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UNIVERSITY OF GHANA - LEGON

ASSESSING THE EXTENT OF ADOPTION AND USE OF ELECTRONIC HEALTH (EHEALTH) TECHNOLOGIES IN HEALTH CENTRES AND INSTITUTIONS IN THE GREATER ACCRA REGION

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DECLARATION

I, AGYENNA KESSE-TACHI, hereby declare that except for references to other people's work which have been duly acknowledged, this thesis is the result of my own research carried out at the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana under the supervision of Professor Kwabena Asomanin Anaman (ISSER) and Dr. Nana Akua Anyidoho (ISSER). This thesis has neither in whole nor in part been presented for another degree elsewhere.

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DEDICATION

This work is dedicated to my industrious wife, Nana Asaa Kesse-Tachi and my sons, Papa Oheneba Kesse-Tachi and Nkunim Kesse Kesse-Tachi, for bringing such warmth, blessing and favour to my life. Indeed, your arrival has been a source of innumerable BLESSINGS.

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ABSTRACT

The World Health Organization (WHO) has noted that the benefits of technology have to be integrated in healthcare delivery in their Health-For-All Strategy which recommends that member countries incorporate health telematics into their healthcare system. The benefits of eHealth are thus underscored in this directive and a similar motivation underlies this study, which investigates the use and adoption of Electronic Health technologies in healthcare delivery in Ghana. The study was designed to achieve three objectives: to establish the extent of eHealth use and adoption, examine the factors driving eHealth use and adoption, and finally ascertain the constraints in eHealth use and adoption among health centres and institutions in the Greater Accra Region.

The study was designed as a quantitative survey with questionnaire research instrument. The population of the study comprised 469 health centres and institutions in the Greater Accra Region, out of which a sample of 82 was taken. These were made up of one CHIPS compound, 50 clinics, four health centres, 50 maternity homes, 17 hospitals and one polyclinic. A sample of 1,640 questionnaires were administered to medical doctor, nurses, administrator/administrative staff, pharmacists, records/attendance staff and laboratory technicians in the selected institutions. The researcher received 810 questionnaires, representing 49.3% of the original sample size of questionnaires sent to respondents.

About 50% of the institutions indicated that they have not integrated eHealth in their operations. Hence, eHealth technologies are not used to a large extent in the health centres and institutions in the Greater Accra Region. Among the institutions that use eHealth technologies, however, the multimedia devices, internet and imaging devices ranked foremost. eHealth is highly deployed in the patient records, pharmacy and laboratory diagnosis departments. Hospitals and clinics administrators ranked as the major professional groups, which use eHealth technologies. The study further concludes that the institutional characteristics and health care manager characteristics have a high influence on eHealth adoption. However, factors related to performance expectancy and effort expectancy only have low influence on the adoption of eHealth devices and systems.

The study also concludes that the major constraints affecting the use and adoption of eHealth were perceived corruption involved in the procurement or the supply chain of eHealth technologies, lack of commitment of the health care managers in instituting eHealth and ignorance about ICT solutions. Accordingly, the study recommends that the Ministry of Health use a bi-partisan approach to roll out eHealth system adopting programmes into the institutions, hospitals and clinics. This can be done through proper budgetary allocation; leverage of favourable professional factors to institute eHealth in the sector; embarking on a programme that integrates software into singular operational entity that ensures that information is not held in silos or stand-alone departments as well as instituting improved monitoring and audit systems to curtail corruption in the sector.

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LIST OF ACRONYMS/ABREVIATIONS

ATU	-	Attitude towards Use
CHAG	-	Christian Health Association of Ghana
CHIPS	-	Community Health Improvement Services
DHIS	-	District Health Information System
DHIMS	-	District Health Management Information System
EE	-	Effort Expectancy
eHCD	-	Health Care Delivery
EHR	-	Electronic Health Record
eHealth	-	Electronic Health
FC	-	Facilitation Conditions
GHS	-	Ghana Health Services
GDP	-	Gross Domestic Product
HISs	-	Healthcare Information Systems
HMIS	-	Health Management Information System
ICU	-	International Communication Union
ICT	-	Information and Communications Technology
ISO	-	International Organization for Standardization
ISP	-	Internet Service Providers
MOH	-	Ministry of Health
NGO	-	Non-Governmental Organization
PE	-	Performance Expectancy
SI	-	Social Influence
SE	-	Self-Efficiency
SPSS	-	Statistical Package for Service Solutions
TAM	-	The Technology Acceptance Model
UTAUT	-	Unified Theory of Acceptance and Use of Technology

WHO	-	World Health Organization

CHAPTER 1

INTRODUCTION

1.1 Background to the Study

Information and Communications Technology (ICT) is fast altering how business, social interactions and medical science are conducted globally. According to Ranta (2010), it has led to improved productivity in several sectors of the global economy, causing a reverse positive effect on ICT innovation and growth. Oshikoya and Hussein (2007) have noted that the deployment of ICT in an economy leads to the creation of effective macroeconomic and public sector management, promotion of private enterprise development and the integration of local, regional and national economies into the global economy of trade and finance as well as the promotion of education and health control (Oshikoya & Hussein, 2007).

ICT is fast gaining grounds as a promoter of efficient healthcare. Dawson (2011, p1) confirmed this observation with the remark that the "usage of ICT to advance healthcare delivery is gaining grounds in both developing countries with weak or unstable economies as well as the industrialized countries". The World Health Organization (WHO) (1998) also recognized the potential benefits of integrating ICT into healthcare administration. In their Health-For-All Strategy, the organization recommended member states to "integrate the appropriate use of health telematics in the overall policy and strategy for the attainment of health for all in the 21st century, thus fulfilling the vision of a world in which the benefits of science, technology and public health development are made equitably available to all people everywhere" (cited by Dawson, 2011, p1). Again, WHO has adopted Resolution WHA58.28, which urges member states to develop long-term strategic plans for eHealth services. In addition, the popularity of

eHealth is evidenced in the establishment of eHealth programmes across the countries in the 53-nation Commonwealth Organization; the enactment of an action blueprint by the European Union to achieve borderless trans-European health information systems by 2010; the launch of "Providing for Health Initiative" (P4H) by the G-7 and Russia, which has eHealth as a huge component (Rockefeller Foundation, 2010). These global efforts indicate that serious efforts are being made to integrate eHealth in the general healthcare administration.

The Royal Society (2006) has also observed the tremendous growth in eHealth. It stated, "the healthcare system will evolve continuously in the next 15 years and that ICT is likely to be both a driver for change and an enabler of the changes needed" (cited by Wallin and Xu, 2008, p 1). Similarly, the Rockefeller Foundation (2010) has observed that eHealth represents an effective means of ensuring quality healthcare globally and narrowing health disparities through appropriate equipping of health care providers.

In spite of the potential of eHealth in simplifying, cutting cost and improving efficiency in health service delivery, it is yet to receive wide-scale adoption globally and in Ghana particularly. According to the Rockefeller Foundation (2010), countries, notwithstanding their different political ideologies or leadership, wealth or health-insurance systems, face similar challenges in their bid to integrate eHealth with the general health administrative set-up. These include but are not limited to "funding, government/private sector co-operation, stakeholder engagement or integration of local perspectives, workable approaches to interoperability, documented best practices, affordable open-source options as well as privacy and security issues" (Rockefeller

Foundation, 2010; pg 8). Other authors have corroborated the observations of the Foundation (e.g. – Fernando 2010; Waegemann, 2003).

With specific reference to Ghana, Acheampong (2012) recounts that eHealth or health informatics is still at the neophyte stage with most hospitals being only partially electronic. Although efforts to establish an adequate management information system throughout the health sector have been ongoing for some time now, these projects have been stuck at the pilot stage and their implementation is rather disjointed. According to Acheampong (2012), the meager uptake of technology in the health sector could be attributable to lack of a Health Management Information System (HMIS) Strategic Plan, Policy and Legal framework for health data reporting. Also, the lack of Medical records policy, Framework for a central data repository, Computerized District Health Management Information System and a Centre for Health Information at central level are cited for the meager uptake of technology in the health sector in Ghana.

In a news report, Agyemang Badu Akosa (a former Director General of Ghana Health Service) recounted additional hindrances to the use and adoption of eHealth in Ghana. He noted that the major constraints facing Ghana's eHealth programme includes the health institution's rigid loyalty to the colonial model, overemphasis in providing healthcare at the capital, regional and district levels, at the expense of the periphery communities as well as challenges with internet connection and low internet penetration (Ghana News Agency, 2013). Akosa reiterated the dearth of innovation or electronic platforms in the current health care delivery in Ghana. Along similar lines, the Rockefeller Foundation (2010) echoed that the major hindrances to eHealth in

the West African sub-region are principally policy hindrances, funding and unaligned projects. These views represent diverse understanding of the hindrances that have made eHealth adoption lag behind global and local expectations. A window of hope was however emphasized by Agyemang Badu Akosa, who speculated that if an eHealth initiative is rolled out properly many people would benefit from health care services irrespective of distance (Ghana News Agency, 2013).

1.2 Problem Statement

Ghana has been recognized as an African regional leader in ICT penetration since the first internet connection was set up in 1989 (Acheampong, 2012). In fact, the country has been adjudged to have one of the highest ICT penetration rates in sub-Saharan Africa; a feat fueled by a number of huge submarine communications cable projects such as GLO1, SAT3, and WASC, several Internet Service Providers (ISP) and many internet cafes (Acheampong, 2012). Acheampong further postulates that with the government and the private companies working to increase ICT and internet awareness, there is bound to be an exponential increase in internet penetration in the country.

The ICT and internet penetration that Acheampong (2012) describes seems to have had little effect in health management administration in Ghana and ultimately, health outcomes. According to the Ministry of Health (MoH) (2010), a high number of different and independent management units working and generating large amount of information held in separate silos has characterized the sector. Invariably, this creates difficulties in information sharing with a ripple effects on the management of common, chronic, communicable and lifestyle diseases between

hospitals and even between and among various departments in the same hospital. Poor communication has been implicated in many instances of inefficiencies in the health sector, with even well-rehearsed procedures to combat emergencies and epidemics suffering major hiccups due to the general lack of good communication among health practitioners (MoH, 2010). These challenges can however be minimized through eHealth, the implementation of which is presently largely uncoordinated, not based on existing standards and focused on small components of healthcare delivery, rather than being system-wide or organization-wide.

In addition, the majority of the empirical studies on the subject matter have focused on developing standards as well as the security, privacy and confidentiality concerns associated with eHealth adoption (Anderson, 2007; Adebesina, Kotzéb, Greunenc and Fosterd, n.d.). This focus has invariably shifted attention from core issues pertaining to the level of use and adoption, and the possible factors that drive and constrain them. This study therefore seeks to investigate these fundamental issues without losing sight of the constraints that could impede the adoption and use of eHealth technologies in Ghana.

1.3 Objectives of the Study

The principal objective of the study is to examine the extent of eHealth use and adoption among health centres and institutions in the Greater Accra Region. The specific objectives of the study are as follows:

- To establish the extent of adoption and use of eHealth technologies among health centres and institutions in the Greater Accra Region;

- To examine the factors driving the adoption and use of eHealth technologies in health centres and institutions in the Greater Accra Region;
- To ascertain the constraints in the adoption and use of eHealth technologies in health centres and institutions in the Greater Accra Region.

1.4 Hypotheses of the Study

The study used various descriptive and inferential statistics to test the following hypothesis:

- The use and adoption of eHealth technologies is relatively low with less than 50% of health centres using these technologies;
- Factors influencing the use and adoption of eHealth technologies include institutional and health professional/manager characteristics;
- Constraints affecting the adoption and use of eHealth technologies include wider geographic areas, lack of commitment and clear decisions on investments in technology, shortage of ICT skilled personnel among others.

1.5 Significance of the Study

This research attempted to investigate eHealth adoption and use in Ghana. The findings of this study are therefore relevant to the institutions that were selected for the study as well as other health institutions in general. It can help hospitals and other health institutions appraise their uptake of technology and particularly assess the constraints that militate against it.

The findings of the study are beneficial to the Ministry of Health and the Ghana Health Services and other agencies that have oversight responsibility of healthcare administration in Ghana.

Based on the findings of the study, they can re-appraise some of the strategic issues concerning eHealth adoption and constraints in the country. Finally, the study is beneficial to future researchers as it serves as background information on future studies on the subject matter. This is especially important because eHealth is still in its infant stages in the country and hence benefit from work from researchers.

1.6 Scope of the Study

This study focuses on eHealth use and adoption in Greater Accra Region in Ghana. This scope therefore defines the limits of data used in the study. This happens especially because eHealth issues could be approached from a multiplicity of perspectives but this study chose to focus on its use and adoption. Every discussion or deliberation therefore reflected this narrowed scope. Incidentally, this also points out the uniqueness of the study. In fact, most of the empirical studies encountered focus on eHealth security issues, as if the adoption is wide scale and presents security or confidentiality issues that needs to be addressed. This study however goes down to the basis and assesses the extent of use and adoption of the eHealth technologies, factors driving their adoption and constraints affecting their adoption and use.

Focusing the study on health institutions in the Greater Accra Region also defines the scope of the study. It means that the study does not consider any health care institutions that operates beyond the region. It is common knowledge that most of the best healthcare institutions are concentrated in Accra, at the expense of the other regions. This study that therefore focuses on this region might have different findings if is focused on the Upper West Region for instance.

This also goes to emphasize that the findings in the study should be interpreted in the light of the Greater Accra Region, considering its uniqueness, vis-à-vis the other regions in the country.

1.7 Limitations of the Study

Sampling the doctors and nurses sampling took much time as the researcher had to get the number of staff from the administrative unit of each hospital. Also, a substantive major supervisor was assigned for this thesis only in December 2013, instead of August 2013. This forced the researcher to seek an extension for completing the study to December 2014, instead of the end of July 2014. This was a major limitation in this study, as it affected the number of questionnaires the researcher was able to recover in the study.

The data gathering in this study took approximately six months, partly as a result of the number of health institutions targeted in the study. One key issue that however accounted for this length of time in data gathering was undertaking the simple random sampling method in each institution, which took quite a considerable time and effort. In addition, the delay of respondents in filling out the questionnaires for the researcher also accounted for six months spent in data gathering. In most instances, the researcher had to visit health institutions more than five times before he could get the questionnaires filled and returned. Again, this explains the inability to recover more than 50% of the questionnaire administered to respondents.

1.8 Organization of the Study

The study is organized into six chapters: Chapter 1 comprises the background to the study, statement of the problem, objectives of the study, research questions, and significant of study

among others. The second chapter covers the review of literature relating to the subject matter of the study from scholarly sources as well as the theoretical and conceptual framework of the study. Chapter 3 covers the Research Design, Sampling and Sampling Techniques, Data collection procedure, Validity and reliability of data while the Chapter 4 captures the analysis of simple descriptive statistics. The Chapter 5 focuses on the analysis of complex or inferential statistics in the study while the Chapter 6 focuses on the summary, recommendation and conclusion of the study.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Rodrigues (2008) notes that eHealth is the most efficient means of ensuring information capture, data mining, and concomitant access by multiple stakeholders. EHealth promotes the partnering of providers, insurers and clients, and brings about transparency and co-operation among healthcare providers and breaks down barriers between independent professional roles (Wallin and Xu, 2008). Consequently, this chapter reviews literature on the evolution of e-Health over the years and then zeroes in on the genesis of its adoption in Ghana. It further discusses the extent of its usage in the Ghanaian health sector focusing on such issues as the infrastructure put in place to utilize e-Health services for the benefit of Ghanaians, as well as the opportunities available in the utilization of the service in the health sector. The review also covers empirical data relating to the nature of e-Health adoption; factors that drive eHealth as well as the constraints/challenges facing eHealth implementation in Ghana and efforts that have been made to mitigate them. The review concludes with the theoretical framework of the study and the conceptual framework for the study, which acts as a bridge to the Chapter 3 – the methodology used for the study.

2.2 Evolution and Nature of eHealth Adoption

The evolution of ICT has had a phenomenal change in society, not just in its mode of conducting business or interacting but also equally in its mode of offering healthcare services. According to the Rockefeller Foundation (2010), the ubiquity of eHealth is evidenced by breakthroughs in Telemedicine networks in Bangladesh, e-pharmacy projects in Malaysia, web-based

communication system to decrease maternal and child deaths in Peru among others. For practical reasons, eHealth is adopted in most hospitals due to the sheer quantum of information generated by the healthcare institutions. In fact, a visit to the records department of any hospital will make one appreciate the importance of deploying, for instance, an Electronic Health Record (EHR) Systems to save space, retrieval time and general accessibility of information. The critical needs to simplify the healthcare delivery system and make it relevant to current demands have powered such multiple national initiatives including the creation of an electronic health records system in Australia, linking inter-operable health information technology in the United States and the development of a single electronic health record for every individual in the United Kingdom (The Rockefeller Foundation, 2010).

Though eHealth is defined in Chapter 1, suffice to mention that the concept generally refers to the use of information and communication technologies (ICT) in health care (Khoja Durrani and Fahim, 2008). Similar to the broad spectrum and multiplicity in the application of ICT, eHealth has several facets. According to Khoja, Durrani and Fahim (2008), its application can be synthesized into the following:

1. EHealth in the provision of health services at a distance (tele-health)
2. Management of clinical and administrative information (health informatics)
3. Sharing information and knowledge with health care providers, patients, and communities (eLearning).

A cursory look at these three components or classification reveals that there could be several sub-components that can be classified underneath each. For instance, telehealth has telemedicine

or e-medicine, e-pharmacy and e-care, among others, under it. These categories of application of the concept are extensively discussed under nature of eHealth adoption.

Tracing the path of its evolution, the United States National Economic Council (2006) is of the view that eHealth received its greatest boost in 2004 when the then US President George Walker Bush announced a huge strategic initiative to radically increase the adoption of HER system in the United States by 2014 (cited by Dixon, 2007). Dixon further narrated that following this announcement, the President appointed a national health IT person to lead the process, with the full support of the US Congress. The US congress further authorized the use of funds for the process.

The President's (George Walker Bush) initiative received a further boost when Independent professional and non-profit organizations (NGOs) in the eHealth and the healthcare sector, such as the American Academy of Family Physicians, eHealth Initiative, Health Information Management Systems Society and American Medical Informatics Association, provided lobbying legislative support, funding and advocacy efforts to make the strategic initiative a resounding success in health delivery in the US. From this beginning, eHealth has been deployed in almost all operations or spheres of healthcare delivery in the global north. However, it must be pointed out that eHealth has been as old as ICT itself, i.e., ICT innovations have been applied in the health sector since the invention of ICT and through every step of its multifaceted innovation. Generally, however, system-wide ICT adoption in the health service has lagged behind the adoption in the banking and the manufacturing industries (Dixon,

2007). Different eHealth applications have been used across countries, corresponding to their health needs and priorities.

2.3 Benefits of Incorporating ICT in Health Management

The relevance of deploying ICT in the healthcare industry cannot be overemphasized especially when quality improvements in the sector are being considered. Wallin and Xu (2008) argues that in spite of the healthcare sector's bias for conservatism (due to "the complexity of healthcare concerning different working forms and organizations" p 13), its need for ICT platforms to enhance operations cannot be overlooked. The authors noted that opportunities offered by IT solutions are very important for healthcare. Information Technology may improve and facilitate, for instance, documentation, information gathering and decision-making in healthcare. Although IT investments are costly, IT-support will generate cost savings by providing more efficient work routines and information management as well as increasing the quality of healthcare (Royal Society, 2006).

Similarly, Luyera (2012, pp 5-6), citing Westbrook *et al.*, (2004) noted that ICT in healthcare ensures greater efficiency and effective work processes, thus reducing the margin of error while improving quality and importantly, safety. Wallin and Xu (2008) could not agree with Luyera more in their assertion that eHealth leads to the exposure on "inconsistencies and inefficiencies in organizations, promote self-care, facilitate joined-up healthcare provision, make service-providers more accountable and even help coping with workforce shortages if correctly used".

Rightfully, therefore, Wallin and Xu have predicted that ICT will redesign the organizational structure of the health care industry, ultimately enhancing its delivery potential and healthcare outcomes. According to the authors, these will come in the form of patient-focused healthcare delivery, remote linkage with patients and on-demand access to information through mobile technologies or WLAN.

