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Assessing and improving EHRs data quality through a socio-technical approach

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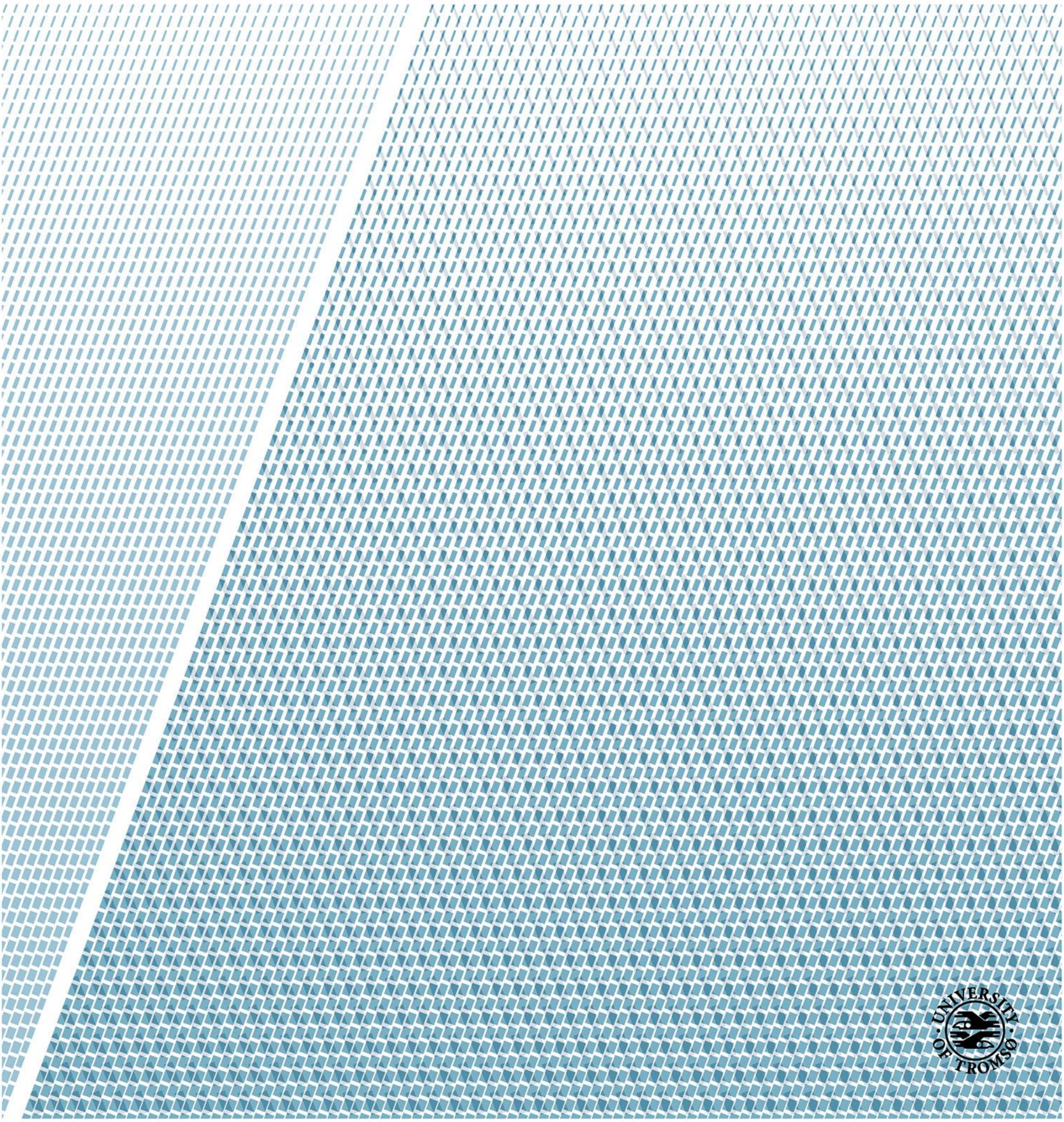
Master’s Thesis in Telemedicine and E-health (TLM-3902)

May 2016



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A Thesis Submitted by;

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ABSTRACT

The implementation of Electronic Health Records (EHRs) in developing countries is considered a means for improved data quality and high quality care. However, existing research, indicate that EHRs have recorded greater quantity of bad data instead of improving the quality of data. The reasons for this is not exactly clear. Accordingly, this paper takes a broader socio-technical approach to explore the issues in more detail. The paper explores the relationship between EHRs and quality at the Pentecost Hospital Madina-Ghana by using an interpretative research approach with an in-depth semi-structured and unstructured interviews, observations, documentation and photographic analysis without any preconceived hypothesis to research the phenomena under study. The result of the study indicates that the EHRs introduced at the hospital have so far had limited effect on data quality and that context-related challenges are the major pitfalls identified in the study. Based on a socio- technical approach the paper discusses the need to; consider users and technology as intertwined, how technology changes practice, how it formalizes roles and responsibilities in the process, why it requires collaborative work and why realistic goals as opposed to exaggerated expectation.

Keywords: Electronic Health Record system (EHRs); Data Quality; socio-technical approach; Ghana.

DECLARATION

I hereby assert that this thesis is the result of my own research and has not been presented by anyone for any academic award in this university or any other university. All references used in this work have been duly acknowledged. I bear sole and full responsibility for any shortcomings of this research work.

Samuel Darko-Yawson

I hereby certify that this thesis was supervised in accordance with the procedures laid down by the University of Tromso, Department of Clinical sciences/Telemedicine.

Professor Ellingsen Gunnar Supervisor

Acknowledgment

The successful accomplishment of this dissertation is in fact an outcome of collective efforts of many individuals, to whom I am highly indebted. First of all, I would like to express my sincere gratitude to my supervisor Gunnar Ellingsen for the opportunity he gave me as a teaching assistant and for his valuable time, motivation and guidance throughout the study period.

Also, I appreciate the Norwegian government for the financial support, through the quota scholarship program, throughout my study and research period. To Judy Yu-Ying Au, the student advisor at the Department of Telemedicine and E-health, Vraberg Line, the counsellor for International Student, and Widnes Hege Kristin, I say thank you for your assistances.

I would also like to express my appreciation to the management of Pentecost Hospital for their permission to conduct this study. I am thankful to all the participants of this study for sharing their opinions and providing valuable information. Without you this project would not have been successful.

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LIST OF ABBREVIATIONS

ICTs - Information and Communication Technologies

EHR- Electronic Health Records

EHRs- Electronic Health Records System

DHIMS-District Health Information Management System

ANT- Actor Network Theory

II - Information Infrastructure

USA- United State of America

HAMS- Hospital Administration and Management System

OPD- Out-patient Department

IT- Information Technology

WHO-World Health Organization

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

HIE- Health information exchange

CHAPTER ONE

INTRODUCTION

1. BACKGROUND

Globally, the management of healthcare data is acknowledged as a key component that has the potentials to strengthen health care quality delivery agenda. The implementation of Electronic Health Records (EHRs) in developing countries is considered a means for improving data quality and high quality care. Owing to this, governments in developing countries are investing hugely in EHRs in an attempt to improve healthcare and the general performance of public healthcare facilities (Yusif & Soar, 2012). This is because quality data can contribute to the assessment of quality of care, examine the effectiveness of quality improvement initiatives (Institute of Medicine, 2001) which serve as the basis for reliable health policies and planning. This significantly improves healthcare institutions, providers and all other stakeholders as well as, serving as a vital element for individual health facilities in managing and improving healthcare delivery in general (Teviu, Aikins, Abdulia, et al., 2012). However, although EHRs in developing countries have proven great advancement in terms of collection of data from health facilities (Manya, et al. (2015). While this is recognized, there is an urgent need to advance from just the data collection to the quality of data collected from the system as this is used for healthcare decision making (Manya, et al. (2015). This is because, improving the quality in health data and the proper usage of data is very important in the task of achieving and maintaining optimal level in health by healthcare authorities (WHO 2003). As such, health sectors in most developing countries like Ghana as part of the strive to improve healthcare delivery just like most developed countries are experiencing active proliferation of and the subsequent adoption and implementation of ICT projects (Adjorlolo & Ellingsen 2013) such as Electronic Health Record systems (EHRs). The essence of these adaptation is with the vision of improving the means to provide a comprehensive health care system to their citizens (IICD, 2014). This is very significant in relation to quality related challenges characterizing the paper record system coupled with the aspirations for transforming the healthcare delivery through improved record system (Coeira, 2003). However, although EHRs systems may have proven effective in terms of reduction in patient visits, reduction in provider time per patients and reduction in time spent by the patients as well as reduction in medical errors (Fraser et al., 2005). In the absent of solid and correct content in a usable and accessible form, these benefits will not be realized.

1.1 STATEMENT OF THE PROBLEM

Evidence from the growing body of literature has suggested that the introduction of EHRs, has led to the recording of a greater quantity of bad data instead of improving the quality of data being recorded (Hobson,2010; Weiskopf &Wing,2013; Bowmen et al.2013). This indicates that experience from running computerized health information systems such as EHRs has not always shown to improve data quality. Although, EHRs have a positive impact on quality of care, patient safety, and efficiencies, it can have negative impacts without accurate and appropriate content in a usable and accessible form, taking into consideration other stakeholders.

Essential to the problem appears to be that EHRs is implemented and used in a variety of different and complex systems made up of different users with different data interest to generate information that serves as input to healthcare decision. This management complexity also increases the risks of poor data quality. Incorrect data in EHRs threaten patient's safety and healthcare quality and can result in accumulation of cost and financial loses, restraint health information exchange, contravene clinical research, performance improvement, and quality assessment initiatives (AHIMA 2013).Hence, in order for higher quality to be achieved, the web of interactions always entails humans (social systems) solving problems with limited resources (technical systems) and working around imperfect processes (Coiera, 2004) to enhance overall outcome. Hence, it is very significant to clearly identify certain EHRs data quality dimensions, challenges, assessment plans and ways to improve it to ensure accuracy in healthcare data. Along these lines, several studies have shown that defining the data quality seems to be almost as elusive as measuring it, hence there is no single accepted definition for data quality and seems to be shaped by various use contexts. In this study, I take a socio-technical approach to examine the problems more broadly where we also take into account the particular context the EHR is implemented.

In this study, I zoom in on one developing country Ghana in Africa, being one of the few African countries which has implemented a substantial amount of EHRs the recent years. Some projects produced both locally and international with the ultimate goal of generating health information to facilitate health intervention and policy building (IICD, 2014). However, in putting into effect the implementation of EHRs in Ghana such as HAMS software recognizes the need for a quality human interface to be able to achieve its objectives, success and acceptance by its users including management and all other stakeholders (www.infotechsystemsonline). On the other hand, its implementation recognizes the need for a socio technical approach and not just the technology. Also, with no existing studies in Ghana as at October 2015, pinpointing exactly how the EHRs has improved quality in healthcare data. Hence, a post EHR implementation evaluation will help shape both the practice and its evolution and to identify the data quality related lapses. This is because, often what happens before and during the implementation phase is very different from what is actually implemented or in practice. The practice needs to continuously evaluate its processes to ensure that the system functions efficiently in practice to enhance user satisfaction and to know the accuracy of data retrieved by the technology and how it has contributed to improve further clinical and other related studies.

1.2 RESEARCH QUESTIONS

The following research questions were addressed by the study:

1. What is the relationship between EHRs, quality and the contexts where it supposed to be used?
2. And how has EHRs been a data quality enabler to healthcare delivery in Africa-Developing countries and what are the implications for implementation strategies of EHRs?

1.3 OBJECTIVES OF THE STUDY

The objectives of the study are to,

- Examine the relationship between EHRs, quality and the contexts where it supposed to be used.
- Examine how has EHRs been a data quality enabler to healthcare delivery in Africa-Developing countries and what are the implications for implementation strategies of EHRs?

1.4 MOTIVATION FOR THE STUDY

Health care data is noted to be crucial in ensuring collaboration among health providers. A wide range of research has proven that efficient electronic health records ensures quality of care and guarantees patients′ safety. Quality dimensions is an area I took special interest in right from my bachelors. My motivation to undertake this study is stemmed from my findings and result of bachelor thesis on “assessing quality of health care delivery” which ascertained in the findings of the need for more adaptation of EHRs. As such, the joy and expectations of it continues advent in Ghana is enough motivation for me to know whether or not EHRs has really helped to improve health care data. Also experiencing and following some challenges of EHR data usage in the developed countries such as Norway, Germany, U.S, Demark and others, is another factor motivating the need for assessing and improving EHRs data quality in Ghana. Such studies will be very significant in knowing its current impact on data and future potentials when it is well improved. Consequently, my worry about the poor state of EHRs in Ghana stems from this assertion.

1.5 EXPECTED CONTRIBUTION OF THE STUDY

The overall aim of the study is to unravel how EHRs has been a data quality enabler to healthcare delivery by deepening understanding of the relationship between EHRs, quality and the contexts where it supposed to be used. Generally, it has been observed that EHRs implementation has several lapses which go a long way to decrease its data quality. In addition, the study being the first of its kind in Ghana, is expected to showcase the extent to which EHRs has achieved its introduction expectations of improving health care data quality in Ghana. This study is also designed to support and guide organizations, health information management (HIM) professionals such as INFOTECH Dot Net Systems and health providers to assess, improve, and support the management of electronic health information. Lastly this study will be used as partial fulfilment of Master of Science Thesis at the department of Tele medicine and e-health application in the University of Tromso.

1.6 OUTLINE OF THE THESIS

The thesis is organized into seven chapters. Chapter one (1), being the introduction gives a foretaste of the study. Thus presents the background information of the research topic, defining the research problem, objectives, purpose of the study and research questions that the project seeks to answer, highlighting the significance of the study, pointing to the limitations of the study, and defining key terms that will be used constantly in this project Chapter two (2), aims to review findings from prior researches conducted in relation to the study, especially those related to EHRs and quality in health care settings. It also describes the potential quality related benefit in relation to EHRs in improving the health care. Furthermore, the chapter will delineate on the sociotechnical perspective of EHRs by building on existing theory of the Actor Network Theory (ANT) to depict the various actors, their roles, interactions and contribution towards data quality. This theory guides the study given that it dwells on the socio-technical approach, which involves the connection and interrelation between humans and technological components to make up a complete system.

Chapter three (3), delineates the the research setting, here the researcher will totally elaborate details on how the research was carried out. Chapter four (4), will look at the research method, which elaborates on the research approach and provides insight into how the study was conducted. It explains the purpose of the research and mentions the research questions. It also describes a qualitative research designs with particular exposition on the interpretive research approach because it is the approach used during the research. Context such as detailed description of the research seen, where the research was conducted, the hospital considered for the study, and the particular research site. Chapter five (5) presents the workflow and the state of information infrastructure(EHRs) of the research setting. It ends with the empirical data collected. The key findings of the research are discussed in Chapter six (6). Finally, Chapter seven (7) consists of the conclusion drawn from the study and highlights on the implications of the study and recommendations. References used and appendices follow this Chapter.

CHAPTER TWO

LITERATURE REVIEW ON EHRS, DATA QUALITY, AND SOCIO-TECHNICAL SYSTEMS

2. INTRODUCTION

The aim of this chapter is to examine how EHRs can be seen to have improved data quality and by delineating on EHRs and it component, data quality and it properties and the consequences of implementation context on the quality of healthcare data from a socio-technical perspective within the lenses of Actor-Network Theory.

2.1 Electronic Health Record (EHR)

Many studies have defined EHRs in various ways yet the internationally recognized definition for EHRs was given by the International Standard Organization (ISO) who defined EHRs as "a repository of information regarding the health of a subject of care, in computer processable form" (ISO 2005). However, Hayrinen, Saranto and Nykanen (2008) sought to broaden this definition by delineating that 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 (Hayrinen et al. 2008). Hence, quality and up-to-date data collection is very important, not just for improving quality clinical care, but also to ensure consistency in health care delivery, maintenance of optimal level, enhancement of clinical and health service research, and planning and management of health systems (WHO 2003).

