacy of the training provided to the users, the one respondent stated his uncertainty about the adequacy of the training provided but mentioned that some level of training was provided to the users. On-the- Job training was identified to be the main training technique adopted by the hospital.

4.2.1.4 Supply of Electricity

The erratic nature of the national power supply in Ghana, which has led to the shedding of load, could undermine the benefits of using EHR in healthcare as well as the provision of healthcare services in the hospital. Hence, the study saw the need to evaluate the preparations made by the hospital to mitigate this challenge faced by most EHR implementation in most developing countries. In the interviews conducted, it was identified that prior to the systems

implementation, the hospital had a standby generator which provides power to some aspect of the hospital 5 seconds to a disruption in the national power. The hospital additionally procured a 1 kilovolt uninterrupted power supply (UPS) which keeps the system running up to 10 to 15 minutes for the change over to the secondary power supply after the disruption in power from the national power supply.

4.2.2 System usability and users' satisfaction

A section of the interview focused on the views of the Administrators on the satisfaction of the users with the system and the ease at which the users work with the system.

4.2.2.1 System Usability

Usability of the system is mandatory for all members of the department of implementation. However from the observations made, the users who did not feel comfortable with the system left the systems' use to those who felt confident with its usage for the fear of running into errors. This was also asserted in the interview where one respondent mentioned that, the users who perceive the system to be easy to use were those that were familiar with computers.

The interviews also revealed that the system meets the specific needs of the users since it is an automation of the task performed with the paper records, which enhances the usage of the system. However, a respondent opined his dissatisfaction with the attitude of some users towards the system.

“hmmmm, the attitude of some users to the system is not much encouraging because what they are doing is not up to expectation but we may get there some day. Some are still making wrong entries as at this time when they have used the system for at least a year now”
(Respondent III).

On one of the daily runs made to some units, one of the users obviously had a problem with an entry on the system. And instead of reporting the exact problem, the user in a local language squawked rather fiercely that *“wo adze no befa k) anaa beye no yie, na maa bre no”*. This translates into *‘come and take your thing away or do it well because I am tired with it’*. This created the impression that some users have still not embraced the system as something to help improve their work practices but as something that was forced on them by the management.

4.2.2.2 Users' Satisfaction

According to an Administrator of the system, the feedback he receives from the users of the system is generally positive, hence his belief that the users are satisfied with the system. *“The users I think are satisfied with the system especially with what one in-charge said in our implementation review committee meeting. The person said ‘please I don’t want to go back to the old system ooo because this system has made my work very easy. I do no longer have complaints of insurance claims forms getting missing and asking for more claims and being denied. Once I ensure that the information is adequately entered into the system, I am done’”.*

However, other respondents expressed the non-satisfaction of some users with the system, which was attributed to their poor knowledge on computing.

4.2.3 Impact of the EHR on healthcare delivery

Although the system is at its initial stages of implementation (and hence the net benefit is presumed to be unrealised at the time data was collected), questions were raised on the impact of the EHR to healthcare delivery. This was to identify some of the realised benefits and challenges to the system as at the time data was collected. This section thus presents the respondents views on some of the benefits and challenges to the system as well as measures taken to ensure the future sustenance of the EHR.

4.2.3.1 Benefits of the EHR

The respondents were generally optimistic that the full implementation of the EHR would reduce the workload of its users, aid in the provision of timely services to the patients, as well as, reduces the errors associated with the paper-based records keeping. The interview however generated a number of interrelated data on the benefit of the implemented EHR to the management of records and the general care delivery. The primary benefit of the system to the hospital noted in all the interviews conducted was its ability to reduce errors associated with the processing of insurance claims. Other benefits of the system were also mentioned to include; retrieval of bills from absconded patients, reduce workload for it users, reduce expenditure on logistics, among others.

Improved Claims generation

One benefit of the system that became noticeable in the interviews was the ability of the system to fast track the generation of insurance claims for submission and reimbursement from the NHIA and other private insurance providers. One respondent particularly mentioned that;

“...yes the system is speeding up everything now. It took longer time for the NHIA to reimburse the hospital for services rendered” (Respondent IV).

According to the respondent, the hospital prior to the systems' introduction spent a lot of time in processing the claims for submission since the insurance unit had to count all the claims, vet them to ensure accuracy of patients information and batch them into groups before submission. This according to him, had been reduced with the introduction of the system since the system does the counting and batching for them. He also mentioned that vetting of the claims is also facilitated with the introduction of the system since the system alerts the user on any incomplete claims forms. Therefore there is no need to set up committees to vet the processed claims, which was hitherto the situation. This was affirmed by another respondent who also mentioned that the system is able to identify all incomplete records which is indicated in red ink to prompt the user of the incompleteness of the claims generated. The respondent was emphatic in stressing that *“the paper record was very tedious. Because when processing the claims we needed to count them one by one in batches of 200 for more than 1000 claims each month before submission. And should you make a mistake in the counting or forget where you have gotten to, you need to start all over again or you submit inaccurate information to the NHIA which raise issues. But with the system, the counting of the claims, number of patients and the amount due is all in the system...”* (Respondent V)

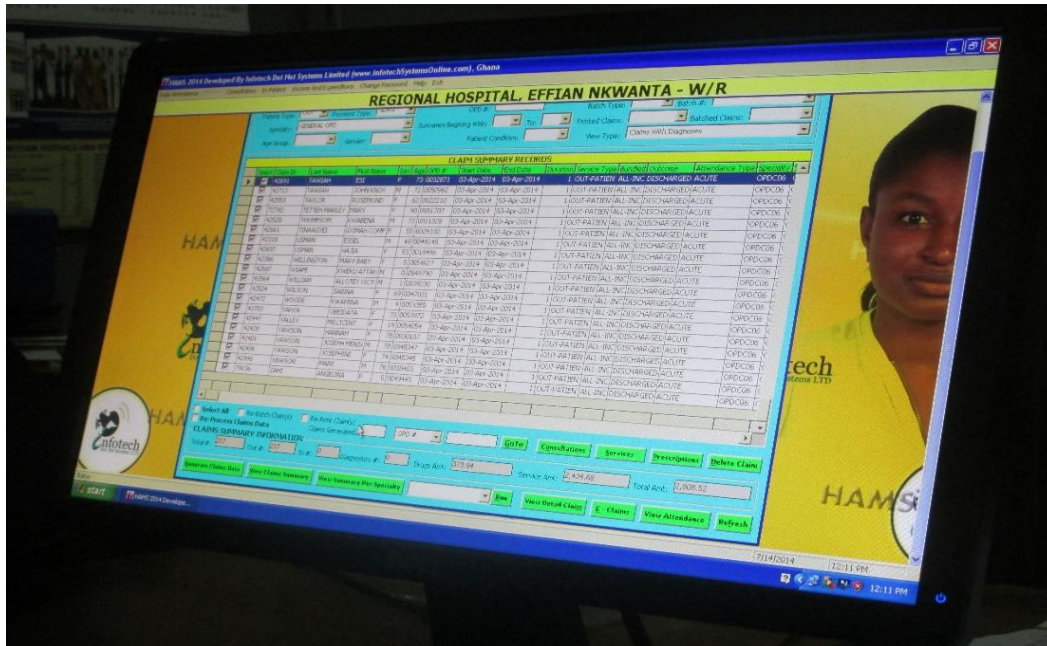


Figure 11: Sample of complete claims generated by the EHR

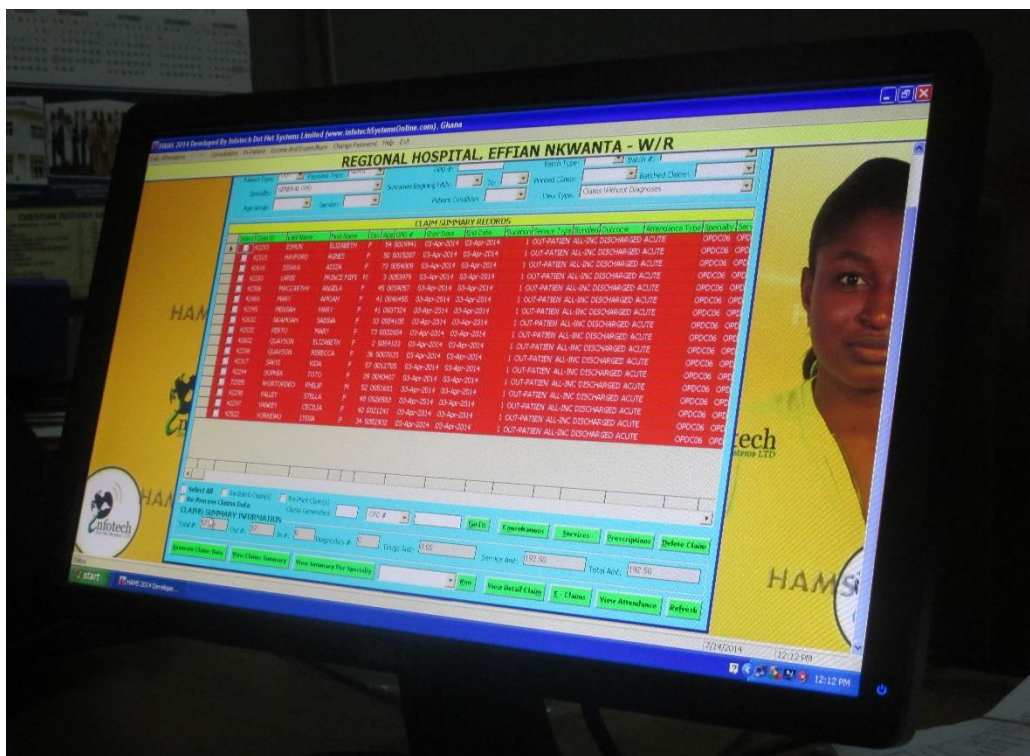


Figure 12: Sample of incomplete claims generated by the EHR

Reduction in Patients' missing records

Another benefit noted to have been brought by the system is the reduction in the missing records or folders of the patient. A respondent mentioned that, the introduction of the system has helped reduced the misplacement of patients' records. He cited an example as;

"...the in-charge at a point in time have to always ensure that the insurance claims form is in the folder, if it gets missing you have to look for another claim form to replace it which would be difficult for you to get. With the system you don't have to police the claim sheet anymore".

(Respondent VI)

The respondents also mentioned that patients' folders could now be easily traced since the system indicates where last the patient visited for the folders to be retrieved from that unit. It was also mentioned that, hitherto when a patient visit the hospital and the records is not found, a new folder is issued to the patient making it difficult for the attending physician to have access to the previous medical records of the patient. The system has however bridge this gap by providing the physician with the previous diagnosis and treatment of the patient. This is however upon a request to the departments with the system since the doctors are currently not using the system. The same folder number is issued to the patient with reference to the information in the system, which would not have been the case with the paper records.

Reduction in the workload

Although the same cannot be said for all departments, the respondents were quick to mention that the system's introduction has reduced the workload of some departments and cited the pharmacy and insurance units as examples. From the information gathered, the system has reduced the task of the pharmacy by aiding in the costing or billing of patients drugs. Previously, all the prices of the drugs were calculated manually for each patient and this was time consuming both for the patient and the pharmacy personnel.

In the interview, one respondent mentioned strongly that the EHR has reduced their workload and is *"very good"*.