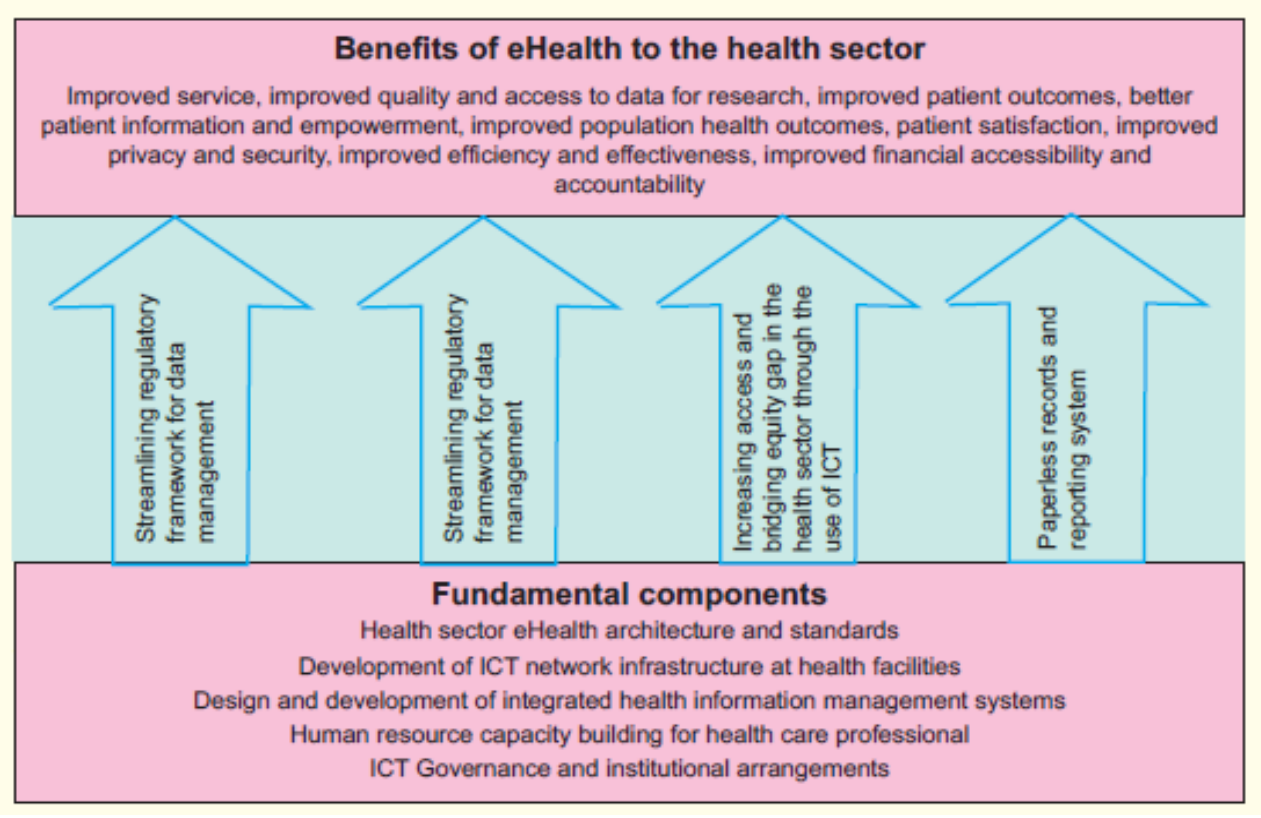
Luyera (2012) has also noted that eHealth could be advantageous, particularly in the context of developing countries. Arguing along EHR, the author notes that in developing countries, the "healthcare systems are mainly used for storage and transportation of textual information using stand-alone computers" (p 9). Eventually, citing Semwanga Agnes Rushana (2008), Luyera notes that though nascent in its deployment, ICT has aided the healthcare institutions to develop efficient billing, financial systems, patient registration; computer-based record systems and pharmacy systems. The author applauds developing countries for using the eHealth approach by computerizing their laboratory and radiology equipment as well as using telemedicine facilities for remote consulting, diagnosis and examination. Finally, touching on education, the author notes that ICT has made possible the sharing of documents, efficient simulation of practical health care situations, interactive training environments and e-learning.

MOH (2010) recounts some of the key benefits to be achieved through a comprehensive eHealth in Ghana to include:

1. Improved access and availability of healthcare services in remote or rural areas. Through mobile telephony or telemedicine, health care consumers will reduce the need for travel and referral to a secondary or tertiary health institution.

2. Improved quality of care as a result of reduction in wait-times for medical treatment and surgical procedures and enhanced access to data for research. This will in turn improve patient health outcomes.
3. Improved logistics and supply chain due to enhanced management information system for medical and non-medical supplies.
4. Facilitate the adoption of eLearning systems in medical education training and continuing professional development.
5. Improved data and information to generate evidence to support timely and informed clinical and non-clinical decisions as well as planning.

Figure 2.1: Benefits of eHealth to the health sector



Source: Ferguson (2002)

Figure 2.1 summarizes the benefits of eHealth, means of achieving those outcomes and the fundamental components of the processes. According to Ferguson (2002) the comprehensive benefits of eHealth are improved service, improved quality and access to data for research, improved patient outcomes, better patient information and empowerment, improved population health outcomes, patient satisfaction, improved privacy and security, improved efficiency and effectiveness, improved financial accessibility and accountability. Ferguson (2002) also indicates the means through which the fundamental components of the process could be channeled to lead to these benefits. As indicated, the details can be found in Figure 2.1 below.

2.4 Nature of eHealth Adoption

EHealth refers to healthcare services that are supported by electronic means (Busagala and Kawono, 2013). EHealth application in the health sector includes all medical healthcare services and technologies that rely on modern information and communication technology (Busagala and Kawono, 2013). A typical example of it is the adoption of telemedicine in Health Care Delivery (eHCD) programme as a means of bringing specialist health care to rural communities. Another specific example is the adoption of electronic health records (EHR) as means of improving the healthcare of patients (Li *et al*., 2013).

According to Das (2010) the nature of eHealth is encapsulated in the following:

1. Healthcare information networks and electronic record systems including information systems for healthcare professionals and hospitals, online services e.g. electronic prescriptions, databases used for patient care, research and public health, health portals and online health promotion services.

2. Telemedicine systems and other similar services
3. Specialized tools or machines for healthcare professionals and researchers including robots used for diagnosis and surgery; simulation and modeling equipment; healthcare grids and equipment for training.

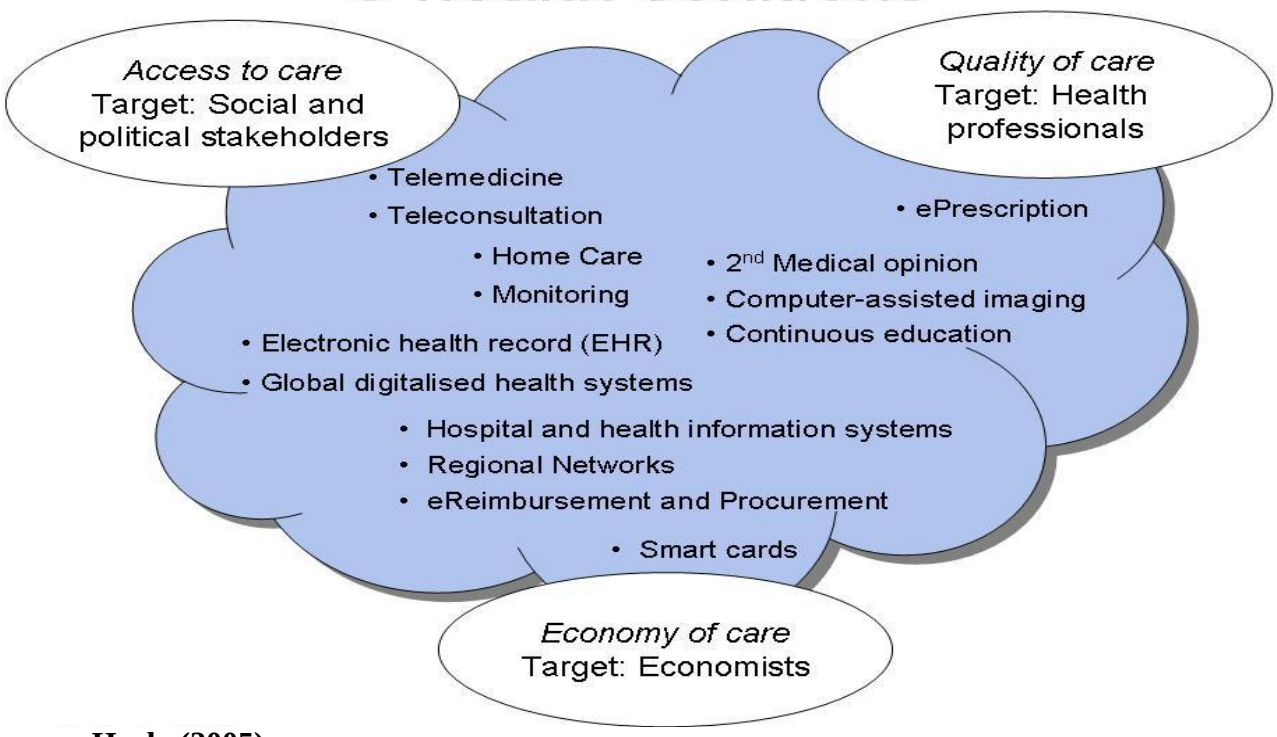
However, MOH (2010) argues that computing equipment, networking devices, multimedia systems, mobile telephony and communication, imaging devices and internet systems form the basis of ICT infrastructure in eHealth. This argument indicates that eHealth goes beyond the simple automation of health records and tele-consulting to entire automation of the healthcare system for efficient productivity. According to the International Communication Union [ICU] (2008), eHealth covers the areas of:

1. Products: such as instruments to ensure the constant monitoring of blood pressure in ambulatory patients.
2. Systems: such as computer-assisted surgery systems.
3. Services: such as operating surgical and intensive care units, with interconnected instruments and surveillance services ensuring continuous patient monitoring; computer-assisted prescription services, where the software checks for incompatible drugs, contraindications and dosage levels; information services for patients and consumers including individual electronic health records.

Though Das (2010) and the MOH (2010) mentions different aspect of eHealth composition, the totality of their treatise constitutes the coverage of eHealth. Thus, none of the two authors adequately covers eHealth, without the complementing efforts of the other.

Based on the study done by ICU in 2008, it is realized that eHealth functions effectively when there is proper integration of products, systems and services; hence, implementation of eHealth in a given country (such as Ghana) without strong inter-relationship between the three prime factors (product, system and services) may result in unproductive operation. Healy (2005) expounded the findings of ICU (2008) and stated that eHealth comprises telemedicine, tele-consultation (i.e. home care and monitoring), electronic health record (EHR), global digitized health systems, hospital and health information, Regional Networks, reimbursement and procurement, ePrescription, computer-assisted imaging and continuous education. This comprehensive constituents of eHealth is depicted in Figure 2.2.

Figure 2.2: eHealth components



Source: Healy (2005).

Healy's (2005) findings significantly differed from Busagala and Kawono (2013) in that Healy's looked at eHealth as a cross-functional system consisting of human resource capacity,

information technology (IT) and online procurement while Busagala and Kawono (2013) only expressed that eHealth is the application of information technology in the activities of a given healthcare centre. Examining eHealth in a holistic manner presents Healy's findings more appropriate and, therefore, would seem highly expedient if factors such as human resource, IT system and online procurement are seriously considered in the implementation of eHealth in any healthcare set up. Herein lies a gap in research on the nature of eHealth adoption which this study seeks to fill. In other words, it investigates these factors in the Ghanaian context while considering other critical variables that have not been covered by the earlier researchers, including human resource and IT system issues. These factors were empirically proved in the Indian context, which makes it important to undertake similar studies in Ghana in order to contribute to literature on the subject matter in the broader developing countries intercourse with these factors and how they facilitate or militate against e-Health adoption.

In Ganesh's (2004) study, he posits that application of eHealth in the medical field encompasses consumer health, clinical care, financial and administrative transactions, public health, professional education and biomedical research. This clarifies that gaining efficient IT system, proper online procurement, electronic payment of service as well as online claims management as noted by Healy (2005), are not only enough for sustainable eHealth implementation but also the human resource capacity ought to be given adequate and continuous professional training. According to the Royal College of Nursing (2012), eHealth embraces the electronic patient records, telehealth/telecare, information management, personal health records and information governance. This finding corroborates that of Healy (2005) except that health inventory system or management has been incorporated in the latter, which makes it more formidable to Healy's

findings. It must, therefore, be noted that proper eHealth system should cover a broader perspective and not be limited only to the application of IT in healthcare. This represents another angle of inquiry that contributes to the broader literature on the subject matter. In essence, the holistic adoption of eHealth in the entire healthcare sector should be the desired focus rather than the standalone application of ICT in some sections of hospital operations. This is investigated in the present study by assessing how eHealth has been incorporated in all departments of hospital operations.

A study conducted by the National eHealth Strategy (n.d.) on the current status of eHealth in Ghana reveals that eHealth involves the use of computing equipment, multimedia device, diagnostic and imaging system and ICT in healthcare. This again emphasizes that the continual development of the human resource capacity as well as inventory management have been neglected and may pose threat to the entire eHealth system in Ghana. There is the need, therefore, as already asserted several authors, to adopt the habit of training health officials continually for efficient operations.

Ford (2006) however argues that the effective eHealth implementation does not occur simply from the introduction of ICT infrastructure but rather may also require remodeling of the job design of interconnected health professionals to effectively and efficiently incorporate technology. In view of that Lehman *et al*. (2006) remarks that without the presence of motivational forces (e.g., health care providers' dissatisfaction with the status quo), it is unlikely that the innovation process would be initiated. Also if health care providers resist change or do

not possess attributes necessary for change (e.g., adaptability and growth-orientation), the change process is less likely to proceed efficiently and effectively.

2.5 Factors that Drive eHealth Adoption

Sun, Wang, Guo and Peng (2013) observe that the adoption of eHealth in health services is determined by five key factors: performance expectancy, effort expectancy, social influence, facilitating conditions, and threat appraisals. He however did not mention the influence of customers as well as technical and operational issues that might dictate that the health institution either adapt to the efficient eHealth platform or goes bankrupt. Further, they do not rank these characteristics to indicate those that exert the most important influencers and those that are secondary.

Ganesh (2004), on the other hand, indicates that eHealth to a large extent is driven by consumer preferences, technical capabilities, health system policy and economic considerations. Ganesh (2004), unlike Sun *et al.* (2013), does not classify competition in the health care industry as one major facilitator of eHealth adoption. The increased number of healthcare institutions has led to the need to differentiate one's product from the other as well as to gain speed in service provision. This need is one major facilitator in eHealth adoption (Sun *et al*., 2013; Li *et al.*, 2013). It is, therefore, apparent from the views of these authors that there are several factors that drive eHealth adoption. To the best of my knowledge, no study has been done in Ghana to bring to the fore the factors that drive eHealth adoption, hence prompting the study that is reported in this thesis report. Among the studies conducted along these lines in Ghana, some have looked at the preparedness for eHealth in developing countries (Yusif & Soar, 2014); determinants of

eHealth in developing countries (Mugo & Nzuki, 2014) which covered the adoption of eHealth in Ghana as part of a wider developing countries context. Later, Acquah-Swanzy (2015) evaluated eHealth record systems in Ghana where she briefly touched on the factors that promote eHealth adoption at Efua Nkwanta Hospital. Also, there has been the National eHealth Strategy which was enacted by the government of Ghana to guide eHealth adoption in Ghana. There is therefore the lack of adequate or thorough studies that have focused on the factors that promote eHealth adoption in Ghana, thus presenting a critical research gap that this study wants to explore and fill.

It has been aptly demonstrated that eHealth is leading to a progressive blossoming of automation in the health sector (Rodrigues, 2008). Rodrigues further notes that the development of eHealth has not only occurred in libraries, business offices and the management of assets, but also in patients' administrative data, instrumentation and diagnostic equipment, departmental systems, and patients' care. The use of eHealth technologies enables efficient delivery of information and services, including remote monitoring and direct-care; and ultimately, solving health needs. However, there are several constraints such as high cost of IT infrastructure and low level of human capacity to the adoption of eHealth globally (Moniz, 2009) and must, thus, be critically considered for sustainable eHealth operations. A study conducted by Busagala and Kawono (2013) to identify the challenges on the adoption of eHealth in Tanzania reveals that the adoption of eHealth in that country is constrained by inadequate ICT skills, high cost of ICT in relation to economic status of community members, less developed infrastructure including lack of imaging equipment, small proportion of internet users and lack of information about suitable ICT solutions.

Similarly, Anderson (2007) notes that eHealth has the potential to positively influence the quality of care, and improve healthcare service efficiencies. However, it is hindered by a number of factors such as high cost of acquisition especially at the initial stage, security, privacy and confidentiality concerns and lack of technical skills. Moniz (2009) also indicates that resistance to change on the part of healthcare professionals hinders eHealth adoption. The International Telecommunication Union (2012) points out that the major barrier to eHealth adoption is the inability of healthcare information systems (HISs) to interoperate to share information and the huge number of available eHealth standards, with many of them competing and overlapping, and some even contradicting one another. Further Vishwanath and Scamurra (2007) attributed the low adoption rate of eHealth to both macro-level factors (e.g. supportive policies) from the perspective of the public, health care organization, and system, and micro-level barriers from the perspective of health care providers (e.g., physicians' perception about technological complexity). As earlier indicated, there is a dearth of information that addresses the factors that promote eHealth adoption in the Ghanaian context. In the general African context, though some studies have been done, this is not enough to enable one conclude that the factors that promote eHealth adoption have been exhaustively explored. As such, the present study seeks to fill this apparent gap by exploring the factors that promote eHealth adoption in Ghana.

2.6 Factors that Constrain eHealth Adoption

Although, eHealth has the affinity to positively influence the quality of healthcare and improve health services, there are a number of challenges to its adoption. In Ghana, according to MOH (2010), the major factors that usually hinder the successful adoption of eHealth are as follows:

1) Low distribution of health services across wide geographic areas.
2) Lack of commitment and clear decisions on investments in technology

3) Low budgetary allocation to the Ministry of Health
4) Shortage of ICT skilled personnel
5) Weak information technology infrastructure.

With these challenges, eHealth implementation in Ghana stands a low chance of being adopted by a large proportion of health institutions and therefore, has poor sustainability unless these predicaments are carefully rectified.

WHO (2012) indicates that constraints to the adoption of eHealth in Africa include the low ICT budgets, poor infrastructure in support of health services, erratic electricity supply and inadequate human resource capacity. Busagala and Kawono (2013), however, argues that the high cost of acquisition of IT facilities particularly at the initial stage, resistance to change on the part of healthcare professionals, and lack of technical skills are the main constraints to the adoption of eHealth technologies. WHO (2013) again noted that the major barrier to eHealth adoption is the, inability of healthcare information systems (HISs) to interoperate in order to share information.

Acheampong (2012) also mentions that, poor leadership, governance, and multi-sector involvement in eHealth hinder its adoption. In this instance, there is no provision of directives and coordination for eHealth initiatives at the national level and, therefore, health goals in the country are poorly aligned with eHealth strategies. Cardellino and Finch (2006) add that, inadequate human resource capacity remains a crucial threat to the adoption of eHealth in general. They observe that the development of effective health professionals with the requisite

technical expertise in ICT with high capability of designing, building and running eHealth services greatly improve the performance of eHealth in Ghana.

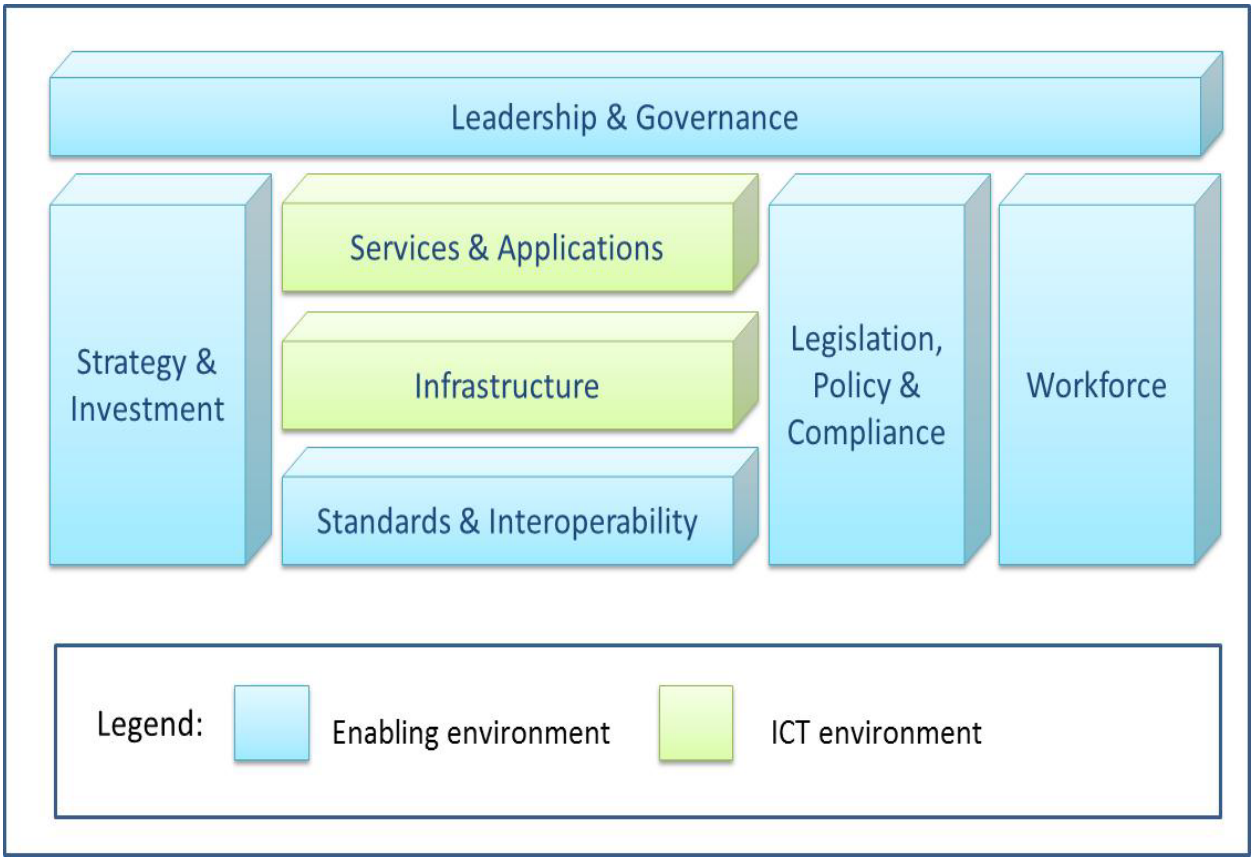
A study conducted by Adebesin *et al.* (n.d.) on barriers and challenges to the adoption of eHealth in Africa using 200 survey questionnaires reveals that, African countries' active participation in eHealth standards development is limited to the requirements of the International Organization for Standardization (ISO). As much as this is hailed, Adebesin *et al.* (n.d.) observed that there is no substantiation of active involvement in this and other international standards' development initiatives in West Africa. Accordingly, Adebesin *et al.* enumerates factors that contribute to the poor adoption of eHealth by West African countries using eHealth interoperability and adoption model developed by Wager *et al.* (2009). These factors have been summarized into constraints identified in the general environment and constrains identified in the ICT environment. Apparently, the interplay of the enabling and the ICT environment ensures the appropriate use and adoption of eHealth. Adebesin *et al.* however overlooked other factors that were equally important, especially constraints that lies outside the influence of the organization. These external factors are however influential in a health institutions adoption of eHealth and hence have to be considered. These factors could be external to the health care professional or external to the healthcare institution. This gap has been explored in the present study.