2.1.1 Components of EHR

Tang (2003), identified that a well functioning EHR system: should have the capacity of storing patients' health information and data longitudinally; it should be able to properly manage results generated from the system; it should also enable 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 enable 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 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 being managed properly. ***Management of security issues:*** All EHR systems have special features that help manage authentication and authorization of users.

2.1.2 Impacts of EHRs on Healthcare delivery

EHRs and the ability to exchange health information electronically can help to provide higher quality and safer care for patients while creating tangible enhancements for your organization. EHRs help providers better manage care for patients and provide better health care through(website);

- Providing accurate, up-to-date, and complete information about patients at the point of care
- Enabling quick access to patient records for more coordinated, efficient care
- Securely sharing electronic information with patients and other clinicians

- Helping health care providers to more effectively diagnose patients, reduce medical errors, and provide safer care
- Improving patient and provider interaction and communication, as well as health care convenience, thus enabling safer, more reliable prescribing
- Helping promote legible, complete documentation and accurate, streamlined coding and billing Enhancing privacy and security of patient data
- Helping providers improve productivity and work-life balance
- Enabling providers to improve efficiency and meet their business goals
- Better health care by improving all aspects of patient care, including safety, effectiveness, patient-centeredness, communication, education, timeliness, efficiency, and equity
- Improved efficiencies and lower health care costs by promoting preventative medicine and improved coordination of health care services, as well as by reducing waste and redundant tests.
- Better clinical decision making by integrating patient information from multiple sources.
- Reducing costs through decreased paperwork, improved safety, reduced duplication of testing, and improved health.

2.2 Defining Data Quality

Defining and describing EHRs *data quality* is key to maintaining and improving it. Ever since the Institute of Medicine (2001) described the so-called “quality chasm” in health care, data quality improvement has become an important policy issue. However, studies have shown that there is no clear definition for data quality because quality it self is not straightforward not to think of defining quality for data. There are a variety of views on its meaning and some debate as to what degree quality is measurable. The World Health Organization (WHO) suggests: Quality is a process of meeting the needs and expectations of patients and health service staff (WHO 2000). However, while some authors delineate data quality as “Fit for Use” others see data of high quality when it accurately represents what is constructed in the real-world it referring to. For example, Chisholm (2012), argues that the extent to which the data actually represents what it intended to represent”, is more appropriate for defining data quality as “Not just Fitness for Use". This can also be recognized with Orr, (1998) who delineate data quality as "the measure of the agreement between the data views presented by an information system and that same data in the real-world". Deducing from this, the current study although agrees to the above definition, adds to suggest that; data quality is the degree to which the data reality evenly meets data expectation, its intended user needs and objective with Conformance to establish quality Standards or properties. In this definition, data reality represent how data exists in the real world settings, evenly of data means free from biased and, data expectation represents the desired features that is required by users for the various operations and decisions. Lastly, the conformance to establish quality standard represent the data ability to comply to known standards and properties. However, based on this description, data can be referred to as poor if the reality of the data does not meet purposes hence not in usage. Hence, it has been observed that most data in several developing countries is poor. This is because the data is often not in use, incomplete, inaccurate, untimely, obsolete, and unrelated to the task and function of local health personnel. This poor data quality in turn greatly accounts for the fact that program planning and implementation in most developing countries are often based on estimation, tradition, and guess work. Braa et al (2012), identifies a clear relation between data quality and data use, he delineates that poor quality in data affects its usage, hence such data will remain poor in quality because the less usage of data often results in its inability to enhance its quality (Braa et al., 2012; Manya et.al.,2015). Therefore, it can be said that achieving the expectation of a data management system (EHR) in the real-world is the basis of data quality. However, there is the need to assess the data from system by examining the usefulness of data in the systems in the real-world to the address data quality related issues (Manya et.al.,2015). Hence, data quality assurance comprises all of the planning and strategic actions needed to ensure the certainty that data from the system meet the quality requirements in the real-world.

As such, the requirement of an EHRs to be able to achieve quality data is also a reflection of data quality properties and component. In much of the literature, quality has been defined through properties including: relevance, accuracy, timeliness, reliability and completeness

2.2.1 Data quality properties requirements of EHRs

The requirement of an EHRs to be able to achieve quality of data is also a reflection of data quality properties and component. These properties must be encouraged and recognized in EHRs usage in order for the system to be able to achieve quality in data. This is because, the quality of the overall data identified by its component with information generated depends on the design (Wand and Wang,1996). and implementation of the EHRs, thus whether or not the EHRs is designed to fit it implemented environment. In recent times, most of the properties used to acknowledge data quality are quite general and cannot typically be used without further elaboration to describe specific properties of databases that might affect analyses and modelling. Most often, quality dimensions including accuracy, completeness, consistency, and timeliness have been associated with data and information quality in perusal of literatures. The reason behind this dimensional recognition is remotely based on industrial experience, intuitive understanding or literature review (Wand and Wang,2006). In a comprehensive review, Wand and Wang identified 26 data quality dimensions. Out of this, the five most commonly cited components are (1) relevance, (2) accuracy, (3) timeliness, (4) reliability, (5) completeness. For example, Orr, (1998) described data quality based on various attributes like accuracy, timelines, integrity and completeness (Orr K.1998). Also, according to the Government of British Columbia, data quality is the state of completeness, validity, consistency, timeliness and accuracy that makes data appropriate for a specific use. In addition, according to the World Health Organization (WHO) guide on data quality, good quality data is described as being accurate, complete, readable, accessible when it is required, and useful for the intended users (WHO, 2003).

In perusal of literatures, specific data quality requirements for EHRs have been recognized by few studies (D'Onofrio &Gendron,2002; Brown &Sonksen, 2002; National Health Service; Orfanidis et al. 2004). Although, the presence of an EHR is Not an automatic guarantee of improved quality of data, the ability for an EHRs to achieve this requirement can enhance its data quality. Hence, the current study adopts the five most commonly data quality properties including; relevance, accuracy, timeliness, reliability, completeness but adds *Accessibility and availability, and* Security and confidentiality to collate EHRs data quality requirements.

2.2.1.1 Accuracy; According to studies accuracy is one of the key most data quality dimensions which appeal very intuitive (Wand and Wang,1996). However, no single definition is accepted on accuracy but most definitions indicate its dependence on the actual usage and purposeful achievement satisfaction. Hence, although accuracy has been linked to correctness of output (Kriebel, 1979), the current study adds to interpret accuracy as the *correctness of the data output to achieve users purpose by representing the reality of the data.* Hence, this study combines correctness and representation of data to know the level of truth over false information in data elements collected from the EHRs looking at rate of missing data, omissions, local data entry process, validity checks. According to the WHO, 2003 report, the EHRs must have in-built checks such as edit and validation checks, which are built to support that the data added to the record are valid. Hence, the remote or original source of the data must be correct and representative of the referred patients in order to be useful by ensuring that what is being documented reflects what really happened (WHO 2003). The quality of the documentation in the patient record is contingent upon the accuracy of information entered into the record by all parties involved in the patient's care (AHIMA 2013). Accuracy in EHRs data can be enhanced and well achieved through the application of documentation guidelines and data standards (AHIMA 2013). In addition, Edits or rules should be developed for data format and reasonableness, entailing conditions that must be satisfied for the data to be added to the database, along with a message that will be displayed if the data entry does not satisfy the condition (WHO 2003).

2.2.1.2 Timeliness. Timeliness is often linked to availability of data output on time (Kriebel, 1979; Wang and Wand 1996). Thus it delineates how current the information need to be, to be able to predict the needs of current users and perspective patients. The make up of an EHR should be as near real-time as possible. Thus, data should be timely, in that it reflects to the present (Orfanidis et al. 2004). Hence, information, especially clinical information, should be documented as an event occurs, treatment is performed or results noted (WHO 2003). For example, medical records of patient should be processed and completed, coded and indexed within a specific period of time upon discharge or death (WHO 2003). If data editing delays the health information or patient results, the delays can affect the use of the data use in general as well as its intended purpose. WHO 2003report identify some examples of timeliness in healthcare data.

2.2.1.3 Data Completeness. Completeness though often linked to the recording of all necessary variable and the absent of missing data element has also been referred to as the representation of every meaningful state of the data in the real world system (Wang and Wand 1996). The current study adopts this definition by Wang and Wand (1996) because in order for data to be complete all the data element must conform to what happened in reality but not just inclusion of all data element that may not have happened in reality. Hence the existence of further data should comply, indicate and possibly link to other data already in the system on the patient to enhance information to be complete (Orfanidis et al. 2004). All required data should be present and pertinent in the EHRs(WHO,2003) as a representation of the reality.

2.2.1.4 Reliability; Although there is no general accepted idea on reliability, it has often associated with consistency and dependability of the output information (Kriebel, 1979; Wang and Wand 1996). The current study adopts the interpretation by Wang and Wand (1996) who delineates it as a "*measure of agreement between expectations and capability and as how data conforms with user requirements or reality"*. This is because the EHRs data has expectations by users, as such in the absence of data contradictions or the presence of data conformance between the reality and expectation the data will influence users to find data more reliable. Hence, EHRs data should yield the same results on repeated collection, processing, storing and display of information (WHO 2003). As such, there should exist consistency between items of multiple data from multiple sources to meet the requirements of what is already in existence such as security, data protection, and communication standards (HL7) (Orfanidis et al. 2004). Therefore, it is imperative that abbreviations are used in the same manner throughout documentation so that the patient is treated accordingly (AHIMA 2013). Hence, data should yield the same results on repeated collection, processing, storing and display of information.

2.2.1.5 Accessibility and availability**;** EHRs data should be made available upon request to authorized stake holders and users including patients, care providers, mobile users, emergency services, and members of integrated care teams and others (Orfanidis et al. 2004). This should be possible through simple interface that support both healthcare professionals and patients to easily access data when there is the need for it (Orfanidis et al. 2004; WHO,2003). The value of accurately recorded data is lost if it is not accessible, hence in the EHRs clinical information should be readily available when needed(WHO,2003). However, Privacy from users with no approval should be strictly maintained, and with recorded documented reasons if there are constraints prevailing of approval (Orfanidis et al. 2004).

2.2.1.6 Security and confidentiality; Data from EHRs must be secure and confidential. Patients should have ideas about who has access to their data and in what circumstances (Orfanidis et al. 2004). Also, the EHRs should ensure compliance with privacy regulations but also supported pliant security measures to protect patient information across the entire wired and wireless environment (Cisco, 2005)

2.3.1.7 Relevance*;* In other for EHRs to achieve data quality, relevant variables must be reliable. Relevant variables are the specific objectives or purpose for obtaining the EHRs data which is often set in mind before purchasing the system. As such data output must meet the primary needs for which the data were collected, added to database, and used, and also should support additional purposes (Herzog et al,2007).

2.3 EHRS IMPLEMENTATION CHALLENGES AFFECTING DATA QUALITY IN DEVELOPING COUNTRIES

Data quality issues usually stem from relatively simple situations in implementation process, hence for an EHRs to be able to achieve the requirement in meeting data quality certain challenges in the implementation environment have to be considered. However, it has been suggested literature that the introduction of HIT such as EHRs, has led to the recording of a greater quantity of bad data instead of improvements the quality of data being recorded (Hobson,2010; Weiskopf &Wing,2013; Bowmen et al.2013). These can be said to be even higher in developing countries where the challenges root from shortcomings such as designing and implementation challenges (Kellermann A. L.& Jones S. S., 2013). Among various literatures some of this challenges are as follows;

2.3.1 Insufficient time

Insufficient time has been repeated in several literature as one of the reason for poor data quality. For example, in the book Nurses Clinical Decision Making, Gurbutt. (2006), cited that insufficient time was the reason why most nurses refused to record and read all record even when they new it will assist them in their decision making. This can be caused by pressure of work, poorly trained and insufficient staff(WHO,2003). Furthermore, many health care professionals such as physicians are under pressure to provide maximum services at minimum cost, hence they may not always see documentation a high priority (WHO,2003). For example, the record department have many pressures on them during the day, for example the number of patients waiting for outpatient/clinic registration or inpatient admission, or the number of medical records waiting completion, which may cause them to take"short cuts"or make errors in data collection (WHO,2003) hence leading to data inaccuracy.

2.3.2 Limited resources; The implementation of EHRs require not just sufficient resources but adequate and efficient as well. However, in most developing countries and even some developed counties, some implementers of EHR systems are often overwhelmed with with the lack of resources and weak healthcare infrastructure (Ibid) required to maintain such system. These may include inadequacy of the resources available for both staff education and the implementation of data improvement measures (WHO,2003). This can also be noted in the report from WHO (2010a) Regional Office for Africa, which identifies the national health systems in the African region having inadequate human and financial resources. Moreover, the lack of regular Power Supply (UPS) and stable internet connection in most developing countries invariably affects any good ICT service provision like EHR (Achampong, 2012). This shortage of resources is in turn responsible for the poor data quality because it implies the absence of more skilled personnel to ensure patient care (Azubuike & Ehiri, 1999) and the maintenance of software and hardware (Lippeveld, 2001).

2.3.3 User acceptance and understanding challenges; For EHRs to achieve data quality, the effective use and the general acceptance of EHRs on the part of users is a prerequisite for a successful EHRs implementation in any healthcare facility (Coeira, 2003; Vikkelsø, 2005). However, among perusal of literatures there are evidence indicating the difficulty relating to acceptance and usage of EHRs by by physicians, nurses and other healthcare professionals (Crownower and Rosenbaum; Orfanidis et al. (2004)). Poor computer literacy, the lack of trust and the perception of EHRs being a distraction which impedes the physician's focus on the patient are identified by Orfanidis et al. (2004) as possible reasons relating to the difficulty in acceptance by some healthcare personnel. In addition, Schumacher, Berkowitz, Abramson and Liebovitz (2010) identified 'failure to use human factors design principles' as a major factor that impede usability and user acceptance in their use of EHR. Hence, Chau and Hu (2002:308); suggested that in other to enhance EHRs users' acceptance, management in the health facility needs to work out a plan for cultivating positive attitudes toward using the technology Crownower and Rosenbaum (1998) conclude that the best way to achieve acceptance from users is by enhancing user participation and their role the user community in the development cycle of the EHRs. This is because with the EHRs the role of data quality does no longer rest largely on HIM professionals, but everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records will be tasked with ensuring data quality (AHIMA 2013).

2.3.4 Poor data abstraction or mining

Even with single record, some health care professionals are often discouraged the practice of examining large pre-existing databases in order to generate new information because of the fear of how it should be done or the uncertainty data source (Terry K, (2015) Most physicians are not certain about the anticipations that EHRs will improve the quality of care (Terry K, (2015); Orfanidis et al. (2004). It is often difficult for most providers to enter patient data consistently not to think of extracting the once in the system they may not even trust to result in a reliable health information on the patient. This is more serious in cases where by multiple records are kept on the same patient either by different system say both manual and electronic or from one facility to another there is a possibility of limiting the overall collection of meaningful data about an individual patient. For example, in a situation where by various department such as cardiology, oncology and social work, insist on having their own records system (WHO,2003).

2.3.5 Resistance to new technologies

Health care professionals just like professionals in other sectors often taken by a fear that integration of new EHR systems into existing work practice might alter existing work practices, or interrupt workflow (WHO, 2010). As such they turn the resist the change by adopting the practicing their old working culture even with the introduction of the new technology. Thus healthcare professionals turn to defy new technological developments like EHR that may threaten or slow down their job particularly in cases where the organization introducing new EHR anticipates reducing staff strength and cost of operation (Achampong, 2012) or introducing the EHRs as a stand alone possibility towards data quality of data. This greatly affects the the quality of the data from the system.