Reduced the expenditure on paper logistics

Although not clearly evident in the hospital's financial reports, the study gathered that the introduction of the system has reduced the amount spent on procuring stationaries to maintain

the paper-based records. In a meeting held between the users and the Medical Director, it was agreed that there has been a reduction in the amount spent by the hospital in acquiring the various paper-records or logistics. This was also collaborated by the other respondents who also mentioned that there has been reduction in the cost incurred as a result of the double issue of folders, which the EHR system has helped addressed.

Retrieval of Absconded bills

During the interviews also, a respondent mentioned that one of the benefits realised from the systems' implementation is the retrieval of bills from 'run away' patients. He mentioned that prior to the system's introduction, the hospital had no means of tracking patients who have absconded from the hospital without paying their bills. He also revealed that most of these patients visit the facility with different name and try avoiding contact with personnel who attended to them on their previous visit. However, the system has helped tracked some of these patients on the entry of their bio demographics into the system. The system indicates patients who have outstanding bills from their previous visit to the facility and instruct payment to be made before the access to other health services by the patient.

“the system also helps to track outstanding bills of the patient which is retrieved on the next visit of the patient should they run or abscond without paying on their previous visit”
(Respondent VII).

Other benefits of the system

As earlier mentioned, the system is also able to detect the issuance of wrong dosage of drugs to the patient. At the pharmacy, it was indicated that the system based on the age recorded in the system prompt the dispensing officer of the wrong dosage of drugs should there be a mistake in the prescription issued by the physician. The system however does not alert on other incongruities associated with prescribed drugs such as contra-indications and the side effects of the drugs prescribed. Such inaptness are detected and reported to the prescribing physicians.

4.2.3.2 Challenges to the EHR Implementation

The interviews conducted revealed three categories of challenges faced by the hospital with the implementation of the EHR; “*hardware*”, “*the layout*”, and “*the personnel*”.

i. “The personnel”

This challenge is further categorised into; inadequate personnel, inadequate training and fear of the unknown (attitude of personnel).

Inadequate personnel

In the one of the interviews conducted mentioned that due to the overall shortage in personnel and shortage in the number of people with computer knowledge, it was difficult to decide on who should make entries in the system. Hence management was compelled to identify and create a separate unit with personnel who had adequate knowledge in computing to enter the information in the patients’ folder into the system.

“....there was a problem with the personnel. The problem was, who does the transcribing. Should the transcribing be done using an ordinary nurse and the doctor or the transcribing be done using somebody with IT knowledge or the transcribing be done using the pharmacist (as for using the doctors we didn’t even go there) or should there the transcribing be done using the people called the medicine dispensers or medicine counter dispersers. So all these options were there, so we zeroed down on using the medicine counter dispensers because they had some level of appreciation for the folder in terms of reading what was written in the folder. But what was the challenge again? We could not employ because we were restricted by the existing rules in the sector not to employ on our own so we had to lean back to the ordinary people who had computer knowledge to perform such task” (Respondent VIII).

The nature of the system necessitated its usage by the doctors and the nurses to input their work proceedings in the system, however, they were excluded from the system usage due to the some resistance received from them. It was revealed that some computers, which were sent to the wards to be used by the nurses, were sent back and redistributed to other units as a result of its non-usage by them. The nurses argued that their number was less and since both paper and electronic records are to be kept, it would increase their work task hence they needed medical

transcribers to input their information generated into the system. This was again a challenge for management since they did not have the capacity to employ more people to perform such task.

It was also revealed that, the lack of other IT professionals to support the work of the IT manager is also a challenge to the systems implementation. This is because all problems identified with the system are directed to the IT manager who singlehandedly cannot address all the challenges which affect the use of the system.

Inadequate training

Like most system implementation in both developed and developing countries, inadequate training was identified to be one of the challenges faced with in the implementation of the EHR at ENRH. One respondent stated the inadequacy of the training provided to the staff;

“...we did not deliver an effective training to the personnel. Because something happened when we were trying to submit the claims for one of the months and I was asking the question why? Did we suddenly realise that we had to do this entry? some users were not entering the procedure properly.... That is why I said I think the training was not effectively delivered. Secondly, certain petty complains kept coming up, for example, they would keep telling you that, there is a window that kept popping up indicating outstanding bills, but if you are properly trained and you are committed, that thing shouldn't come because you know how to deal with it. Usually the outstanding bill comes up because of two things, either the right registration was not done or the patient actually owe the hospital. In either case the person who is delivering the IT service knows what to do should this problem arise. If you actually owe, you must pay before you move to the next level simple as that. If it is a registration problem and you do the right thing the thing would not pop up. That is why I said the training was not effectively delivered” (Respondent IX).

Fear of the unknown- Attitude of Personnel

It was further indicated that some personnel feared the loss of their job hence were not receptive to the system. A respondent indicated that *“...the personnel I also think fear the unknown... people feared what will come with change so they were not very sure what the implications are. Whether some of them would not even lose their jobs, they were not very sure. Even though, we tried to sensitize them on how the thing works and that it's not about someone losing the work and all that...” (Respondent X).*

ii. “The hardware” and “The software”

The hardware and software infrastructure were also cited as one of the factors contributing to the challenges of the system. According a respondent, “.... *some of the network switches were not working and at a point in time the whole system run into a halt because the network switches were not working. That was one of the challenges that came up. The other one has to do with, some challenges with the system or software itself for which reason the developers were called to rectify it*” (Respondent XI).

Aside the problems identified with the network switches, the problem of inadequate computers to serve all the user departments was also a noted challenge. At the initial stages, there was a misunderstanding between the implementers or the administrators as to the meaning of piloting the system. Management wanted to pilot the system at one unit and transfer to other department with time, however, the IT manager misunderstood management decision and distributed the few computers purchased to all other department where claims is processed. This led to the mass shortage of computers for the user departments. Currently at the user departments, the issue of inadequate computers is still a challenge to them.

iii. “the Layout” – the layout of the hospital

As mentioned in the earlier chapters, the main hospital building is situated on a hill and has some buildings at the bottom of the hill with other buildings along the stairway leading to the top of the hill. This according to a respondent, makes it difficult for the IT manager to manage all the issues raised by the users at a point in time.

“The hospital is so scattered to the extent that if you are looking for the expert to look at a problem at one end and another person at the opposite end is also looking for the expert it just put undue pressure on the manager (Respondent XII).

Illegible handwritings of some doctors

Another challenge believe to affect the use of the implemented EHR is the illegible handwriting of some health professionals. A respondent revealed that, more time is spent on the entries made into the system as a result of the illegible handwriting of some doctors. He mentioned that, the folders have to be returned to the consulting rooms for clarity before entries can be done.

“.....sometimes the doctors do not clearly state the patients’ diagnosis so we have to send the folders back for the diagnosis before we can request consultation for the patients. And when the diagnosis is written, it is sometimes very difficult to read the writings of the doctors, which sometimes makes our work difficult.....” (XIII).

A respondent also mentioned that, he had received a lot of complaint from the users of the system especially the users at the transcribing unit about the illegibility of the writings of some of the health professionals. This he believes makes their work difficult considering the layout of the hospital where one has to climb a lot of stairways to find the doctor for clarity on a patient’s diagnoses or procedures.

4.2.3.3 Impact of the system on Patients

Findings from the interview revealed that, allegations had been made by some individuals that the general attendance rate of patient to the facility had reduced with the introduction of the system.

“.... there have been allegations that there has been a reduction in the hospitals utilisation because this system has brought in some little frustration into the general hospital care system because you have to go to the consulting room then to the transcribers to wait and then to the pharmacy to wait and sometimes you go there and they say no your information is not complete so go back to the transcribers and so on” (Respondent XIV)

However, an Administrator mentioned that the attendance of patients to the hospital for the first quarter of 2014 indicates a 20% increase, hence, such allegations are not founded. Although such allegation were not founded due to the rise in patients’ attendance, he also mentioned that he cannot attest to the fact that the patients were satisfied with services provided with the changes brought by the system.

“.....Attendance for the first quarter indicate a 20% increase. However, it is difficult to tell why the figures are up. I would have believe that the system has frustrated people if the attendance had gone down but if the figures are up I cannot believe that it has actually frustrated the patients neither cannot say that the patients are satisfied with the system”

Other respondents were however of the view that, the introduction of the system had increased the time spent by the patient in the facility as well as frustrated some patients. Some respondents responded that;

“...you see, gone were those days that when the patient after seeing the doctor goes for their drugs but now it is very stressful and time wasting for the patient. Let’s assume you wasted 30 minutes at the OPD, which is the first point, to see the doctor you waste another 30 minutes making an hour, and you come to our unit and also waste let say another 30 minutes. In all you waste one hour thirty minutes, which was not the case with the old system. You would have just wasted one hour instead of the one hour thirty minutes created by the system.” (Respondent XV).

“...when the patients are admitted to a ward, they are asked to go the data entry room for their information to be entered, most of the time they go and they are told that the ward is full on the system so they should go back for them to be re-admitted to a new ward. Meanwhile there would be empty beds on the ward. This I think is a problem to the patient and their relatives since they have to be climbing up and down this long stair case before they are finally admitted because someone forgot to do their work by sending the folders for discharges....” (Respondent XVI).

4.3 FINDINGS FROM OPEN-ENDED QUESTIONNAIRES

The open-ended questionnaire was designed to reveal the perception of the actual users regarding the impact the EHR system has on their work practices. This includes outlining mainly the system’s benefits and challenges and how satisfied they were with the system’s introduction.

The data generated from the questionnaire pointed a variation in the benefit or relevance of the EHR across the various user departments. Some of the users perceive the system to have increased their work task and entails more work while others perceive the system to have reduced their work task thus helping to reduce errors in their work. However, the users of the system in general view the system to be supportive to their work task and have higher expectations of the EHR to the hospital, patients, staff and the general care delivery in the hospital. This sub-section of the chapter presents the findings from the questionnaires to reflect the objectives of the study.

4.3.1 Information about Respondents

4.3.1.1 Role of Respondents

In order to achieve a fair representation of the users of the system in the study, the various user departments were identified and questionnaires distributed. From the 35 questionnaires received out of the 50 questionnaires distributed, twelve (34%) of the respondents were Health information officer, six (17%) NHIS officers, four (11%) Pharmacists, four (11%) Pharmacy Technicians, three (9%) Doctors, three (9%) Nurses and three (9%) Revenue Officers. Users from the Health information unit represented the majority of the respondents as a result of the unit being the main source of record keeping in the hospital.

4.3.1.2 Respondents' number of years worked in the hospital

As mentioned earlier as one of the criteria for respondents' inclusion in the study, respondents were asked to indicate the number of years worked in the facility. Majority (63%) of the respondents had worked in the facility for a period ranging from one to five years. The remaining 37 % had worked in the facility for more than six years.

4.3.1.3 Respondents' computer knowledge and mode of knowledge acquisition

Respondents were asked to rate their computer knowledge. Majority of the respondents (48%) rated their computer knowledge as average, 23% as novice and the remaining 28% of the respondent rated their computer knowledge as experienced.