According to Adebesin *et al*. (n.d.) eHealth adoption is the key to ensuring that healthcare information systems are being exchanged and shared for continuity of care. Nevertheless, there are significant challenges that hinder widespread adoption of eHealth, especially by African countries. The major barriers enumerate included the lack of understanding of the importance of

e-Health, limited participation in eHealth standards development, lack of foundational ICT infrastructures, and limited human resource capacity for e-Health standard development (Truffer *et al*. 2010; Anon, 2013). The study, however, recommends some measures that could be implemented to overcome the stated barriers, which include transformation of eHealth standards development process at an international level and the adoption of a user-centered eHealth development approach. Besides, governments have to give precedence to investment in basic ICT infrastructure and the development of human resource capacity and as well as play active role in eHealth adoption through implementation of appropriate national policies and guidelines (Benson, 2010).

Finally, Adebesin *et al.* (2013) suggests that special strategy has to be put in place by governments and policy makers to ensure proper plan for a national eHealth environment and align funding for eHealth implementation with national priorities and create the legal framework for its implementation and long-term sustainability.

Figure 2.3: EHealth Interoperability and Adoption Model. Source



Wager *et al.* (2009).

Confirming the observations made by Adebesin *et al.* (2013) Wager *et al.* (2009) and Truffer *et al*. (2010), the Ministry of Health (MOH) has identified several challenges in eHealth implementation in Ghana. MOH (2010) outlined quite a number of these challenges, not least among them are challenges relating to integrity, confidentiality, authenticity and data protection. The ministry however notes that by far, the most potent challenge to the deployment of the programme is training of practitioners. The ministry laments the lack of programmes to train officials who are supposed to lead in the implementation. MOH (2010) states emphatically that one of the biggest challenges to eHealth capacity building in Ghana is the shortage of qualified, trained health care professionals and training resources as almost all the health training

institutions in the country do not run e-learning programmes. The Kwame Nkrumah University of Science and Technology and the Komfo Anokye Teaching Hospital have started an eLearning training session for medical professionals. This is not available for other health professionals. The Rural Health Training School, which runs a diploma programme for middle level health professionals have for the last decade run a programme for Health Information Officers. This happens to be the only programme in the health sector that focuses on ICT to some degree (MOH, 2010). It is therefore apparent that adequate training for implementers represent major constraints in the adoption of eHealth.

The Ministry also acknowledges the serious challenge of ICT support systems, as well as the lack of linkages of the various components in its deployment. MOH (2010) therefore asserts that the internal ICT support is very weak at all levels leading to a very weak oversight responsibility for ICT services that are outsourced. From reports on capacity for ICT in the health sector, it has become increasingly clear that not much priority is placed on ICT in the health sector. Besides the lack of professionals to manage the eHealth facilities, a further challenge the ministry notes are the state of the facilities of the eHealth platform itself. The National eHealth Strategy notes that the eHealth facilities in the various hospitals are at basic stages and not advanced. This research will therefore contribute to the observations of the MOH as well as other researchers and investigate to what extent the factors they have identified hinder eHealth adoption and move on to ascertain the measures put in place to address these constraining factors.

2.7 Electronic Health in Ghana

In a comprehensive overview of ICT and health informatics in Ghana, Acheampong (2012) observes that eHealth is at its embryonic stage in Ghana. Accordingly, the author notes that

several pilot projects are being run at various hospitals to ascertain the feasibility of eHealth in the country. The author further notes that despite the implementation of eHealth projects suffering from lack of adequate coordination, implementation relating to Health Management Information System (HMIS) has generally been successful. However, Acheampong failed to desegregate his information from the viewpoints of private hospitals and government hospitals. Similarly, his finding does not consider the specific situation of the clinics and those of the ordinary hospitals and the sprawling and complex teaching hospitals. This observation is made against the general backdrop that private hospitals, due to their profit motive, are more likely to have access to greater resources to deploy eHealth in their operations, relative the under-resourced government hospitals. However, teaching hospitals, which are normally publically owned, have more resources and can more easily deploy eHealth relative to government-owned clinics and the polyclinics.

After a careful investigation of the present state of HMIS, Acheampong surmises that its basic building blocks are in place in some hospitals in Ghana, particularly the teaching hospitals. These basic building blocks are as follows:

1. HMIS Strategic Plan
2. Policy and Legal framework for health data reporting
3. Medical records policy
4. Framework for a central data depository
5. Computerized District Health Management Information System
6. The establishment of a Centre for Health Information at central level

According to Wager *et al.* (2009), though HMIS is successfully deployed in some hospitals, different software are being used by various hospitals in the country in their pursuit of electronic data entry, processing and delivery. Sadly, this software is also modular in nature and only support some processes in the operations of these institutions operations and not in others. Truffer *et al.* (2010) also notes that in the public sector, the HMIS is usually deployed at the district level. The system was initially known as "District Health Management Information System (DHIMS)" software and later changed to "District Health Information System (DHIS2)". However, its functions, which are data capturing, aggregation and generation of management report, remain the same.

According to the MOH (2010), the government of Ghana has started an eHealth programme that confirms the government's support in incorporating ICT into the healthcare industry. The Ministry noted that The Government of Ghana has developed an eGovernment Interoperability Framework which sets out the government's policy and standards for interoperability across the public sector, especially health (MOH, 2010, p. 42).

In spite of its recent deployment, the GoG has clearly outlined how it wants its eHealth platform to be. Specifically, in the future of eHealth, the MOH (2010) states that Government is putting in place several regulations to deal with how electronic data will be created and managed to serve the nation in the digital revolution. These include the Electronic Transaction Bill, Data Protection Bill, Electronic Investigations and Inception Regulation, Electronic Payment Mediums Regulation, Electronic Signature (Certifying Agency) Regulation and Electronic Waste

(Disposal and Recycling) Regulation (MOH, 2010, p. 42). There are however various challenges to eHealth in Ghana as discussed in the previous section.

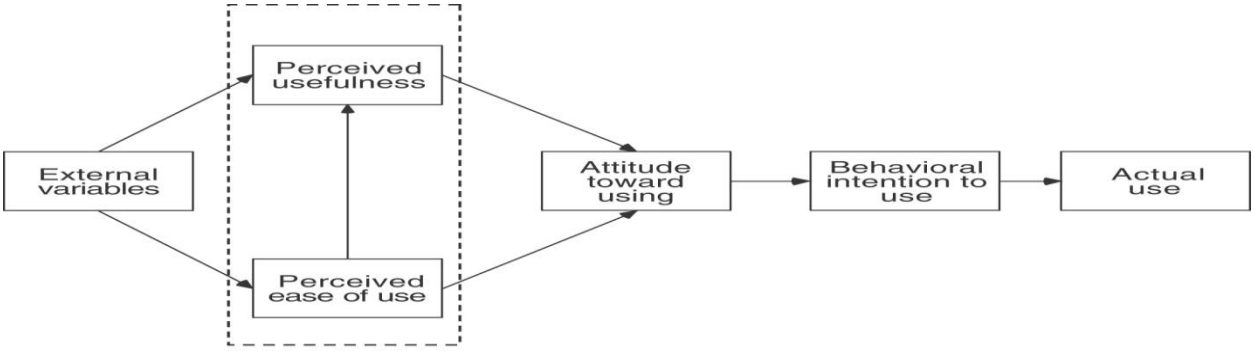
2.8 Theoretical Framework

There are several theories that explain the use and adoption of technology in institutions. These include the technology acceptance model, the unified theory of acceptance and use of technology, the diffusion of information theory, the theory of planned behavior or the unified theory of use, acceptance of technology, the Rogers Model and the protection motivation theory.

2.8.1 The Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is an information systems theory developed by Fred Davis and Richard Bagozzi (1989). The model assesses how users come to accept and use technology. The model holds that a number of factors determine the decision about how and when to use new technology, with the notable ones being perceived usefulness and Perceived ease-of-use. While perceived usefulness represents the degree to which a person believes that using a particular system would enhance his or her job performance, the perceived ease-of-use represents the degree to which a person believes that using a particular system will require less effort (Davis, 1989). These are however influenced intensely by attitudes toward the technology being introduced, the behavioural intention to use such and its actual use. The model is illustrated in Figure 2.4 below.

Figure 2.4: The Technology Acceptance Model



Source: Davis and Bagozzi (1989)

TAM has been criticized by Chuttur (2009) as having questionable heuristic value, limited explanatory and predictive power, triviality, and lack of any practical value. These criticisms led to a later modification of the theory into the new Unified Theory of Acceptance and Use of Technology (UTAUT) model.

2.8.2 The Unified Theory of Acceptance and Use of Technology

According to Li, Talaei-Khoei, Seale, Ray and MacIntyre (2013), the UTAUT model seeks to integrate the fragmented theory and research on individual and institutional acceptance of information technology into a unified theoretical model, which highlights the importance of contextual analysis in developing strategies for technology implementation within organizations. Li *et al* (2013) and Oye, Iahad and Ab-Rahim (2012) notes that the UTAUT model accounts for 70% of the variance in usage intention, which is a substantial improvement over any of the original models and their extensions. Venkatesh, Morris and Davis developed the model in 2003.

As depicted in Figure 2.5, there are four core constructs that impact on behavioral intention, and consequently technology use behavior in the UTAUT model. These are performance expectancy (PE), effort expectancy (EE), social influence (SI) and facilitation conditions (FC).

According to UTAUT, PE, EE and SI are theorized to influence behavioral intention to use a technology, while behavioral intention and FC determine technology use. In addition, individual variables such as age, gender, and experience are theorized to moderate various UTAUT relationships. Oye, Iahad and Ab-Rahim (2012) defines the specific variables as follows:

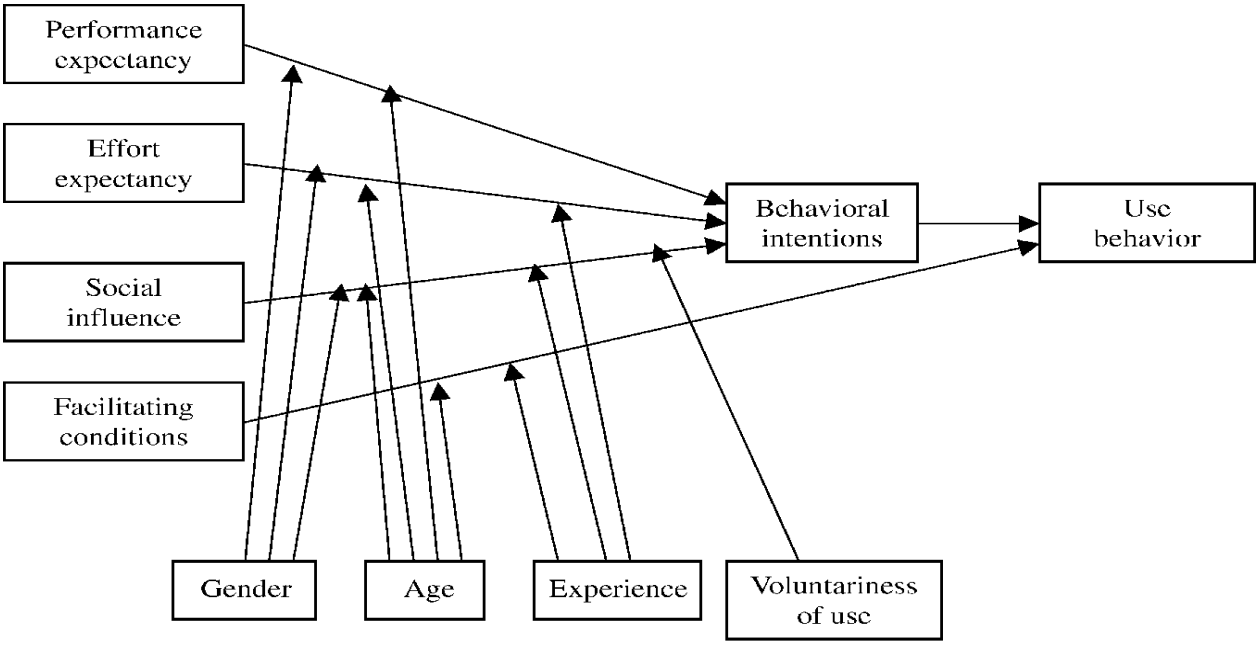
1. PE - is the extent an individual believes the system will help them do their jobs better. This matches with the Perceived Usefulness (PU) in the TAM model

2. EE – relates to the ease an individual believes the system is to use. This matches with the Perceived Ease of Use (PEOU) in the TAM model.

3. SI - relates to whether or not other important variables influence an individual's intention to use the system.

4. FC - whether individual has the personal knowledge and institutional resources available to use the system.

Figure 2.5: Unified Theory of Acceptance and Use of Technology



Source: Venkatesh, Thong and Xu (2012)

Other authors have added anxiety self-efficiency (SE) (AX) and attitude towards use (ATU) as some other relevant variables that affect technology adoption (Oye, Iahad and Ab-Rahim, 2012). However, the originators of the model have revised the model as UTAUT 2. In this review, they added Hedonic Motivation and Price Value as constructs that influence behavior intention while Habit influences both behavioral intention and use behavior. These modifications became necessary as these researchers realized that SE and ATU equally (if not more) influence technology adoption behaviors beside the four main effect and four moderating factors (Oye, Iahad and Ab-Rahim, 2012). It should, however, be noted that despite the modifications, the original UTAUT model remains the theoretical model of the present study due to its simplicity and accuracy. The three modifications are explained by Oye, Iahad and Ab-Rahim (2012) as follows:

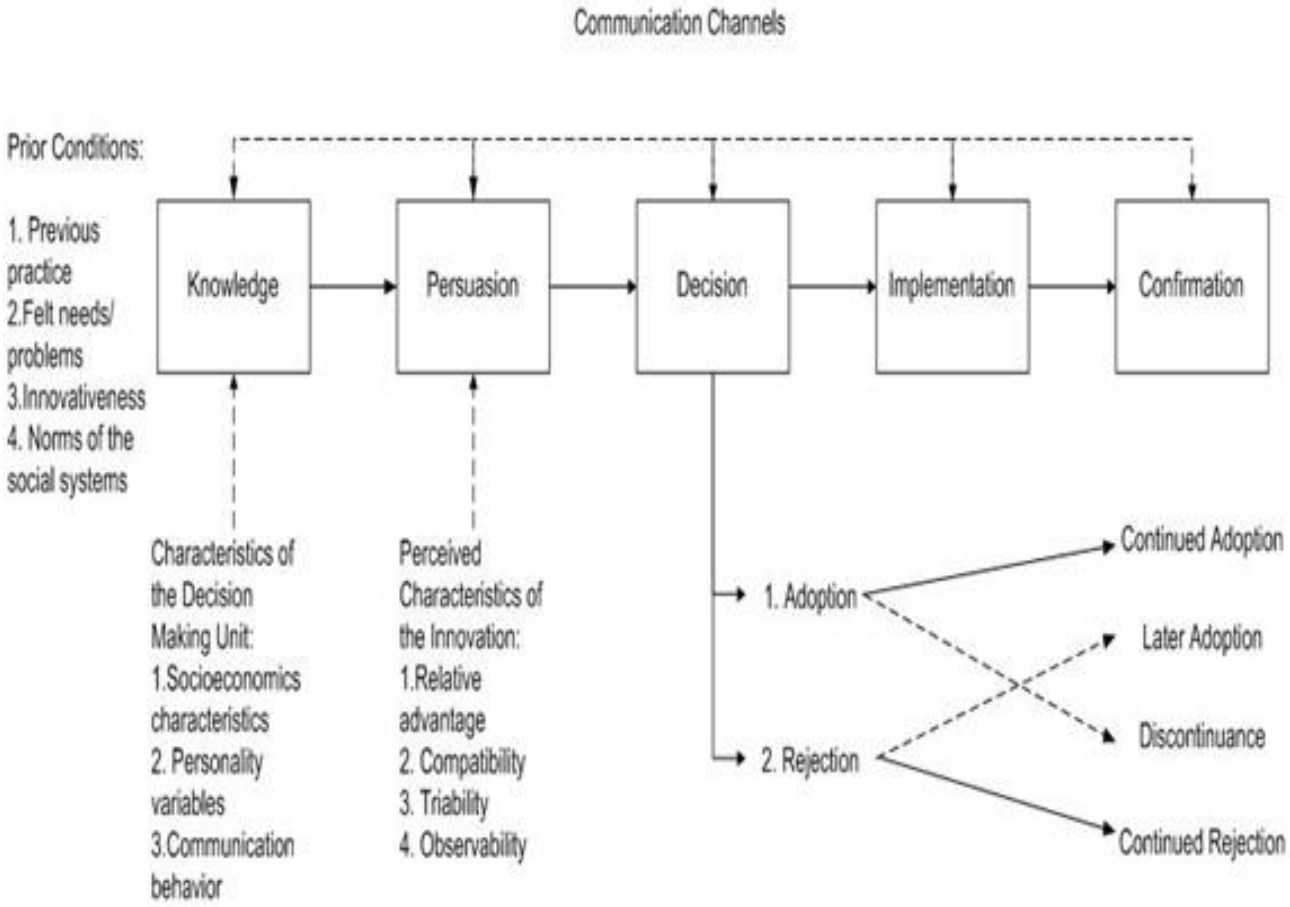
1. SE - related to an individuals' confidence in his/her ability to perform the behavior required to produce specific outcome.

2. AX- related to fear of computer (ICT) when using one
3. ATUT- Related to monitoring users' attitudes towards computers (ICTs)

2.8.3 Diffusion of Innovation Theory

The Diffusion of Innovation theory is attributed to Everett Rogers, who propounded the theory to explain the uptake of innovation in general (and technology in particular) by individuals and institutions (Tagoe, 2013). Rogers (1995, p. 5) defines innovation as "an idea, practice, or object that is perceived as new by an individual or another unit of adoption" and diffusion as "the process by which an innovation is communicated through certain channels over time among the members of a social system". Therefore, the Innovation Diffusion Theory argues, "potential users make decisions to adopt or reject an innovation based on beliefs that they form about the innovation" (Agarwal, 2000, cited in Lee, Hsieh and Hsu, 2011, p. 9). Thus, individual and institutions' adoption of technology is based on innovation decision model, which Roger (2003) defined as "the process through which an individual or any decision making unit passes from gaining initial knowledge of an innovation, to forming an attitude toward the innovation, to making decision to adopt or reject, to implementation of the new idea and to the confirmation of this decision" (Shea, McDall and Ozdogru, 2006; cited in Tagoe, 2013, p. 58). These processes of innovation adoption have been summarized in Figure 2.6 below.

Figure 2.6: Diffusion of Innovation Process;



Source: Rogers (2003)

According to Rogers (2003) the innovation decision, as illustrated above, catalogues the steps individuals or institutions take in their adoption of innovations. It starts from being aware or having knowledge of the innovation, to forming attitudes about the innovation, which eventually leads to a decision whether to adopt or reject. After a decision is reached, the individual/institution then implements the decision and confirms it. However, the author notes that the awareness of the innovation could be facilitated by certain characteristics of the individual such as socio-economic status, personality type and communication behavior. Similarly, the persuasion or the attitude formation stage is influenced by five variables – relative advantage, compatibility, observability, trialibility and complexity of the innovation. Other

authors have corroborated Rogers's argument, through their empirical findings, that these factors determine the likely of adoption rate (Bates, Manuel and Oppendheim, 2007; Tagoe, 2013). Robinson (2009) and Tagoe (2013) describe the variables as follows:

1. **Relative advantage:** According to Robinson (2009), the extent to which an innovation is perceived to be better than the existing one, the more rapid is it likely to be adopted. Hence, eHealth implementation in Ghana has the relative advantage to the manual or traditional system where the affairs of hospitals and clinics are managed through manual means. This may, therefore, encourage health administrators and practitioners in adopting the eHealth concept.