2.3.6 Poor user participation and educating health professionals on their roles in EHRs data quality

The healthcare industry as a whole is made up of different professional with various roles. Hence, for healthcare organization such as a hospital to fully enjoy benefit from the potentials of an EHRs and it ability to improve data quality, there is the need to ensure that roles of various users are well communicated and understood with necessary participation to achieve data quality. Unlike in the paper base record system where the role of data quality rested largely on HIM professionals, with the EHRs everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records will be tasked with ensuring data quality (AHIMA 2013). Also, 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. However, studies have shown that the result of inadequate resources in developing countries restrict the ability to thoroughly involve users and clearly educate them their roles towards achieving data quality. This, in turn, suggests that an EHRs should be educated as should an actor with proactive role and users being the other actor with their roles within which the EHRs is used so as to better integrate with users' working practices (Orfanidis et al. 2004).

2.4. SOCIO-TECHNICAL ASPECT OF EHRS DATA QUALITY

A socio-technical approach to the notion of quality also includes the human dimension. A socio-technical approach acknowledges that the system is made up of people, tools, and conversations joined together (Coiera, 2003), and organizational or technical systems cannot be designed independently of each other (Coiera, 2004). The reason being that the health care environment is multifaceted, implying that different groups use various technologies in complex ways (Cresswell, Worth, & Sheikh, 2010). As such, AHIMA (2013) identified that with the introduction of EHRs unlike the PBRs, the role of data quality no longer rest largely on health information management (HIM) professionals, but everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records will be tasked with ensuring data quality (AHIMA 2013). 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 achieving EHR data quality. However, studies suggest that users are often thwarted with apprehension emanating from shift from paper based records to EHR.Hence, users' reluctance to adapt to new technology (Fitzgerald, Piris & Serrano, 2008) has led to the poor usage leading to it inability to achieve data quality. Chau and Hu (2002:308); suggested that in other to enhance EHRs users' acceptance, management in the health facility needs to work out a plan for cultivating positive attitudes toward using the technology. In many developing countries like Ghana, the concerned for data and quality of care has not been overlooked at, yet quality improvements interventions such as EHRs have been slow in implementation partly because quality improvement activities have received inadequate priority by some care providers. Hence, a socio-technical will help cultivate a plan that will enhance the role of everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records by aligning their interest on the work required in order to facilitate the meeting between the technology and the work practices to meet quality expectations. According to ANT, stability, technological and social order, are continually negotiated as a social process of aligning interests (Aanestad & Hanseth, 2000; Monteiro, 2000). Hence, a sociotechnical approach through ANT in particular contexts support the researcher to try to trace to understand the processes whereby relatively stable networks of aligned interests are created and maintained, or alternatively to examine why such networks fail to establish themselves (Walsham, 1997).

2.4.1 ***The Actor Network Theory (ANT)***

ANT is seen as an approach that seeks to conceptualize the relationship between technology and societies. Hence, it is identified with social scientists to investigate the social and technical aspects of an institution that include people, organizations and technology -all enmeshed in a network (Monteiro, 2000; Walsham, 1997). However, on the bases of the underlying projections and assumption that use of IT in health care will improve data quality management, information flow and the quality of care, it can be argued that health services research especially evaluations of complex IT systems in a healthcare organization like the EHRs at the hospital benefit from being informed by ANT (Cresswell, Worth, & Sheikh, 2010). This is because ANT is an extremely effective tool for analyzing the processes by which inventions and technological systems such as EHRs come into being, or fail to materialize (Manya 2015). As such, ANT can be useful in exploring changing power relationships in relation to work practices, health care reforms, and IT introduction(EHRs) at the Hospital. (McLean & Hassard, 2004). ANT views an information infrastructure (EHR) as both an actor in the organization 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). These, actors have various perceptions and interests and the stability of EHRs depends on the ability to translate the different actors' interests through a process of negotiation to an accepted fact (Law,1986). Consequently, because the EHRs at the Pentecost Hospital are socio-technical systems (Coiera, 2004) and by implication IIs too, the latter could be analyzed in the light of ANT to enable a better understanding of the respective roles different actors play toward data management at the hospital. In this vain, the activities of an actor (both human and non-human) are conceived within a network, but not as acting independently (Aanestad & Hanseth, 2000).

2.4.2: Some Key Concepts of ANT

2.4.2.1 Actor (or actant;) An actor is one who is counted on in the network; cannot be ignored but relates to other actors, because of the actor's role or influence (Law, 1987). Actors include both human beings and nonhuman actors such as technological artifacts (Walsham, 1997).

2.4.2.2 Inscription; refers to how technological artifacts or objects embody pattern of use (Akrich, 1992). Inscription includes program of action that defines the role to be played by actors and also used to describe the vision of the development and use of new technology. Monteiro (2000) argues that artifact is always interpreted as an appropriated flexible, and that the notion of an inscription may be used to describe how concrete anticipation and restrictions of future patterns of use are involved in the development and use of a technology. Thus inscriptions can be flexible or not depending on the context in which they are used

2.4.2.3 Translation; This concept of translation involves *"creating convergences and homologies by relating things that were previously different"* (Callon 1981; 211). That is to say it involves collaboration, compromise, and negotiation between different users with different goals depending on the available possibilities. 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. Hence translation aligning with each of the various actors in such a way that by the end, the different users reach their own respective goals. 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). This means that the occurrence of a successfully aligned network depends on how successful actors translate each other's interests. The latter is very vital because amongst several possibilities, actors would only select that which in their own eyes would help them arrive at their goals (Latour, 1987)

CHAPTER THREE

THE RESEARCH SETTING

3. INTRODUCTION

This chapter illustrates and provides a picture of where this study was carried out. It begins by presenting the profile of Ghana, the study site and the structure of its health system. The study site was however chosen by the researcher because the researcher had a vision to study from the perspective of various departments or units directly using the EHRs. With this in mind, a much bigger hospital was not ideal since all departments could not be thoroughly studied. As such, although the Pentecost hospital is not one of the biggest hospital's in Ghana, it is one of the few private hospital with a full EHRs implementation which have been in used for 8 years. The study site was also selected because of its proximity to the researcher's residence of stay thereby reducing the expenditure of the researcher.

3.1 The Profile of Ghana

The study was conducted in the Pentecost Hospital-Madina (Ghana). Ghana, formerly known as the Gold Coast; because of abundance of Gold, is a West African State sharing borders with neighbouring West African States; Togo on the east, Cote d΄ Ivoire on the west, the Atlantic Ocean and the Gulf of Guinea on the south and Burkina Faso on the north. Ghana was the first sub-Saharan country in colonial Africa to gain independence in 1957. 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.

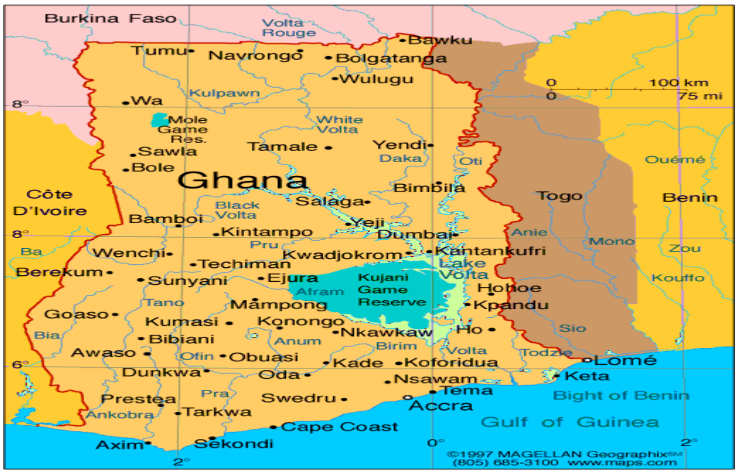

Figure 1; Map of Ghana showing major towns and countries it shares borders with.

3.2 The Profile of Pentecost Hospital

Pentecost Hospital, Madina was established in May, 1997 as Alpha Medical Centre. It is currently the La Nkwantanang Municipal Hospital, receiving referrals from other clinics in the municipality and beyond. Pentecost hospital has been duly accredited by the National Health Insurance Scheme Board. The overall mission of the hospital is to provide affordable and quality health care to its clients. The hospital has 12 full time medical officers including general practitioners and specialist like Dermatologist, surgical specialist, obstetric and Gynaecologist, Ophthalmologist and Internal Medicine specialists in different stages of post graduate training. The hospital was one of the few hospitals who adopted EHRs in its early stage. It adopted EHR system in 2007 and have been operating since its implementation. According to the hospital administrator the reason for the purchase was to improve the data management system and to improve healthcare and data quality. Currently it is among the few hospitals with an active EHR system which is working thoroughly throughout the facility. The hospital has been proven reliable partner for Clint's offering services in several health care areas. The centres OPD attendance increased from 17,794 in 2005 to 89,336 in 2011 and the number currently is much higher than in 2011 necessitating the expansion of the facilities. Currently the Key staff include 12 medical officers, 56 nurses, 18 midwives, 9 community health nurses, 28 enrolled nurses, 24 health assistance,4 anaesthetists and 98 others.

Figure 2: Directional chart and the gate of Pentecost Hospital

Staff Category	Number Represented
Hospital Administrator	1
Doctors including specialists	12
Community Health Nurses	9
Anaesthetists	4
Nurses	18
Midwives	55
Enrolled Nurses	28
health assistance	24
Casual workers	98
TOTAL	245

Table 1. The Staff composition of the Pentecost's Hospital as at the time of data collection

3.3 Healthcare Delivery system in Ghana

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 and Ghana Health Service are the two legal institutions responsible for regulating healthcare practices in Ghana. 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. 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 that 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). Health care is mainly financed by the National Health Insurance Scheme (NHIS). This however requires that people to pre-register with the NHIS in other to enjoy the benefits offered by the scheme. While all government health institutions deliver health services on the scheme, accessing health services from some of the private and mission based institutions is based on "cash and carry system". However, few some private hospitals like the Pentecost hospital accept the NHIS just like the government hospitals. In providing healthcare services, the health facilities in Ghana are required by law to ensure increase in the access to quality healthcare whiles managing resources available for the provision of healthcare prudently. A report on the health sector in 2010 indicated that, there were about 343 hospitals; 156 were privately owned and 96 were government owned (Ghana Health Service, 2010). There were also 11 polyclinics, 2,083 health centres and clinics, 389 maternity homes, all distributed across the country. (Ghana Health Service, 2010). On the number of healthcare professionals across the country, the Ghana Health Service report further revealed that, in 2008, there were 1,180 medical officers, 31 dental surgeons, 1,129 pharmacists and 9,775 professional nurses (Ghana Health Service, 2010). Hence the small number of healthcare professionals as against a total population of 24,685,823 million people (Ghana Statistical service, 2012) is an indication of low health professionals to population ratio. For instance, the doctor to population ratio was 1: 11,929 with nurse to population ratio also being 1:971 as at 2009 (Ghana Health Service, 2010). There is a problem of unequal distribution of healthcare professionals. Health centres in the urban regions are stocked with more qualified health professionals to the neglect of the rural regions.

3.4 Electronic Health Records System in Ghana

Ghana has not been left out in the global interest of using ICT to harness health care delivery. Like most African countries, Ghana is revolutionizing its healthcare system to include ICT and its applications to improve care delivery and facilitate the access to quality health by its citizenry. Ghana, unlike in the past can now boast of a nationwide electronic health management projects, this is because it 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). Others EHRs include DHIS, IHOST, Healthfore and HAMS (Afarikumah, 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 Ghana to use ICT in improving its healthcare system cannot be overlooked. There is no standard regulatory framework for e-health practices in Ghana. In view of this, the Ministry of Health facilitated a report dubbed e-health strategy for Ghana. 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; 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).

CHAPTER FOUR

METHODOLOGY

4. INTRODUCTION

This chapter gives insight overview of how the whole research process was planned and executed, thus detailing the entire research approach adopted for the study. The study adopted the qualitative research approach in which interpretive research methods were used during data collection. These consisted of observation, interview and document review.

4.1. Qualitative Research Method

This approach was chosen with the aim of gaining an in-depth understanding of the problem under study by investigating the various roles and behavioural perspective of the users of the system and the context within which they acted to contribute to data quality with the system. Traditionally, the two main approaches to research work are the quantitative and qualitative (Robson, 2011). However, deciding on which research approach to adopt in a particular study is a function of multi factorial consideration including the research focus, nature of participants, the expectations of the researcher and others. According to Cohen, quantitative research is defined as social research that employs empirical methods and empirical statements. He further indicated that empirical statement as a descriptive statement about what “is” the case in the “real world” rather than what “ought” to be the case. Moreover, Robson (2002, p. 81), enforce this by seeing quantitative research design to be associated with the fixed research design which requires a close blueprint laid down before reaching the main data collection stage. As such, it is recognized to be more 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 pre-specified effect” (Stoop & Berg, 2003; 463). Although, quantitative approach is widely used in information system studies, the study approach is mostly criticized to rather view information system research as within the view of technology (Gallies & Land, 1987). As such, it is seen to ignore the relationship between the context, human behavior and the technology (Benbasat et al., 1987). Hence, qualitative research approach which focus on the understanding of an existing phenomenon from the view point of the participants in relation to their specific social and institutional context (Robson, 2011; Stoop & Berg, 2003) is a burgeoning approach in information system studies. This is because qualitative research involves much of systematic study and detailed study of individuals in his or her natural settings, instead of in settings constructed by the researcher. According to Creswell(1994) qualitative methodology as an approach, useful for exploring and gaining deeper understanding of a social phenomenon such as a social or human problem, based on building complex, holistic pictures, formed with words, views of informants and conducted in natural settings. This is supported by Kaplan & Maxwell, (2005) with the idea that the regular usage of open-ended interviews will enhance to elicit detailed, in-depth accounts of the interviewee's experiences and perspectives on specific issues, situations, or events.

Also, unlike quantitative research 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. As such, it can be said that the design of the study is built, evolved and developed to be whole as the study proceeds and it allows for rich, relevant and accurate data collection from the participants (Robson, 2011). This makes this approach very flexible as researchers are not restricted to a particular format throughout the research work. In this study the data under assessment is created by various human interface with various data needs and usage. As such, it is important to understand the complexity of the EHRs as a result of it integrated parts among users. Hence, a focus on complex interdependencies and system dynamics that cannot meaningfully be reduced to a few discrete variables and linear cause effect relationships (ibid) should be considered for such studies. With this, qualitative research which allows the researcher to directly contact the people, situation and the general phenomena under study (Patton, 2002) is the best approach for the study. However, given the different stances of qualitative research (Klein & Myers, 1999) interpretive research approach (Klein & Myers1999; Walsham, 1995b) was adopted to in this study among the three main Paradigm within information system research which include positivist and critical research (Orlikowski & Baroudi, 2002). According to Meyers (2008), Positivist qualitative research delineate on the idea that social reality is objective, independent of theoretical explanation and can be tested while the researcher should be a detached value free observer for the object of the study. On the other hands the critical paradigm focuses on identifying and challenging the ordinary and traditional methods of research (Myers et.al 1997). It challenges the established social practices and considers the complex relationships between human interests, knowledge, power and form of social control

4.2. Interpretive Research Approach

Interpretive research method was applied during data collection because what we know or perceive to know in practice maybe our own interpretations of the reality or our expectation not the actual reality. Interpretative research method considers knowledge as a product of social construction (Klein and Myers 1999). However, social reality is social construction and access to this reality is through language, consciousness and common shared meanings (Myers 2008). Hence, this method does not predefine dependent or independent variables, does not set out to test hypotheses, but theories and judge on the abilities of the research to explain the relationship between the factors constituting the social setting and these can be derived only by in-depth examination of the phenomenon and processes (Walsham 1995). However, it is important to identify that there is no clear distinction written between these two researches in order not to draw attention to overlaps. Walsham (1995) correspondingly indicated that qualitative research in a way could be interpretive or positive depending on the philosophical assumptions of the researcher. Hence, in this study I briefly address this confusion by indicating that, interpretive research is more appropriately viewed as a subset of qualitative research. This is because '*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...."* (Trauth ,2001). Although interpretative studies have received several criticisms about its quality and validations, it is very well applicable in this studies based on the 7 principles identified by Klein and Myers (1999).