Most participants (37%) indicated that they received their training on computing from their training institutions or schools while others indicated that their training on computing were self-acquired. Other respondents' also indicated that, they received their training on computing from the hospital prior to the introduction of the system. Computers applications trained on ranged from Microsoft Assess, PowerPoint, Word and Excel. However, seven of the respondents were bold to indicate that they only had knowledge on the use of the HAMS solution and nothing else.

4.3.1.4 Knowledge of respondents on Electronic Health Records

To solicit the knowledge of respondents on electronic health records, respondents were asked to assign meaning to the term EHR. Seven of the respondents did not answer this question. However, majority of respondents (28 respondents) indicated that "*Electronic health records*

is the system of entering health information or patients records electronically or on a computer". Other meaning given to the term by respondents included;

"A system used in place of hospital claims forms for patient"

"It is a system in which patient records amongst other health information is placed on technological or electronic safe or records"

"The keeping of the hospital's daily attendance by patients and the capturing of data of the hospital and various units daily activities in the hospital"

"This is the electronic way of keeping patients medical and drug records"

"It is an easy and accurate way of keeping document and processing of patient health information"

"It brings about transparency, speedy of work and accurate accountability"

The diverse definitions provided by respondents to term Electronic health records indicated their fair knowledge on EHR and the benefit of such systems to their work practices.

4.3.1.5 Experience with EHR and other ICT application

Out of the 35 respondents who answered the questionnaire, only 12 (34%) had prior experience with the use of an ICT application in their work practices. The remaining 23 (66%) participants had no experience with the use of ICT or any telemedicine application in their work practices prior to the EHR implementation in the hospital.

Of the 12 respondents who indicated the use of ICT in their work practices prior to the systems' introduction, 4 of them belonged to the NHIS unit which used excel in processing the final report generated for submission to the NHIA, hence their use of ICT in their work practices. The remaining eight respondents indicated their experience with other ICT solution from their private places of work. They cited examples of such solutions as "*pharmacy manager*", "*point of sale pharmacy software*", "*HAMS*" and other electronic health records.

4.3.2 Users perceptions on the initial preparation made by ENRH prior to the EHR implementation

Participants were asked to indicate the organisational and personnel readiness to the systems implementation. Hence questions were raised on user's involvement in the decision making process to introduce the system and the adequacy of the training received.

The overall preparations made by the hospital prior to the systems introduction seem lacking from the data generated from the questionnaire. 26 out of the 35 respondents indicated that the planning or preparations towards the systems implementation was not adequately effected hence the challenges faced by the system. However, the remaining 9 respondents viewed the systems implementation to be well planned to promote its usage.

4.3.2.1 Users' involvement in Decision-Making process

Out of the 35 respondents, the majority representing 29 (83%) of the respondents indicated their non-involvement in the decision by management to introduce ICT in their work practices. The remaining six (17%) respondent indicated they were somehow involved in the decision making process. Two of the respondents mentioned their membership of the team created to assess the EHR at other facilities to arrive at the decision whiles the remaining four indicated their partial involvement and sensitization through staff durbar organised by management on the system.

In system development and design, it is recommended to engage the actual user of the system to enhance its acceptability and the commitment of the users. However, the data generated from the questionnaire indicated that, the users were not involved in the design or configuration of the system. 30 (86%) out of the 35 respondents indicated they did not have any influence of the systems design or functionality. Three (9%) responded to have recommended some changes in the system, which some were followed and others neglected.

Respondents who indicated their non-involvement in the systems design were asked if their non-involvement had influenced their use of the system. Out of the 30 respondents, 14 (47%) indicated that their non-involvement has influenced their use and cited some of the under listed reasons;

“...yes, because the drug section is a speciality area and the IT personnel had little or no knowledge on that which made it quite difficult at first to use the system”

“..yes, because I believe that it is a collective responsibility to share ideas and make it work properly”

“..it was difficult for me to use the system because I couldn't find my way around it when we started using the system ”

“... all departments have a role to play but because we were not involved there are some lapses in the system making it difficult to use...”

“Currently, when the patient comes in and there are beds, the system indicates no beds because the number of beds in the system reflect less of what we have on the wards. But if we had been consulted earlier it would have reflected the actual number”

Other respondents also mentioned that their non-involvement had affected their understanding of the system, which made it difficult to operate at some point in time. The remaining 16 (53%) respondents indicated that their non-involvement in the system design have not affected their use and cited reasons such as;

“no, after the installation of the programme we were given on the job training to use it effectively”

“no, because it is a directive which needs to be followed”

“no because I have had similar experience with other software”

4.3.2.2 Training on the EHR

All the respondents agreed to have received some level of training prior to the systems introduction in their respective units. However, their responses varied as to the adequacy of the training provided. Majority of the respondents representing 21 (60%) out of the 35 respondents, were of the view that the training provided by the facility were inadequate for them to know the system properly. One respondent mentioned that, they were given one day training, which he believes was not adequate to know everything about the system and what to do and what not to do with it. He also mentioned that the system was actually introduced one year after they had received the training hence they should have been retrained before the on-job-training.

The remaining 14 (40%) respondents however were of the view that the training was adequate for them to use the system.

4.3.3 Usability and Users satisfaction

Usability of the system as earlier mentioned is mandatory among the various unit of implementation hence all respondents agreed to their use of the system with exception of the doctors and nurses who currently do not have access to the system. However, the frequency of use varied among the respondents as 23 of the respondents indicated that they ‘often’ use the system while 6 indicated their ‘less often’ use of the system. Most of the respondents who indicated their less use of the system however failed to give reasons for their less use.

Again, 25 out of the 35 indicated that it was quite easy for them to learn how to use the system and attributed it to their background in computing and the trainers’ readiness to assist them whenever they encounter challenges with the system. However, one respondent mentioned that his ease was as a result of his quest to learn new things; “*the quest to learn new things. It was fun though the knowledge imparted was very shallow*” (Respondent XVII). The remaining 10 respondents indicated that it was not easy for them to learn how to use the system. Some of the respondent explained that their unease was as a result of the workload presented by the system and believe the system had a lot of components, which made it difficult to use. Others also indicated that the training received was inadequate for them hence the difficulty experienced in the learning process.

Support of work task: With the exception of the doctors and the nurses, all the other respondents indicated the support of the system to their work task. Also, majority of the respondents asserted to the ease of documenting information into the system with the exception of three respondents who mention that it was not easy to document information into the system, which they attributed to their poor computing skills and age.

Satisfaction: Respondents were asked to rate their level of satisfaction under ‘very satisfied’, ‘moderately satisfied’, ‘satisfied’, and ‘less satisfied’. Six of the respondents indicated they were very satisfied with the system, 15 moderately satisfied, 11 satisfied and 3 responded to be less satisfied with the system. From the figures above, majority of the respondents (91%) indicated their satisfaction with the EHR as presented in the figure below

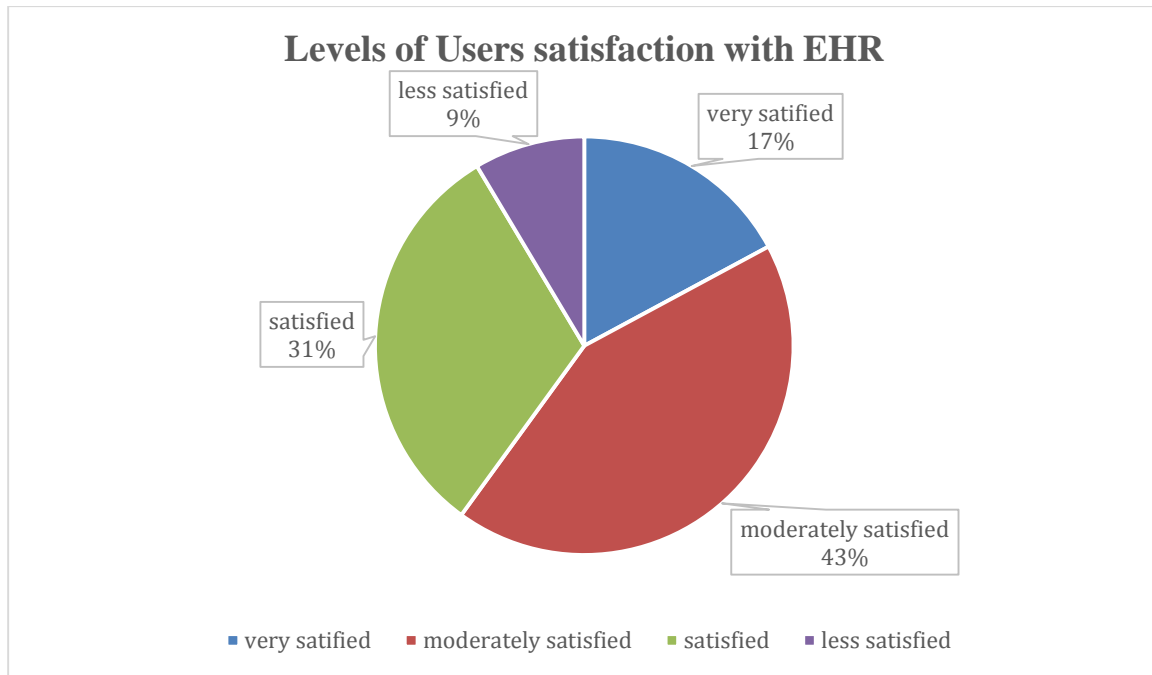


Figure 13: Levels of Users satisfaction with the EHR

4.3.4 Impact of EHR on healthcare delivery

Data generated from the questionnaires pointed to a variation in the benefits or relevance of the EHR across the various user departments. Some users perceive the system to have increased their work practices and as they perceive it to entail more work. Others however view the system to have reduced their work practices and errors associated with their use of paper records. However, the respondents in general see the system as supportive to their task and have higher expectations of its benefit to the staff, patients and the hospital at large.

4.3.4.1 Benefits of the EHR to the users

The respondents identified some benefits of the system, which is discussed under the various headings below;

Facilitated work task

Some of the respondents indicated that, the introduction of the EHR has made their work easier and cited some of these reasons;

“...it has reduced the manual documentation of the NHIS claims forms which was tedious to do” (Respondent XVIII)

“...it has made it easy to locate patients’ folder and I believe it would reduce waiting time if implemented properly” (Respondent XIX)

“...the computer has reduced the overcrowding of patient at the revenue point since patients information is recorded at the Records Unit making my work easier for me..” (Respondent XX)

“... It has reduced the time spent on costing the patients drugs now it is all done by the system” (Respondent XXI)

“..Since we are no longer using the claims, it has made documentation easier and faster” (Respondent XXII)

Although respondents from the records units perceive the system to have enhanced their folder arrangement and filing, my observations indicated a less improvement in folder arrangement since one out of four folders searched, seem to be misplaced or found in a different cell and not the original cell assigned to it. However, it was worth noticing that the system has helped in the easy tracking of the folder.

Reduced errors

Some respondents indicated that the introduction of the system has reduced the errors made in the paper records.