2. **Compatibility:** This is the degree to which an innovation is perceived as being consistent with the values, past experiences, and needs of potential adopters (Tagoe, 2013). This, then, suggests that an idea that is steady with ones' values, norms or practices has greater chances of being adopted after its implementation.

3. **Observability:** Robinson (2009) suggests that, the more individuals, groups or institutions can vision or describe an innovation; the more likely they are to adopt it. For instance, adoption of eHealth by health professionals may seem more promising in comparison to adoption by the ordinary Ghanaians since they might have not experienced how helpful or beneficial the innovation may be. It is, therefore, suggested that health professionals grasp the idea of implementing eHealth technology in various hospitals and clinics and champion its course among others to enhance its adoption.

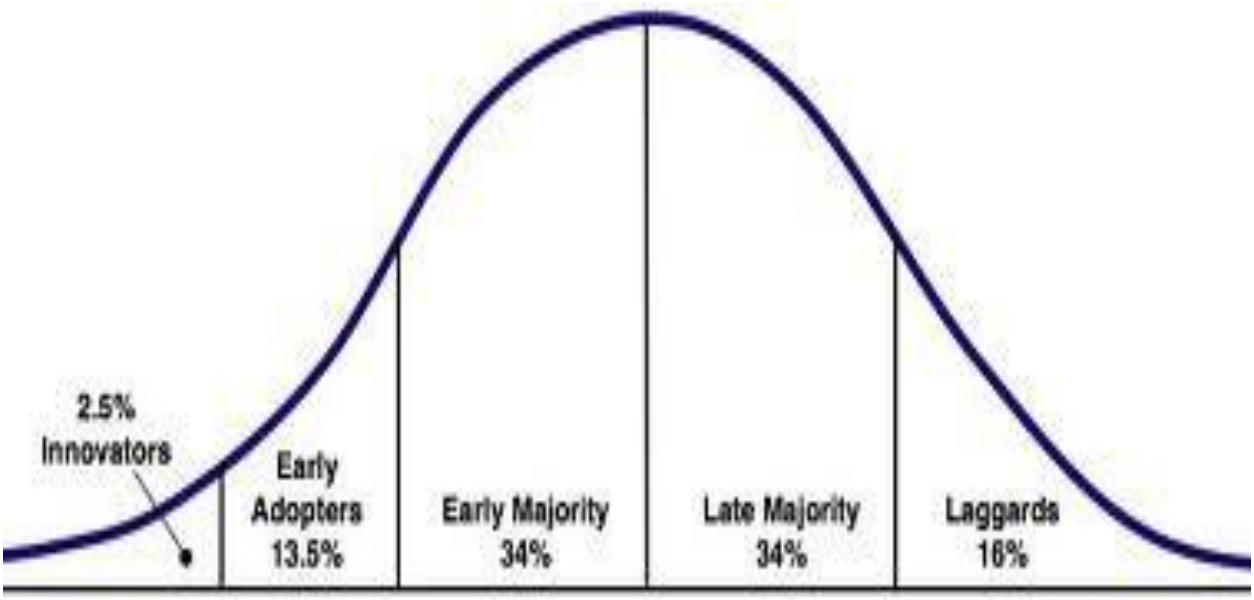
4. **Trialibility:** According to Rogers (2003), trialibility represents the extent to which an innovation could be experimented within a shorter time frame. Hence, an innovation that

is triable within a short period presents less uncertainty to the individual considering it and consequently, likelihood for its adoption increases.

5. **Complexity:** This is the degree to which an innovation is perceived as difficult to understand and use (Tagoe, 2013). This implies that new ideas that are simpler to understand are rapidly adopted than innovations that require the adopter to develop new skills and understandings. It is, thus, suggested that eHealth technology be assessed for its relative advantage, compatibility, observability, trialibility and complexity for its easy adoption among Ghanaians and long-term sustainability.

Citing Rogers (2003), Robinson (2009) asserts that these five qualities determine between 49 and 87 percent of the variation in the adoption of new technology. These factors also explain the innovation adoption curve presented in Figure 2.7. Individuals who are positively exposed to these factors are more likely to adopt innovation earlier than those who are less exposed. Hence, the researchers break population of adopters into five segments, based on their propensity to adopt a specific innovation. These are the innovators, early adopters, early majorities, late majorities and laggards.

Figure 2.7: The Innovation Adoption Curve.



Source: Rogers (2003)

Tagoe (2013) notes that innovation or technology adoption does not happen at the individual level only but also at the organizational level, in the case of my study, the level of the health institutions. Rogers (2003) proposes a model of five stages to explain innovation uptake at the organizational level. These are the agenda setting, matching, redefining, restructuring, clarifying and routinizing stages. Tagoe (2013) observes that the first two stages are initiation phases while the last three are the implementation phase of the technology adoption (cited from Cardellino and Finch, 2006, p. 34; Shea, McCall and Ozdogru, 2006, p 12).

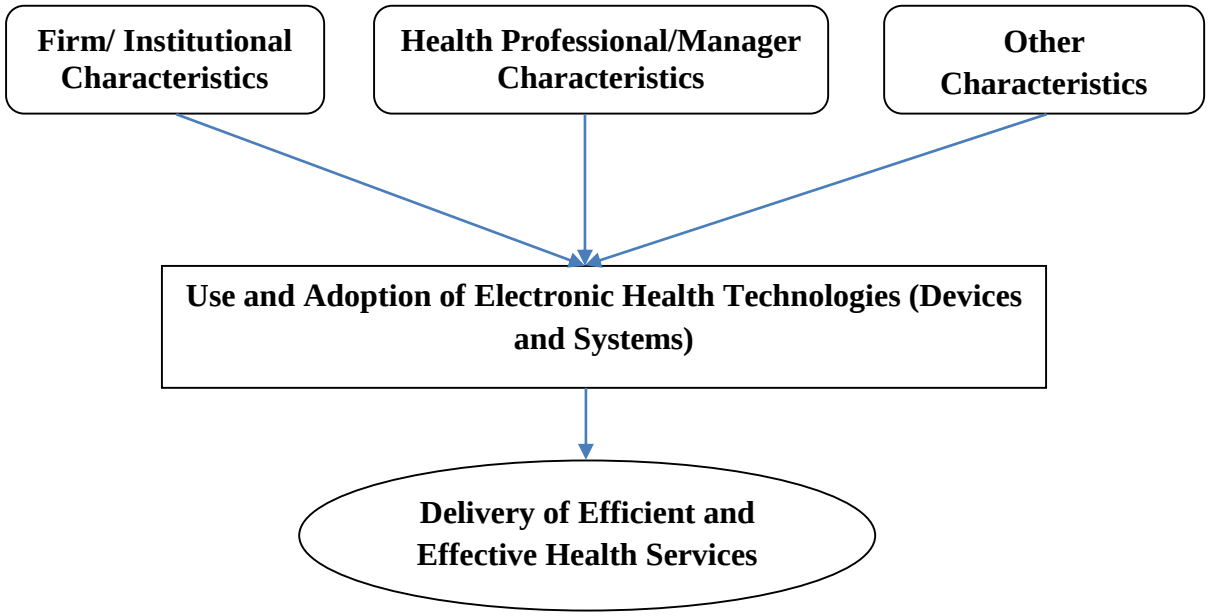
The Rogers model was adopted as the theoretical framework of the present study because, besides being more recent an approach, it covers the adoption related variables captured in the other theories (especially TAM and UTAUT) and adds to these in greater details. In addition, the focus on the innovation adoption curve is considered critical to the present study because it will

enable the researcher pinpoint the present status (or stage) of adoption for individual health professionals or the institution in general. In each institution, the initiation phase would involve setting the strategic objective or priority by senior administrators through information gathering, conceptualizing and planning for the adoption. The implementation phase would involve all events, decisions, and actions to adopt the innovation and also determining its sustainability. Cardellino and Finch (2006) points out that it is at this phase that the technology is assimilated into the organization and becomes mainstreamed and hence ceases to occupy the periphery (cited by Tagoe, 2013). In the present study, Rogers Diffusion of Innovation theory is adopted as the main theoretical framework due to its dual focus on the institutional and individual drivers on eHealth adoption.

2.9 Conceptual Framework

As shown in Figure 2.8, the adoption of eHealth devices and tools are influenced mainly institutional characteristics such as the area of specialization, the practice level of the institutional and ownership (private or government). Aside these, the characteristics of the healthcare professionals – age, gender, years of experience, and education among others also influence eHealth adoption. The use and adoption of eHealth technologies then can lead to the delivery of efficient and effective health services. Rogers variables that covers characteristics of the individual such as socio-economic status, personality type and communication behavior are implied in the health care professional's characteristics. Similarly, the persuasion or the attitude formation stage at the institutional level are influenced by five variables – relative advantage, compatibility, observability, trialibility and complexity of the innovation. These have not been explicitly noted in the conceptual framework in Figure 2.8 but these have been implied in figure below (Bates, Manuel and Oppendheim, 2007; Tagoe, 2013; Robinson, 2009).

Figure 2.8: Summary of the concepts used iterated in this study



CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the procedures and methods employed to collect the necessary data for the study. It covers the research design, sampling procedure, population and sample size among others. The population for the study is clearly defined while the main sampling methods employed in the study are also defined and explained.

3.2 Research Design

Research design represents what form the plan for the collection, analyzing and evaluating the data takes. According to Fisher (2010) research design constitutes the blueprint for the collection, measurement and analysis of data. Thus, the quality of a research largely depends on the understanding of the research design approach used.

The study adopts the quantitative survey approach as its research design. According to Fisher (2010) when researchers try to obtain a broad and representative overview of a situation, then the survey approach would be appropriate. Therefore, the choice of this method of research design was based on the researcher's interest in seeking the views, opinions or perspectives of respondents on the subject matter of the study. According to Ahiadeke (2008), survey research is a data collection method, which requires asking people, referred to as respondents for information using either verbal or written questions. The author adds that these respondents are normally people who have certain information or have experienced certain phenomena or

participated in a social process that interest the researcher and hence satisfy the research objectives/questions.

The survey was considered appropriate because it is the best method to describe the characteristics, perceptions and opinions of the group under study. It also gives the respondents the opportunity to respond to the questions asked as much as they know. Survey research is a data collection method, which requires asking people, referred to as respondents for information using either verbal or writing questioning. Survey research provides a quick, inexpensive, efficient and accurate means of assessing information about the population. It requires that questions to be asked, whether verbal or written are well thought of and structured by the researcher. The structured method of survey therefore involves the development and administration of a questionnaire with a fixed list of questions in a standard sequence, which has mainly fixed or pre-categorized answers.

3.3 Research Population

Babbie (2005) defines a population as the people about whom a researcher will like to draw conclusion of a study from. According to Kazeroni (2001) substantial research questions deal with matters of vital relevance to important groups, or populations of individuals. However, important populations are generally large and, because of numerous practicalities (economy, time, and ethics), researchers cannot afford to study all members of interesting populations. Babbie (2005) agrees with this stance of Kazeroni (2001) when he states that it is almost impossible to study a whole population. The time-honored scientific solution to this problem is

to draw a representative subset, or sample, from the population and to base conclusions about the population on conclusions drawn from the sample (Kazeroni, 2001).

The research population for this study was health professionals and managers in the Greater Accra Region. According to the Ghana Health Services, there were 504 health institutions in the Greater Accra Region, which are owned by private business people, the government, non-governmental institutions (NGO) and the Christian Health Association of Ghana (CHAG). The rest are designated quasi-government institutions. The numerical details are provided in Table 3.1 below:

Table 3.1: Ownership of Health Facility and Number

Ownership	**Number**
CHAG	31
Private	340
Government	103
Quasi-Government	26
NGO	4
Total	**504**

Source: Ghana Health Services (2012)

In terms of the type of health institutions, the population used in the study has been classified as clinics, district health directorate, health centre or polyclinics, maternity homes, hospital, regional health directorate, teaching hospital, polyclinics, psychiatric hospitals, training institutions, Community Health Improvement Services (CHIPS) among others. The detail as to the number of hospitals that falls under each classification is summarized in Table 3.2.

For the purpose of this study, only those health institutions that falls under the Private, Government and Quasi-Government designation as well as those that offer direct health care

were considered in the population of the study. In other words, the district and regional health directorates were not considered, since they do not offer direct health care to patients. The study focused on institutions that offer direct healthcare in order to assess how their services have been impacted by technology towards offering superior healthcare to patients. Though the use of technology could also impact those healthcare institutions that do not offer direct healthcare, the study considered those that offer direct healthcare, and hence interfaces with patients on a daily basis, of critical relevance in healthcare administration and were hence considered in the present study.

The respondents in the study were therefore selected from the following broad categories – 1) CHIPS, 2) Clinics, 3) Health Centres, 3) Maternity Homes. 4) Hospitals, 5) Teaching/University Hospitals, 6) Polyclinics and 7) Psychiatric Hospitals. The sample of the study was therefore to be selected from a total of 469 health institutions (see Table 3.2 below).

Table 3.2: Type of Health Facility and Number

Type	**Number**
CHIPS	5
Clinics	276
District Health Directorate	11
Health Centre	23
Maternity Homes	50
Hospital	91
Regional Health Directorate	2
Teaching/University Hospital	1
Polyclinics	8
Psychiatric Hospitals	2
Total	**469**

Source: Ghana Health Services (2012)

3.4 Sample Size

The study sample refers to the group selected from the population for the purpose of drawing conclusion about the entire population (Neuman, 2007). According to Neuman, the answer to the question of how large should a sample size is depends on several factors, such as the budget of the study, the objectives of the study, and to what extent the policy recommendations were implemented. Yamane (1973), however, is convinced that to select a sample that is representative of the population, a mathematical formula has to be followed. Thus the study uses Yamane's formulation in the formulation of its sample size. This formula is given as $n = N/1+N(e)^2$ where N is the total number of households and e is the margin of error (assumed to be 10% for this study). The details of the determination of the optimal sample size are provided in Appendix 2. With a population of 469 health institutions, 82 institutions were considered representative based on Yamane's formula. Thus, the sample for the study consisted of 82 health institutions, representing approximately 18% of the targeted healthcare institutions in Table 3.2.

Table 3.3 summarizes the number of health institutions chosen under each category of health institutions. Using the population of health institution under each category, multiplied by 0.18 (the sample percentage) the researcher chose one CHIPS compound, 50 clinics, four health centres, 50 maternity homes, 17 hospitals and one polyclinic. The clustering ensured that at every operational level, there is enough health institutions to enable the study generalize its findings. It must however be explained that the teaching/university hospitals and the psychiatric hospitals had to be added to the general hospital theme in order to make the selection easier. Other than that, using the formulae explained above, some of these hospitals might not be represented in the study, due to their small numbers.

Table 3.3: Population and Sample

Type	Population	Sample Size
CHIPS	5	1
Clinics	276	50
Health Centre	23	4
Maternity Homes	50	9
Hospital/Teaching and University Hospitals/Psychiatric Hospitals	94	17
Polyclinics	8	1
Total	**456**	**82**

Source: Authors Deduction from the Ghana Health Services Data

The researcher administered 20 questionnaires to workers in each institution, bringing the total sample size to 1,640. In a typical institution, the researcher administered questionnaires to four Medical Doctor, eight nurses, two administrator or administrative staff, two pharmacists, two records staff and two lab technicians. These respondents were selected randomly, where possible and where it is not possible, the healthcare administrator(s) in the institution suggested potential respondents in the study.

After the introductory letter and subsequent introduction and interaction of the researcher with the administrative staff, the researcher request for the number of staff to undertake a simple random sampling of respondents. Where this is not forthcoming, the administrator was asked to suggested some medical doctor, nurses, administrative staff, pharmacists, records staff and lab technicians whose suitability were assessed before the research instrument was administered to them. This suggestion became even more necessary due to the shift nature of the work in the hospitals visited. The shift, coupled with the busy work schedule of the healthcare, made the intervention of the administration a very helpful one.

Where randomization or suggestions were not possible, the hospital administrator(s) was asked to show the researcher the various departments for data gathering to commence with the healthcare professionals available upon the visit. Thus, the study used the simple random sampling approach and the convenience sampling methods iteratively.

However, it was observed that the maternity homes and the CHIPS compounds did not have many workers so in those instances; the researcher administered the questionnaire to all the staff. This partly accounts for the recovery rate in 49.2% in the study. Though the bigger hospitals, for instance, Korle Bu, Ridge, Cocoa Clinic, Nyaho Clinic among others, had more departments, the respondents were selected without considering which departments they operate from. These were facilitated by the administrator of the hospital and the departmental heads.

3.5 Sampling Technique

Sampling technique represents the process researchers use to select the sample from the population of study (Mustafa, 2010). In this study, both the non-probability and the probability sampling methods were utilized in the selection of respondents. The purposive sampling method was the main non-probability sampling method used while the cluster and the simple random sampling method was the probability sampling methods used in the selection of health institutions and two category of healthcare workers – doctors and nurses.

As already explained, several health institutions fall under the healthcare sector. These include CHIPS, Clinics, Health Centre, Maternity Homes, Hospital/Teaching and University Hospitals/Psychiatric Hospitals as well as Polyclinics. In order to get equal representations from each category, the study used the cluster sampling method, where approximately 18% were

selected from each cluster of health institution (See Table 3.3). The details of the specific institutions selected have been annexed to this study as Appendix 4.

Selection of the specific respondents in each institution was based on availability or the role the personnel occupies. This general falls under the convenience sampling and the purposive sampling approaches. In some institutions, however, the respondents were sampled randomly. It must be clarified that the simple random sampling method was the primary sampling approach used in the study but where it was difficult to randomly select respondents, the convenience or the purposive sampling approach was used. This happened in the bigger health institutions, for instance, Tema General Hospital, Kaneshie Polyclinic, Holy Trinity Medical Center, Police Hospital, Nyaho Medical Center among others. In these hospitals, the administrators were helpful in getting some healthcare professionals to whom the research instrument was administered to.

Randomization, on the other hand, was especially feasible in the smaller hospitals – for instance – Stadium Clinic, Susan Clinic, Oman Clinic, Adenta Clinic, Cocoa Clinic, the Madina Health Center among others. The study ensured representativeness by randomly selecting respondents. In the conduct of the simple random sampling approach, the researcher, after presenting his introductory letter in each institution and getting the go-ahead from the administrator requested for the names of the nurses and doctors in these institutions. When the list was made available, the researcher then used a lottery method to select four and eight out of the respective professional group. However, with the other professionals, i.e., the administrator, pharmacist, records keeper and laboratory technicians, questionnaires were administered to the head of department and their assistants or in their absence, the available senior officers were selected.

On the administrative side, it was observed that in some cases, the accountant, the human resources manager or the administrative assistants were the available staff to respond to the questionnaire.

3.6 Research Instrument

The study used questionnaire as its main data-gathering instrument. Questionnaires are noted to produce quick result, convenient and less expensive to use. Questionnaires are advantageous whenever the sample size is large enough to make it uneconomical for reasons of time or funds to observe or interview every subject (Kalton, 1983). The greatest difficulty with questionnaires that are distributed to the subjects or potential respondents is the probable bias, which exists when, less than the total number in the sample actually responds to the questionnaires (Ogboru, 2010).

The questionnaire was designed to feature mainly close-ended questions. Some open-ended questions were asked to give respondent the freedom to decide the aspect, detail and length of some explanations that were sought on certain positions taken or views expressed. In essence, the open-ended questions enable the respondents to give a more adequate presentation of his/her understanding or appreciation of the issue under study and convey flexibility in their choice. The closed questions on the other hand were designed to limit responses to particular options while minimizing the risk of misinterpretation.

The research instrument is divided into five main sections. Sections A and E covers the background of the institutions and the responding health professionals/managers respectively.

The objective was to establish the background of the respondents, hence increasing the reliability of the data gathered on the other sections of the study. Section B elicits data on the extent of eHealth adoption among the health institutions in the country. This covers outlines various eHealth tools and assess its extent of use by the individuals and the institutions targeted. Section C focuses on the factors that drive eHealth adoption in the hospitals/clinics. Using the theoretical model targeted in the study, the section sought to find out how the various factors in the model influences eHealth adoption among the institutions under study. Section D deals with the constraints that inhibit eHealth adoption among the institutions targeted. The objective here was to assess which factors negatively influences the adoption of eHealth among the targeted institutions and workers. A copy of the questionnaire used for the study is presented in Appendix 1.