These seven principles are based on the fundamental principles of the hermeneutics circle, this being the first principle 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). These principles aided as a guideline in my data collection on data quality of the EHRs at the Pentecost hospital. It also inspired me to interact freely with the various actors involved. The aim here was to build trust from participants while I concentrated on the numerous interpretation and other suspicions which will be compared to observations and other informal discussions to enhance information accuracy from the various actors with different data roles and needs. These principles are elaborated as follows.

4.2.1. The Fundamental Principle of the Hermeneutic Circle

This principle proposes that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. Hence, shared meaning of the whole context is built from the interactions between the pre-understanding of the researcher and the participants of the context (ibid). This principle of human understanding is fundamental to all the other principles. This principle 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)

4.2.2. The Principle of Contextualization

This principle requires the researcher to critically reflects on the social and historical background of the research setting, so that the intended audience can see how the ongoing phenomenon under study was created. Therefore, according to Klein & Myers (1999), there is the need to detail the historical background of the setting for understanding by its intended audiences.

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

This requires critical reflection on how the data was socially created through the interaction between the researchers and participants of the study. The aim here is to produce reliable and deeper insights of the research setting which may not be revealed when the researcher solely concentrates on historical secondary data (ibid). This can be seen in the case of Trauth (2001) when she explains how her understanding improved as she became self-conscious and started to question her own assumptions.

4.2.4. The Principle of Abstraction and Generalization

This principle supports an interpretive researcher to relate the data interpretation from respondent through the application of the previous principles to general theories and concepts that describes the nature of human understanding and actions. This reflects the discussion of Monteiro and Hanseth‘s (1996) findings in relation to Latour‘s Actor Network Theory.

4.2.5. The Principle of Dialogical Reasoning.

From the reflections in Lee (1991) describing how Nardulli (1978) came to revise his preconceptions of the role of case load pressure as a central concept in the study of criminal courts several times. This principle requires the detailing or sensitivity of possible contractions between the researchers' pre-conceptions or knowledge supporting the research design and the actual findings generated from the story which the data or the researcher gives.

4.2.6. The Principle of Multiple Interpretations

This principle inspires the interpretative researcher to highlight the different perspective and interpretations of the participants. In doing so, the possible variations among the data participants are clearly presented in multiple narratives or stories of the same sequence of events under study.

4.2.7. The Principle of Suspicion

The last principle cautions the researcher against possible biases and systematic distortions in the in the narrations and stories collected from the participants. (Klein & Myers, 1999).

4.3 Qualitative Interpretive Research Approach and its' Rational to Case Study

In a qualitative case study, the researcher explores the case or any other entity bounded by time and activity such as a program or an event and collects detailed information through a variety of data collection procedures over a period of time. 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"*. From the above discussion of the 7 principles, I agree with the view of Yin (1994), that case studies are much preferred research strategy to answering 'how?' and the 'why?' questions in research work. Moreover, case study which is a vehicle for interpretive investigation (Klein & Myers, 1999; Walsham, 1995b) attempts to highlights on an identified phenomenon by researching in-depth of the case to an identified phenomenon. Such case can be an individual person, an event, a group, or an institution. Further, this view is supported by the interpretative school of thought as noted by Walsham (1995). This made me foresee the need to look at how the EHRs(HAMS) was implemented at the Pentecost hospital and why HAMS? I became so interested in this questions because I wanted to know the basis of the EHRs implementation to know as to whether data quality improvement was an ultimate goal of the implementation. As such, I adopted a qualitative research approach with an interpretative case study approach for my research through observations, interviews and informal discussions among various departmental staffs at the Pentecost hospital directly using the EHRs(HAMS) to unravel the impacts and challenges relating to EHRs usage towards improving the quality of EHRs data, its ability to support primary and secondary usage and the ways to improve data quality to achieve user satisfaction from the view of different actors through multiple sources.

According to Yin (1989), case studies can be derived from multiple sources; *documents, archival records, interviews, direct observations, participant observation and physical artifacts*, which helps in capturing as many variables as possible from a homogeneous group or social context under study. This is much enhanced with the adaptation of qualitative research approach with an interpretative method as described above because it enables more freedom when conducting a case study because of its flexibility in choice of methods, use of theories and altering or arranging your research questions according to the available data and their relevance to the study. Hence the adaptation of these design and approach will help the researcher to evaluate the study site and system thoroughly by bringing out every detail of the system in the context.

4.4. DATA COLLECTION

The empirical data in this study were collected from June to July 2015 through interviews, site observation and informal discussions. Before I went for this field study in Ghana June-July 2015), I did a pilot survey through phone calls and emails among three hospitals that uses the same EHRs. This was the Tamale teaching hospital, the Pentecost hospital and the Korlebu teaching hospital.

The gathering of data for the study started with a literature review, searching for related studies that had been done before in order to gather the basic information about EHRs and data quality. I searched and read more articles on the Internet to familiarize and acquaint myself with the research topic and read other articles about the EHRs usage in Ghana. These updated my background about the EHRs and other related on-going ICT projects in Ghana. The main search engines I used were the Google search, Google Scholar, PubMed and I availed myself at the library services for reference books. Search phrases EHRs, EPRs, healthcare data and data quality.

Upon arrival and visiting the various hospitals, I choose the Pentecost hospital because the hospital had 8years consistent usage of the system and its proximity to the researcher's residence of stay thereby reducing the expenditure of the researcher. Also I saw the possibilities of involving all the department directly using the system for data collection since all I needed was the permission from the administrator to access all departments unlike the other bigger hospital where I needed various departmental approval which was delaying the study progress. An introductory letter indicating that I was a student of UIT, written by my supervisor was presented to the hospitals Administrator. He was very welcoming and wanted to know more about my study. As such, a proposal was submitted to the administrator who later approved my permission for the study. He then took me to the head of the Records Department personally who also later took me around to the other departments; where I was introduced and had a very welcoming response from the various departmental heads on post. I started the study right from there; sitting at a position where I could observe and hear what was going on in there. The administrator gave me thirty names of health professionals I could talk to. He further took me around to introduce me to some of them. However out of my curiosity I did not follow all the list but rather tried seeking personal permission from the others. Hence the study which was supposed to take me in a week took about 72 hours in two weeks to complete the data collection processes. In addition, relevant articles and governmental policy documents were also reviewed. Ethical Approval was taking from the Pentecost hospital and Participants were informed about the purpose of the study and verbal consent was taken.

Despite the different sources from which data could be collected, McNiff (2002) contend that, the method used to collect the data must always be appropriate to the type of the research being conducted and that, the method used must be able to collect data to answer the research questions and to achieve the research goals. To ensure the likelihood of high accuracy in research, there was 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 hence adopted the dimensional, purposive and convenient non-probability sampling techniques in the selection of respondents to represent the study population. Here, two steps are considered, firstly 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. However, since the hospital is fragmented into various departments or units, these techniques was used to identify the actual departments directly using the EHR system through the Hospital's Administrator. The overall goal here is to provide a framework for drawing a purposive sample representative (Arnold, 1970) of the hospital under study. As such, *purposive sampling* was used to identify the actual users from the dimensions (various departments) since not all members within the dimensions are actual users of the EHR system. In addition, the researcher used convenient non-probability sampling to include as much users as possible due to the shift system in the various user departments. 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). Furthermore, with the aim of using data to answer the research question and to achieve the purpose of the study, single or multiple data collection method (s) can be adopted by the researcher. However, Oates (2008) emphasized on the use of multiple data source position to enable the researcher to understand the phenomenon of interest from broader angles. As such, the current study employed multiple data collection strategies. This is because the researcher was of the view that multiple data collection strategies will help supplement each other, in case of inaccuracy in one method the other can help validate it accuracy. The strategies adopted in this study included interviews, observations, informal discussions and photographs.

4.4.1 Interviews: interviews could be described as fully structured, semi- structured and unstructured, however semi structured interview and unstructured interview are widely used in flexible designs (ibid). According to Robson (2011) *interviewing as research method typically involves you, as researcher, asking questions and, hopefully, receiving answers from the people you are interviewing"* (Robson, 2011; pp; 278). He further delineated that the use of interview as a primary tool in data collection could be used together with other data gathering tools (Robson, 2011). Hence, it has been regarded as the method of choice in qualitative research (Potter & Hepburn, 2005). In this study, most of the interviews were semi–structured and unstructured. The unstructured were largely in the form of informal talks to get clarity of issues that were not clear to me. In total 20 was conducted on the field and 3 before going to the field. All the 20 participants interviewed on the field was face to face and the other three which was on phone was used when the researcher was looking for the best hospital to suit the study.

4.4.1.1 Profile of Participants

Here the researcher present the participant of the study based on factors such as age, sex, professions, working experience, level of education employment, among others.

No of participants	Age Range	Sex M/F	Profession	Working Experience (Years)	Level of Education	Experience with EHRs
1	30-40	M	Hospital Manager	8	Masters	6
2	30-40	M	Head of Record department	12		8
3	30-40	M	Staff record department	10	Diploma	8
4	Above 30	F	Staff record department	12	Diploma	8
5	Below 30	F	Staff record department	8	Diploma	8
6	Below 30	F	Staff record department	8	Diploma	8
7	Above 40	F	Nursing manager	14	Diploma	8
8	30-40	M	Nurse	12	Diploma	8
9	30-40	M	Nurse	10	Diploma	8
10	30-40	M	Nurse	8	Diploma	8
11	40-50	M	Pharmacist	6	Degree	8
12	40-50	M	General Practitioner	12	MD	8

13	30-40	F	GP	10	…..	8
14	40-50	M	GP	16	MD	12
15	40-50	M	Surgeon	22	….	8
16	30-40	M	Optometrist	14	….	8
17	40-50	M	Dermatologist	18		14
18	30-40	M	Data Manager	12	Diploma	12
19	50-60	F	Lab Technician	28		8
20	30-40	M	Lab Assistant	8		8

Table 2 indicating profile of participants

4.4.1.2 Drawbacks during Interview

The draw backs of this study stems from the researcher experiences relating to the difficulty in booking an appointment with various respondents. I had to wait a bit longer ranging from days to weeks waiting for response from the requested interview. As indicated earlier out of the thirty names I had only fifteen gave me an appointment. And among this number three of them couldn't make it to their appointment. So, I needed to carry out alternative interview with some of the users outside the list and this was difficult because I was doing it on my own with the help of the administrator or record or data manager. As such there were times I needed to describe the whole projects again and even elaborate on my program of study since it was new to most of them. Also, most respondent just wanted to say positive answer to every question to especially those I was introduced to by the administrator. Hence, the researcher adopted another strategy of asking further question about the reason for most answers the respondent gave and some of them still refused to give you a clear point. Furthermore, some respondent did not really see the need for research work and as such did not want to participate in the study. The reason according to them was because it is not used in practice. This was expressed by participant 2 as:

> *Clinical research? Where will it go to, I don't think that was the purpose for the purchase of the system. The hospital wants to know its productivity and improvement and the system is serving that purpose from the data we retrieve. We are tired of so called research work, every year Ghanaian student are doing research but have not been able to produce anything to prove their study (participant 2).*

4.4.2 Observation: ***S***ilverman (2005) identified observation as been fundamental to understanding another culture. The researcher also employed observation as a data collection strategy to complement the interviews, Hence the researcher observed the participants, how they interacted, their routines, rituals, temporal elements or critical incidents, interpretations and social organization. This was informed by the suggestion of Denzin (1989) as to what to observe in a field study. In all, I conducted 12 hours of observation; seven-times visit to the hospital; spent 40min- 60minutes time together with the users in the system. For example, the picture indicates how the researcher observed insurance validation check through the EHRs.

Figure 3. Observation on insurance validation claims at the hospital

Furthermore, during the time that I spent observing users at the OPD and the record department. I noticed how they are currently working with the introduction of the system, I watched their work routine; by reflecting my previous exposure to the routine flow of work prior the EHRs(HAMS). This was also supported with the interview which was done earlier about how working routine was before and after the introduction of the system. I further observed how they collaborated with other users from other departments. I got the chance to ask questions during these observations, to write down as much notes as possible about the activity and the discussions that were going on; at the same time wrote down the artefacts used, how they were used, by whom and in what situations. Hence lots of ***informal discussions*** were carried out.

Although I used my phone as a tape recorder, I also used handwritten field notes which were transcribed immediately afterwards, usually later the same day. This jotting down of notes assisted me in recollecting events, personal impressions, thoughts and interpretations on some occasions.

4.4.3 Photographs: This was used to obtain pictorial evidence for the study. My phone was also used as a camera in order to document situation where it was difficult to describe in words such as the users' working areas and the software the users were using in the system. This was very helpful later in my analysis as some of the pictures proved contrary to what I gained from the interview. Example; with all the bed capacity the hospital had some patient were sleeping outside the compound of the hospital and were exhibiting several sign and symptoms which were not been observed or documented by any care giver.

Figure 4. A photograph indicating patient was sleeping out unattended at the hospital contrary to responses made.

4.4.4 Reflections on the Data collection- The Researcher and his Role

As Atkinson (1995) wrote in his book, to be able to understand a cultural domain such as medicine, it is often necessary to acquire some degree of "insider" knowledge because in the exploration and analysis of a domain such as medicine, it is virtually impossible in the absence of the will and capacity to make sense of the technical content of working knowledge. Quality dimensions is an area I took special interest in, when I was looking more into the health care delivery system in Ghana. My motivation to undertake this study was stemmed from my findings and result of bachelor thesis on "assessing quality of health care delivery" which ascertained in the findings of the need for more adaptation of EHRs and my experience with hospital administration. Through this familiarity, my role in the data collection could be described and would give me the privilege to be an “insider”. Hence, being an insider, I felt very competent to be an accurate observer due to my experiences with publication on EHRs. Also, I had the opportunity to hold a seminar with some providers where I elaborated more on telemedicine and e-health. Most participant especially doctors were interested in the Clinical Decision Support Tool(CDSS) I introduced as a benefit of EHRs. In addition, the familiarity of the administrator who introduced me to most participant as “a researcher and a student from Norway” made me experience Some user`s trust and this contributed to a relaxed atmosphere during the interview. The users easily opened up their experiences, which resulted to more information that I obtained from them. However, this was not the same everywhere as the researcher later had to look for participants who were outside these sects.

4.5 DATA ANALYSIS STRATEGY

According to Biggam (2011; p. 236) analyzing qualitative data is *“not a linear activity and requires an iterative approach to capturing and understanding themes and patterns”*. Also, Robson (2011; pp. 468) identified that, analyzing 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 analyzing of words in the form of narratives or accounts from respondents (Ibid).

Therefore, to easily analyze the data generated from this study, interviews and informal discussion used in study were structured according to themes to reflect the main objectives of the study and this aid an easy way of analyzing transcribed data. The themes; which are a set of inter-related topics all directed at the overall data quality assessment with the introduction of the EHRs. This was used to reflect what is already in literature and supported by existing theories. The data generated from the study was hence analyzed based on the themes that includes; impact assessment of EHRs on patient care delivery and as a data quality enabler at the Pentecost hospital, data quality-related challenges relating to EHRs(HAMS) and ways and implementation strategies to improve the quality of healthcare data through EHRs. Also, 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 context 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 generalization were further linked to theories, literatures or constructs.

4.6 REFLECTION ON THE STUDY APPROACH

The growth and the success of every organization immensely depend on reliable record generation and data management. Inferring from this, EHRs has been acknowledged as the key vehicle on which health care delivery is centered to keep proper data management with the aim of enhancing quality of data in the healthcare industry. However, based on the history, culture and limitations of data recording and the recognition by EHRs (HAMS), there is the need for quality human interface to be able to achieve its intended objectives and quality improvement purposes (www.infotechsystemsonline) with no studies in Ghana underpinning its data quality outcomes. The study adopted an interpretive case study, which enabled the researcher to gather data from the participants' point of view. This approach was most suitable for the study due to its ability to reveal the participant's social construction in using the system and the perceived benefits of the system. Furthermore, the researcher referred to the seven set of principles for interpretive research approach which served as a framework in evaluating the validity of data and tried to explain how this set of principles had been applied in this study.