“...the system has reduced errors and redundancy in patient information” (Respondent XXIII)

“...smooth working, there is about 90% reduction in folder lost at the pharmacy hence the good relationship between patient and the pharmacy staff” (Respondent XXIV)

Easy retrieval of patient information

A respondent also mentioned that the introduction of the system has made it easy to retrieve patient information, which would not have been possible with the paper records and cited an example as;

“a patient came to the hospital and reported of his missing folder ID card, so we just asked for his health insurance card, type the number, then we search for his details and brought out every information needed about the patient and his number from the system...” (Respondent XXV)

4.3.4.2 Benefit of the EHR to the hospital

Although most of the respondents pointed out that the system is at its early stages and hence it little impact or benefit to the entire hospital. Some respondents indicated that, the system has help improved the storage of patients folder and reduced the storage space due to the less issue of double folders to the patients. Other respondents also indicated that the hospital has benefited from not printing claims forms and believe it has save the hospital some money. Another respondent indicated that absconded patients are easily traced with the system thus contributing to the further saving of the hospital, a lot of money.

4.3.4.3 Challenges of the system

Majority of the respondents identified inadequate computers and training as the major challenge with the system as identified in the interviews. However, some other challenges were identified to include; poor network connections, unstable power supply, increased work task and illegibility of doctors' handwriting.

Poor network connections

Some of the respondents indicated that, there are often breaks in the network connections of the system, which makes working with the system difficult. One respondent mentioned,

“the system is sometimes not working. There is often breaks in connections especially when there is rain or sometimes when the cables comes into contact with water which makes it impossible for me to prepare patient bills” (Respondent XXVI).

In such situations the users are forced to document the proceeds in their books and transfer it to the system when the connection is restored. This according to the respondent is a lot of work for them, which has resulted in a lot of backlog data to be entered into the system.

Illegibility of doctors' handwritings

Another challenge identified by the respondent to inhibit their use of the system is the illegibility of some doctors' handwriting. This challenge was particularly cited by the officers from the Records Unit and the Transcribing Office. One respondent indicated that;

“one out of the four folders received from the consulting room is sent back for clarification because we do not see what the doctors have written. I sometimes try to guess what is written or show it to my other colleagues to see if they know the diagnose, in cases where no one knows we either take the folder back or ask the patient to go for the nurse with the doctor to rewrite it which I think is a lot of work for us and the patient” (Respondent XXVII).

Unstable power supply

The respondents identified unstable power supply as one of the challenges faced by the system. It was mentioned that although the hospital has a secondary power supply, not all the units were connected to the source, which indicate the non-use of the system when there is power outage. Even with the departments that have access to the secondary power supply, respondents complained about the frequent interruption in the power supply for various reasons unknown to them. This according to them also interrupts the use of the system

“the system relies greatly on electricity so when there is erratic power supply as we have here in Ghana, the system suffers too” (Respondent XXVIII).

Increased work task

Some respondents identified the system to have increased their workload since double entries are made both in their books and on the system. They however indicated that should they stop entering the patients' records in their books, their workload would decrease immensely.

“.. it is time consuming compare to the using our books and folders. We have to key every information about the patient into the computer after you are done with the paper work.” (Respondent XXIX).

4.3.4.4 Overall no difference between user departments

Overall the questionnaires generated similar responses from the different users of the system. Inadequate training, insufficient computers, poor network connections and increased workload were identified by the users to be the main challenges to the effective use of the system. However, it was asserted by the users that the system supported their work task and its full implementation in the hospital would reduce their work task and its benefits realised. They cited the reduction in workload as well as improve access to patient information as some of the benefits to be realised on the full implementation of the system.

4.4 MEASURES TO ENSURE FUTURE SUSTENANCE OF THE EHR

To ensure the future sustenance of the system, the hospital have requested the support of external agencies to help evaluate the implemented system and recommend where necessary, measures to adopt to improve the current system. The interview with one of the systems Administrator reflected that the hospital sent a proposal to an international organisation with expertise in IT management and have an experience with EHR implementation to help address some of the issues and help in the full implementation of the system.

He however mentioned that since the networking of the system to other departments, which are not using the system, is complete, the future extension of the system to those units is not a challenge. However, more computers and other infrastructures need to be procured to reverse some of the challenges faced with as a result of inadequate computers at the user departments. He also revealed management's decision to provide in-depth training for all staff on the system before its introduction to the other units where the system is not in use.

The other participants of the study were optimistic that the system would be successful if adequate training is provided for all the projected user of the system. They also recommended for the provision of adequate computers to support the number of computers in their respective units as well as all units designated for the systems' use. Respondents also cited the recruitment of more staffs to support work practice as well as more IT personnel to support the current IT officer as a measure to ensure the sustainability of the system.

Power supply which was identified by the users as one of the main challenges confronting their usage should also be addressed by the hospital by extending the secondary power to all service point to prevent the excess work created by the system when there is power outage.

They also mentioned that for the future sustenance of the system the usage of the system should include the doctors and the nurses to address some of the challenges such as the illegibility of their handwriting and reduce the additional work task created by the doctors and nurses who are not using the system. However, in the interview with an Administrator, he mentioned that management did not include the doctors and nurse for fear of increasing the time spent by the patient in the hospital. He, however, added that they have been informed about the management's decision to engage them in the system's use, which they warmly agreed to.

4.5 SUMMARY OF FINDINGS

This chapter presented the data obtained from the study site. The chapter first of all described the EHR system implemented in the hospital as it illustrates the full picture for its actual implementation. The study then proceeded to present the findings from the system Administrators on one hand and responses from the direct users on the other hand, regarding the study's objectives. The study found out that preparations by the Hospital prior to the introduction of the systems were to some extent sufficient. The Hospital did not only do a thorough understudy of other systems been implemented in other regions but also made sure that an IT department was in place to spearhead the smooth implementation of the project. Personnel were also given some level of training as a measure to equip them on how to make the best use of the system. In spite of these however the study found out that there were some fissures in the preparations. These included inadequate computers, inadequate involvement of users in the decision by management to procure the system as well as users non-involvement in the design or configuration of the system in the facility.

Although usability of the system was mandatory, the study gathered from a system Administrator that the attitude of the users to the system is not that to be deserved. This was collaborated by the users themselves as the frequency of use largely varied among the respondents. This variation in the frequency of use was again attributed to inadequate training. Majority of respondent were either satisfied or were moderately satisfied. This also reflects the

viewpoint of management. For instance an Administrator indicated his belief that the users were satisfied with the system.

The study further established from the users and management that the implementation of the EHR system has yielded some benefits regarding Improvement in the generation of insurance Claims. Other benefits identified were; reduction in patients' missing records, reduction in the work load, reduction in the expenditure on paper logistics, retrieval of absconded bills, among others. In spite of these benefits, the study also uncovered some pitfalls that inhibit the smooth running of the system. These challenges were again shared by both users of the system on one hand and the system Administrators on the other hand. The challenges include Poor network connections; Illegibility of doctors' handwritings; unstable power supply and Increased work task. Additional challenges identified include the Hospital layout itself, inadequate personnel and the issue relating to hardware and software together with fear on the part of users. It must be stated that the perceived negative impact of EHR on patient turnout was refuted by an Administrator who based his point on evidence generated from the hospital's report with respect to the rate of patient turnout.

CHAPTER FIVE

DISCUSSION

5.0 INTRODUCTION

This section of the thesis discusses the findings of the study as presented and interpreted in Chapter Four. In the preceding chapters, the study discussed the appositeness of using open-ended questionnaires, interviews, observations and informal discussions as the methodological approach for the study in evaluating the implementation of EHR in Effia Nkwanta Regional Hospital. This chapter elaborates on the objectives of the study by discussing both theoretical data from the literature reviewed and empirical data obtained from the field.

5.1 THEMES AND FRAMEWORK FOR DISCUSSION

The essential proposition of the study as specified in chapter one was to evaluate the EHR Implementation in Effia Nkwanta Regional Hospital in Ghana. The study realizes this charge, by discussing some relevant issues relating to the central thesis, which are categorized into five main themes for which adequate evidence have been gathered through field work and interviews. The themes are; (1) Record Keeping in the Hospital, (2) The Initial Preparation made at ENRH before the EHR Implementation, (3) System Usability and Users Satisfaction, (4) The Impact off the EHR on Healthcare Delivery, and (5) The measures to ensure future sustenance of the EHR system. These themes furnish this study a framework for discussing the findings the study obtained as well as to fit the three-tiered approach to telemedicine evaluation as developed by Bashshur (1980) and Stood and Berg (2003). Agreeing with Grigsby et al. (2005), that telemedicine in general is fluid and evolving, there was therefore the need for this study to have had careful stipulations.

Bashshur (1980) identified ‘*evaluability assessment*’ as the first step of an evaluation process into EHR systems, as identified in Stoop and Berg (2003) as the “*Pre-implementation phase of evaluation*”, and this finds expression in the second theme - The Initial Preparation made at ENRH before the EHR Implementation. The study in part also adopted the *Formative* evaluation model, and this model draws attention to the implementation as well as the measurement of changes in the process of implementation (Grigsby et al., 2005) as it aims to improve the EHR under evaluation by means of providing feedback to users and system

designers (Wills et al., 2011). Giving meaning to the formative evaluation model by Bashshur (1980), the study developed themes 1, 3 and 5. Theme 1 was developed to evaluate the paper-based record and EHR in order to assess the changes the implementation of the EHR has brought to the processes of keeping records in the hospital. Theme 3 also aims at gaining insight into how satisfied users were and this was again aimed at providing feedback to management as well as the developers of the system. Theme 5 epitomizes the feedback process emphasized by the formative evaluation model, as this theme largely aimed at knowing the measures to adopt to ensure the future sustainability of the system. The last of the three-tiered approach to telemedicine evaluation developed by Bashshur (1980) is the *Summative* evaluation framework as reflected in the work of Stoop and Berg (2003) as the “*post-implementation phase of evaluation*”. This draws on the need to measure outcomes, including changes in health status, quality of life, and functional performances at the hospital (Grigsby et al., 2005). Therefore, theme 4 was developed to measure the Impact EHR has on Healthcare Delivery in the hospital although the evaluation in this study is mainly formative.

5.1.1 Record keeping in the hospital

The means of keeping records in the ENRH was largely based on the paper-record keeping system. However the technology in use for keeping records witnessed some changes with the rolling-out of the EHR. The implementation of the EHR system has not yet seen the complete demise of paper-based record keeping in the hospital as the old procedure for recording patients’ information is still being kept together with the electronic recording of patients’ information. Thus, the use of paper which has led healthcare delivery systems for decades (Scott, 2006), is still been used at the hospital. Although the hospital has recognised the need for EHR systems to aid in the automation of paper based health records, the complete passage to EHR system and thus the resulting eradication of the cosmic majority of paper in the delivery of healthcare in the facility seem to be a long time away. This finding does not only confirm the expressions of Varga (2011) with his studies in some health facilities in the US, but the same occurrence of combing paper based health records with EHR has been observed by some writers in the implementation of EHR systems (Kalra & Ingram, 2006). The study observed two primary motives for the hybrid system of keeping records at the hospital. Firstly, it is a statutory requirement from Ghana Health Service (the regulatory body) to provide paper documentation for services delivered for auditing purposes. Secondly, the study observed that there were unreliable and inadequate backup systems to the EHR systems in use at the hospital thus the use of the paper records as a backup for entries made into the system.

Findings from informal discussion reveals the advantages of using the paper record in healthcare delivery at the hospital, and these findings are unfailing with other previous studies. Coeira (2003), for example remarks the physical way individuals interact with paper. From the informal discussions, the study found out that health practitioners were more comfortable with the use of paper records as they are a highly familiar method of recording information, and require no special training. Finding from the study also discovered that, the use of the paper record instil in the users a sense of control of the record. Health workers can clearly see their signature and unique handwritings when using paper to make records and this in turn makes it easier to identify every procedure they carried out on patients and who is responsible for which error.