3.7 Data Collection Methods

Data gathering was undertaken with the aid of questionnaires. The structured questionnaire included the biographical information and sections that featured questions on each objective of the study. These questionnaires were administered to the selected officers in their offices, after permission was sought from the management of the health institutions. The researcher ensured that the phone numbers and emails of selected officers were taken to ensure appropriate follow up. Such follow-up ensured that the questionnaires were returned on time, though it must be admitted that this was very difficult as health officials are understandably busy.

Before the questionnaires were administered they were pre-tested. The pretesting exercise helped toredefine some aspects of the questionnaires to make to make it easier and more user friendly, hence reducing the time spent on answering. In addition, comments from my supervisors helped

to improve the reliability of the research instrument. Details of the pretesting have been presented in Section 3.8.

3.8 Pretesting

The data gathering instrument (questionnaire) was pretested at Tema General Hospital in February 2014. The pretesting was done with a doctor, nurse, lab attendant and a hospital record keeper respectively. Some observations were made with respect to some components of eHealth that needed revision. Specifically, respondents pointed out that there were repetitions on the eHealth devices and services itemized under Section B. For instance, they revealed that the imaging devices included television, x-ray, ultra-sound and tomographic devices. They therefore suggested that there could be one option named "Imaging Device" with the various imaging devices put into bracket to avoid confusion. On the same section, respondents pointed out that the multimedia devices also have some devices that fall under that classification repeated, which ought not to be so. The researcher therefore reclassified the section, with the various items classified under their major classifications – electronic devices (Digital video/photo cameras), imaging devices (x-ray, tomography, MIR, ultra-sound machines) and multimedia device (television, mobile phones, personal computers)

Besides the suggestions made above, the respondents did not have any challenge with understanding the questions nor the options provided. However, two respondents expressed concern with the length of the questionnaire. They were concerned that respondents might not get enough time to fill out a nine-page questionnaire. The researcher therefore had to encourage

them to do their best and spare sometime to fill them out, as there was little that could be done to reduce the number of questions or options provided.

3.9 Data Analysis

Data obtained from the questionnaires were analyzed using the Statistical Package for Service Solutions (SPSS) software, version 21. The researcher first entered the data into a spreadsheet format with the aid of Microsoft spreadsheet software. The data was then uploaded unto the SPSS software in readiness for analysis. The flexibility in data management and manipulations that is allowed in the use of SPSS analysis software made the researcher chose it as the main tool in the analysis.

Phase one of the analysis involved descriptive univariate analysis where frequencies and percentages were derived to describe the social and demographic characteristics of the respondents as well as those of the health institution. Thus, information regarding respondents' gender, age, highest educational qualification, professional role, and number of years spent in the current health facility fell under the respondent demographic information while information regarding ownership of the institution, specialization, and practice level were gathered under the institutional demographics.

Descriptive statistical tools such as pie chart, bar graphs and tables were used to illustrate the data in the study. In addition, mean scores, standard deviations and co-efficient of variations were used to report the dispersion of the data. With respect to the advanced statistics, the study used chi square, standard multiple regression and logistic regression analysis to evaluate various

factors influencing the use and adoption of eHealth devices and systems. The author wrote a computer programme using the SPSS syntax commands to analyze the data.

3.9.1 Analysis of Objective One - Establishing the extent of eHealth adoption among health institutions in the Greater Accra Region

Respondents were given a score table of a Likert scale of 0 to 5 to rank their level of adoption of various eHealth tools and systems in the health institution. A score of 5 represented very high use, 4 represented high use, 3 indicated moderate use, 2 represented low use, 1 represented very low use and 0 non-use or total lack of use of the eHealth tools or system under focus. The extent of adoption was ranked under the descriptive analysis while a chi-square was conducted on each tool and system under the advanced analysis, using the extent of adoption of tools and systems versus other variables. Under the descriptive analysis, the standard deviation and the coefficients of variation of the average scores were derived to establish the spread of adoption of the eHealth tools and systems. In addition, this section analyzed the various factors that were associated with eHealth adoption, such as relative advantage, compatibility, trialibility, observability and complexity, as emphasized in the Rogers Model. Using chi-square test, the study sought to establish the degree of statistical association between the extent of adoption and the factors that may influence adoption.

3.9.2 Analysis of Objective Two - Examining the factors driving the eHealth adoption among health institutions in the Greater Accra Region

A descriptive analysis was undertaken based on five major factors that affected eHealth adoption in the health sector. The sub-sections were 1) health care manager/professional characteristics, 2) medical practice characteristics, 3) performance expectancy of the device and system as judged by the responding health professional, 4) efforts required to use the device or system by the

health care managers and professionals and finally 5) other factors that influence the use of electronic health devices and systems as declared by the responding health care managers and professionals. Again, the descriptive analysis covered the mean score, the standard deviation and the coefficients of variation of each variable, with the standard deviation and coefficients of variation designed to establish the spread of the various factors that influence eHealth adoption.

A standard multiple regression and a logistic regression analysis were undertaken to determine health centre/firm characteristics, and socio-economic characteristics of responding health managers and professionals that significantly influences the use and adoption of eHealth devices. The multiple regression and the logistic regression models used various classifications of adoption of eHealth technologies as the dependent variable. The independent variables were as follows:

- Specialization of the health institution – gynecology/obstetrics, surgery and pediatrics
- Practice level of the health institution – primary, secondary or tertiary health care institution
- Ownership of health institution – private, government or quasi-government
- Gender of health care manager/professional
- Age of health care manager/professional
- Educational status of healthcare manager/professional
- Years of practice of the health care manager/professional

3.9.3 Analysis of Objective 3 – Ascertaining the constraints in eHealth adoption among health institutions in the Greater Accra

This objective analyses responses pertaining to challenges in the adoption of the various devices or systems in the health sector. Respondents were given a score table of a Likert scale of 0 to 5 to rank their level various constraints that impact the adoption of various eHealth devices/tools and systems in the health institution. A score of 5 represented very important constraint, 4 important constraints, 3 indicated moderately important constraint, 2 represented lowly important constraints, 1 represented very lowly important and 0 non-important constraint. The descriptive analysis covered the mean score, the standard deviation and the coefficients of variation of each variable, with the standard deviation and coefficients of variation designed to establish the spread of the various factors that impeded the use and adoption of eHealth technologies.

3.9.4 Brief Summary of the Multiple Regression and Logistic Regression

Multiple regression is an extension of simple linear regression. It is used when we want to predict the value of a variable based on the value of two or more other variables. The variable we want to predict is called the dependent variable (or sometimes, the outcome, target or criterion variable). The variables we are using to predict the value of the dependent variable are called the independent variables (or sometimes, the predictor, explanatory or regressor variables).

Brief Description of the Model

The general purpose of multiple regressions (the term was first used by Pearson in 1908) is to learn more about the relationship between several independent or predictor variables and a dependent or criterion variable. A multiple regression model for the study is of the form:

$$yi = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_{15} x_{15} + \varepsilon_i$$

Where, β_0 is the intercepts (the value of y when $x_i = 0$) and $\beta_1, \beta_2, \beta_3, \ldots, \beta_i$ are the slopes of the regression line which are the coefficients of the explanatory variables and $y_i, x_1, x_2, \ldots, x_n$

Model development and assumptions

The following assumptions as applied to fitting regression models were verified.

1. There must be a linear relationship between X and Y, in this case CBMI and fifteen explanatory variables. Of course non-linear relationships are very common, and can be easily addressed.
2. The error terms should average out zero, in the long run.
3. The variance of the error terms should be constant across observations. This refers to as homoscedasticity and the error terms must be normally distributed.
4. The error terms are not auto correlated, any one residual is not correlated with any other residual.
5. The use and interpretation of a multiple regression model also depends implicitly on the assumption that the explanatory variables are not strongly interrelated (multi-collinearity).

Logistic regression is a statistic that allows group membership to be predicted from independent variables, irrespective of whether the independent variables are continuous, discrete, or a combination of both. For a binary response models, the response, Y, of an individual or an experimental unit can take on two values denoted for convenience by 1 and 0 (for example, Y=1 if adoption of e-health is present, otherwise Y= 0).

The logit model can be written as the log-linear model:

$$In\Omega(\mathrm{x}) = \mathrm{x}\beta \qquad \text{Equation (1)}$$

Where

$$\Omega(\mathrm{x}) = \frac{P_r(y=1/x)}{P_r(y=0/x)} = \frac{P_r(y=1/x)}{1-P_r(y=1/x)} \qquad \text{Equation (2)}$$

The equation (2) is the odds of the event given x that a e-health adoption is present given the gender, years, education, type of hospital facility and type of medical practitioners.

$In\Omega(\mathrm{x})$ is the log of the odds – the logit. Equation 1 shows that the logit model is linear. Consequently,

$$\frac{\partial In\Omega(\mathrm{x})}{\partial x_k} = \beta_k$$

Since the model is linear, β_k can be interpreted as: For a unit change in Ω_k, we expect the logit to change by β_k holding all other variables constant. This means that effect of a unit change in x_k on the logit does not depend on the level of x_k or on the level of any other variable, taking the exponential of equation one.

The dependent variable was the adoption of e-health. Adoption of e-health was a dummy variable with 1 representing firms that used eHealth technologies very highly or highly and 0 otherwise (moderate, low and no use).

The following were the independent variables:

GYNECOLOGY was a dummy variable for health centres that had gynecological services with 1 representing presence of these services and 0 absence of these services;

PEDIATRICS was a dummy variable for health centres that had pediatrics services with 1 representing presence of these services and 0 absence of these services;

TERTIARYPRACTICE was a dummy variable with 1 representing health centres, which were referral, service institutions such as the university hospitals and zero otherwise;

PRIVATE was a dummy variable with a value of 1 for privately-owned and managed health centres and 0 for publicly-owned health centres;

GENDER was a dummy variable denoting the sex of the responding health managers and professional with 1 for males and 0 for females;

AGE was the age group that the responding health managers and professional belonged to. This variable took five values from 1 to 6, as described earlier;

EDUCATION was the educational attainment level of the responding health professional or manager with 1 representing diploma holders, 2 representing those with completed Bachelor degrees, 3 representing those with completed Master degrees and 4 denoting those who were classified as medical doctors or had doctorate degrees;

YEARS was a variable denoting the number of years that the responding health manager and professional had worked at the health centre or organization; and

3.10 Ethical Considerations

Various ethical considerations were observed in this study. These are confidentiality, privacy for participants and informed consent. Towards this end, the researcher ensured that participation is

this study was purely voluntary, without any element of coercion. To ensure privacy, questionnaires were given to respondents in their various offices at the health facilities. Where such facilities were not available, they were called aside and the questionnaire handed over to them in a confidential manner.

Moreover, respondents were told not to indicate their names on the questionnaires. Further, respondents were assured confidentiality in a confidentiality clause on the questionnaire. This clause gave respondents the confidence that the responses given would not traced back to them. After the analysis, the data were kept locked in a password protected locker to prevent the data from getting into the wrong hands.

CHAPTER 4

RESULTS OF SIMPLE STATISTICAL ANALYSIS OF USE AND ADOPTION OF ELECTRONIC HEALTH DEVICES AND SYSTEMS

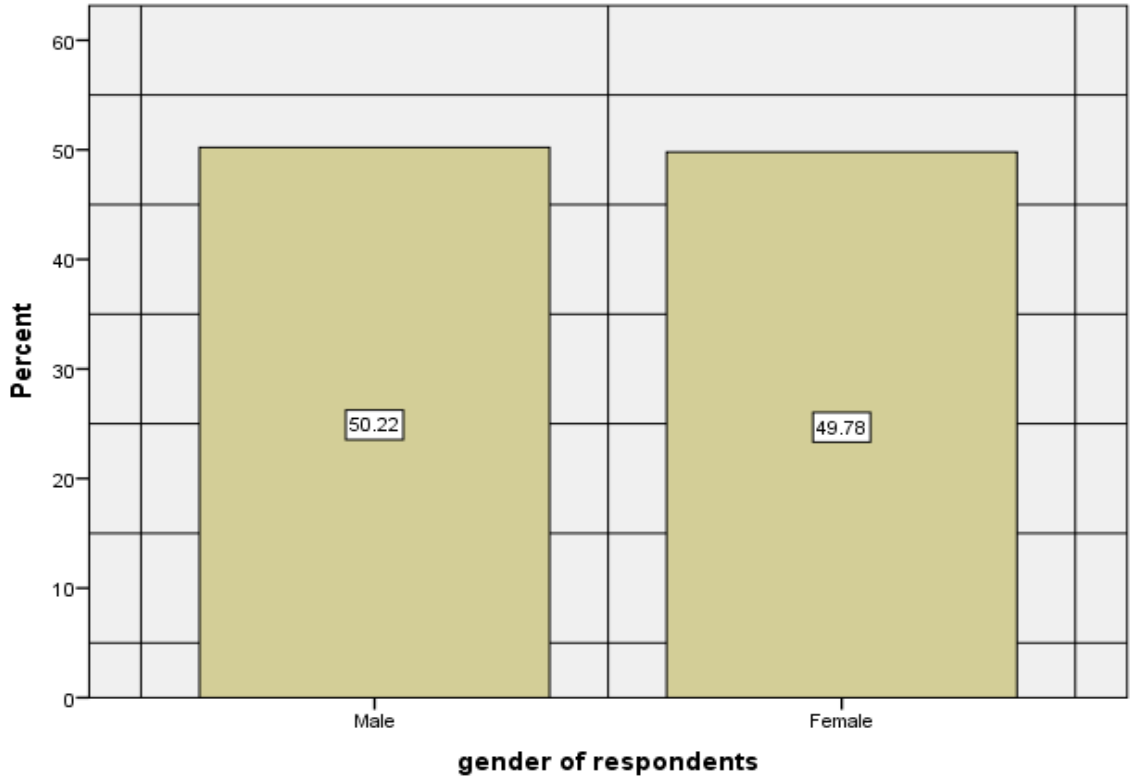
4.1. Introduction

The analysis of data in the study is grouped into two parts – the descriptive and inferential statistical analysis – involving the current and potential adoption of Electronic Health (eHealth) systems and devices in hospitals and clinics in the Greater Accra Region. This Chapter 4 covers the descriptive analysis while chapter five covers the inferential analysis. The descriptive analysis entails simple representation of data using frequencies, means, standard deviations and co-efficient of the variables. The socio-economic background of respondents is presented first before the summary descriptive analysis report dealing with use and adoption of eHealth technologies.

4.2 Socio-economic Information on Responding Health Care Managers and Professionals

The respondents' socio-economic information entails their gender, age, educational status, and the institutional place of work. Concerning gender, it was observed that the males were slightly more represented than females. Males constituted 50.22% while females constituted 49.78% of the sample of respondents. These gender proportions are illustrated in Figure 4.1.

Figure 4.1: Illustration of the proportion of respondents by Gender



Source: Derived from survey data, 2014.

Majority of the respondents were between 25 to 30 years. This age group had 42% of the total respondents represented therein. Those aged 31 to 35 years were 16.8%, bringing the total number of under 40 years to almost 60%. Thirty-three percent (33%) of the respondents were between 41 to 45 years while the rest (8.2%) were 51 years or above. It was also observed that none of the respondents were between 36 to 40 years and 46 to 50 years. These details are presented in Table 4.1.

Table 4.1 also indicates the number of years respondents have practiced in their current place of work. Slightly above 50% of the respondents have been working in their respective institutions for one to three years; while 35.7% have been working between four and six years. Fourteen percent (14%) have been working in their respective institution between seven to nine years. Overall, the responding managers have worked long enough in their respective institutions to be abreast with the operational issues relating to the delivery of health care outcomes to their customers, including the availability and utilization of eHealth technologies.

Table 4.1 also reports on the educational qualifications of respondents. The largest group of respondents (47.7%) were degree holders.The second largest group was medical doctors comprising 29.8% of the total respondents. Diploma holders were 9.6% of the respondents while Master's degree holders constituted 14.2% of the total respondents. Overall, the responding healthcare professionals/mangers were highly educated.

Finally, with respect to the respondent's place of work, it was observed that majority were working in private practice, i.e. private clinics and maternity homes followed by those who work

in private hospitals. Cumulatively, these two places constituted 54.4% of the respondent's places of work (refer to Table 4.1). The health centres/polyclinics constituted 18.1% while the government, teaching and the psychiatric hospitals made up 18.7% of the institutions. Quasi-public institutions constituted 7.8% of the total respondents. In general, these figures give a picture of adequate representation of the various categories of primary, secondary and tertiary healthcare institutions in this study (refer to Table 4.1).

Table 4.1: Summary of Socio-Economic Characteristics of Responding Healthcare Managers and Professionals

Item/ group	Percentage
Age group	
➢ 25-30	42.0
➢ 31-35	16.8
➢ 36-40	0.0
➢ 41-45	33.0
➢ 46-50	0.0
➢ 51- years and above	8.2
Years in Practice	
➢ 1 to 3 years	50.3
➢ 4 to 6 years	35.7
➢ 7 to 9 years	14.0
Educational Level	
➢ Diploma	9.6
➢ Bachelor degree	47.7
➢ Master degree	14.2
➢ Medical Doctor	28.5
Current Place of Work	
➢ Hospitals Private practice	27.3
➢ Health Centres/Polyclinics	18.1
➢ Government hospital/Teaching Hospitals	18.7
➢ Quasi-Public Hospitals/Clinics	7.8
➢ Private Clinics/Maternity Homes	28.1

Source: Derived from survey data, 2014.

4.3. Extent of Current Use of Electronic Health (Ehealth) Devices and Systems

Table 4.3 presents information about the extent of current use of eHealth devices by the responding health care managers and professionals in the Greater Accra Region. It is apparent from the table that the multimedia devices, internet and imaging devices are the three most widely used eHealth devices or tools. These were reported by 694,732 and 657 respondents respectively in terms of the Likert scale-scoring index for use of devices. The devices, which were least, used were telemedicine devices (score of 0.94), video conferencing (score of 0.53) and tele-consulting equipment (score of 0.45); refer to Table 4.3.

Table 4.2: Ranking of the current use of electronic health devices by health care managers and professionals

No.	Device/Tools	Number of responding health care managers and professionals	Average score of importance	Standard deviation of score	Coefficient of Variation
1.	Multimedia devices	694	4.05	1.476	0.364
2	Internet	732	3.32	2.000	0.602
3.	Imaging devices	657	2.93	2.048	0.698
4.	Electronic devices	656	2.65	1.875	0.709
5.	Projection devices	618	1.06	1.522	1.434
6.	Telemedicine devices	618	0.94	1.827	1.934
7.	Video conferencing systems	578	0.53	1.305	2.464
8.	Tele-consulting equipment	425	0.45	1.428	3.195

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting very high use, 4 high use, 3 moderate use, 2 low use, 1 very low use and 0 means not used at all.

The coefficient of variation is the standard deviation divided by the mean score.

Table 4.3 presents information about the extent of current use of eHealth systems by the responding health care managers and professionals in the Greater Accra Region. It is apparent from the table that the administrative systems and the patient record system are highly used, with a mean score of 3.56 and 3.50 respectively. The pharmaceutical/prescriptive system, procurement and supply chain system and the laboratory management systems are moderately used with mean scores of 3.36, 3.36 and 3.17 respectively. It is also apparent from the table that the specialization (gynaecological/paediatric) management systems, ward management systems, consulting and remote service system, the public health management, patient appointment system and the referral management system were lowly used. This was attested to with mean scores of 2.48, 2.45, 2.21, 2.13, 2.00 and 1.69 respectively. The two very lowly used eHealth systems were the electronic prescription system and the web based disease surveillance image management system which had mean scores of 1.31 and 1.18 respectively (refer to Table 4.3).

Table 4.3: Ranking of the level of current use of electronic health systems by responding health care managers and professionals

No.	Device/Tool	Number of responding health care managers and professionals	Average score of importance	Standard deviation of score	Coefficient of Variation
1.	Administrative Systems	772	3.56	1.931	0.543
2	Patient Record System	772	3.50	2.014	0.575
3.	Pharmaceutical/prescriptive system	772	3.36	2.148	0.639
4.	Procurement and supply chain system	771	3.36	1.979	0.589
5.	Laboratory Management	693	3.17	2.114	0.668
6.	Specialization (gynecological, pediatric, surgical) management	655	2.48	2.174	0.877
7.	Ward Management	694	2.45	2.139	0.875
8.	Consulting and Remote service system	732	2.21	2.286	1.033
9.	Public Health Management	616	2.13	1.935	0.909
10.	Patient appointment system	655	2.00	2.118	1.058
11.	Referral Management system	616	1.69	1.993	1.180
12.	Electronic prescription system	616	1.31	1.761	1.341
13.	Web based disease surveillance image management system	616	1.18	1.547	1.310

Source: Derived from survey data, 2014

Note: The scoring is based on 5 denoting very high use, 4 high use, 3 moderate use, 2 low use, 1 very low use and 0 means not used at all. The coefficient of variation is the standard deviation divided by the mean score.