The study applied the ***Principle of the hermeneutic circle"*** which serves as a guidance to these principles, to repeatedly transcribe and analyze the results of interviews. Moreover, the study applied ***the principle of contextualization*** by ensuring consistency in seeking meaning into the social and historical context or background of the research setting. This was particularly relevant in understanding the introduction of the EHR and its impact on both patient care and data quality as compared to the formal record keeping practices in the hospital. With regards to principle three, "***The Principle of Interaction between the Researchers and the subjects***" the fieldwork was also characterized by the interaction with the participants through interviewing, informal discussions and observations to understand the impact of EHRs on patient care delivery and as a data quality enabler at the Pentecost hospital, data quality-related challenges relating to EHRs(HAMS) and ways and implementation strategies to improve the quality of healthcare data through EHRs. Furthermore, with the ***principle of abstraction and generalization*** the notion on II and the ANT, were applied in the interpretation of data that had been collected. This principle guided me in understanding the phenomena behind the EHRs, for instance, EHRs technology have the same qualities as II. While in ANT, I was able to identify the different actor`s role in EHRs and data quality. Also this principle was identified in chapter 5. Here the findings of the study were limited to the study context, although it could be useful for hospitals with similar characteristics with the hospital of study. The fifth principle of ***Dialogical reasoning*** was done in discussions based on the findings of the study, the theoretical preconceptions guiding the study as well as the literatures reviewed. As pointed out by the principle of '***multiple interpretations'*** data was collected from different categories of users and analyzed critically by cross examining their responses on similar issues such as their response on the accuracy and completeness of data with the EHRs. Furthermore, from the ***principle of Suspicion*** in order to remove possible biases and distortions in the information from participants, the data was gathered anonymously from multiple sources such as interviews, observations, photographs and informal discussions. All in all, these methods adopted by the researcher to collect the data were appropriate because they yielded answers to what I was looking for in this study, thus it helping me to reach my goal.

4.7. Limitations to the study approach

The reliability of the study approach is also questionable especially with the use of interviews as the main data collection methods. This is because interviews rely solely on personal opinions of the respondents which are open to poor memory recall, bias, and inaccuracies. However, these issues were in part addressed following the 7th, ***the principle of Suspicion*** by gathering anonymously from multiple sources such as interviewing different categories of users and supplementing the interviews with other data collection methods, like observations, photographs and informal discussions. In addition, a considerable number of respondents were also contacted on the same issues to reduce such effects.

CHAPTER FIVE

THE FINDINGS OF THE STUDY

5. INTRODUCTION

This chapter presents the research findings and the interpretations of the data collected via observations, interviews and informal discussions at the Pentecost Hospital. From the adopted methodology, data was collected from the staffs of various departments directly using the EHR system(HAMS) for documentation and data management at the hospital. This includes the record department, Patient wards, Laboratory department, consultation rooms and others. The presentation of findings will follow a presentation of the Case study, and findings relating to EHRs data quality from the Pentecost Hospital.

5.1 Introduction of HAMS^{TM} at the Pentecost Hospital

In 2007, Pentecost hospital with the vision to provide a more quality healthcare to its customers through quality information management and also to meet the National Health Insurance Authority (NHIA) campaign on the general changes in technology to address insurance claim issues implemented an EHRs known as HAMS. The goal here was to help improve the entire record system of the hospital and also to achieve quality data to meet the need of it stakeholders (individual, groups, organizational bodies and other users) such as NHIA. According to the hospital administrator, the reason for the purchase and implementation of HAMS was based on its efficiency, user friendly and contributing innovative nature in some major hospitals in Ghana to meet their administrative and management challenges.

5.1.1 The Hospital Administration and Management System (HAMS^{TM})

Developed by InFotech Dot Net System Limited (IDNS) Ghana, HAMS is a client server solution which is designed using a Microsoft Visual Studio and a Microsoft Dot Net framework which serves as the front-end portion of the system. This is purposely designed to serve the administrative setup and structure of hospitals. As such, HAMS aimed at bestowing quick, easy and secured access to information and data, assisting administrative decision making, bettering the quality of information and reporting with unbeatable accuracy to boom productivity and faster backpedalling of management and relations with external agencies and other stakeholders and others (www.infotechsystemsonline). To achieve this, the developers used the crystal Report Writer, an inherent part of Microsoft Visual Studio, in designing all HAMS reports. In addition, outstanding technical features such as immense data security, certainty and integrity, eminent ease of interoperability with other external Systems, user friendliness, system flexibility, continuous user support and maintenance and others are incorporated in its adaptation. Owing to this objective and successful productivity in some major hospitals in Ghana, it has been implemented in over 40 hospitals and its implementation is still ongoing. Practically, the HAMS solution is categorized into modules reflecting the basic needs of its various users and can also be implemented autonomously of each other. This includes, the eFolder Management module, the patient Registration and Record Management deliveries, the Consulting Room Management module, the Investigations Management (Laboratory, X-ray and Ultra Sound Scan) module, the Birth, Death and Referral Management module, the Ward Management (Admissions and Discharges Processing), 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) and the Management and other Reports modules.

5.3. The implementation of the EHRs

The introduction of HAMS at the Pentecost Hospital came with an expected working routine at the hospital in other to achieve its objective. However, it implementation based on the various responses from various department, can be said to be a top management approach. This is because the decision was taken by management and communicated to the various heads of department and was subsequently through staff meetings about the managements’ intention to purchase the system, the reason behind the purchase was communicated to the staffs. Hence, training was giving as such, the training lasted for one month based on level of IT experienced and user needs. According the Administrator, the change was very necessary as a result of the challenges identified in the hospitals data management system though the system was perceived to be quite expensive. As such the decision was made as it was identified by the board as the only way of solving the administrative and data management issues of the hospital based on a visit and survey to some bigger hospitals like Eastern Regional Hospital and others already using the system in Ghana. When a participant was asked why the direct users were not added in the decision making to know their readiness? The participants stated that;

> *The decision was made by board of directors and communicated it to the heads of department of various units and engaging the heads to a larger extent reflects the engagement of all users though they could not give their suggestion but people in the board of directors are more knowledgeable since most of them are professional in healthcare. We just can't include everybody you know? (three participant)*

Also, out of the twenty respondent only four was included in the decision to purchase the system, fourteen out of the sixteen respondents at the various department were not worried about their absence in the decision making. Among them, twelve believe that such decision is the job of management and not them and the other two delineated how they will have absolutely nothing to have contributed even if they were invited in the decision making because they have no prior idea to ICT and EHR. However, the two who disagreed were senior stuffs who indicated their level of readiness was poor in the initial stage because they were not oriented and employed with that and suddenly had to learn it usage within few weeks. Hence for the fear of running into unknown errors cause some users to leave the systems' usage to those who felt comfortable using it. This was a bit confusion especially when the system providers highlighted that quality output from the system depended on usability. Surprisingly, most of such users were nurses and some physicians who are the key to recording patient information. Hence the researchers further interviewed users about their satisfaction with the system. Although eleven out of twenty respondent indicated that they were satisfied with the system with reasons related to the systems ability to reduce costs and facilitating Insurance Claim, errors, enabling quick access to patient records, privacy and safer prescription enhancement. Observation and further responses indicated they did not trust the data from the system. For example, two of such respondents delineated that;

> *some user's attitude towards the system does not make me trust the information sometimes and always want to verify again because some just make entries to fill space in the records.*
>
> *With all the issue of transcribing and wrong entries by some users, there can be lots of errors so I preferred the manual one where I use to see in their hand writing and be certain about validity.*

However, others who were dissatisfied indicated the over exaggerated expectation they had from the system thinking it was coming to make their work so easier but the system has unfortunately increased their work load more than they had.

5.3.1The Routine Workflow at the Pentecost hospital via HAMS^{TM}

The day-to-day functioning of the hospital through the system is based on the module and the technical features incorporated in HAMS. At the Pentecost hospital when a patient enters the hospital the patient is supposed to go to the record section where an efolder will be created or retrieved electronically. This is recognized from the ***efolder management module***. This calibre was developed 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. This 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. Old client's records are assigned a new cell unit and number, which is re filed according to the new number issued by the system. The location of the folder is generated by HAMS using the identification card number. Before the allocation of a cell unit to a patient, the patient's bio-data such as name, date of birth, gender, OPD number and NHIS (National Health Insurance Scheme) number are entered to generate a patient's folder location tag which is printed and pasted on the folder. This is done through *the* ***Patient Registration and Records management module***. 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. With this all services offered to the patient is identified easily by other stakeholders like NHIA in identifying insurance claims. On the issue of the folder or efolder, the patient is directed to the insurance verification center which is attached to the records unit, where his or her finger print is used on the verification machine to check the insurance validity. This help to ensure the validity of sponsored period and validate the clients who fall under the various medical insurance using their unique identifications issues by the sponsors. Here the ***Pay group and Service charge Management*** module is used in the capturing all services giving to insured patients affiliated to a medical sponsorship registered with the hospital. These insurance organizations may either be a private insurance companies, private companies, nongovernmental organizations and the public insurance scheme (NHIS). However, for a non-insurance holding patient, payment is made at the revenue collection point also attached to the records section.

Figure 5. A figure showing the finger print verification for checking validity of insurance card

Afterwards, the patient is directed to the nurses who takes their vitals who document on the system the patient vital signs, basic symptoms treatments, new medication, and change of medication, nursing interventions, information on pending procedure, investigation, discharge and usually verbal orders given by medical officers on ward rounds and other nursing documentations required. This however varies whether the patient is an in-patient or out-patient. They do this by login in into the system with their unique user name and login

Figure 6. A figure showing some of the record taking at the ward upon the arrival of a patient.

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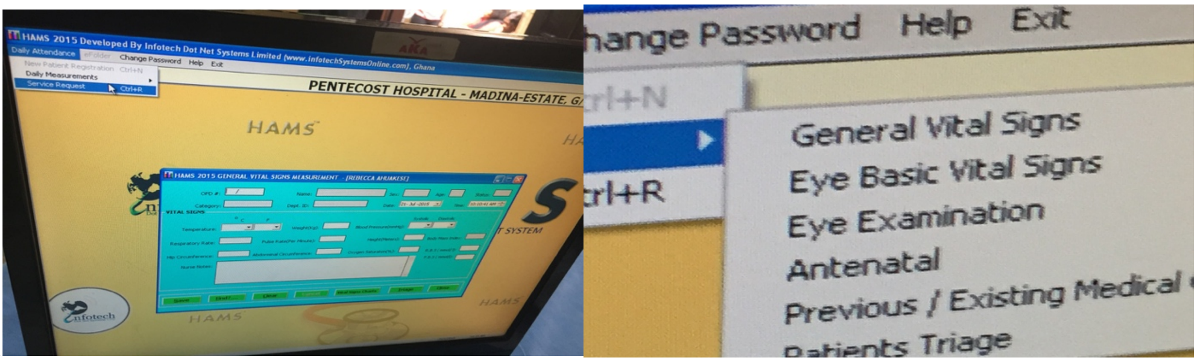

However, with the in-patients not all the patient information is to be documented during the care processes, some are written in folders and submitted to the record department where the information is transcribed on the system. Normally, the nurse directs the patient to the available physician for a medical consultation or diagnosis, dependent on the service requested without knowing the particular provider who will attend to him or her. The patient upon arriving to the medical consultant will give his or her card number to the consultant to retrieve his full details through the patient record module. Here diagnosing or consultation details is recorded on the record system by the medical consultant. 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. Here, the laboratory technician can only login to add result of the examination but can not see details of patient diagnosing and other details. This is a result of the data security measures incorporated into the system. A patient with insurance who does not need further examination moves straight from the consultation room to the Pharmacy for the prescribed medication by the doctor they consulted. However, those without insurance goes to the revenue unit where the total bill is accessed there and is being paid by the patient before he/she proceed to the pharmacy unit. The revenue unit uses the ***Billing Management module*** to generate patients' bills invoices and payments, services due amount rendered to insurance holders and total amount generated from the non-insurance holders. Afterwards, the ***Pharmacy and Dispensary Management module*** is used by the pharmacists and dispensing technicians in managing the dispensary of prescribed drugs and expendables. Even though, this module should serve as an alert tool to the pharmaceutical unit in relation to the side effects of drug, level of in-stock and expiry dates of drugs on the bases of the reorder level and the recorded expiry dates. However, the module is currently only 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.

5.3.1 Key Technical Features in HAMS^{TM}

5.3.1.1 Data security; HAMS recognizes the need for data security of the system. Hence, among the various users of the system, each of them is to be assigned with user names and password, environment settings and start up command. The created passwords by users are uncarted automatically when creating them. with that when user's login, the system automatically will request for a password after a valid user name and the user has a maximum of three attempt to login. Moreover, with the start-up command the users were limited and assigned access levels to the type of menu they can call and what data entry screens they can access. In addition, a report of log activities can be produced as and when required because there is a general system log that records all users who accesses and operates the system with specific details on the username, the type of operation, Date, & Time of login and time of logout.

5.3.1.2 User Friendliness and Flexibility; Without having to learn any of HAMS commands, the user-friendly menus incorporated in HAMS enables various users to approach data entry screens, reports and processing tools. various users can do assorted task by choosing options from menus. Menus may be menu bars and pull downs, they are anchored, and therefore will redisplay when an activity is completed by a user. A menu bar is the menu that display on top line of the screen, and a pull down is the one that displays below a selection in a menu bar. HAMS creates various menus for various users unlike some available application software which comes with one general menu for all users. As such, user can give a data entry person and an account with different sets of options. However, for security concerns, there can be restriction on access to specific menu selections or to entire menus. With this, users can only access the purpose which he is permitted to perform.

5.3.1.3 Interoperability with other external Systems; the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged is well considered in HAMS SQL which is significant to its philosophy of integrated data resources – common, transparent ways to manage information across hardware and software boundaries. It is an industry standard tool for data base management. The ability of HAMS to work with any of the major industry leading standard database management systems (DBMSs) as a backend makes it flexible and easy for Hospitals to decide which DBMS backend they want to use for their data and information storage and needs. The integration of HAMS and SQL has produced a pre-eminent front-end for database servers. The database server architecture promises much greater efficiency and performance.

5.3.1.4 Multiple-User, Multi-tasking; The HAMS encourage a flexible means for various modules to run at the same time, at distinctive work posts. As such, distinct work posts can also run the same module concurrently. The number of concurrent users depends on the type of User-license acquired. User licenses are available in packs. Each pack increases the availability of users by five. The only limitation to the maximum number of users is your hardware. HAMS will accommodate as many concurrent users as your hardware will permit.

5.4. DATA MANAGEMENT AT PENTECOST HOSPITAL via HAMS^{TM}

This section of the presentation focuses on the way data is managed at various department with the introduction of the EHRs

5.4.1 Record Keeping; Record keeping with the introduction of HAMS have been a transitional stage from data disorganization to data organization. This is because the issue of stocky storage, difficulty in finding folders and others was a problem of the past according to the responses from the participants. However, it was observed that the department still had a lot of folders in their shelves even in the era of the HAMS. The question that came in my mind was why then do they have all these folders here? From further interview it was revealed that the patient wards still keep folder for patients. According to the 2nd participant:

> *The reality is that the hospital cannot totally stop using manual folders, as such we still keep the manual folders mostly from the patient wards although we do everything electronically here (participant 2).*

However, participant 3,4,2 and 5 at the record keeping department defended those at the out-patient ward with the reason that they cannot type everything that goes on in the nursing care process. This include nursing interventions, information on pending procedure, investigation, discharge and others. According to participant 7 and 9, they know they are supposed to record this electronically when they are done. Yet, they do not always do this because they feel tired after attending to a lot of patients. As such, according participant 3,4 and 2 they still need to keep the folders as back up, in case the information on the system is not enough or not completed when it required for the patient care processes. In spite of the persistent existence of the folder usage, all respondent admitted that the quantity of folders has reduced unlike in the past when record was kept only manually. In addition, retrieving patient data has been much easier with HAMS (participant 2). This is because with the patient details on the system we are able to use their unique numbers to easily locate the folder. The participant delineated further as:

> *Currently our storage room is not overcrowded, we have clear data entry processes and standards such as abbreviations are well known in the department to prevent such mistake. (participant 2).*

From the responses, it can be said that the routine data storage and extraction has improved very well as compared to the past. In all, the five respondents at the record keeping said their way of organizing data has been good.