In spite of the advantages mentioned, the paper-based record could be said to be woefully insufficient to meeting the needs and challenges of healthcare delivery in this present age. Coeira (2003), like ISMP (2000) and Warshawsky et al. (1994) have all noted that paper based record, intrinsically pose some physical and informational challenges, and this to them makes it equally difficult for it to be sustained as a proper means of keeping records in healthcare delivery. An additional challenge of paper-based record keeping in the hospital relates to illegible writings on the folders of patients, a finding that collaborates the findings of Coeira (2003) and Luo (2006). This problem of illegible handwriting goes a long way to affect healthcare delivery in the facility, as data entry clerks now would have to report back to the original writers for correction. Illegible handwritings also lead to errors in prescriptions and medications. With paper based record systems, prescriptions are written completely by hand and this largely leads to a pharmacist making mistakes in filling prescriptions because of an illegible handwriting, or may have to spend extra time calling the doctor's office to get clarification about a prescription. The Institute for Safe Medication Practices in a report estimated that pharmacists make more than 150 million calls to physicians each year to clarify what was written on prescription forms in order to avoid error of medication (ISMP, 2000). This was the case at the hospital where pharmacists admitted making calls to doctors in an attempt to avoid error in medications given to patients. In addition, the study found out that paper based records results in the improper certification of patient folders. Thus there were risks of assigning wrong codes or symbols to patient folders and other medical records, and this in turn makes it extremely difficult to locate these same files and folders in when patients come back to the facility for healthcare services. Again, the retrieval of medical file from a pile of

health records, which were not properly coded was found to be daunting and time consuming. This again confirms the findings of Warshawsky et al. (1994) and Coeira (2003).

5.1.2 The initial preparation made at the hospital before the EHR implementation

The decision by the hospital to procure the EHR was motivated by the hospital's own altruistic intents to go electronic, however this was motivated by the recommendation from the National Health Insurance Authority, to keep a proper record of claims. Some writer (Adjorlolo & Ellingsen, 2013; Demiris et al., 2004; Jennett et al., 2003) have already allured to the essence of making adequate readiness assessment before rolling-out any useful EHR system. Thus a health facility which demonstrates a noticeable lack of readiness, according to Brender (2006) would invariably lack the capacity to undergo any meaningful transformation for successful implementation of a useful EHR. In recognizing this need, the hospital before choosing the EHR system (HAMS), sent out a team to study a facility that had already implemented a similar EHR system. This exercise granted the management of the hospital the opportunity to identifying failure factors accompanying the actual implementation of the system and the factors to be deplored in order to address or mitigate these failures. This again allowed the management of the hospital to appropriately plan and in an attempt to test the feasibility of the EHR system (Stoop & Berg 2003; Vretveit, 1998).

The findings of the current study reveal that generally, an adequate initial preparation was made the hospital, before the system was announced and introduced at the facility. Firstly, the hospital was adequately prepared in terms of funding, particularly so when the sources of funds to procure this rather expensive system was to be borne internally. The management of the facility also made sufficient budgetary allocation to procure computers and other logistics to facilitate and augment the actual implementation of the systems. Also, as part of the pre-implementation preparation, the hospital created a well-functioning IT department to coordination the actual implementation of the system while also ensuring that the necessary infrastructure were provided for the operation of the EHR. The IT department was again instituted to ensure the configuration of the system to support the work task of the various user departments. Although, prior to the implementation of system, most departments were already networked to support the use of Internet services, the hospital as part of its initial preparation ensured that all departments and units were networked to support the Internet and other telemedicine applications. Thus currently, all departments or units in the facility are having Internet connections. Lastly, before the implementation of the system, the hospital organized some training programs for users to

aid them in understanding the use of the system and how the system is going to enrich their performances. Approximately, 200 staff were selected out of the 807 staff of the hospital and trained on the system.

Although the initial preparation made by hospital was generally satisfactory, the study gathered some gaps in the initial preparations made, prior to the procurement of the system. Users of the system indicated their non-involvement in the decision by management to procure the system and also introduce it in their work practices. Users were not only involved in the decision of the management but they were also largely neglected regarding the design and actual configuration of the system in the facility. One respondent indicated that “*all departments have a role to play but because we were not involved there are some lapses in the system making it difficult to use*”. This finding of the study falls short in the face of Payton (2000) and Sood et al. (2008) pronouncement to engage the actual user of the system to enhance its acceptability and the commitment of the users. The measure of the hospital to involve only units’ heads in the decision to procure and configure system in the facility was therefore not apt enough as the impact of this initiation did not trickle down to the actual end users. Another gap the study discovered in the initial preparation has to do with inadequate computers to support the various user departments. Even though some measures were taken by management of the hospital to ensure the smooth running of the system, by procuring computers and logistic, these measures were woefully inadequate, considering the capacity of the facility. Furthermore, the IT department established to spearhead the implementation of the system was inadequately staffed. Another, fissure observed in the initial preparation of the hospital was the inadequate training given to users. The one-day training workshop given to the users was identified as woefully inadequate to equip users with the ‘know-how’ needed to operate the system. The study recalls a respondent saying “*it was difficult for me to use the system because I couldn’t find my way around it when we started using the system*”. This problem could have been avoided if series of training were organized at least for a week or a fortnight.

5.1.3 System usability and users satisfaction

The study deemed it necessary to also evaluate the usability of the system and how users were satisfied with its usage as these were considered as a precondition for a successful implementation of EHR systems in the facility. This assertion also reflects in the opinions of Coeira (2003), Vikkelsø (2005) and Tang et al. (2006) who considered the physiognomies of human–computer dealings or interactions in a system as essential for a successful telemedicine

implementation program. Among the various unit of implementation in the facility, usability of the system was mandatory, as it has now formed part of their work practices. The study however found it revealing that doctors and nurses, who to a large extent, are the chief healthcare givers were not currently in use of the EHR system. Again, even amongst those who were obligated to use the system, the regularity or frequency of use varied, as six respondents indicated their 'less often' use of the system. The study however observed that users who were not comfortable with the system left the system to be used by those that felt confident with its usage, and the users who perceive the system to be easy to use; as they feared running into errors when making entries into the system.

According to Nielsen (1994) as also expressed by Tang et al. (2006) to label an EHR system like the one currently in use at the hospital as having good usability, means that the system is easy to learn and remember, efficient to use, and also generates very few errors. This study observed that the current EHR system in hospital meets these requirement as majority of respondents suggested that it greatly support their tasks and easy to use. Again, the system to a larger extent meets the specific needs of the users since it is largely an automation of the tasks that were hitherto performed with the paper records. These functionalities of the system were expected to enhance the usage of the system but the story was different amongst some section of users in the hospital. The inertia, torpor and crooked attitudes of some of the users towards usability of the system need mention. For instance, the remark "*wo adze no befa k...*" (*come and take your thing away*), is a clear manifestation of a poor user's attitude and Fitzgerald et al. (2008), Chau and Hu (2002), together with Schumacher et al. (2010) and other writers have all identified poor attitudes of users as a factor which impedes usability and success of an EHR. This indeed generates the impression that some users have still not welcomed the system into their work practices, rather perceiving the system as something they were tugged into by management.

The study also made an inquest into how users were satisfied with the system of users and observed that generally users were satisfied. This was indicative of 81% of respondents saying they were either very satisfied, moderately satisfied or were just satisfied with the system. Again one of the interviewees indicated that the users were very much "*satisfied with the system especially with what one in-charge said in our implementation review committee meeting. The person said 'please I don't want to go back to the old system ooo because this system has made my work very easy. I do no longer have complains of insurance claims forms getting missing*

and asking for more claims and being denied...Once I ensure that the information is adequately entered into the system, I am done". Earlier studies by Bonner et al. (2010) and Christensen and Grimsmo (2008) on user satisfaction with the implementation of EHRs in some health facilities have all suggested the possibility to realize a general level of satisfaction among health professionals, which is affirmed by the findings of this current study.

Furthermore, Bonner et al. (2010) assert that the processes of entering and retrieving information from EHR systems itself contribute adversely to usability and thereby user satisfaction but the findings of the study does not reflect this assertion. Majority of the respondents emphasized to the ease of retrieval and documentation of information into the system, which partially explains the general usability and user satisfaction.

5.1.4 The impact of EHR on healthcare delivery in the hospital

The ultimate rationale for the implementation of every EHR system is to have a positive bearing on the general delivery of healthcare. Thus this current study found it congruent to assay the actual impact the implementation of the system has on healthcare delivery in the hospital and also the benefit the EHR system is having on the hospital as an organizational entity. Like other previous studies have reported (Bossen et al., 2013; Ludwick & Doucette, 2009; Nah et al., 2001), the benefits of the EHR system encountered at the hospital of study, was largely dependent on a range of contextual and organizational factors. The benefits the study observed is construed within the remit that the implementation of the system is at its initial stages and has not fully gusted in all the units and departments of the hospital. From the respondents, the study gathers that they were general optimism that when the system is fully implemented, it would lead to the reduction of work load users, aid in the provision of timely services to the patients, as well as, reduces the errors associated with the paper based records keeping.

Although at its early stages of implementation, one primary noticeable benefit of the EHR implementation in the hospital was the ability of system to lessen blunders and miscalculations concomitant with the processing of health insurance claims. Generally in most hospitals in Ghana, cost incurred in the provision of healthcare is on the ascendancy, partly because of the inefficiencies in insurance claim forms that in turn makes it difficult for the National Health Insurance Authorities to cater for these cost by way of reimbursement to the hospitals. The hospitals therefore bear these costs resulting from inaccurate information in insurance claim forms. But the studies of Remlex (2007), Menachemi and Brooks (2006) and Agrawal (2002)

have all established that using ICT in health sector largely reduces the cost of running health facilities. The implementation of the EHR system in the hospital had not only reduced the cost as a result of uncompensated insurance claims, resulting from wrong manual entries, but has also increased revenues of the hospital by ensuring timely and accurate capture of charges for medications, medical supplies, and the provision of clinical services. However, the study also revealed that, this benefit of the EHR has not been fully realized by the hospital. As at the time data was collected, the claims generated from the system had still not been submitted to the insurance authority due some identified errors such as the non-entry of procedure performed on the patients in the system although significant increase in the reimbursement amount was detected. Now there has been a reduction in the expenditure incurred in the procurement of paper logistics and other stationary. Again the study found out that the system has improved the retrieval of patient who absconded with their previous medical bills. These findings are again consistent with the findings of Menachemi and Brooks (2006) and Agrawal (2002) that EHR can be used as a measure to increase the cash flow of health facilities.

Further, it became eminent to the study that the introduction of the EHR system in the hospital, has raked-in the benefits of reducing patients' missing records particularly. Again, the system has led to the general improvement in the management of record-keeping in the hospital, with patient folders now becoming easy to identify as a result of the special coding system offered by the EHR system. Reflecting from this finding the study noticed, some writers have intimated that the implementation of EHR advances the access to precise and up-to-date health records thus improving the quality of care given to patients (Bossen et al., 2013; Boyer et al., 2010; Khalifehsoltani & Geremi, 2010; Randeree, 2007 ; Sood et al., 2008). Currently at the hospital the EHR system affords physicians with the previous diagnosis and treatment records of the patient because patient folders in which these information are access are proper kept and located with the help of the system. The patients' previous medical records are also now timely accessed and this manifests the outcome of the study done by DesRoches et al. (2008).