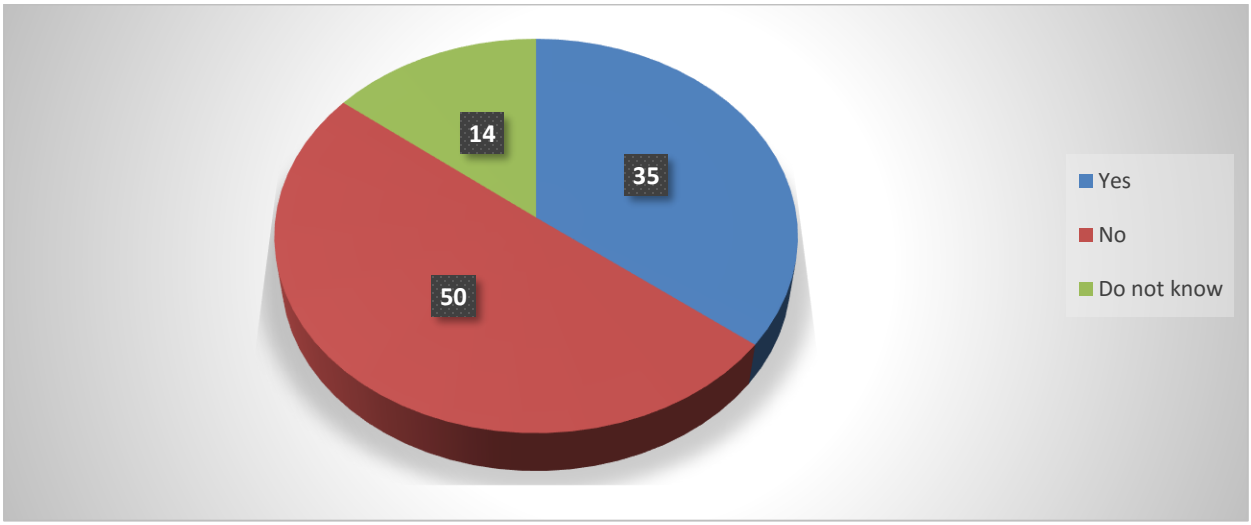
Figure 4.2 illustrates the degree of integration of eHealth devices and systems into the operations of the health institutions understudy. While 35 perceived that the entire facility is networked, a whopping 50% indicated otherwise. Fourteen percent (14%) indicated that they do not know whether their facilities have been fully integrated. It is however obvious that majority of health institutions have not fully integrated eHealth devices and systems into their operations.

In order to establish which category of institutions has more fully integrated eHealth into their operations, a cross-tabulation analysis was undertaken. As summarized in Table 4.4, 73 respondents indicated that the private hospitals, as a whole, have integrated eHealth into their operations while 35 and 36 said similarly for the health centre/polyclinics and the government/teaching/psychiatric hospitals respectively. Seventeen (17) respondents indicated that the quasi-public hospitals have integrated eHealth into their operations while 32 from the private clinics and maternity homes indicated that the integration has taken place in those facilities.

It is however obvious from the negative responses that the private medical practices as well as the government hospitals and the teaching/psychiatric hospitals have not adopted eHealth in their operations. While 138 responded in the negative for the private medical practice, 107 responded similarly for the government or public institutions. When the number that answered "Yes" and those that answered "No" are compared, it becomes obvious that several respondents do not share the idea that eHealth is fully integrated in the operations of health care institutions.

Among the healthcare institutions, it is only the health centres/polyclinics, which recorded only a "Yes" with respect to the integration of eHealth in their full operations. Thus, compared to the bigger and obviously better resourced institutions, it appears these smaller institutions have better integration of eHealth, making size a non-consideration in the integration and usage of eHealth. This was further confirmed in the 32 respondents who indicated that the private clinics and maternity homes have integrated eHealth in their operations, as against only one respondent who indicated otherwise.

Figure 4.2: Illustration of the integration of eHealth into the entire operations of health care delivery



Source: Derived from survey data, 2014

Table 4.4: Cross tabulation analysis results of integration of eHealth into operations and type of institutions

		Has eHealth integrated the entire operations of your health institution			Total
		Yes	No	Do not know	
Institutional Type	Hospital private practice	73	138	0	211
	Health Centre/Polyclinics	35	0	0	35
	Government Hospital/Teaching/Psychiatric Hospitals	36	107	1	144
	Quasi-Public Hospitals/Clinics	17	27	3	47
	Private Clinic/Maternity Homes	32	1	74	107
Total		**193**	**273**	**78**	**544**

Source: Derived from survey data, 2014

It is obvious from Table 4.5 that the combination of Patient records, pharmacy and laboratory diagnosis departments, followed by the patients' records departments, as a single unit, uses eHealth devices and systems relatively more than the other departments. These submissions were given by 18.5% and 13.8%. The other stand-alone departments that use eHealth devices and systems are the laboratory and diagnosis, administration and the pharmacy units. These recorded 12.6%, 11.6% and 10.4% respectively. It is however obvious that the patient records department has the highest integration of eHealth devices and tools followed by the laboratory/diagnosis and the administration departments. Other healthcare operations such as consulting, ward management were the least users of eHealth devices and systems in the various health institutions.

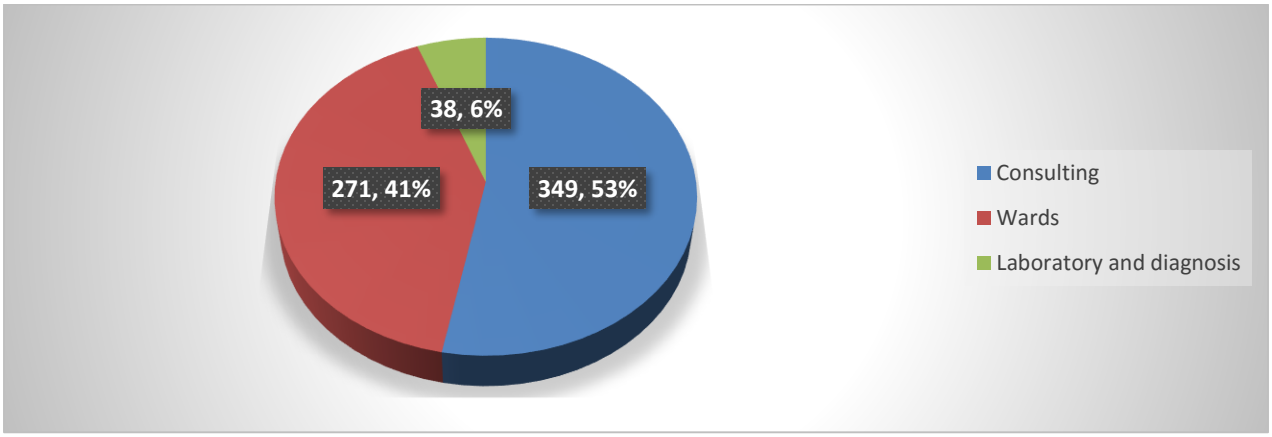
The rare usage of eHealth devices and systems in the wards and in consulting services was confirmed when respondents were asked to indicate the departments where eHealth is least used. Here, 53% mentioned that eHealth is least used in consulting services while 41% indicated that it is least used in ward management. Thus, a cumulative 94% indicated that eHealth is least deployed in consulting and ward management services. These responses confirmed the earlier responses given in Table 4.5. The details of the least usage of eHealth devices and systems are captured in Figure 4.3.

Table 4.5: Ranking the departments that most use eHealth devices and systems as reported by health care managers and professionals

	Frequency	Valid Percent
Patient record systems	112	13.8
Pharmacy	84	10.4
Laboratory and Diagnosis	102	12.6
Patient records and ward management	48	5.9
Patient records and consulting	24	3.0
Patient records, consulting and ward management	44	5.4
All departments in the hospital	70	8.6
Patient records, pharmacy and laboratory diagnosis	150	18.5
Administration	94	11.6
None of the departments	72	8.9
Pharmacy and ward	10	1.2
Total	**810**	**100.0**

Source: Derived from survey data, 2014

Figure 4.3: Illustration of the Departments in which least use eHealth devices and systems



Source: Derived from survey data, 2014

Next, respondents were asked to indicate which professional group most and least use eHealth devices and tools in the various health institutions in the region (refer to results in Table 4.6). Concerning the group that most use eHealth, 32% mentioned administrators, 18.3% mentioned doctors while 17.8% mentioned laboratory technicians or the diagnostic specialist. The case of the administrators and the laboratory technicians are not surprising since their job involves using eHealth tools or computers, especially in the case of the laboratory technicians. Moreover, this finding confirms earlier responses given on which departments' uses eHealth most and least, as captured in Table 4.5 and Figure 4.3 above.

However, one would not expect several respondents to indicate doctors as one of the topmost professional groups that use eHealth, considering that the consulting and ward management systems recorded low use of eHealth. However, the researcher observed that most of the doctors he administered questionnaires to had tablets and smart phones, which they use for their personal research. These devices are however not deployed in their work in a system-wide integration, as every process in the consulting and ward management service was manually done. This might explain why respondents indicated that doctors are one the highest users of eHealth tools and systems but the consulting role fell low on the ladder of the departments or healthcare roles that use eHealth in their operations. The details are reported in Table 4.6 and Figure 4.4.

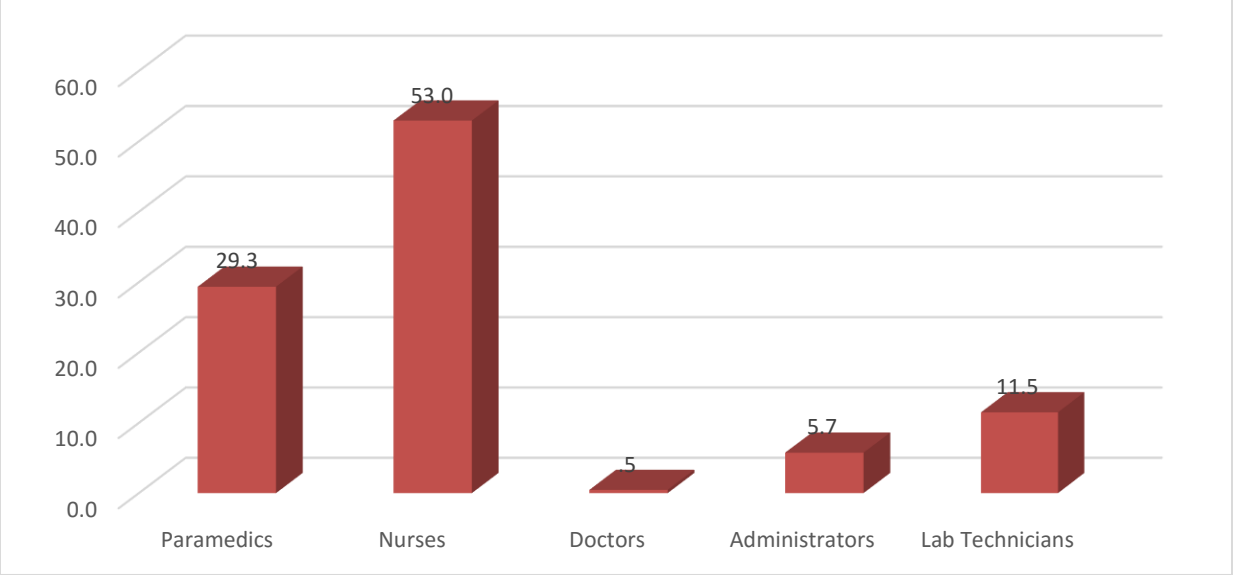
With respect to the group that least use eHealth devices and systems, nurses came up topmost, followed by paramedics and lab technicians. These had 53%, 29.3% and 11.5% respectively. Approximately 6% and 5% mentioned the administrators and doctors respectively. It is however apparent that eHealth technologies are least used by nurses and paramedics.

Table 4.6: Ranking the Professionals that most use eHealth devices and systems as reported by health care managers and professionals

Variable	Frequency	Valid Percent
Doctors	146	18.3
Nurses	32	4.0
Paramedics	40	5.0
Administrators	256	32.0
Lab Technicians	112	14.0
Radiologist	32	4.0
None	142	17.8
Pharmacist	16	2.0
All the professionals	24	3.0
Total	**800**	**100.0**

Source: Derived from survey data, 2014

Figure 4.4: Illustrations of the Healthcare Professionals that least use eHealth Devices and Systems



Source: Derived from survey data, 2014

Regarding the software used to run the various healthcare systems in the targeted institutions, it was obvious that majority of them did not have such a facility. Out of the few that had such facilities, these specific software mentioned included the following:

- Bliss
- Medical pro
- PM2 (Practice Manager 2)
- Health pro
- Flipson
- Lupsol
- SQL
- Look up systems
- Web applications
- DHMIS (District Health Management Information System)

Respondents in the public health institutions mentioned the DHMIS as the software used, though majority indicated that they do not have any idea the features of that software. In fact, even for those who mentioned the DHMIS, only a handful could indicate the key features of the software, indicating that they might know this software by name but not in functionality.

Among the private health practices, several software was mentioned but the researcher observed an interesting trend. In some hospitals, for instance, Cocoa Clinic, Lighthouse Hospital, Barnor Hospital, respondents mentioned more than one software being used in their operations. This triggered the curiosity of the researcher and upon further inquiries, it was realised that the software in these institutions were not integrated for an institution-wide application but were used in specific

departments. In other words, the principal departments have their own software for managing their operations, rather than one integrated software with different phases to managing different operations of the same hospital. It was also obvious that the software is used mainly for billing, records or attendance and accounting purposes. The software were thus intimately integrated into administrative/financial operations than with the core healthcare delivery itself.

4.4. Factors Driving Current Use of Ehealth Devices and Systems

The factors that drive eHealth devices and systems use and adoption have been grouped under various sub-themes. The first theme covers the health care managers/professional characteristics that influence the current use of electronic health systems and devices. The factors considered here are the manager/professional' computer anxiety, years in practice, age, IT experience and knowledge, gender and the role they perform in the organization. Among these factors, none wielded a very high influence or a high influence. Only computer anxiety and years in practice wielded a moderate influence which means that among the health care managers/professionals characteristics that influences adoption of eHealth systems and devices, only computer anxiety and the years of practice had some influence, albeit moderate. These had mean score of 3.41 and 2.67 respectively. The other factors, being age, IT experience and knowledge, gender and the role they perform in the organization wielded only a low influence on eHealth systems and devices adoption. These had mean scores of 2.31, 1.88, 1.87 and 1.63 in that order.

Table 4.7: Ranking of the degree of importance of health care manager and professional characteristics that influence the current use of electronic health devices and systems

No.	Characteristic	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1.	Computer anxiety	656	3.41	1.192	0.350
2.	Years in practice	117	2.67	0.473	0.178
3.	Age	617	2.31	0.981	0.424
4.	IT Experience and knowledge	617	1.88	1.112	0.592
5.	Gender	617	1.87	0.332	0.177
6.	Role	618	1.63	0781	0.480

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting the characteristic has very high influence, 4 high influence, 3 moderate influence, 2 low influence, 1 no influence in influencing adoption.

The coefficient of variation is the standard deviation divided by the mean score.

Respondents also assessed how characteristics related to the medical practice or the clinic influences eHealth systems and devices adoption as ranked by the health managers/professionals. Four factors - patient age range, single/multi-speciality, practice Levels and the availability of ICT infrastructure – were observed to wield a high influence of the current use of eHealth systems and devices. These variables had mean scores of 4.20, 4.12, 3.94 and 3.65 respectively. The results of this analysis are reported in Table 4.8.

On the other hand, practice size; management commitment in supporting change, financial constraints and IT support had moderate influence on medical practice characteristics in the adoption of eHealth system and devices among the health institutions. These variables had mean scores of 3.44, 3.42, 3.35 and 3.12 respectively. Location was the only variable with a low influence on the adoption of eHealth systems and devices. Overall, it is obvious that medical practice characteristics had moderate to high influence on the adoption of electronic health systems and devices (refer to Table 4.8).

Table 4.8: Ranking of the degree of importance of characteristics of the medical practice or clinic that influence the current use of electronic health devices and systems as declared by the responding health managers and professionals

No.	Characteristic	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1.	Patient age range	578	4.20	0.751	0.179
2.	Single/multi-speciality	617	4.12	0.988	0.240
3.	Practice Levels	617	3.94	0.966	0.245
4.	Availability of ICT infrastructure	656	3.65	.834	0.228
5.	Practice Size	617	3.44	1.116	0.325
6.	Management commitment in supporting change	734	3.42	1.272	0.372
7.	Financial constraints	656	3.35	.837	0.250
8.	IT support	656	3.12	1.130	0.362
9.	Location	617	1.63	0.859	0.528

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting the characteristic has very high influence, 4 high influence, 3 moderate influence, 2 low influence, 1 no influence in influencing adoption.

The coefficient of variation is the standard deviation divided by the mean score.

Another factor that influences eHealth adoption is performance expectancy of the eHealth systems and tools which essentially refers to how respondents expect the system to function to make their work easier. Based on the results reported in Table 4.9, perceived usefulness and need had a high influence while computer self-efficacy, job fit and cost saving had low influence. While perceived usefulness had 3.67 mean score, the other variables had 2.00, 1.88 and 1.69in that order. Overall, it is apparent that performance expectancy of the system or devices had a low influence on eHealth adoption among hospitals and clinics in the region.

Another factor that influences eHealth is the effort required to use eHealth systems and devices, relative to the efforts expended on a manual system. This was termed effort expectancy. Among variables that fell under effort required, it was observed that perceived ease of use ranked highest, having a mean score of 3.41 (refer to the results in Table 4.10). Ease of use was however not ranked as high as the perceived ease of use. This variable had a mean score of 2.06. Complexity was also considered to wield a low influence on the adoption of eHealth systems and devices.

Table 4.9: Ranking of the degree of importance of performance expectancy of the device and system as judged by the responding health professional that influence the current use of electronic health system devices and systems.

No.	Characteristic	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1	Perceived usefulness and need	578	3.67	1.349	0.368
2	Computer self-efficacy	656	2	0.843	0.421
3	Job fit (designed to simplify my work)	618	1.88	0.931	0.496
4	Cost saving	617	1.69	0.582	0.345

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting the characteristic has very high influence, 4 high influence, 3 moderate influence, 2 low influence, 1 no influence in influencing adoption. The coefficient of variation is the standard deviation divided by the mean score.

Table 4.10: Ranking of the degree of importance of efforts required to use the device or system by the health care managers and professionals that influence the adoption of electronic health devices and systems

No.	Characteristic	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1	Perceived ease of use	656	3.41	1.092	0.32
2	Ease of use	617	2.06	0.752	0.365
3	Complexity	617	1.88	0.784	0.418

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting the characteristic has very high influence, 4 high influence, 3 moderate influence, 2 low influence, 1 no influence in influencing adoption. The coefficient of variation is the standard deviation divided by the mean score.

Table 4.11 reports the ranking of the degree of importance of other factors that influences the current use of eHealth systems and devices in health institutions. Among these other factors, end-user involvement in the design and usage of eHealth systems and devices ranked highest, with a mean score of 4.31, indicating that it wields a high influence as far as use and adoption is concerned. Other variables that also have high influence on the adoption and use were interoperability (which is interpreted as the ability to make systems and organisations work seamlessly) and professional autonomy, i.e., the ability of eHealth to help the health care professional to be self-sufficient in their work. While patient privacy concerns and legal concerns had a moderate influence of eHealth adoption and usage among the health care professionals, time cost had a low influence on eHealth adoption in the sampled health institutions. The above three variables had a mean score of 2.78, 2.53 and 2.12.

Table 4.11: Ranking of the degree of importance of other factors that influence the use of electronic health devices and systems as declared by the responding health care managers and professionals

No.	Factor	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1.	End user involvement in the design and usage of eHealth devices and tools	734	4.31	.799	0.185
2	Interoperability (the ability to make systems and organisations work together)	618	4.12	.599	0.145
3.	Professional autonomy	734	3.79	1.057	0.279
4.	Patient privacy concerns	734	2.78	1.281	0.460
5.	Legal concerns	578	2.53	1.257	0.497
6.	Time cost	656	2.12	.899	0.424

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting the factor has very high influence, 4 high influence, 3 moderate influence, 2 low influence, 1 no influence in influencing adoption.

The coefficient of variation is the standard deviation divided by the mean score.

4.5. Constraints Impeding the Use of EHealth Devices and Systems

This section covers the descriptive analysis of the constraints impeding the adoption and use of eHealth systems and devices. Among the constraints identified, ten were observed to be very important in impeding eHealth adoption in the healthcare sector. The highest three among these, however, were corruption involved in the procurement or the supply chain of eHealth systems and devices, lack of commitment and clear decisions on investment in technology by health managers or administrators and ignorance about ICT solutions. The results of the analysis of the level of importance of various constraints are summarized in Table 4.12.

The other factors were widespread ICT illiteracy among patients, resistance to change on the part of healthcare practitioners, high cost of acquisition especially at the initial stages, shortage of ICT skilled personnel (technical skills), inadequate budgetary allocation to the health sector, security, privacy and confidentiality concerns and weak information technology structure. The latter had the least mean score of 3.56, which also interprets to indicate that these factors are important in blocking electronic health adoption and usage in the health care sector.

Only two factors, i.e., healthcare professional's perception about technological complexities and the provision of health services across wide geographic areas were not regarded as very important constraints in the adoption and usage of eHealth systems and tools. These had a mean score of 1.94 and 1.84, confirming that they are not very potent hindrances.