Figure 7. A figure showing folders still stored at the record department with the system in place

5.4.2 The Nursing Documentation; Unlike the Paper based record where the nurse manager each morning had to read the day and night report book to familiarize herself with the happenings at each of the wards, With HAMS she is able to access and summarize daily report by the close of work because she is able to supervise daily nursing interventions without compiling books to read later. These makes it easier for the manager to prepare monthly statistics on admissions, discharges, and the number of operations done, grouping them into major, minor and day cases which is forwarded to the Hospital Statistician.

Interviews with various nurses showed a positive acceptance especially among the senior nurses who said the system was easy to use and has saved a lot of time. However, some junior nurses complained of how they have to type too much into the system, thus discouraging them to record. As such, although they document some information with the system like the vital signs and others, not all important information are documented. An empirical case was identified by participant 9 who said that

> *This morning the doctor asked me why the drug was not given to the patient on bed 6, However, the nurse who left duty before I came told me she gave the drug to the patient but was not documented. (participant 9)*

To ascertain a rightful position of the respondents, random sampling of two in- patients' data on the system indicated that, most of the nursing interventions were not documented but the basic documentation and assessment finding were documented on the system. When the researcher asked the participant 10 the cause of that, the participant said:

> *Yes, it is true, this happens sometimes because we use the folder along with the system. As such some nursing intervention and others are written in the folder. This is because the nurse attending to a lot of patient cannot carry the system around to write all such information. This is to be documented afterwards but they mostly forget because of work load. (participant 10)*

5.4.3 Physician Documentation; With HAMS, the physician uses the System to enter, modify, review the patient's medical diagnosis and history by looking back at his records on the system and adding or documenting the new case on the system. Hence all necessary new information about the patient is added to the existing data before he makes prescriptions for the patient. However, documentation of patients' examinations and diagnoses are also recorded in the system by the physicians at the various consulting units. With this, patients do not hold any form of paper to the pharmacy but the pharmacist retrieves the prescription straight on his system. In this manner, this prescription has improved in a much safer way and as a result reduced errors associated with routine tasks such as repeat prescribing. With this, documentation on prescription has improved unlike in the past. However according most of the physicians interviewed (4 of 6), they described that typing has been a problem to them as it is seen to slow down their work processes. This was elaborated by participant 14 as:

> *The system has been good, yes we all know especially with prescription and others stuffs but the typing is too much and it makes some patient uncomfortable knowing that you are typing everything they are saying. That reduces their confidentiality and they feel reluctant to say too much. (participant 14)*

Also, participant 13 describe further that:

> *I was not trained to be typing and working you know? But I have to adjust to it and trust me it has not been easy but we are trying our best, it's just that it is slowing down consultation and what will we achieve if we get quality data but not quality of the care given to the patient. Sometime I concentrate on the patient before typing. (participant 13)*

Further, they elaborated that, although data sufficiency has improved than before, there was still incomplete data related issues. However, the physician who participated acknowledged the fact that records on patient has improve way better than it was. Specifically, the issue of multiple folders on one patient is no longer a problem at the consulting room. Also, out of the 6 physicians interviewed 5 of them indicated insufficient knowledge on record keeping but limited their level of Information technology to medical related issues. As such, EHR usage and typing documentation were not incorporated in their academic curriculum at the medical school.

> *We have been trying our best to learn faster and catch up with good typing skills because it is part of us now, but this was not part of my training in medical school. But I am sure with time it will improve. (participant 12)*

5.4.4 Laboratory Documentation; According the responses at the laboratory, with the introduction of HAMS the incompleteness or misplacement of laboratory test results affecting clinical care process is no longer a big problem again at the Pentecost hospital. With the current system patient's lab and test results are entered directly in their patient's records and this allows easy retrieval and reference when required anytime at the hospital. As such the respondents indicated the current available structured lab result with the introduction of HAMS contributed in assisting providers' ability to make real time decisions about the patient's care. This was delineated by a participant 19 as:

> *Now lab issues are very less, patients do not hold their lab results again to be given to the doctors. It is retrieved directly on the system by the physician in his office and any details that has to be known by the patient is giving to him by the doctors. This has helped a lot as reliable patient lab result from us contribute a lot in his or her care delivery.*

5.5. IMPACT OF THE EHR ON HEALTHCARE DELIVERY AT THE PENTECOST HOSPITAL

Here the researcher wanted to know the impact of the system so far since its introduction. The responses from the interview and personal observations indicated various benefits of the EHRs (HAMS) across the various departments using the system. Although some users perceived the system to have increased their work load, majority of the respondent perceived it to have reduced their work load and challenges associated with their use of paper based records system. This include:

5.5.1Reducing costs and facilitating Insurance Claim; From the respondent, the systems introduction has reduced previous expenses through decreased paperwork, reduced duplication and also enriched the hospital's insurance claims. From personal observation at the insurance section, the system security was able to easily detect insurance card which did not belong to users visiting the hospital with their finger print and this has helped the hospital to retrieve all such money from fake card users. In an interview with participant 2, the respondent described that:

> *We do not have problem with our insurance claims again because we are able to detect double users with our verification machine'.*

Also other responses indicated reduction in hospital cost. Participant 4 delineated that:

> *The system has really come to help, now we do not have to be buying more folders and pens, employ more staffs in the folder room and all other expenses that we used to have with the paper work. (participant 4)*

5.5.2 Reduced errors; According participant 2, 4,9,8 and 18, the introduction of the system has reduced the problems of errors made previously in the paper records. When the researcher wanted to know the reason for their stand, they delineated that the system prevents some duplication error especially in prescription and treatment. When asked further about such duplication the respondents were not so specific but gave responses such as:

> *a lot (part 4), ooooh errors are under control now (participant 2), like over dosage of drugs (participant 14) , more duplicate have stopped oooh (participant 9)*'

From observation although they agreed of error reduction only one was specific and clear with drug dosage. The oooooh in a conversation in Ghana shows a level of uncertainty. Also other respondent expressed their gratitude with the system indicating the existing data help them to easily make references preventing them from making some minor errors like spellings of drug and names.

5.5.3 Enabling quick access to patient records; Some respondent also indicated that the introduction of the system has made it easy to retrieve patient information, which would not have been possible with the paper records as cited by participant 3 as:

> *I don't have to search all day for a folder I may never find, sometimes we step on other folders to look for other ones. It was not easy retrieving patient's folders you know? But now all those stress is over.* Participant 3)

Also, participant 5 expressed this as:

> *….. it has made it easy to locate patients' folder and it has reduced time waiting as well, it makes us so fast at the record section and with it patients no longer complain of time wasting. (participant 5)*

Furthermore, participant 15 highlighted further that:

> *Although sometime I may ask for other documentation outside the system because patient information may not be completed, most of the time I get all details I want from the system in my own office without asking for any details from anybody. In such situation I enjoy using the system so much. (participant 15)*

Also a patient expressed his joy in the way he is quickly served with the present system at the record section. In his own words he said:

> *I do not stand here longer these days when I come to the hospital, I am very fast as compared to those days when I had to join a long queue before I get my folder. oooohhh now they are fast'.*

5.5.4 Enhancing privacy and security of patient data; The indication of the EHRs introduction privacy and security was acknowledged by all respondent during the interview. All respondents were certain with privacy enhancement and some even elaborated that it is restricting their work on patients because they do not know everything about the patient. With my personal observation not any user could access any kind of information. I witnessed at the pharmacy where the pharmacist really wanted to know the patient's history before giving the drug the physician prescribed for the patient because he felt the patient was too young for such drug. And the best he could do was to ask the patient some questions from the drug counter again which was not supposed to be done. This was further highlighted by participant 1 as:

> *I am very sure of the security of our patient's information now unlike the past when every detail about the patient was in one folder which could easily be picked by one person who may never return it, or may be gotten wet by water or any other issue. But now even not all staff can access all information on a patient. (participant 1)*

5.5.5 Enhancing safer and reliable prescribing; From the responses, the system proves a much safer way of prescription, with the e-prescription at the hospital although it is to only the hospital pharmacy, patients no longer see their drugs or try to edit stuffs when they are not too comfortable with the number of medication. Physician were very confident in their responses as they were certain the right prescription they gave will be giving to the patient and nothing else. This was expressed by a respondent as indicated below.

> *I can be certain about prescription in this hospital, trust me it is one thing I can be so sure of. it is much safer than before. it only becomes a problem when the link breaks-off. (participant 13)*

5.6. EHRS AS A DATA QUALITY ENABLER

Generally, because EHRs data are entrusted with the ability to ensure a more accuracy in healthcare data, the latter is aimed at identifying data quality properties at the Pentecost Hospital via HAMS. Based on the five most common dimensions (accuracy, reliability, timeliness, relevance, and completeness) which appears in most published data quality frameworks with the addition of accessibility and availability.

***5.6.1 Completeness*;** Here, the researcher was seeking to know if the whole of patient health information could be found in the data retrieved from HAMS and also to ascertain how local data entries and storage have been done to meet accuracy validations. The aim here was to know how HAMS introduction has improved data accuracy in the hospital.

In general, although some respondents responded positive to data completeness and accuracy, when they were asked how it was achieved, the researcher realized that all such respondents were giving answers which had nothing to do with completeness and accuracy. According to participant 9, 8 and 2 they gave reasons such as:

> *it is user friendly, it is easy to use, I like it because its fast, it is flexible and others.*

From their responses, the researcher realize they were only trying to give positive response but did not know what they were saying. However, those who indicated data incompleteness and inaccuracy did with empirical examples in their care settings. They reiterated that, the incompleteness of the record currently in the department may be originated from the fact that some patients are not consistent with the information they provided such as names, age, marital status and others causing us to enter information that was later rectified from their insurance claim as false. According to participant 5 this has been our major problem these days. Participant 5 further described that:

> *A lady came here and said she was married and she was 24 years old so I recorded it like that in the system, however upon diagnosing her the doctor called the record section to say she was under 18 and she did that because she was shy of pregnancy. (participant 5)*

Also, response from some participants indicated that, internet failure affects the operation of the department and in effect slows down work processes and may cause data inaccuracies. This was delineated by participant 3 as:

> *there have been issues where the internet is either slow or down, in such situation other users like the nurses or doctors are not able to access the patient history and may contact us to find out if we can retrieve it for them. (participant 3)*

In addition, the style of record keeping in both folders and on the system at the in-patient's wards may often cause data incompleteness because some records may not be recorded thinking it in the other and others will be repeated leading to double recording.

Also, At the patient ward, response from the nurses were mostly negative. Majority of the nurses were not certain with data completeness. In an interview with one of the nurses she said '*Asem ooooo'* this in Ghana means it is really a big issue. According to participant 7:

> *we know we have to document our findings carefully and we do that on the average, but due to inadequate staff and time constraints we turn not to put in our best because the patient safety is more important. Just imagine the situation where you are alone in the ward with twenty patients: how much can you do alone? Sometimes one may forget to*

> *document in writing how much more on the system with all these pressure and workload.* (participant 7)

5.6.2 Accuracy, Correctness and Representation of data; Here the researcher was seeking to know the level of truth over false information in data elements collected from the system looking at rate of missing data, omissions, local data entry process, and validity checks. Also, the researcher wanted to know if the abstracted data for indices, statistics and registries meet the hospital, national and international standards and have been verified for accuracy. In this response, *participant 8, 2,3,5 and 7* were very certain about data representation of the patient and has contributed to further records on the patient. With that they were sure the element in the data at the department is the basic and root of the entire hospital data. When these respondents were asked about their level of certainty, most of them did not have anything to say. However, those who did gave some comments like …

> '*why will the information on patient not be for the patient? Who's name is there….who will it be for then?*' (*participant 3,5,8).*

Some respondent like participant 6, 9, and 4 also said the question did not make sense to them…they indicated that as far as it is the patient's data how can the researcher ask if they belong to them. Moreover, those respondents who indicated uncertainty to represent the patient supported their stand that, the data at the record section indeed represent majority of the patients in terms of bio data and other basic information but not always the case. For example, participant 2 in her own words described that:

> *apart from few issues in the data entry process like wrong basic information from the patient for their own reason which is gradually being identified with insurance verification, the basic data really represent all our patients in our record. (participant 2)*

In addition, at the ward, the nurses indicated that the information recorded on the system mostly has more certainty in representing the patient than the manual one they record. This was deduced from the fact that the vital signs and other things are recorded once the patient comes to the ward, as such it is always done right on the exact patient. However, other nursing activities on the patient care may be done orally and not documented at all but with the mandate to write a report on the patient they are force to remember and write something on the patient's file. With this some information may be written at where they do not belong.

Correctness in the whole data on patient seems impossible to most participants. Although they were to some extent certain about the completed data being representatives of the patient, they were not certain about the correctness of the data. From the responses it was clear that there was no established way of correcting and amending completed data in the system. However, there was a flexibility in changing an information the user entered as far as the user is still logged in. Apart from that anything you forget to add in the patient details after you log out must be taken to the records for transcribing on to the system. This was observed and described by participant 14 as:

> *For now, I cannot be certain if even the complete data in the system is 100% true, you know there are some transcribing issues and misrepresentation here and there and with this issues still in place data may have some true validations but not correct. (participant 14)*

Moreover, participant 16 delineated that:

> *Sometimes, I remember I did not document a particular thing on a patient I saw previously after its reoccurrence with a new patient the next day but there's no way to scroll through the system and the automatic generated text in the note part does not work for me because the patient situation varies a lot. Sometimes I write things on paper in a folder which I may or may not take it to the record section because I do forget as a result of work pressure. I think in reality nobody will be expecting to find correctness or real truth in data with all this mess. (participant 16)*

Also, participant 18 further expressed his frustration as:

> *Hmmmmmmmm sometimes when we are compiling data here at the statistical department we see some issues in documentations from some providers but there is no such alteration in the system of which I can change as a statistician neither can I take it back to the providers to change it. As such, I just keep it like that. (participant 18)*

The Hmmmmmm used by the respondent in Ghana means it really an issue but I compromise to it. Further, it was observed that some patients only give false information at the record section because of insurance claim. There was a situation where a patient gave the name of the insurance card she was holding and the details on it at the record section. This was entered into the system only for the fingerprint machine to detect she was not the one. Some of these cases also contribute to misrepresentation and incorrectness of data in HAMS at the Pentecost hospital.

5.6.3 Reliable and Support clinical decision making; Here the researcher wanted to know constancies in data from the system and how they enhance clinical decision making or a decision support tool. From the responses HAMS introduction have been very supportive in decision making. According to the respondents 2,12and 17 although some information may not be consistent, majority of the data collected in the patient records are consistent and this is retrieved to serve as a knowledge base and quick interference mechanism to generate patient specific output when retrieved from the system. However, according to participant 2 this may not be fully achieved because of the reason below;

> *Well like I said we are trying our best but I can say all the information is reliable because just like I said earlier on, some people give us wrong names or age right from the first day of taking their demographic details at the records section because of health insurance claim. This is the only instances I can say such details may not be reliable and affect decision making.*

Furthermore, participant 17 indicated that:

> *I know the system has the ability to improve my performance and outcome on patient diagnosing with real time evidence on particular situation if I rely on it, but I cannot say I always do that, most often there is always a space not filled especially with the in-patient and you have to go back to the old ways to check the folder to be sure of what to do. How can I totally rely on this alone (participant 1)*

In addition, participant 12 described that;

> *With the system the details of patients is the same everywhere and this can be accessed without asking the patient again who may lie in front of you when their current health status is not favourable to them. For example, some under 18 girls come here and add up to their age but I already see that in the system.*

5.6.4 Timelines; Here, the researcher aimed at seeking to know how current the information needs to be; to predict the needs of current users and it availability to all stakeholders when required for both internal and external usage. This was necessary because EHRs data is seen as an enabler to future development of current healthcare systems characterized by the burgeoning participation of various specialist healthcare providers, often working from various sites with different data usage but with the ultimate goal of contributing to the care of the individual patients.