The implementation of the system has also resulted in the reduction of workload. Although this cannot be said for all the departments, the insurance unit and pharmacy department in the hospital stands out for a special mention. At the pharmacy now, the pricing or billing of patients' drugs, which were hitherto done manually, are now electronically generated automatically. This has indeed saved a lot of patient waiting time at the facility. The reduction of workloads in some unit has also made health professionals in the hospital more efficient and

productive as they do not now have to defer or reschedule some duties (Essex, 2000; Menachemi & Brooks, 2006).

Although the study of Rindfleisch, (1997) as well as Palvia et al., (2012) have all alluded to the improvement of privacy of patient records as a benefit of EHR, the current study was not able to gather enough data to come to that conclusion. That is not to impute that the benefit of 'Privacy of patient records' identified in the literature is not true, but as empirical as this study is, a finding which has not been proven cannot be included in the study.

Challenges of the implemented system

In spite of the benefits being realized from the implementation of EHR in the hospital, the implementation of the system has been fraught with some gainsays, which are impeding the full operationalization of the system hence realization of the system's benefits. Scholars have noted that the advancement of EHR in Africa has never been easy owing to many factors which are peculiar to developing countries (Bra et al., 2004; Khalifehsoltani & Gerami, 2010); Sood et al., 2008). Challenges identified relates to structural, functional and social factors.

One peculiar challenge that became very distinguished was the unreliable supply of electric power. The hospital is unable to securely hinge on the flow of electricity supplied by the Electricity Company of Ghana (ECG) because of the on-going load-shedding exercise. This situation is particularly disturbing as it affects the general healthcare delivery system in the country, as also found by Adu (2013). The system is an electronic device that operates on power, thus the unavailability of power would mean the system would not be operational or would be operational only when power is available. To ameliorate the effect of the power crisis, the hospital has acquired standby generators however, the hospital now is incurring additional cost in buying fuel to power these plants. And because of the huge financial commitment in fuelling the standby generators, some departments that use the EHR are often shut down to the systems' use during the time frame of the power outage. This affects the optimum utilization of the system. Furthermore, the intermittent supply of power does not only upset the operation of EHR systems, but in some cases actually damages the system. The erratic power supply also frustrates the users, who might be in the middle of making entries before the disruption in the power. The effect of this is that entries that were not saved must be re-entered, thus doubling the task of users. The doubling of tasks does not end there as the user has to make the paper

entries and record in the system when the power comes back on. This finding is supported by Achampong (2012) and other similar studies in Ghana.

Similar to the electricity problem is the lack of infrastructure to support the operation of the system. The study observed that physical infrastructures in the hospital were not in enough good condition to upkeep the functioning of new EHR system. Other needed IT accessories that are rudiments for successful implementation of EHR systems were just not available in hospital hence impeding the successful implementation of new EHR system (Bedeley & Palvia, 2014; Martinez et al., 2005).

Other challenges identified by study relates to the issue of poor network connectivity and lack of back-up systems. The provision of Internet services is a major bane that affects the implementation of ICT and telemedicine projects in Ghana and other developing countries (Achampong, 2012; Idowu et al., 2005; Seini et al., 1998). The hospital lacked proper Internet connectivity from their Internet providers and even in case where Internet connectivity available, the speed is often low speed and this result in a high utility cost thus making the use of the Internet unreliable and often expensive (Bedeley & Palvia, 2014; Swinfen & Swinfen, 2002). The issue of lack of back-up is also a great challenge of the system as it was identified by the Administrator as one of the reasons for the hybrid records keeping. This challenge again is in line with the findings in Sood et al. (2008) which identified the lack of back-up systems as one of the challenges faced by developing countries.

5.1.5 Measures to ensure future sustenance of the EHR

As part of measures to ensure the long term sustainability of the system in the hospital, management of the hospital is engaging the service of private sector organizations with expertise in IT and EHR implementation. This to ensure effective evaluation of the system so that the necessarily feedback would be incorporated in the full implementation process. In addition, the study observed that the provision of more computers and other infrastructures are essential to overturn some of the pitfalls faced at the user departments. The study also recognized the need on the part of management of the hospital to provide adequate training for all staff on the use of the system before the system is implemented in other units where the system is not currently in use. To ensure users' acceptance of EHR, management of the hospital needs to mapped out a strategy to cultivate and nature positive attitudes toward using the technology, this means robustly '*emphasizing, demonstrating and communicating*' the

usefulness of *the* system regularly to not only the users but also the entire hospital (Chau & Hu, 2002). Like Walker et al., (2005) and Sahay and Walsham, (2006) this study is also emphasizing the need for management to intensify training programs geared towards increasing usability and adoption of the system in the hospital. As identified in Sood et al. (2008) and Bossen et al. (2013), there is also the need for the systems' implementers to actively involve the users in the designing and configuration of the system. This would help match and meet the requirements of the users as well as enhance their commitment to the system.

Furthermore, as a measure to ensure sustainability of the system, the study gathered the need for the hospital to increase the staff strength of the IT department as the current number is woefully insufficient. Another measure which could improve the long term sustainability of the system is the need to increase the supply of power, which was identified by the almost all the users of the hospital as well as other studies on developing countries, as one of the main challenges confronting the systems usage. To this end, the hospital should make provision to extend the secondary power to all service point to prevent the excess work created by the system when there is interruption of power supply. To ensure the sustainability of the system, doctors and the nurses who are primary healthcare givers ought to be included in the usage of the system as a measure to address the challenges emanating for illegibility of their handwriting and increase workload of some users.

5.2 SUCCESS FACTORS IDENTIFIED FROM THE EVALUATION

The positive factors that came up from the evaluation warrant further discussion. This is because the Hospital is a regional hospital and the successful factors identified could be replicated other hospitals in the region, who choose to also implement EHR systems.

The first success factor was that the hospital had in place a qualified implementation team who had gained much useful insight into the operation of the system before it was introduced into the hospital. This team went round studying the implementation of similar systems and this equipped them with the needed knowledge and appreciation of how the system works.

The second success factor relates to the establishment of a functioning IT department and the provision of hardware and other needed ICT logistics prior to the introduction of the system in the facility. This initial enhancement of ICT has actually contributed to the general success of

the system even at its early stages. However, other facilities emulating similar implementation should endeavour to provide adequate IT infrastructure in order to alleviate some of the challenges faced by most EHR systems in developing countries.

The third successful factor relates to the support given by the hospital's management committee. This was a greater leadership step to get everyone involved in appreciating the use of system. This measure explains the increased usage of the system although usage has been identified earlier as obligatory.

Another successful factor has to do with the cooperation between the vendors and the management of the hospital to the extent that even payment plan were agreed on over a period of time. This successful cooperation translated into regularly provision of feedback and the maintenance of the system. This also helped the facility in alleviating the common challenge faced by most ICT implementation in developing countries; Inadequate funding.

5.3 PITFALLS OF THE IMPLEMENTED EHR

The study also deems it necessary to highlight some unsuccessful factors which should be avoided in any future implementation. The first factor relates to the degree of end-user involvement. The hospital only involved unit and functional head in the decision and configuration of the system, an anticipation that they would go and inform their subordinates but this measure was unsuccessful to the flourishing of the system. A handful of users in the hospital are still unbeknownst to the essence of the system and why it important to their work practice. Hence facilities who intend implementing the system should actively involve users in the decision making process as well as the overall progression of the systems design and implementation.

Further, although some training was provided to the users, the training again was inadequate to equip users with the right skills needed to operate the system. Hence those staff who are not conversant with the use of computers or had previous computer knowledge are still finding it difficult to use the system to its optimum. Hence, adequate training should be provided in similar implementation of an EHR system.

5.4 CONTRIBUTION OF THE EVALUATION TO THEORY

This study adopted the concept of Information Infrastructure (II) and the Actor-Network theory (ANT) owing to their complementary benefits of providing a good theoretical basis for the study (Gammon et al., 2008) as they have also being adopted in other authoritative studies some (Hanseth & Monteiro, 1998). ANT complemented the concept of II by providing a language to understand Information Infrastructure, and its relation with various users. Hence, the ANT was inserted in the study with the concept of II to aid in appreciating the implementation of the EHR in ENRH as an information infrastructure and how the EHR as an II tool is shaped and reshaped by the staff and other social factors.

II in the hospital thus typifies information systems and communication networks together with their attendant software which constitute the EHR system being used at the hospital currently. As an II, the EHR in hospital therefore reflected in the computer software programs and other information systems like file servers, communication protocols, printers, among others. Further this current Evaluation study has lend a great support to achieving the unique functions and characteristics of II. This would imply that the adoption, sustainability and the actual benefits to be derived from EHRs is seen to be achieved as the system was construed within the characteristics or function of II. As an II, the EHR system at the hospital had an ‘enabling’ *function*, which made it possible for the system to back an extensive range of activities in an organization. Although not completely installed in the hospital, the system exhibit the enabling function by supporting activities such as the alert system and the easy and concurrent record retrieval by health professionals.

Because of its *shared* function, the EHR system in the hospital was irreducible and this irreducibility function of the system finds expression in the users, using the same infrastructure as the system was not split or divided into separate parts that are independent of different groups (Hanseth & Monteiro, 1998). This shared function has also assisted the collaborative work in the hospital as it has augment the time and space for information distribution, which has helped to maintain some degree of discipline and rigor (Schneider & Wager, 1993; Vikkelso, 2005). Although doctors and nurses like other professionals are not currently using the system, this does not however defeat the *open function* of the EHR system as an II. The system in place is flexible and this implies that there is no beginning and ending to the perceptible limit to the number of individuals involved in the implementation of the system. As the study observed, the doctors and nurses are earmarked to soon use the system. It is however apt to suggest that the

open function is not fully expressed in the hospital but this can also be explained by the system being at its early stages.

The *Socio-Technical Network Function of II* epitomizes the ANT which was adopted to supplement the concept of II. To this end, the implementation of the system goes beyond the technological operationalization of the system. Management at the hospital has recognized the role of other human and social factors. This study, has therefore established that the EHR in Effia Nkwanta Regional Hospital is as an II that cannot work without the support and backing of the staff and other social elements. As *heterogeneous*, the EHR in the hospital has been able to link some components and assimilate them into interdependent networks. For instances, the e-claims portal which is a system by the NHIA has been fully integrated into the system used in the hospital. However, this functionality has also not been achieved fully but expected to be realized when the system is fully implemented. This current evaluation also contribute to the II by leading data to support the fact that the system in place at the hospital is *installed-based*. The EHR was adopted to mimic the paper-based recording keeping system while supporting other functionalities. It was thus built on the way entries were made on paper hence backing an already existing system.

5.5 STRENGTHS AND LIMITATION OF THE EVALUATION

A major strength of this evaluation is the methods of data collection. The adoption of open-ended questionnaires together with the interviews allowed the study to obtain varying responses from respondents. This method of data collection allowed respondents to freely express their opinions without any restrictions. Another strength of this evaluation is the field observation. The researcher spent almost eight weeks at the facility and this made it possible for the researcher to appreciate the day-to-day activities of staff and their usages of the system in the hospital. This greatly influenced the researcher to modify the questionnaires and interview guide to reflect the actual implementation of the system. The observations also helped in validating some of the responses provided by the respondents.