Table 4.12: Ranking of the degree of importance of constraints that affect the use and adoption of electronic health system devices and tools as declared by the health care professional

No.	Device or tool	No.	Average score of importance	Standard deviation of score	Coefficient of Variation
1	Corruption	619	4.06	0.968	0.239
2	Lack of commitment and clear decisions on investment in technology by health managers	696	4.05	0.972	0.24093
3	Ignorance about ICT solutions	696	4.00	0.884	0.221
4	Widespread ICT illiteracy among patients	696	3.99	1.002	0.251
5	Resistance to change on the part of healthcare practitioners	696	3.94	1.025	0.26
6	High cost of acquisition especially at the initial stages	696	3.89	0.738	0.19
7	Shortage of ICT skilled personnel (technical skills)	696	3.72	1.368	0.368
8	Inadequate budgetary allocation to the health sector	696	3.64	0.906	0.248
9	Security, privacy and confidentiality concerns	658	3.64	0.904	0.248
10	Weak information technology structure	696	3.56	1.067	0.3
11	Healthcare professionals perception about technological complexities	579	1.94	1.185	0.612
12	Provision of health services across wide geographic areas	734	1.84	1.18	0.641

Source: Derived from survey data, 2014

Notes

The scoring is based on 5 denoting that item is extremely important, 4 very important, 3 moderately important, 2 of low importance, 1 not important as a constraint in influencing adoption of electronic health system devices and tools.

The coefficient of variation is the standard deviation divided by the mean score.

CHAPTER 5

RESULTS OF ADVANCED STATISTICAL ANALYSIS OF USE AND ADOPTION OF ELECTRONIC HEALTH DEVICES AND SYSTEMS

5.1: Introduction

This Chapter covers the results of the advanced statistical analysis undertaken in the study. Three advanced statistical analysis undertaken were chi square test, multiple regression and logistic regression analysis. The chi square analysis was to evaluate factors that were associated with use and adoption of eHealth. Multiple regression and logistic regression analysis were undertaken to establish institutional and professional characteristics that influenced eHealth adoption of devices and systems in the various healthcare institutions.

5.2 Results of Chi-Square Analysis of Association between Current Use of Electronic Health (Ehealth) Devices and Systems and Various Factors Related to the Respondents

This section covers chi square test on the extent of institutional eHealth adoption and various factors related to adoption. The results of the chi-square analysis determine the degree of association between the various factors by the Rogers Models as influencing eHealth adoption and the likelihood or extent of adoption. The factors were grouped into relative advantage, compatibility, trialibility, complexity and observability. These factors were pointed out as the attitude formation issues that influence ICT adoption in the Rogers Model. Other authors have corroborated Rogers's argument, through their empirical findings, that these factors determine the likely of adoption rate (Bates, Manuel and Oppendheim, 2007; Tagoe, 2013; Robinson, 2009). It is important to note that chi-square analysis is useful to provide possible candidates for use in regression analysis to determine factors influencing particular choices of respondents.

However, chi square analysis does not imply causation; it only indicates the degree of association.

Table 5.1presents results related to the degree of association between relative advantage and adoption of eHealth devices and systems. It can be gleaned from the table that all the variables are highly significant, meaning that the extent of eHealth adoption is significantly associated with various relative advantageous factors such as “using eHealth devices/systems to improve my efficiency at the workplace”, “mistakes with eHealth Diagnosis/treatment are easier to correct than manual ones”, “enough Advantage of eHealth for me to Consider Using it”, “mistakes are more likely to occur with eHealth usage than with Manual Operations and eHealth helps me better manage my time” variables. In essence, respondents see that they are relatively advantaged if they adopt eHealth devices and system, rather than if they continue with the current manual system of operations. This confirms Robinson’s (2009) assertion that if an innovation is perceived to be better than the existing one, then it is more likely to be adopted.

Table 5.1: Statistical significance of the association between the extent of adoption of eHealth devices and systems (eHealth technologies) and various factors related to the respondent's perceived relative advantage in eHealth usage for improved efficiency of his/her work

No.	Items of Comparison	Pearson Chi-square Test Significance Level
1	Extent of use and adoption of eHealth technologies versus Using eHealth devices/systems to improve my efficiency at the workplace	0.000*
2	Extent of use and adoption of eHealth technologies versus Mistakes with eHealth Diagnosis/treatment are easier to correct than manual ones.	0.000*
3	Extent of use and adoption of eHealth technologies versus Enough Advantage of eHealth for me to Consider Using it.	0.000*
4	Extent of use and adoption of eHealth technologies versus Mistakes are more likely to occur with eHealth usage than with Manual Operations.	0.000*
5	Extent of use and adoption of eHealth technologies versus eHealth helps me better manage my time.	0.000**

Note

*** accepted level of significance was 5% used throughout this study**

Source: Derived from survey data, 2014

Table 5.2 reports the findings of another chi square test that assessed the relationship between the extent of adoption and various factors classified under compatibility of eHealth devices and systems with health manager/professionals work. Again, the study noted a positive relationship between the extent of adoption and various factors classified under compatibility. This means that there was a positive relationship between the extent of adoption and "needing eHealth in my work", "eHealth makes eHealth makes health practitioners redundant", "it's easier to work manually than with eHealth tools", "worry about the privacy of patient information when using eHealth" and "the worry about eHealth are not secure enough to protect patient information" variables.

In essence, if eHealth is perceived to be consistent with the values, past experiences, and needs of potential adopters, then it is likely to be adopted (Tagoe, 2013). Alternatively put, eHealth devices and systems that are compatible with users' values, norms or practices have greater chances of being adopted.

Table 5.2: Statistical significance of the association between the extent of adoption of eHealth devices and systems and various factors related to the respondent's perceived compatibility of his/her work with eHealth usage

No.	Items of Comparison	Pearson Chi-square Test Significance Level
1	Extent of use and adoption of eHealth technologies versus needing eHealth in my work	0.000*
2	Extent of use and adoption of eHealth technologies versus eHealth makes eHealth makes health practitioners redundant	0.000*
3	Extent of use and adoption of eHealth technologies versus it's easier to work manually than with eHealth tools	0.000*
4	Extent of use and adoption of eHealth technologies versus worry about the privacy of patient information when using eHealth	0.000*
5	Extent of use and adoption of eHealth technologies versus worry about eHealth are not secure enough to protect patient information.	0.000**

Note

*** accepted level of significance was 5% used throughout this study**

Source: Derived from survey data, 2014

Table 5.3 presents the results of the analysis that assesses the relationship between the extent of adoption and various variables classified under trialibility. According to Rogers (2003), trialibility represents the extent to which an innovation could be experimented within a shorter time frame, implying that if eHealth is trialable within a short period, then it presents less uncertainty to the individual considering it and consequently, likelihood for its adoption increases. As gleaned from Table 5.3 there was a significantly strong relationship between the extent of adoption and various variables that were classified as trialable. In other words, variables such as "easy to use eHealth after trying them out", "a trial convinced me that using eHealth was better than using manual systems", "I do not need a trial to be convinced which eHealth devices//systems tools are best for me", "I did not take much time to try eHealth devices/systems before I finally accepted their use" and "it is better to experiment with eHealth before adopting them" were found to strongly determine the adoption of eHealth devices and systems.

Again, the study observed a strong linear relationship between extent of adoption and observability, where the latter has been defined as the ability of individuals, groups or institutions to vision or describe an innovation. This study thus saw a positive relationship between the extent of adoption and factors such as "I was influenced by what I observed as the benefit of using eHealth", "I observed others using eHealth and saw the advantages of doing so", "observing eHealth users before using same as unnecessary" and "I have seen how others use eHealth before using them". In other words, the more the healthcare managers and professionals can envision and describe eHealth, the more they are likely to adopt eHealth technologies.

Table 5.3: Statistical significance of the association between the extent of adoption of eHealth devices and systems and various factors related to the respondent's perceived trialibility of eHealth devices/systems

No.	Items of Comparison	Pearson Chi-square Test Significance Level
1	Extent of use and adoption of eHealth technologies versus easy to use eHealth more frequently after trying them out.	0.000*
2	Extent of use and adoption of eHealth technologies versus a trial convinced me that using eHealth was better than using manual systems	0.000*
3	Extent of use and adoption of eHealth technologies versus I do not need a trial to be convinced which eHealth devices//systems tools are best for me	0.000*
4	Extent of use and adoption of eHealth technologies versus I did not take much time to try eHealth devices/systems before I finally accepted their use	0.000*
5	Extent of use and adoption of eHealth technologies versus it is better to experiment with eHealth before adopting them	0.000**

Note

*** accepted level of significance was 5% used throughout this study**

Source: Derived from survey data, 2014

Table 5.4: Statistical significance of the association between the extent of adoption of eHealth devices and systems and various factors related to the respondent's perceived observability of eHealth devices/systems

No.	Items of Comparison	Pearson Chi-square Test Significance Level
1	Extent of use and adoption of eHealth technologies versus I was influenced by what I observed as the benefit of using eHealth	0.000*
2	Extent of use and adoption of eHealth technologies versus I observed others using eHealth and saw the advantages of doing so	0.000*
3	Extent of use and adoption of eHealth technologies versus observing eHealth users before using same as unnecessary	0.000*
4	Extent of use and adoption of eHealth technologies versus I have seen how others use eHealth before using them	0.000*

Note

*** accepted level of significance was 5% used throughout this study**

Source: Derived from survey data, 2014

Finally, the chi square test the relationship between the extent of adoption and various variables classified under complexity was assessed. Complexity has been defined as the degree to which an innovation is perceived as difficult to understand and use (Tagoe, 2013). The study found a positive relationship between the extent of adoption and complexity. Factors such as “eHealth is complicated to use”, “eHealth is difficult to understand and use”, “eHealth is convenient to use”, “eHealth is confusing to understand and apply”, “and eHealth is easy to use even if one has not used them before” were observed to be positively correlated to the extent of adoption of eHealth devices and systems.

Table 5.5: Statistical significance of the association between the extent of adoption of eHealth devices and systems and various factors related to the respondent's perceived complexity of eHealth usage

No.	Items of Comparison	Pearson Chi-square Test Significance Level
1	Extent of use and adoption of eHealth technologies versus eHealth is complicated to use	0.000*
2	Extent of use and adoption of eHealth technologies versus difficult to understand and use	0.000*
3	Extent of use and adoption of eHealth technologies versus convenient to use	0.000*
4	Extent of use and adoption of eHealth technologies versus confusing to understand and apply	0.000*
5	Extent of use and adoption of eHealth technologies versus being easy to use even if one has not used them before.	0.000**

Note

*** accepted level of significance was 5% used throughout this study**

Source: Derived from survey data, 2014

5.3: Factors Influencing the Level of Use and Adoption of eHealth Devices as indicated by the Responding Health Managers and Professionals

A multiple regression analysis was undertaken to determine health centre or firm characteristics and socio-economic characteristics of health managers and professionals that significantly influenced the use and adoption of eHealth devices. The multiple regression model used for the study was as follows:

EXTENTOFADOPTIONOFDEVICES = B0 + B1 GYNECOOGY + B2 PEDIATRICS + B3TERTIARYPRACTICE + B4 PRIVATE + B5 GENDER + B6 AGE +B7 EDUCATION +B8 YEARS + U;

Where

EXTENTOFADOPTIONOFDEVICES was the average scoring index of use of the seven eHealth devices using the 0 to 5 Likert scale with the highest value of 5.0 being the maximum value of use of a eHealth device and 0 representing total lack of use of the device;

GYNECOLOGY was a dummy variable for health centres that had gynecological services with 1 representing presence of these services and 0 absence of these services;

PEDIATRICS was a dummy variable for health centres that had pediatrics services with 1 representing presence of these services and 0 absence of these services;

TERTIARYPRACTICE was a dummy variable with 1 representing health centres, which were referral, service institutions such as the university hospitals and zero otherwise;

PRIVATE was a dummy variable with a value of 1 for privately-owned and managed health centres and 0 for publicly-owned health centres;

GENDER was a dummy variable denoting the sex of the responding health manager/professional with 1 for males and 0 for females;

AGE was the age group that the responding health manager/professional belonged to. This variable took five values from 1 to 6, representing increasing average age of respondents;

EDUCATION was the educational attainment level of the responding health manager/professional with 1 representing diploma holders, 2 representing those with completed Bachelor degrees, 3 representing those with completed Master degrees and 4 denoting those who were classified as medical doctors and/or had doctorate degrees;

YEARS was a variable denoting the number of years that the responding health manager/professional had worked at the health centre or organization; and

U was the error term initially assumed to have a zero mean and constant variance.

Table 5.6 reports the results of multiple regression analysis of factors influencing the level and degree of use and adoption of eHealth devices. The overall power of the model was very high, as measured by the 67.2% R^2 and the 66.4% adjusted $R^2$and the statistical significance of the whole model at the 0.000 levels. The variance inflation factor (VIF) of all the eight independent variables was low and were all below the critical value of 10.0 as suggested by Gujarati (2003, p 362) that indicates the absence of the problem of significant multicollinearity.

The results of the analysis indicate that institutional factors such as being a tertiary of referral practicing institution and being a private health practice were significant at positively influencing the adoption of eHealth devices among health managers and professionals. These results could

be explained from the resources available to tertiary practice or referral institutions such as Korle-Bu, the Ridge Hospital, Nyaho Clinic and similar institutions relative to primary or secondary health institutions. The relatively high resource availability, as a result of their referral or specialized status, influences their decision to adopt eHealth in their operations. Similar arguments could be made for either being a private or public health institutions. Private health institutions generate all their income from patients and therefore have the incentive to institute eHealth to be more efficient and have a shorter turnaround time in order to be more profitable. Public health institutions, on the other hand, generate most of their income from government subventions and are not quite motivated to employ eHealth devices to be more efficient since those subventions are not tied to delivery or efficiency. In addition, the decision on whether to adopt the eHealth devices or not has to go through a bureaucratic process in the public institutions which might delay such decisions but similar hindrance would be low in private health centres.

Other results of the analysis indicate that both professional factors such as being female, being young and having a higher education and having spent more years in the professional role were statistically significant in influencing the adoption of eHealth devices among health professionals or managers. These suggest that the characteristics of the health practitioners are pertinent in the adoption of eHealth in the various health institutions. If health practitioners are not prepared to use a particular tool, every investment made in such an instrument constitutes a wasted effort. It was obvious that the area of specialization of the health institution, being gynecology, pediatrics or surgery were not statistically significant at influencing the adoption of eHealth devices and systems.

Overall, the five ranking factor that has the most influence the use and adoption of eHealth devices in ascending order, were 1) being private, 2) higher education, 3) being a tertiary practice institution, 4) ag, ie being young and 5) gender, i.e. being female. This affirms that any policy intervention meant to increase eHealth adoption among health institutions in Ghana should focus on these factors first before considering the others. The other factors, in ascending order were years in practice, and specialist status, i.e. pediatrics or gynecology.

Table 5.6: Results of the multiple regression analysis of factors influencing the use and adoption of eHealth devices based on both firm characteristics and those of the responding manager/professional or manager.

Explanatory Variable	Parameter estimate (B)	Standardized parameter estimates (BETA)	Student t value	Probability level of significance	VIF
Constant	-1.550	0.000	-5.671	0.000*	0.000
Gynecology	-0.032	-0.015	-0.472	0.637	1.073
Pediatrics	0.135	0.066	1.578	0.116	1.738
Tertiary practice	1.589	0.774	18.015	0.000*	1.855
Private	2.428	1.346	15.514	0.000*	7.568
Gender	-0.650	-0.375	-7.172	0.000*	2.746
Age	-0.298	-0.480	-7.028	0.000*	4.691
Education	0.938	1.313	15.078	0.000*	7.623
Years	0.103	0.110	2.132	0.034*	2.657

Notes:

Sample size was 338

The real value (R2) whole the adjusted R2 value was 66.4%.

***Parameter was statistically significant at the 5% confidence level used for the study**

Source: Derived from survey data, 2014.

5.4: Factors Influencing the Level of Use and Adoption of eHealth Systems by the Responding Health Managers and Professionals

A multiple regression analysis was undertaken to determine health centre or firm characteristics and socio-economic characteristics of health managers and professionals that significantly influenced the use and adoption of eHealth systems. The multiple regression model used for the study was as follows.

EXTENTOFADOPTIONOFSYSTEMS = B0 + B1 GYNECOOGY + B2 PEDIATRICS + B3TERTIARYPRACTICE + B4 PRIVATE + B5 GENDER + B6 AGE +B7 EDUCATION +B8 YEARS + U;

Where

EXTENTOFADOPTIONOFSYSTEMS was the average scoring index of use of the 13 eHealth systems using the 0 to 5 Likert scale with the highest value of 5.0 being the maximum value of use of an eHealth device and 0 representing total lack of use of the device;

GYNECOLOGY was a dummy variable for health centres that had gynecological services with 1 representing presence of these services and 0 absence of these services;

PEDIATRICS was a dummy variable for health centres that had pediatrics services with 1 representing presence of these services and 0 absence of these services;

TERTIARYPRACTICE was a dummy variable with 1 representing health centres, which were referral, service institutions such as the university hospitals and zero otherwise;

PRIVATE was a dummy variable with a value of 1 for privately-owned and managed health centres and 0 for publicly-owned health centres;

GENDER was a dummy variable denoting the sex of the health manager/professional with 1 for males and 0 for females, with 1 for males and 0 for females;

AGE was the age group that the responding health manager/professional with 1 for males and 0 for females. This variable took five values from 1 to 6, representing increasing average age of respondents;

EDUCATION was the educational attainment level of the responding health manager/professional with 1 representing diploma holders, 2 representing those with completed Bachelor degrees, 3 representing those with completed Master degrees and 4 denoting those who were classified as medical doctors or had doctorate degrees;

YEARS was a variable denoting the number of years that the responding health manager/professional had worked at the health centre or organization; and

U was the error term initially assumed to have a zero mean and constant variance.

Table 5.7 reports the results of multiple regression analysis of factors influencing the level and degree of use and adoption of eHealth devices. The overall power of the model was moderately high, as measured by the 39.6% R^2 and the 37.8% adjusted R^2 and the overall statistical significance of the model. The variance inflation factor of all the eight independent variables was very low (all below 3.0) and were all below the critical value of 10.0 suggested by Gujarati for the absence of the problem of significant multicollinearity.

The results of the analysis indicate that institutional factors such as specialization of the health institution (being in pediatrics or not) and being a private health practice were significant at 5%

confidence level in influencing the adoption of eHealth systems among health manager and professionals. Pediatrics covers childcare and the handling of such delicate and vulnerable children motivate the professionals to have the preference of eHealth systems to aid in their diagnosis and treatments. Moreover, as explained earlier, private health care institutions have a higher motivation to employ eHealth systems in their health care operations than their public counterparts. Again, it must be emphasized that the decision making process in a private health set up is shorter and relatively easier and more flexible relative to the bureaucratized public health set up.

The results of the analysis also indicated that professional factors such as being female, being young, having a higher education and having spent several years in the professional role were statistically significant in influencing the adoption of eHealth systems among health professionals or managers. This finding proves that the characteristics of the health practitioners are pertinent in the adoption of eHealth in the various health institutions.

Overall, the five ranking factor that has the most influence the use and adoption of eHealth systems, in ascending order, were 1) being private, 2) specialist status, ie pediatric focus, 3) higher education, 4) gender, i.e. being female and 5) age, i.e., being young. This affirms that any policy intervention meant to increase eHealth adoption among health institutions in Ghana should focus on these factors first before considering the others. The other factors, in ascending order were years in practice, and specialist status, i.e. gynecology.

Table 5.7: Results of the multiple regression analysis of factors influencing the use and adoption of eHealth systems based on both firm characteristics and those of the responding professional or manager.

Explanatory Variable	Parameter estimate (B)	Standardized parameter estimates (BETA)	Student t value	Probability level of significance	VIF
Constant	2.968	0.000	4.913	0.000*	0.000
Gynecology	0.110	0.032	0.586	0.558	1.121
Pediatrics	1.579	0.392	5.771	0.000*	1.753
Private	-1.832	-0.500	-6.320	0.000*	2.384
Gender	-0.815	-0.259	-3.450	0.001*	2.142
Age	-0.186	-0.208	-2.404	0.017*	2.855
Education	0.537	0.276	3.402	0.001*	2.504
Years	0.116	0.076	1.115	0.266	1.777

Notes:

Sample size was 237

***Parameter was statistically significant at the 5% confidence level used for the study.**

Source: Derived from survey data, 2014.

5.5. Logistic Regression Analysis of Factors Influencing Use and Adoption of eHealth Technologies (Both Devices and Systems)

A logistic regression analysis was undertaken to determine health centre or firm characteristics, and socio-economic characteristics of health managers and professionals that significantly influenced the use and adoption of eHealth technologies. The logistic regression model for the study was as follows.