From the response of the participants, most of the data is recorded along with clinical care and this makes data more current which is supposed to meet the current need of users. However, according to participant 13, the system's technical features makes it possible to share information on patient only internally from one department to another but not to other hospitals. However, participant 14 expressed his worry on the effect of some records outside the system making it difficult to access current information for its intended usage. This was expressed as;

> *Being a surgeon sometimes you urgently need a patient's information on a particular issue but unfortunately you cannot request this from the in- patient unit because it is not on the system and it will take them very long to go through their books and get it for you. But this should not be the case in the electronic way of management. (participant 14)*

5.6.5. Accessibility and availability.

Furthermore, the issue of information exchange difficulties prior to the implementation of HAMS was acknowledged to have improved relating to the use of paper record at the hospital. Hence, all participants to some extent agreed that the introduction of HAMS has improved information exchange internally than in the past. Currently the hospital is able to easily exchange most information among various department and providers. This was related to the level of information detailed in the electronic record system. However, information exchange outside the hospital setting is not really in practice, the sharing ability is mostly restricted for privacy reasons and also the inability to share with facilities with only manual record. The 2nd participant describe this as;

> *HAMS has helped us in making proper summary and more details in our record keeping, as such it has improved our potential to share between providers. However, sharing across the*

> *hospital setting is not easily done because of patient privacy and the persistent use of paper base record in majority of other healthcare setting. (participant 2)*

Also, it was observed that, most participants anticipate absolute information exchange and interoperability as something that will not be possible to achieve in Ghana now. Their reason for such anticipation is because, the EHR implementation comes with a strict data security and privacy with clear limit to all users, which must always be considered in data sharing especially with patient information. Hence, such detailed information cannot easily be retrieved unless with authoritative enforcement. Participant 1 expressed this as:

> *We see the need to allow seamless information transfer and data access throughout the hospital but this will require more investment in hardware and software as well, and this will require a lot of money even though it would be cost saving if we were sharing a lot of information with other hospitals. But for now we are aiming more at sharing accurate information among the various providers in the hospital. (participant1)*

5.6.6 Relevance; Here, the researcher wanted to know how important data has been in achieving it implementation objects and other projected benefit. Here, the response of the participant indicated that currently the data collected is more focused with the primary aim of achieving quality of care and insurance claims in the hospital. Participant 16 delineated this as:

> *the system is on target especially with insurance verification and cost claims but other benefits will come along I believe.*

Another participant said

> *With the rate of the incompleteness due to insufficient recording of clinical care information, some of us do not really trust the quality of the data to base on them for further clinical findings. However, I must say it has helped more internally especially on insurance (participant 4)*

However, when participants were asked about the ability of the data for clinical research, they indicated that was not part of the implementation purpose. This was expressed by participant 2 as:

> *Clinical research? Where will it go to, I don't think that was the purpose for the purchase of the system. The hospital wants to know its productivity and improvement and the system is serving that purpose from the data we retrieve. We are tired of so called research work, every year Ghanaian student are doing research but have not been able to produce anything to prove their study (participant 2).*

5.7 DATA QUALITY-RELATED CHALLENGES RELATING TO HAMS AT THE PENTECOST HOSPITAL

Data retrieved from HAMS(EHRs) faces a number of constraints that affect its quality. Hence the researcher aimed to delineate on the data quality related challenges constraining HAMS to achieve a much accuracy in the hospital data. The following were identified,

5.7.1 Poor user participation and acceptance Related challenges; Responses from various participant indicate that, majority of the users were not involved in the decision making to purchase the system and was not thoroughly involved in the implementation stage. Hence this causes some form of acceptance related challenges among some users**.** This was delineated by participants as;

> *The decision was made by board of directors and communicated it to the heads of department of various units and engaging the heads to a larger extent reflects the engagement of all users though they could not give their suggestion but people in the board of directors are more knowledgeable since most of them are professional in healthcare. We just can't include everybody you know? (three participant)*

5.7.2. over exaggerated expectation; the issues of exaggerated expectation of EHRs was acknowledge by respondents as they expected more from the system and made them felt relaxed this was because of the perception that this system would replace the paper documents, and result in a perfect work set up at the hospital. For example, a participant a delineated by as;

> *after everything they said about the system I thought our data related problem were already over with it implementation. I don't even know why you are still asking about the quality of the data in the system when that is why we have the system.*

5.7.3. Time Constraint and Patient Discomfort; From the various respondent HAMS despite all the benefit in a way takes a lot of their time and slow down work processes. While the source of some staff's difficulties stems from the expectation that the expensive technology(HAMS) was to make data and documentation much easier, the reality is that the system rather requires greater involvement at a time when many practitioners struggling to manage the overflow of patients. As such, they end up using most of their time in typing and doing less job on patients. According to participants from the record department they are not always recording everything because of the number of patients waiting for various clinical registration and admissions were sometime too much at a particular period. As such they end up using most of their time in typing and doing less job on patients. Participant 15 indicated the stress in a local expression indicating serious stress. In his own words he said:

> *Hmmmmmm, it takes a lot of times to enter all information on the patient and with the pressure here sometimes I just want to write it down and enter it later into the system. Honestly I feel I was way to faster with the paper based record than the electronic health recording. (participant 15)*

5.7.4. Poor data documentation; Documentation and data content within an EHRs must be accurate, complete, concise, consistent, and universally understood by data users, and must support the legal business record of the hospital by maintaining these parameters. With the introduction of HAMS at the Pentecost Hospital, there have been all sort of challenges relating to data inadequacy, but basically from the responses the root of this inadequacy stems from those doing the data entry thus, the clinicians who are directly involved in the data entry like physicians, nurses and others. From the interview, most respondent especially the physicians expressed their thoughts that, they only care more about treating the patient with the information they are getting but not for other reuse or secondary analysis. With this they take information they will need but not others that may be needed for further analysis. The responses from the participants is as follows:

> *I don't have time asking more information about the patient that has nothing to do with his current health situation, and I cannot record every conversation I had with the patient because there are a lot of informal stuff from the patient which may be considered in the diagnosing but not documented. We are always typing a lot about*

> *patient but we don't really benefit anything serious from this documentation. I was paid to treat the patient and as such I concentrate more on that, not the typing stuff. We are not secretaries but doctors. (Participant 15)*

Moreover, participant 17 delineated further that:

> *I will love to write the full story of the patient sometimes but the typing and pointing and others discourage me from entering everything. I am not lazy but I am not fast with typing because I never learnt it but have been using it on the job and I can't use all the time I have to be typing when I have to treat the patient. (Participant 17)*

5.7.5. poor role definition toward data management at the introduction stage.

From observations and previous responses, the researcher noted that majority of the respondents do not really see the need for data accuracy especially for secondary usage. As such they only see the information they enter into the record as strictly for diagnosing purpose and assume as far as patient is diagnosed and treated he has served his purpose and these perceptions affect their commitment to data documentation. This was express by a participant as;

> *I am not paid to be typing unnecessary information, I cannot type everything a patient says to me because I don't have that time so I write what I can. If you talk about data accuracy that should be the problem of record keeping and transcribers to check the entries made and those we are not able to put on the system directly because of some reasons.*

Also, the researcher identified that the problem of "*I have more important duties*" indicated by most respondent causes most of the data quality related problems the hospital faces. According to some respondent the time spent on a patient is too small to be using it to be typing and writing, this is because there are a lot of patients to attend to and the main aim of the hospital is to save lives and not to do research or manage data. This was express by a participant as;

> *imagine only me during night shift with about 15 patients, do you think even if I was a machine I could record all that happens here during the night ..NO. I just can't after all that was not why I was employed. But it would have been better if we were many you know?*

Also, participant 10 supported this by indicating that:

> *Imagine only me on a night shift with about 20 patients, what time will I use to document stuffs, all I do is move from one patient to another because their condition is very important to me not the typing even though I know I have to write a report but I always write what I remember and so far as the patients are good it is okay. (Participant 10)*

5.7.6 Insufficient documentation guidelines and data standards; Ghana as a country being new in electronic health implementation does not have an affirm EHRs data laws, as it is not yet established in compliance with governmental, regulatory and industry standards because it has no affirm electronic laws as a whole. This would have included those for accuracy, timeliness, and copy functionality that should have been applied to electronic formats. As such, individual users of systems create their own way of records entry and standard mostly in the form of abbreviation. At the Pentecost hospital although there was some form of standard in data management in the form abbreviation, not all users were familiar with these standards. This was because although a particular standard maybe familiar among the Lab and the physician it was not familiar with some nurses and some transcribers. Also staffs had to learn them on the job to be familiar with them as it may be different from their preview work place. This made it difficult for some users to understand some of this standard adopted by the hospital. According to participants the hospital need consistency in the abbreviations used in all departments, especially with the young and new nurses who like to write short hands.

5.7.7 Inadequate personnel and personnel requisite skills to use and operate the system;

Until recently, Ghana was not so much into learning of ICT in the training of health professionals especially the nursing schools and health assistant schools. Also the hospital staffs are still inadequate looking at the number of patient that come in everyday. The situation would have been better if there were more staffs with few personnel with the requisite skills to use the system since a number of users complained of lacking the requisite skills to fasten up their work processes. This was illustrated by respondents as indicated by participant 16 as:

> *Despite the fact that I have a lot of working experience as a physician, I was not used to this technology stuffs in health you know? Although we had good training from the system providers, I still find it difficult in using the system. Sometimes I still write on*

> *paper and take it to those at the record for transcribing into the system and this comes with its own challenges*

In Addition, it was indicated from responses and observation, there was no software operator or representative from HAMS. According to them they have one external person who only come from another region in case they are encountering some software issues. This was expressed and observed by participant 2 as:

> *We do not have a software operator here, all we have is our IT unit, but we always call one from Kumasi to come when there is a related issue in the system and the IT personnel cannot handle it. We do not often encounter challenges so we cannot hire a permanent personnel here for that but we wish there was one in Accra who will be here faster anytime we need him.*

CHAPTER SIX

DISCUSSION

6. Has EHRs has been a data quality enabler to healthcare delivery in Ghana-Developing countries?

literature indicates that for EHRs to be able to be a data quality enabler the real time data must meet not just user expectation but also established properties. Hence the current study assessed the EHRs under study to know how it can be identified with these properties.

Based on the findings of the current study, there were evidential constraints pertaining to the possibility in accuracy especially at the first point of collection of data at the hospital. However, for accuracy to be achieved in EHRs data, the remote or original source of the data must be accurate in order to be useful by ensuring that what is being documented reflects what really happened (WHO,2003). Example, the patient's identification details are correct and uniquely identifies the patient (WHO,2003). In addition, according to AHIMA (2013), the quality of the documentation in the patient record is contingent upon the accuracy of information entered into the record by all parties involved in the patient's care. However, throughout the current study most participant including physicians and nurses indicated that data recording and management is not their responsibility in the hospital but they only take information to assist in diagnosing and patient care and will always care for the patients than waste all the time recording data they may not benefit from but this contradicts AHIMA (2013) who further noted that, with the introduction of EHRs the role of data management is now the responsibility of all direct users of the system. In relation to timeliness, Orfanidis et al. (2004); WHO (2003), identifies the need for the availability of in-time information to meet the present need of the patient especially documentation of clinical information as in when an event occurs or treatment is performed. However, from the findings of the study, data from the EHRs is based on the system's technical features which was identified to be recorded along with clinical care and this makes data more current which is supposed to predict the needs of current users and perspective patients. However, observations and other findings indicated that, this is not well achieved because some folders are still in use which often causes delay for prompt data because data editing and transcription data is not always on time. These according the report from WHO (2003) can affect data usage in general as well as it intended purpose.

Furthermore, although some respondents to the current study were positive to the uniqueness of all necessary data from date of admission to discharge or death identifying an individual patient, the overall findings including observations indicated incomplete patient record, data mismatch and differences with the real world system. This according to the findings was caused by no entry error, misrepresentation, transcription problems, inadequate staffs and work pressure. However, based on literature for EHRs data to be complete, extracted data should comply, indicate and possibly links to other data already in the system (Orfanidis et al. 2004) on the patient with right dates to prove that data is free from missing records or data elements (WHO,2003) and is representing the real world system. Hence it can be deduced that the EHRs under study is still yet to achieve completeness in it data. Also, in order for EHRs to achieved data quality, relevant variables must be reliable. The relevant variables are the specific objectives or purpose for obtaining the EHRs data which is often set in mind before purchasing the system which in this case was to enhance quality data management for quality patient care and insurance claims. Although the participants were not certain about achieving quality data management, the responses to the study indicates that data collected from the EHRs is more perceived to have achieved quality patient care and insurance claims within the hospital. However, it was also indicated that the EHRs data has been used for other purposes like assisting researchers and other governmental institutions like the police in authorized investigations. This is similar with the work of Herzog et al, (2007) who indicated in relevance, it's important that data output must meet the primary needs for which the data were collected, added to database, and used, and also should support additional purposes. Also, the study revealed that the EHRs has yet not supported any internal clinical research as most participants were not interested in research work.

Another property requirement for EHRs to be able to achieve data quality is Reliability. In the current study participants indicated some level of dependability in relation to data storage but were not certain about how reliable the data collection and processing as it often varies upon repeated collection or processing especially abbreviations and this slows down their work processes. Hence most providers did not really depend solely on the processed data because they didn't trust it's consistency. Similarly, findings were made by Crownower and Rosenbaum (1998); Orfanidis et al. (2004)). However, the EHRs should yield the same results on repeated collection, processing, storing and display of information (WHO, 2003) in order to relate with the existing required standards, such as security, data protection, and communication standards (HL7) (Orfanidis et al. 2004). According to the findings participants elaborated that they have individual roles towards patient care and it was not supposed to be their responsibility of collecting and processing data. However according to AHIMA 2013, with the introduction of EHRs the role of data management has evolved from HIM professionals to everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records. furthermore, AHIMA,2013 identified that it is absolutely necessary that abbreviations are used in the same manner throughout documentation so that the patient is treated accordingly.

Furthermore, accessibility and availability is very significant to data quality because prompt data availability can help stop the occurrence of other similar issues or how to handle the already existing ones. From the current study, all participants indicated that, information exchange difficulties prior the implementation of the EHRs has totally improved in the hospital. However, the hospital is currently only able to exchange information electronically among various departments and providers but not outside the hospital setting because of privacy reasons, lack of appropriate tools and other hospitals still running on manual record but often share information manually upon authoritative or emergency request with necessary reasons. This in a way reflects Orfanidis et al. (2004); WHO,2003; AHIMA,2013 who accept that ability to share electronic health information both internally and externally available upon request to authorized healthcare organizations, stake holders and users including patients, care providers, mobile users, emergency services, and members of integrated care teams and others to enhance it quality. Also Orfanidis et al. (2004) indicated the need for maintaining strict privacy from users and the need for recorded documented reasons if there are constraints prevailing of approval. The writers also identified the need for appropriate tools like quality interface to support interoperability. Deducing from the above it can be said that the EHRs under study has enhanced accessibility and availability. However, what value does the hospital get in accessing inaccurate available data? Such accessibility to some extent can be harmful to patients if care is not taken since information being carried out may be incomplete.