A major limitation of this evaluation was that, primary data were obtained during a time when users were just adapting to the system (Bossen et al., 2014). Regardless of this, the study was able to do a vigorous evaluative assessment of the system in the hospital. However, the study recommends a follow-up study or longitudinal study in any akin future evaluative study (Ibid).

Assessment of staff (through interviews and open-ended questionnaires) might not fully represent the views of user's especially regarding the impact the system has on healthcare delivery. The questionnaires were general in character and the study would have been more enriches if questions were raised on how EHR support specific tasks in the hospital. The questionnaire was also not based on a validated format which could be said to decrease the generalization of the result although the study did not seek to generalize it findings.

The restriction of the study to the use of qualitative data collection method could also be viewed as a limiting factor to the study. A more nuanced findings would have been generated if the study had adopted a mixed method of data collection which combined both quantitative and qualitative data collection methods. Another limitation to the evaluation is that, responses from the respondents might be subject to some degree of recall bias especially in the assessment of the initial preparations made by the hospital before the systems introduction. This is likely the case as the training and other preparations were made a year before the actually implementation of system. Also, data was gathered two years after the implementation and hence might be subject to some recall biases of the respondent. Some questions posed in the questionnaire and interview guide such as the frequency of system use became irrelevant for the study as the use of the system was identified to be compulsory for all user departments. However, the study was able to generate that the use of the system was restricted to staff who felt confident in the systems use which reflected in the findings from the study.

5.6 CHAPTER SUMMARY

This chapter has discussed the findings of the study obtained from the field as it was also compared with findings from existing literatures. The findings of the studies were discussed to reflect the objectives the study set out to find. Hence themes were developed to reflect the study objectives for the purposes of the discussion. From the discussions, the Effia Nkwanta Regional Hospital was seen to have made in general terms, an adequate preparation prior to the implementation of the EHR. This was manifested by the sufficient preparatory works done before the system was introduced. However, the non-involvement of users and the inadequate training given them, stood out as a slack in the initial preparation process. It was realized again that users were generally satisfied with the use of the system although they were not involved. Some benefits of the system to healthcare delivery; including reduced work task, improve

claims generation, reduce errors, retrieval of absconded patients bills among other benefits, as well as, other challenges were also thoroughly discussed. Lastly the measures to ensure that the system subsists for a longer foreseeable future were also featured in the discussion above. The study findings were then inserted within the concept of II as a measure to collaborate this extensively used concept in telemedicine to the study findings.

CHAPTER SIX

RECOMMENDATIONS AND CONCLUSION

6.0 INTRODUCTION

This main objective of this study was to evaluate the implemented EHR at Effia Nkwanta Regional Hospital by assessing the preparations made by the hospital prior to the systems introduction as well as the factors that impedes or promote the systems usability and satisfactions among the users of the system. The objectives was also to be achieved by examining the impact derived from the system by identifying the benefits of the system to healthcare delivery as well as the challenges of the implemented system. This section of the thesis hence presents the conclusion of the study based on the findings from the study and makes recommendations for future research.

6.1 CONCLUSION

This study was carried out in Effia Nkwanta Regional Hospital in Ghana, with the principal aim of appraising the newly installed EHR system. The outcome of this evaluative assessment has produced useful insight into the actual implementation of the system at its early stages and the prospect of fully implementing the electronic record system in the whole hospital. In general terms, the study reveals a fairly positive implementation of the system in the hospital. Thus the hospital has recorded some level of success with the implementation of the system as albeit some inherent challenges. This conclusion is predicated on the fairly adequate provisions made before the system was actually implemented and the tangible benefit the system is currently yielding.

Notwithstanding the non-involvement of users in the decision and configuration of the system and other pitfalls in the initial preparation process, the hospital in almost all areas responded generally positive to providing the physical infrastructure and other infrastructure which would be much needed for the actual implementation of EHR system. The networking, as well as, the availability and accessibility of Internet infrastructure in almost all the hospital departments attests to this claim. The hospital could also hold claim to some ICT infrastructure such as computers, printers, scanners, photocopiers, among others. There was an emergency power plant in the hospital to mitigate the irregularity in the supply of power which serves as a threat

to the systems implementation. Again, in an attempt to guarantee the adequate usage of the system, the hospital funded a training of users regarding how the system is to be used. Health workers in the hospital were therefore generally satisfied with the system, with some indicating their unwillingness to go back to the paper based recording keeping. One peculiar misnomer was that doctors and nurses who are primary caregivers were not using the system for the express reason that it would increase their workload. Data obtained from the study generally reported the displeasure of users in the facility with the paper based record system thus the researcher wonders why the nurses and some other staff are still cold-feet towards accepting the system into their work practices. Hence, the responses the study gathers from staff demonstrates certain compelling factors to forced them to re-think and adopt the EHR system. One of these compelling factors is the illegibility of doctors' handwriting, an issue which could be solved with EHR. Another is the ability of the system to help address the issue of missing folders and claims sheets.

The implementation of the EHR system in the hospital has far resulted in the improvement of keeping records of insurance claims and proper keeping of patients' medical records. It has also helped in reducing the expenditure of the hospital which results from wrong entry of information, particularly on insurance claim forms. The systems has also been perceived to have improved the revenue base of the hospital as patient who abscond with medical bills are now identified and made to account for their non-payment (though not evident in their financial records). Further, the EHR has improved treatment and medication given to patients and this is attested to by the alerts systems and prompts whenever a wrong dosage of medication is given to a patient who reports at the pharmacy. The issues of billing and costing of drugs given to patients are also improved by the introduction of the system. It must be stressed that the use of the EHR system in the hospital to a larger extent is limited to the supportive function of EHR as opposed the Direct Care functions. Thus, the system largely support administrative, financial and clinical support systems in the hospital to other functions such as medical decision support functionality of an EHR.

Beside these positives, the study also discovered some challenges which work against the functioning and thriving of the system. A factor which can easily be identified is the power situation is the country which makes it difficult for the system to operate at optimal capacity. Infrastructural deficits were also recalled as a challenge to the operationalization of the system. Poor Internet connections, and detestable attitudes of some workers were also identified in by

study as a challenge to the system. Measures to adopt to ensure the sustainability of the system was also explored by the study. Management ought to rigorously devise a measure to increase the adoption of the system into the work practice of doctors and nurses. Again there should be some robust attempt to introduce regular training workshops for users to keep them in-tuned with the changes the system brings.

6.2 RECOMMENDATIONS FOR FURTHER STUDIES

It is recommended for further studies to examine country specific policies and its effect on the implementation of EHR especially in the context of developing countries such as Ghana. This would help unearth the limitations and barriers created by national policies and regulations on ICT systems' implementation in both developed and developing countries. It would also help to determine the national readiness for EHR in developing countries.

It is also recommended that future studies evaluate the impact of EHR from the patients' perspective. This would help reveal whether or not the intended benefits of the implemented EHRs to patients are actually realised.

From the identified limitations to the adopted study approach, it is recommended for further studies to adopt both quantitative and qualitative research approaches in similar studies to generate diversified responses from participants.

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APPENDIX

1. LETTER OF INTRODUCTION TO THE VARIOUS USER DEPARTMENTS

In case of the reply the number and the date of this letter should be quoted.

My Ref No: EFH/G 105 VOL 25

Your Ref No:.....

TEL NO. 031-2023151-4
FAX NO: 233-31-2024565
E-mail: enrh@ghana.com



EFFIA NKWANTA REGIONAL HOSPITAL
Ghana Health Service

Sekondi

15TH JULY, 2014

**THE I.T OFFICER IN-CHARGE
EFFIA NKWANTA REGIONAL HOSPITAL
SEKONDI**

INTRODUCTORY LETTER
MS. MARTHA ACQUAH-SWANZY – MSC IN TELEMEDICINE

This is to introduce to you the above-named student from Arctic University of Norway.

She is to undergo two-week attachment training effective 15th July, 2014 at your unit for practical knowledge in electronic system and networking in this hospital.

Please offer her the necessary assistance.

Thank you.

DEPUTY HEAD OF ADMINISTRATION
EFFIA NKWANTA REG. HOSPITAL
SEKONDI

**HABIB GANJYU
DEPUTY HEAD OF ADMINISTRATION**

2. INSTITUTIONAL APPROVAL FOR THE CONDUCT OF STUDY

In case of the reply the number and the date of this letter should be quoted.

My Ref No: G 1/14
Your Ref No:.....

TEL NO: 031-2023151-4
FAX NO: 233-31-2024565
E-mail: enr@ghana.com



*FIA NKWANTA REGIONAL HOSPITAL
GHANA HEALTH SERVICE
P.O. BOX 229
SEKONDI

5th August, 2014

**The Head of Department of Clinical Medicine
Faculty of Health Sciences
University of Tromsø, Norway**

Dear Sir/Madam,

RE: LETTER OF SUPPORT

We refer to your letter dated 3rd July, 2014 on the above subject matter.

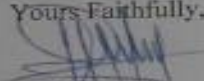
Management of the hospital has approved the request for data collection on the initial phase of EHR implementation in the hospital.
The student would also be allowed to undertake the intended internship for a maximum time of one month.

I wish to remind you that this approval is a privilege and the student must therefore conduct herself within the confines of rules and regulations governing the hospital.

We look forward to meeting with her in the summer.

Thank you.

Yours Faithfully,


**Habib Ganiyu
Deputy Head of Administration
For: Medical Director**

**DEPUTY HEAD OF ADMINISTRATION
NKWANTA REG HOSPITAL
SEKONDI**

3. A COPY OF THE NATIONAL HEALTH INSURANCE CLAIM SHEET



NATIONAL HEALTH INSURANCE SCHEME

Claim Form
(Regulation 62)

Form No. _____
HI Code: _____

Important: This Form should be completed IN CAPITAL LETTERS using a BLACK or DARK BLUE ballpoint Fountain pen. Characters and marks used should be similar in the style to the following:

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z 1 2 3 4 5 6 7 8 9 0

Scheme Code: _____

Month of Claim: _____ / _____ / _____

Client Information

Surname _____

Gender
 Male
 Female

Other Names _____

Date of Birth _____ / _____ / _____

Age _____

Member Number: _____

Hospital Record No. _____

Card Serial Number: _____

Services Provided (to be filled in by all health care providers)

Type of Services
(a.) *select only one*
 Outpatients Pharmacy
 Diagnostic In-patient
(b.) All Inclusive Unbundled

Date(s) of Service Provision DD/MM/YYYY
1st Visit/Admission _____ / _____ / _____
2nd Visit/Discharge _____ / _____ / _____
3rd Visit _____ / _____ / _____
4th Visit _____ / _____ / _____
Duration of Spell (days) _____

Outcome
 Discharged Died Transferred out
 Absconded/Discharged against medical advice

Type of Attendance
 Chronic Follow-up Emergency/Acute episode
Specialty Code: _____
Specialty Description: _____

Procedure(s) (to be filled by health care providers who have provided out or in-patient services)

Physician/Clinician Name: _____

Physician/Clinician ID: _____

	Description	Date	G-DRG
Procedure 1		____ / ____ / ____	_____
Procedure 2		____ / ____ / ____	_____
Procedure 3		____ / ____ / ____	_____

Form No.