It can also be acknowledged from the findings of the current study that security and confidentiality has well been achieved despite accessibility and availability enhancement. This is because the findings indicated that the security features of the system makes it really possible to secure sensitive information, such as fertility and abortions, emotional and others about the patients. Hence the EHRs understudy did not only ensure compliance with privacy regulations but also supported pliant security measures to protect patient information across the entire wired and wireless environment as indicated in Cisco, (2005).

From the above discussion, it can be said that that the EHRs introduced at the hospital have so far had limited effect on data quality considering the data quality properties adopted by the study. However, the major pitfall revealed from the study is the context-related challenges.

6.1 The relationship between EHRs, quality and the contexts where it supposed to be used

By virtue of the fact that quality-related issues are everywhere in the health care system (Institute of Medicine, 2001), it is not surprising that the current study indicated several challenges routing from users and implementation context such exaggerated expectation, inadequate staffs, poor user participation, poor conformance to standards, inadequate role definitions, resistance to change and others affecting EHRs in achieving data quality. Although these challenges exist in previous literature, in this study, the need for the data reality evenly meets data expectation, its intended user needs and objective is very important in achieving data quality. Hence, looking at the various users with different need, understanding and interests to data quality. There is the need to analyze the relationship between EHRs, quality and the contexts, by focusing on aligning users interest and roles on the work required in order to facilitate the meeting between the technology and the work practices to meet their expectations. However, the current study delineated EHRs as an ANT to build a constructivist epistemology to delineate how, where and to which degree the EHRs data is shaped and reshaped by the staff and other social factors (various actors) towards achieving data quality. Hence, EHRs 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. This is because, these actors have various perceptions and interests yet the stability of EHRs depends on the ability to translate the various actors' interests through a negotiation to an accepted fact process (Law, 1986). Also, in the EHRs environment, data stakeholders such as physicians, data manager and others have different understanding and interests of data quality. Hence, ANT holds that from the outset, actors have a diverse set of interests which prompt them to act differently. Therefore, enhancing the network stability, technological and social order to support quality of data would require dependence on the ability of the stakeholder's involvement in the data to align themselves with the central actor's view of the importance of data quality (Manya 2015). However, although EHRs could serve as a good tool in interdisciplinary work to achieve quality data in the hospital, the different actors must continuously negotiate between their varied interests, a process which has proven to be quite challenging. For example, in the current study contrast of actors‟ interests existed between the data management and the physicians-nurses. Here, the physicians and nurses mostly needed data mainly for patient diagnosing and as evidence of patient care where as the data management department desperately needs the complete patient information to aid their monthly statistical analyses which was seen as a secondary interest to the physicians and nurses. As a consequence, they are usually hesitant to recording other details which is seen as not relevant to current patient condition as they see it to be time wasting coupled with cumbersome processes. So, in order for physician and nursing documentation to be of undisputable quality and maximum efficiency, these contrasting interests must be aligned. In other words, all actors will have to translate each other's ‟ interests, meaning that different actors with different goals may collaborate, compromise, and negotiate depending on the possibilities to reach their own goals respectively.

6.2 EHRs Data quality as a Socio-technical system

In complex organizations like hospitals, in order for anything to work, the web of interactions always entails humans (social systems) solving problems with limited resources (technical systems) and working around imperfect processes (Coiera, 2004). Hence, in order to employ and understand the use of IT systems like EHRs in health care to improve quality of data, there is the need to see it from a Socio-technical aspect which recognizes both actors and their need to achieve the ultimate goal. Hence, in the Pentecost hospital the EHRs (HAMS) is seen to involve not only a computer software program but also involves the human interface (users) and a complex array of information systems including basic support systems like communication protocols, data dictionaries, operating protocols, file servers, printers and others which sums up overall achievement of data quality. As such, the EHRs would not work to achieve data quality without people supporting it, likewise if it is not being used properly (Hanseth & Monteiro, 1998). In order to enhance a socio technical aspect to achieve data quality. Also, Orfanidis et al. (2004) suggests that an EHRs should be educated as should an actor with proactive role and users being the other actor within which the EHRs is used so as to better integrate with users' working practices. A such, a socio-technical approach acknowledges that the system is made up of people, tools, and conversations joined together

(Coiera, 2003), and organizational or technical systems cannot be designed independently of each other (Coiera, 2004). Hence, the following need to be considered:

6.2.1. The need to consider users and technology intertwined: The role of users in this intertwined change of technology and practices, and healthcare institutions is very significant in achieving quality data from the system. However, the result indicates that the link between the users and the EHRs was not properly coil, hence users felt that the line of work could be separated from the system. However, as noted in previous research, users or technical systems cannot be designed or used independently of each other (Coiera, 2004). This assertion also reflects in the opinions of Coeira (2003), who considered the physiognomies of human–computer dealings or interactions in a system as essential for a successful telemedicine implementation program.

6.2.2. The need to change practice: result reveal that there were some users who resisted to change their working culture because of familiarity or the fear of the unknown hence were not receptive to the system. For example, some participant indicated they still used folders because it makes them fasters which was later supposed to be transferred by transcribers who often had challenges with hand writing, abbreviations or not being recorded at all. However, studies support that 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 leading to poor data quality. Hence there is the need for management in the health facility to work out a plan for cultivating positive change attitudes toward using the EHRs to prevent the challenge of the fear of the unknown by users.

6.2.3. The need to formalize roles and responsibilities: This can can be identified as the major challenge towards reaching a higher data quality as various users were not certain about their direct role towards achieving quality data from the EHRs. For example, some participant mostly physicians and nurses indicated that their role in the hospital was to save life and not to check on data, hence the saw that to be the work of the data manager and the record department. However, AHIMA (2013) identified that with the introduction of EHRs unlike the PBRs, the role of data quality no longer rest largely on HIM professionals, but everyone from administrative and support staff responsible for specialty applications to direct caregivers who document inpatient records will be tasked with ensuring data quality. Hence there is the need to formalize roles and responsibility in collaborating arena to ensure continuity of record keeping. Also, Crownower and Rosenbaum (1998) conclude that the best way to achieve acceptance from users is by enhancing their participation and role in the user community in the development cycle of the EHRs. Hence, users will see the need to recognized formalizing their informal responsibilities such as oral or manual practices in the course of care giving with the EHRs.

6.2.4 The need for Collaborative Work; Through out this study one major challenge to data quality has been the lack of understanding of the roles played by various users with various interest. However, *the concept of an actors in ANT* elaborate users of the system as various actors counting on one network; cannot be ignored but relates to other actors, because of the actor‟s role or influence (Law, 1987). This will enable users to see how important they are as actors and not just the technology. As such sociotechnical approach will help users of the system to understood the solution to achieve data quality from the system is only by effective collaboration among all users and other social elements involved. Here, the concept of translation in ANT which involves *"creating convergences and homologies by relating things that were previously different"* (Callon 1981; 211) will assist in such collaboration. As such, *translation* enhances collaboration, compromise, and negotiation between different users with different interest looking at the possibilities and the potentials available.

6.2.5 The need for Realistic goals as opposed to exaggerated expectation; socio technical aspects enable users to understand the reality of the EHRs as not an automatic data quality enabler by as studies have shown that IT is usually only integrated with pre-existing systems, but not a process which which changes existing result to perfection (Ellingsen & Monteiro, 2005; Grimson et al., 2000). Hence the issues of exaggerated expectation of EHRs will be well understood by staffs to reduce the perception that this system would replace the paper documents, and result in a perfect work set up but a task that has to be achieved by various actors involved. Monteiro (2000) argues that artefact such as EHRs is always interpreted as an appropriated flexible, and that the notion of an inscription in ANT may be used to describe how concrete anticipation and restrictions of future patterns of use are involved in the development and use of a technology.

CHAPTER 7

RECOMMENDATIONS AND CONCLUSION

The study set to explore EHRs as a data quality enabler and critically appraise to bring out evidence to develop a theoretically informed framework for understanding the challenges and the relationship between the system, data quality and context of implementation in a particular Ghanaian healthcare setting towards the advent of EHRs. The recommendations have been developed to benefit the hospital, as well as future implementers of EHRs and future researchers.

The ongoing introduction of administrative information systems such as HAMS, IHOST, DHIMS and others in Ghana provides a promising basis to improve healthcare data and health information management as a whole. Hence, although the implementation of the EHRs by the Pentecost hospital through the findings of the study revealed that the quality of data from the EHRs under study is quite low as a result of major challenges originating from user- context, the implementation of the EHR(HAMS) by the hospital has been acknowledged as an important step in improving data quality as it has already shown great improvement in managing insurance claims and other improvement including enhancement of patient privacy, reducing time waiting at record section, enabling quick access to patient record, reducing some errors prior the PBRS and others through the system which was part of it implementation objective. However, there is no value in getting quick access to inaccurate data. Although the shortcomings in the implementations remote basically from unfavourable economic situations in the implemented environment of the system. There were challenges relating to user attitude and perception which can be address to improve data quality even with the presence of the general issues such as insufficient staffs.

Hence, the current study delineated on the need to acknowledge data quality from socio technical perspective in other to enhance a common interest with understanding among users on the needs and their roles to data quality. As, the current study proposed the the following was proposed to be considered in other to enhance data quality;

- The need to consider users and technology intertwined
- The need to change practice
- The need to formalize roles and responsibilities

- The need for Collaborative Work
- The need for Realistic goals as opposed to exaggerated expectation

As such, the study propose that the socio-technical approach should be employed when other hospitals in developing are implementing EHRs. This is because in addition to the newly introduced IT system, this approach will help users understand the EHRs as an information infrastructure in which ANT is used to align people's interests with the technology. Hence, there will be the need to educate the users on how and when to use the system, as well as educating users on how the system can support other data quality improvement too. Furthermore, realistic and attainable goals should be set by reducing exaggeration and expectations of the EHRs that the new system will not magically improve data quality problems in the hospital. This will help users understand EHRs as not an automated data quality enabler but that the right collaboration between the various actors which include the users are the ultimate enabler to data quality and not just the EHRs. Otherwise, the exaggerated goals may not be achieved resulting in the system failing, and hence discouragement. This in turn might lead to the abandonment of the system by the users

It is recommended for further studies to examine the role of the various healthcare professionals towards achieving data quality through EHRs especially in the context of developing quality data in health records. This is because the current study found out that as at now most providers still see the role of data quality as a role to HIM and not providers. Also from the adopted methodology, and identified limitations it is recommended for further studies to adopt both quantitative and qualitative research approaches in similar studies to generate diversified responses from participants.

In conclusion, the study reveals that the ability of healthcare institutions in developing countries to achieve data quality is not just the implementation of the EHRs technology as glorified by policy makers but rather a supporting tool to the existing human interface in which the significant of the implemented context including available resources and working culture cannot be over looked. However, this tends to be farfetched in most developing countries due existing challenges that are unique to the population and environment. Hence, the need to consider the context of implementation by aligning their local individual interest to a common interest through encouraging a form of ownership and responsibility to the users towards achieving quality from the EHRs much be acknowledged through a socio-technical approach.

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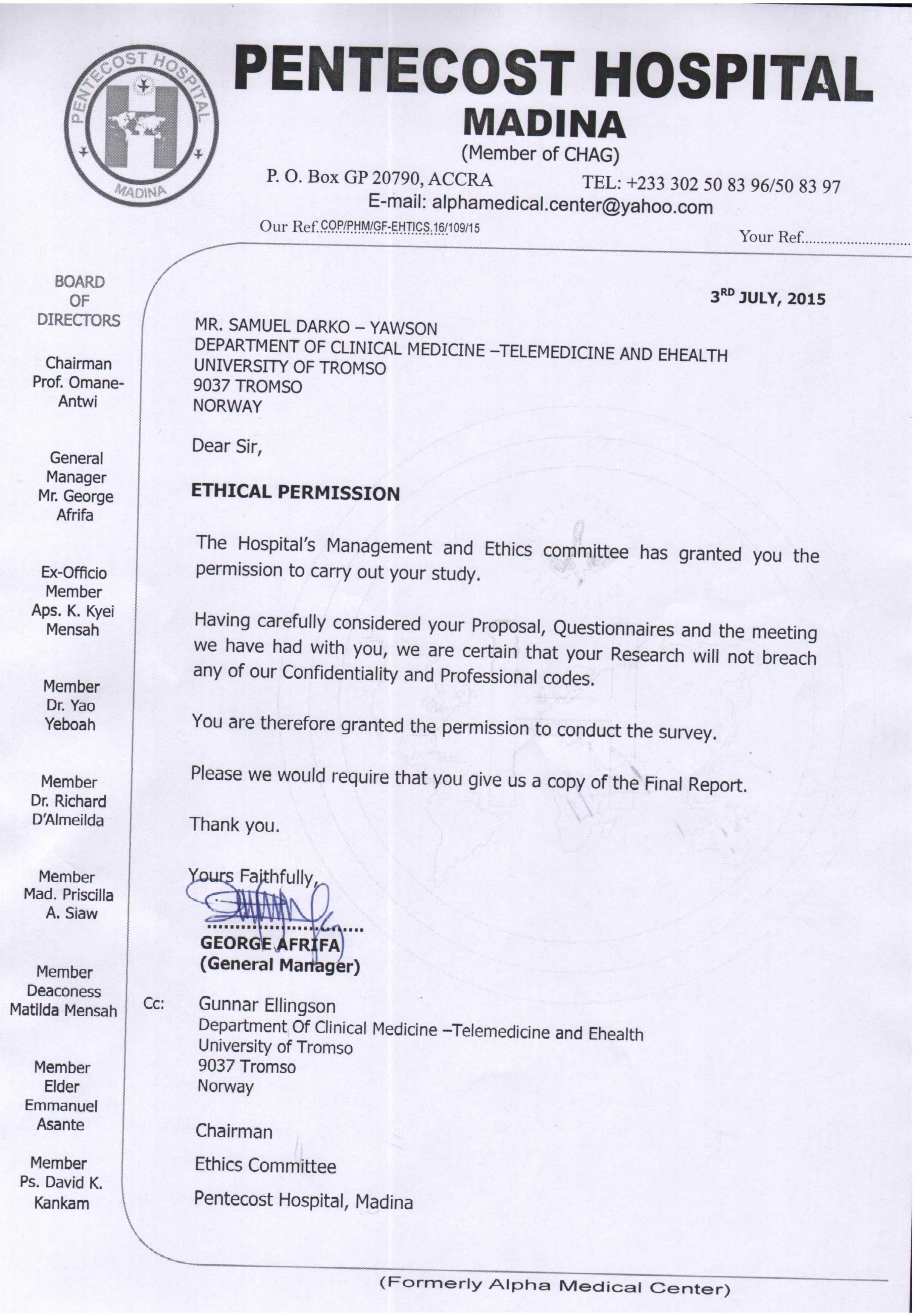
Appendix - Letter of Approval from the Pentecost Hospital.



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Our Ref. COP/PHM/GF-EHTICS.16/109/15

Your Ref...........................

3^RD^ JULY, 2015

MR. SAMUEL DARKO – YAWSON
DEPARTMENT OF CLINICAL MEDICINE –TELEMEDICINE AND EHEALTH
UNIVERSITY OF TROMSO
9037 TROMSO
NORWAY

Dear Sir,

ETHICAL PERMISSION

The Hospital's Management and Ethics committee has granted you the permission to carry out your study.

Having carefully considered your Proposal, Questionnaires and the meeting we have had with you, we are certain that your Research will not breach any of our Confidentiality and Professional codes.

You are therefore granted the permission to conduct the survey.

Please we would require that you give us a copy of the Final Report.

Thank you.

Yours Faithfully,

....

GEORGE AFRIFA
(General Manager)

Cc: Gunnar Ellingson
Department Of Clinical Medicine –Telemedicine and Ehealth
University of Tromso
9037 Tromso
Norway

Chairman

Ethics Committee

Pentecost Hospital, Madina

(Formerly Alpha Medical Center)