Diagnosis(es) (to be filled by health care providers who have provided out or in-patient services)

	Description	ICD-10	G-DRG
Diagnosis 1		<input type="text"/>	<input type="text"/>
Diagnosis 2		<input type="text"/>	<input type="text"/>
Diagnosis 3		<input type="text"/>	<input type="text"/>
Diagnosis 4		<input type="text"/>	<input type="text"/>

Investigations (to be filled in by health care providers providing diagnostics services only)

	Description	Unit Price	Date	G-DRG
1		<input type="text"/>	<input type="text"/>	<input type="text"/>
2		<input type="text"/>	<input type="text"/>	<input type="text"/>
3		<input type="text"/>	<input type="text"/>	<input type="text"/>
4		<input type="text"/>	<input type="text"/>	<input type="text"/>
5		<input type="text"/>	<input type="text"/>	<input type="text"/>

Medicines (to be filled in by health care providers who have dispensed medicines)

	Description	Price	Qty	Total Cost	Date	Code
1		<input type="text"/>	<input type="text"/>			<input type="text"/>
2		<input type="text"/>	<input type="text"/>			<input type="text"/>
3		<input type="text"/>	<input type="text"/>			<input type="text"/>
4		<input type="text"/>	<input type="text"/>			<input type="text"/>
5		<input type="text"/>	<input type="text"/>			<input type="text"/>
6		<input type="text"/>	<input type="text"/>			<input type="text"/>
7		<input type="text"/>	<input type="text"/>			<input type="text"/>
8		<input type="text"/>	<input type="text"/>			<input type="text"/>

Client Claim Summary

	Type of Service	G-DRG/Code	Tariff Amount
A	In- Patient	<input type="text"/>	<input type="text"/>
B	Out-Patient	<input type="text"/>	<input type="text"/>
C	Investigations		<input type="text"/>
D	Pharmacy		<input type="text"/>
TOTAL			<input type="text"/>

Name

Signature

(Health Facility Insurance Officer)

Scheme Use Only

Available choices
A & D or B & D or C & D or C or D

Date Received	<input type="text"/>	Action 1	<input type="text"/>	Date	<input type="text"/>	Signed	<input type="text"/>
Signed	<input type="text"/>	Action 2	<input type="text"/>	Date	<input type="text"/>	Signed	<input type="text"/>

4. QUESTIONNAIRE FOR INTERVIEW

Aim: To determine preparations made before the implementation of Electronic health Record and the impact of the system to the hospital.

Interviewee: Systems Administrator I

Interview date...07/08/2014

DEMOGRAPHIC INFORMATION

Q1. Briefly describe the existing healthcare delivery network of your healthcare setting

(a). What is the Staff complement of the hospital

No. of general Physicians.....

No. of specialist Physicians.....

No. of nurses.....

No. of paramedics.....

No. of IT technical officers.....

Others.....

(b). How many departments/wards are there in the hospital?

(c). What are the healthcare services provided by the hospital?

Q2: (a) Which of the Departments/Wards provides any form of ICT application? E.g Tele-Dermatology, E-referrals, E-learning, E-record taking.

(b) Which ICT application does the department stated above use ?

Q3: Briefly describe the network/hardware components in the hospital

(a). No. of laptop(s).....

(b). No. of desktop(s).....

- (c). No of printer(s).....
- (d). No. of document scanner(s).....
- (e). No of photocopier(s).....
- (f). No. of phone (ISDN/Normal)(s).....
- (g). TV based Video conferencing System (Yes/No).....
- (h). PC. Based Video Conferencing System (e.g. webcam connected to PC) Yes/ No
- (i). Do you have Internet access at the hospital? Yes/NO

If yes,

- (j). How many Departments/Wards have access to the Internet facility?
- (k). How many Departments/Wards do not have access to the Internet facility?
- (l) Do you have inter-connected communication system that connects the various department/wards? (Yes/No)

If Yes

- (m) How many department/wards are connected?
- (n) Does the hospital have constant electricity supply in all department?

Initial Preparations made before the implementation of Electronic Health Record

Q4. Briefly describe the implemented electronic health record system in the facility.

- a) What does the system entail?
- b) How does the system works?

Q5. What are the reasons for purchasing the system?

- a) What were the projected benefits of the system?
- b) Do you have any special reasons for choosing that particular vendor?

Q6. Briefly describe the measures taken before the acquisition of the system

(a) How was the decision arrived at for the purchase of the system?

i) Where the users involved in the decision making process. Yes/No

If yes,

ii) How were they involved in the decision making process?

iii) What were some of their concerns and how were they handled

If No,

ii) Are there any special reasons for their non-involvement in the decision making process.

(b) Was the hospital ready for the system?

i. What was the computer knowledge of the users?

ii. Were the users taking through any computer training? Yes/No

(c) What was the preparations made for the funding of the project in terms of its;

i. Acquisition

ii. Maintenance

iii. Upgrading

(d) Does the hospital have an IT department? Yes/No

i. What are the roles or job description of the department?

ii. What were their roles in the introduction of the system?

iii. What is their current role in the implementation of the system?

Q7. How the system was introduced in the hospital?

*What informed the choice of that particular Department?

Usability and Satisfaction with the system

Q8. Is the system currently in use (at the department of implementation)? Yes/No

If No,

- i. Why is the system not in use?

Q9. From their response, would you say 'the users' are satisfied with the system? Yes/No

If yes,

- i. How satisfied are the users with the system?

If No,

- i. Why are the users not satisfied with the system?

Impact of the system

Q10. Has the introduction of the system impacted healthcare delivery? Yes/ No

*If No, why has the system failed to have an impact on healthcare delivery?

Q11. How has it impacted healthcare delivery?

Q12. What are some of the challenges to the implementation of the system?

Q13. How are these challenges addressed or what steps are being taken to addressing them?

Q14. What is the desired future of the system?

Q15. What measures are designed to attain the desired future of the system?

5. QUESTIONNAIRE FOR INTERVIEW

Aim: To evaluate the implementation of the system

Interviewees: Systems Administrator II

Interview date...20/07/14 and 21/07/14

Q1. What is the role of the IT department?

Q2. What is the role of the department in the introduction of the system?

Q3. What preparations were made by the department before the introduction of the system?

Q4. Was the hospital prepared (infrastructural base) before the introduction of system?

Q5. Briefly describe how the EHR works?

Q6. How was the configuration of the EHR done?

Usability and Satisfaction

Q7. Does the EHR meet the specific needs of its users?

Q8. Is the system easy to use? Yes/No

If Yes,

Q9. How easy is it to use the EHR? What makes the EHR easier to use than the old system?

Q10. Is the EHR in use at the user department? Yes/No

If yes,

Q11. Are the users satisfied with its usage compared to the old system?

If No,

Q12. Why are the users not using the system?

Q13. How stable is the system? How often is it down?

Q14. How many people were trained to use the system?

Q15. How many days were allocated for training?

Q16. Was the training adequately provided?

Impact of the system on healthcare delivery

Q17. What are the benefits so far of the EHR to healthcare delivery?

Q18. How has it improved healthcare delivery compared to the old system?

Q19. What do you think are some of the challenges to the implementation of the EHR?

Q20. What are being done to address these challenges?

Q21. What is the way forward in future implementation of the system?

6. QUESTIONNAIRE FOR USERS OF THE EHR

*I am a second year student of **The Arctic University of Norway, UIT** undertaking a research project in partial fulfilment of the requirement for the award of a Master degree in Telemedicine and E-Health. The purpose of this study is to **evaluate the implemented Electronic Health Records in Effia Nkwanta Regional Hospital**. I would be appreciative if you can take some time off your busy schedule to complete this questionnaire. Please read each questionnaire item carefully and respond according to your true and candid opinion and where you are unable to give an answer to any question, please leave that question unanswered. Be assured that this study is solely for academic purposes. The information provided will be treated as **confidential** and the identity of respondents will be kept anonymous.*

Section A: Information about Respondent

1. What is your role in the hospital (eg. Nurse, doctor, Midwife, etc)?
2. How long have you worked in your current position?
3. What do you know about Electronic health records?
-
-
-
-
4. How would you rate your computer knowledge? Novice Average Experienced
5. How did you acquire the computer knowledge? Self-Training Trained by the facility
Trained in School Other (please specify).....
6. Which windows were you trained on? (Tick as many as trained on) Word Excel Assess
 PowerPoint
7. Do you have prior experience with the use of any ICT programme in the performance of your role? Yes No

If Yes,

8. Which programme (e.g Videoconferencing, electronic health record (EHR), etc)?
.....

Section B: Initial Assessment made (This section is to identify the initial assessment made by the hospital before the implementation of the EHR)

9. Were you involved in the decision to introduce the electronic health records? Yes [] No []

If Yes

10. How were you involved in the decision making (e.g staff durber to communicate intentions to purchase an electronic system, ask for your preference and views, etc)?
.....
.....
.....
.....

11. Did you have any influence on how the system should work before it introduction?

Yes [] No []

If yes,

12. Were your suggestions followed in the design and implementation of the system? Yes []
No []

13. Did you receive any training on the EHR before it implementation? Yes [] No []

14. Was the training adequate for you to use the EHR? Yes [] No []

15. Do you think the implementation of the EHR was well planned? Yes [] No []

Section C: Usability and User Satisfaction

16. Do you use the implemented EHR? Yes [] No []

If yes answer question 17 and 18 (then Skip question 20)

17. How often do you use the EHR? Very often [] Often [] Not Often [] Never []

18. When do you use the system?

.....

If No

19. What are your reasons for not using the EHR?.....

.....

20. Was it easy to learn how to use the EHR? Yes [] No []

a. If **Yes**, What contributed to the ease in the use of the EHR (e.g. your background with similar application, adequate training on use, etc)?

.....

.....

b. If **No**, what were some of the difficulties identified?

.....

.....

21. How easy is it to document information in the EHR? Very easy [] Easy [] Not easy []

22. Generally, does the EHR support your work procedure? Yes [] No []

23. How would you rate your satisfaction with the EHR? Very Satisfied [] Moderately Satisfied [] Satisfied [] Less Satisfied []

Section D: The impact of the EHR on healthcare delivery

24. How has the implementation of the EHR made you work any easier?.....

.....

.....

.....

25. Could it be said that the implementation of the EHR has reduced the time spent on each patient (answer **Yes** or **No** and give reasons)?.....

.....
.....
.....

26. What do you think are some of the benefit of the EHR to the patients?

.....
.....
.....

27. Has the EHR improved healthcare delivery in the facility?

If **Yes**, How?

.....
.....

If **No**, Why?

.....
.....

28. Do you think EHR has benefits over the paper based record? YES [] NO[]

29. If **Yes**, what do you think are some of the benefits of the EHR over the Paper based records?

.....
.....
.....

30. If **No**, what do you think are the benefits of paper based record over EHR?.....

.....
.....

31. What do you think are some of the challenges to the overall introduction and implementation of the EHR?

.....
.....

.....
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.....
.....

32. What do you think should be done in future implementation to improve the system?

.....
.....
.....
.....
.....
.....
.....

THANK YOU!