ADOPTION = B0 + B1 GYNECOOGY + B2 PEDIATRICS + B3TERTIARYPRACTICE + B4 PRIVATE + B5 GENDER + B6 AGE +B7 EDUCATION +B8 YEARS + U;

Where

ADOPTION was a dummy variable with 1 representing firms that used eHealth technologies very highly or highly and 0 otherwise (moderate, low and no use);

GYNECOLOGY was a dummy variable for health centres that had gynecological services with 1 representing presence of these services and 0 absence of these services;

PEDIATRICS was a dummy variable for health centres that had pediatrics services with 1 representing presence of these services and 0 absence of these services;

TERTIARYPRACTICE was a dummy variable with 1 representing health centres, which were referral, service institutions such as the university hospitals and zero otherwise;

PRIVATE was a dummy variable with a value of 1 for privately-owned and managed health centres and 0 for publicly-owned health centres;

GENDER was a dummy variable denoting the sex of the responding health managers and professional with 1 for males and 0 for females;

AGE was the age group that the responding health managers and professional belonged to. This variable took five values from 1 to 6, as described earlier;

EDUCATION was the educational attainment level of the responding health professional or manager with 1 representing diploma holders, 2 representing those with completed Bachelor degrees, 3 representing those with completed Master degrees and 4 denoting those who were classified as medical doctors or had doctorate degrees;

YEARS was a variable denoting the number of years that the responding health manager and professional had worked at the health centre or organization; and

U was the error term initially assumed to have a zero mean and constant variance.

Table 5.8 reports the results of the logistic regression analysis of factors influencing the overall use and adoption of eHealth devices and systems. The overall power of the model was high based on the 83.5 count and R^2 representing the proportion of correct classification using the model. The results of the analysis indicate that institutional factors such as specializing in pediatrics, being a tertiary of referral practicing institution and being a private health practice were significant in influencing the adoption of eHealth devices among health professionals or managers. The results of the analysis indicated that professional factors such as being male, being young and having a higher education and having spent several years in the professional role were significant in influencing the adoption of eHealth devices among health professionals or managers.

Table 5.8: Results of the logistic regression analysis of factors influencing the overall use and adoption of eHealth technologies based on both firm characteristics and those of the responding managers and professional

Explanatory Variable	Parameter Estimate(B)	Student t value	Probability level of significance
Constant	-8.391	105.843	0.000*
Gynecology	-0.475	2.418	0.120
Pediatrics	-1.120	10.802	0.001*
Tertiary practice	3.657	82.885	0.000*
Private	2.941	69.865	0.000*
Gender	1.500	21.017	0.000*
Age	0.460	14.877	0.000*
Education	0.800	32.478	0.000*
Years	0.743	25.167	0.000*

Notes:

Sample size was 533

***Parameter was statistically significant at the 5% confidence level used for the study**

The proportion of correct classification of choice was 83.5% (Count R^2)

Source: Derived from survey data, 2014

5.6. Discussion of Results and Findings of this Study

5.6.1 Extent of eHealth Adoption

It is apparent that eHealth is used to some extent by the healthcare institutions in the Greater Accra Region. In fact, the multimedia devices, internet and imaging devices were observed to be the most used devices. Higher integrations in the administrative, patient record, pharmaceutical/prescriptive system, procurement and supply chain and the laboratory management systems were also observed. The above findings confirm Dawson's (2011) and Rodrigues' (2008) argument that the usage of ICTs to advance healthcare delivery is gaining grounds in both developing countries with weak or unstable economies as well as the industrialized countries. It also means that the WHO (1998) Health-For-All Strategy, that recommends that members states "integrate the appropriate use of health telematics in the overall policy and strategy for the attainment of health for all in the 21st century, thus fulfilling the vision of a world in which the benefits of science, technology and public health development are made equitably available to all people everywhere" is being adhered to some extent in healthcare delivery in Ghana. These findings also confirm the arguments of Dixon (2007) that though the adoption of eHealth has lagged behind ICT integration in the operations of the financial sector, its innovations have been applied in the health sector since the invention of ICT.

Using the Rogers Model, the study assessed how the five factors espoused in the model could influence the extent of use and adoption of eHealth technologies in the responding health institutions. The results of a chi-square analysis confirmed that there is indeed a strong association between the extent of use and adoption and factors classified under relative advantage, compatibility, trialibility, complexity and observability. The finding confirmed

similar findings made by other authors, including Bates, Manuel and Oppendheim (2007), Tagoe (2013) and Robinson (2009).

Although about 50% indicated that eHealth has not been fully integrated in the operations of the hospital where they work, the 35% who did say that such an integration has taken place confirm that indeed some of the health institutions have come to believe that the industry is evolving (Wallin and Xu, 2008) and that eHealth represents an effective means of providing quality healthcare delivery and narrowing health disparities through appropriate equipping of health care providers.

However, the relatively large number of respondents who indicated that eHealth has not been fully integrated into their operations (50%) including 138 from private practice and 107 from the public institutions did not give an impression of an industry that has positioned itself to reap the full benefits of eHealth application by virtue of its uncoordinated application. Thus, the findings here confirm the observations of Acheampong (2012) who noted that eHealth or health informatics is still at the neophyte stage with most hospitals being only partially electronic, leading the researcher to also conclude that indeed eHealth is largely not integrated in the healthcare sector.

The fact that majority of the respondents indicated that eHealth has not been deployed in private and the government set up runs contrary to the researcher's earlier notion that private hospitals, due to their profit motive, are more likely to have access to greater resources to deploy eHealth in their operations, relative to government hospitals. The finding also runs contrary to the notion

that teaching hospitals have more resources and can more easily deploy eHealth relative to the clinics and the polyclinics as the health centrers/polyclinics and the private hospitals and the maternity homes were noted to deploy eHealth more than the hospitals.

The truth in Acheampong's (2012) observation is better appreciated when one considers the departments and the professionals that most or least use eHealth devices and systems in their work. It was observed that the departments that use eHealth devices and systems most were the Patient records; pharmacy and laboratory diagnosis departments while the consulting and wards departments least use them. Professionally, however, the aadministrators, doctors and laboratory technicians or the diagnostic specialist use eHealth most while nurses use it least. These were confirmed in a later question that asked respondents on the software used and the primary roles this software are used for. It was obvious that the software is deployed in administration, accounting and hospital attendance functions rather than consulting, ward management and other core healthcare functions. Again, this confirms that there has not been a fluid, organisation-wide adoption of eHealth; rather the adoption appears to be departmentally or professionally specific. In other words, the fact that eHealth has not been fully integrated in the operations of the health institutions were confirmed by the findings here. Acheampong (2012) put this more aptly when he emphasized that eHealth projects in most health institutions are stuck at the pilot stage and its implementation is rather disjointed.

The administrators were the professional group that uses eHealth most. This was explained by Luyera (2012) as coming about because ICT tools and systems have to be used to develop efficient billing, financial systems and patient registration. However, Luyera's applause for the

usage of ICT in Consulting and Remote service system, Referral Management system and Web based disease surveillance image management system in the developing countries was not supported in this study, as the mean score showed respondents disagreement in the utilization of these systems in the healthcare industry.

It was obvious in the study that eHealth was intimately integrated in the operations of the records department relative to the other departments. This could be due to the huge quantum of data these departments generate that have to be save, stored, retrieved and used, making the Electronic Health Record (EHR) Systems a relevant eHealth tool in managing these activities (The Rockefeller Foundation, 2010). Although a system-wide integration of EHR was not seen in most of the hospitals visited, most had computers that aid in the storage and retrieval of patient records. Luyera (2012) made similar observations in his study where he observed that most healthcare institutions use EHR for the storage and transportation of textual information using stand-alone computers. MOH (2010) is however hesitant to acknowledge such a stand-alone application of ICT to constitute eHealth. It argues that eHealth goes beyond the simple automation of health records and tele-consulting to entire automation of the healthcare system for efficient productivity. For MOH (2010), these constitute the bare basics in the deployment of eHealth, at best. Similar views are held by the Royal College of Nursing (2012) and Healy (2005).

With respect to the usage of hospitals in healthcare administration, the study observes that majority of the healthcare institutions do not have any software of any sort. Among those who

had such facilities, they were used departmentally, rather than in the whole institution. Along these lines, Wager *et al* (2009) noted that that though HMIS is successfully deployed in some hospitals, different software are being used by most hospitals in the country in their pursuit of electronic data entry, processing and delivery. However, this software is also modular in nature and only support some processes in the operations of these institutions operations and not in others, confirming similar observation among the hospitals sampled.

Concerning the public health care institutions, Truffer *et al.* (2010) noted that the HMIS use in those institutions were initially known as "District Health Management Information System (DHIMS)" software and later changed to "District Health Information System (DHIS2)". It was however obvious in this study that the DHIS2 is not familiar with respondent at all, negating what Truffer *et al.* (2010) said here.

A greater number of the health practitioners in the study did not know the key features of the software their organization use, indicating that they only know these products by name and not in functionality. They also indicated that the software is used for mainly administrative purposes, ie, billing, attendance and accounting. The above functions were also reiterated by Truffer *et al.* (2010) who was concerned that the District Health Management Information System used in public institutions for instance was used mainly for data capturing, aggregation and generation of management report, and hardly for integrating the core functions of the movement institutions. From the foregoing, it can be surmised that the Government of Ghana's eGovernment Interoperability Framework that sets out the government's policy and standards for

interoperability across the public sector, especially health (MOH, 2010) is yet to be implemented in the healthcare sector.

5.6.2 Factors that Promote eHealth Adoption

Lehman *et al*. (2006) argued that if health care providers resist change or do not possess attributes necessary for change (e.g., adaptability and growth-orientation), the change process is less likely to proceed. This makes it imperative to investigate the attributes or the characteristics of the healthcare provider that positively or negatively influence the adoption of eHealth. Most of the professional characteristics that influence eHealth adoption had a low to a moderate influence on eHealth adoption. The human resource challenge in the deployment of eHealth has been noted by MOH (2010). The ministry emphasized that one of the biggest challenges to eHealth implementation borders on capacity issues, as most health institutions lack qualified, trained health care professionals at all levels.

Multiple regression analysis was undertaken to assess the use and adoption of eHealth devices and systems as influenced by professional factors. Accordingly, the study assessed how professional factors such as gender, age and education, and years of experience play in the adoption of eHealth devices and systems among health professionals or managers. The study concluded that indeed, professional factors such as being female, being young and having a higher education and having spent several years in the professional role were significant in influencing the adoption of eHealth devices and systems among health professionals or managers. By the same token, professional factors such as being female, being young, having a higher education and having spent several years in the professional role were significant in

influencing the adoption of eHealth systems among health professionals or managers. These results were validated by a logistic regression analysis, indicating that any policy targeted at integrating eHealth should take the indicated professional characteristics into consideration to increase its likelihood of adoption.

Rank wise, the multiple regression undertaken under the adoption of devices and systems both confirmed that 1) being in a private, 2) having a higher education, and 3) ag, i.e. being young and 4) gender, i.e. being female were the factors that affect use and adoption most, when considered in an ascending order. This affirms that any policy intervention meant to increase eHealth adoption among health institutions in Ghana should focus on these factors first before considering the others.

Unlike the professional characteristics, it was observed that most of the medical practice characteristics had a moderate to high influences in the adoption of eHealth systems and devices in health institutions in the region. Beside the location of the health institutions, which only had a low influence on the adoption of eHealth, other factors such aspatient age range, single/multi-specialization, practice Levels, availability of ICT infrastructure, practice size, management commitment in supporting change, financial constraints and IT support all had moderate to high influence on the adoption of eHealth. It is apparent from the responses that respondents regard what the institutional characteristics pertinent in the adoption of eHealth relative to their own characteristics. This is worth noting because notwithstanding how savvy one might be with ICT, if the institution does not encourage its use, it will be of no relevance. However, if an ICT system has already been set up and running, employees have no choice than to fall in line in using it. The institutional role notwithstanding, Anderson (2007) observed that eHealth implementation at

that level is challenged by high cost of acquisition especially at the initial stage, security, privacy and confidentiality concerns and lack of technical skills.

Vishwanath and Scamurra (2007) synthesized the relationship between the personal characteristics and the medical practice characteristics when they attributed the low adoption rate of eHealth to both macro-level factors (e.g. supportive policies) from the perspective of the public, health care organization, and system, and micro-level barriers from the perspective of health care providers (e.g., physicians' perception about technological complexity). They in essence argued that just addressing one of the characteristics without adequate attention paid to the other does not sustainable eHealth implementation (Healy, 2005).

Other factors that influence eHealth adoption, as identified by Li *et al*. (2013), include performance expectancy, effort expectancy and other facilitating or inhibiting conditions. With respect to the performance expectancy variables, it was observed that only perceived usefulness and need had a moderate to high influence of eHealth adoption while the rest - Computer self-efficacy, Job fit (designed to simplify my work), Cost saving – had a very low to low effect on the adoption of eHealth. Similar observations were made with respect to the variables that fell under efforts expectancy, where only perceived ease of use had a moderate to high influence of eHealth adoption while all the other factors had a low influence on adoption. It is therefore apparent the various healthcare professionals consider the perceived usefulness and ease of use of the eHealth platform important in the adoption of eHealth.

Among the other factors, end user involvement in the design and usage of eHealth devices and tools, interoperability (the ability to make systems and organizations work together) and professional autonomy had a moderate to high influence on eHealth adoption while patient privacy concerns, legal concerns, time cost had low influence. In fact, interoperability has been observed by the MOH (2010) Wager *et al*. (2009), WHO (2013) and the Rockefeller Foundation (2010), as one of the major factors that influence eHealth adoption as well as being the ultimate objective of eHealth adoption. The International Telecommunication Union (2012) points out that interoperability could also be a major barrier to eHealth adoption. It explained that the inability of healthcare information systems to interoperate to share information and the huge number of available eHealth standards, with many of them competing and overlapping, and some even contradicting one another hinder the effectiveness of any eHealth device or system adopted.

5.6.3 Constraints Impeding eHealth Adoption

Although, eHealth has the potential to positively influence the quality of healthcare and improve health services in Ghana, there are a number of challenges that confronts its wide scale adoption in the Ghanaian health care environment (MOH, 2010). In this study, the major hindrances were observed to be corruption involved in the procurement or the supply chain of eHealth systems and devices, lack of commitment and clear decisions on investment in technology and ignorance about ICT solutions. Though these factors were rated very important in hindering eHealth adoption in the healthcare industry, these were rated as highly by the MOH (2010). The highest rated constraint, corruption related to procurement, was in fact not mentioned by most of the empirical discourse on the challenges that confront ICT implementation. These includes reports by WHO (2012), Busagala and Kawono (2013), Acheampong (2012), Cardellino and Finch

(2006), Adebesin et *al.* (n.d.), Truffer *et al*. (2010) and Anon, 2013). This confirms that corruption has not been regarded as a potent challenge in the implementation of eHealth in the health sector and may be due to the excessive publicity about this issue by opposition parties in Ghana in a polarized political environment.

On the other hand, the lack of commitment and clear decisions on investment in technology were confirmed by MOH (2010) while ignorance about ICT solutions was not, rather it was couched by the MOH as weak information technology infrastructure. The other factors such, as widespread ICT illiteracy among patients was also not supported in the literature. In sum three prominent factors that set, as the major constraints in eHealth implementation were not regarded similarly in the empirical literature.

Resistance to change on the part of healthcare practitioners, high cost of acquisition especially at the initial stages, shortage of ICT skilled personnel (technical skills), inadequate budgetary allocation to the health sector, security, privacy and confidentiality concerns and weak information technology structure were however copiously endorsed by the empirical findings as constrains in the implementation of eHealth. Authors such as Truffer *et al*. (2010), Anon (2013), Adebesin*et al.* (2013), Cardellino and Finch (2006), Busagala and Kawono (2013) and MOH (2010) concurred on these constraints.

CHAPTER 6

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 Introduction

The objectives of the study were to establish the extent of eHealth use and adoption among health centrers and institutions in the Greater Accra Region, to examine the factors driving the eHealth adoption among health centres and institutions in the Greater Accra Region and to ascertain the constraints in eHealth use and adoption among health centres and institutions in the Greater Accra Region. The objectives were fulfilled by undertaken a survey-based study of 82 health institutions in the Greater Accra Region. The summary of the results of the study is provided below in the next section. The conclusions and recommendations of the study are presented in the next two sections.

6.2 Summary of the Results

6.2.1 Extent of eHealth Adoption

The study found that overall eHealth technologies are not extensively used in the health centres and institutions in the Greater Accra Region. Having about 50% healthcare managers/professionals indicating that their institutions do not have eHealth in their operations leads the researcher to conclude that the extent of eHealth adoption is very low in the healthcare institutions. In terms of the specific eHealth devices, the multimedia devices, Internet and imaging devices were used while the rest were hardly used. The systems used in running the administrative, patient record, pharmaceutical/prescriptive system, procurement and supply chain

and the laboratory management systems were observed to be poignant while the rest were hardly used.

The study confirms the Rogers Model, which postulates that the use and adoption of eHealth technologies is associated with factors such as relative advantage, compatibility, trialibility, complexity and observability. Departmentally, the use and adoption of eHealth technologies was more pronounced in the management of patient records, pharmacy and laboratory diagnosis departments while the consulting and wards departments were those that least use them. Professionally, the aadministrators uses eHealth most in the billing, financial systems and patient registration, corroborating literature evidence. However, there was little usage of these technologies in consulting and remote service system, referral Management system and web based disease surveillance image management system.

The study also found evidence that support the literature that the implementation of eHealth is disjointed and departmental, rather than involving the institution as a whole. In fact, several health care institutions did not have software that are used in their core operations, i.e. consulting, wards management, referrals, disease surveillance among others but rather, as earlier indicated, in their administrative operations primarily. Interestingly, the study also unearthed that where the software are used, respondents hardly know the features of those software, casting doubt on whether they use those software in their day-to-day operations.

6.2.2 Factors that Promote eHealth Adoption

Multiple and a logistic regression analysis showed that gender, age and education, and years of experience of medical practitioners/managers within the institution have a significant influence on the use and adoption of eHealth devices and systems. The study also found that most of the medical practice characteristics had a moderate to high influences in the adoption of eHealth systems and devices in health institutions in the region. This was confirmed by both multiple and logistic regression analysis which established that institutional factors such as being a tertiary of referral practicing institution and being a private health practice significantly influences the adoption of eHealth devices while the specialization of the health institution (being in pediatrics or not) and being a private health practice significantly influences the adoption of systems.

The study further observed that performance expectancy variables, effort expectancy variables had a moderate to low association of eHealth use and adoption while the other factors had a low association on eHealth use and adoption among the health institutions. When ranked together, it is apparent that the medical practice characteristics and other inhibiting/influencing characteristics have a high association with eHealth adoption in that order. The other three characteristics, i.e., health care manager characteristic, performance expectancy and effort expectancy only have low association with the adoption of eHealth devices and systems.

6.2.3 Constraints Impeding eHealth Adoption

The major hindrances in the use and adoption of eHealth among the institutions understudy were the perceived corruption involved in the procurement or the supply chain of eHealth systems and

devices, lack of commitment and clear decisions on investment in technology and ignorance about ICT solutions. These were incidentally not confirmed in the literature.

Resistance to change on the part of healthcare practitioners, high cost of acquisition especially at the initial stages, shortage of ICT skilled personnel (technical skills), inadequate budgetary allocation to the health sector, security, privacy and confidentiality concerns and weak information technology structure were other hindrances. These were however as highly rated as those above, though these were confirmed by literature evidence.

6.3 Conclusions

6.3.1 Extent of eHealth Adoption

Under the first objective, the study concludes that the extent of eHealth adoption is low among the healthcare institutions. However, the use and adoption is highly associated with factors classified under relative advantage, compatibility, trialibility, complexity and observability, which are enshrined in the Rogers Model.

6.3.2 Factors that Promote eHealth Adoption

Under the second objective, the study concludes that the medical practice or health institution characteristics, health care manager characteristics and other inhibiting/influencing characteristics have a high association with eHealth use and adoption while the factors related to performance expectancy and effort expectancy only have low levels of association with the use and adoption of eHealth devices and systems.

6.3.3 Constraints Impeding eHealth Adoption

Under the third objective, the study concludes that the major hindrances in the use and adoption of eHealth among the institutions understudy were perceived corruption involved in the procurement or the supply chain of eHealth systems and devices, lack of commitment and clear decisions on investment in technology and ignorance about ICT solutions.

6.4 Recommendations

In the light of the findings of the study, the following policy recommendations are made:

- It is obvious that the DHMIS exist more in the government policy statement than the actual operations of the healthcare institutions. This problem can be solved if the Ministry of Health institutes a bi-partisan roll out of that eHealth system through proper budgetary allocation. Accordingly, the integration of eHealth in healthcare delivery in the country should be revisited, with government leading the way and setting the example for all players in the sector. Taking a cue from the United States, eHealth started to become serious after the then President, George Bush, had taken the lead and pushed for it. Similarly in Ghana such an approach can be pursued, especially when we consider that the government institutions cater for majority of the vulnerable and poor in society, further implying that the efficiency of such a healthcare delivery should not be compromised in a slow, laborious and mistake ridden manual system of healthcare delivery.
- Promoting the use and adoption with eHealth technologies should take into considerations factors relative advantage, compatibility, trialibility, complexity and observability which is enshrined in the Rogers Model, since these were found to be highly associated with use and adoption of eHealth technologies.

- Considering the professional characteristics that were observed to influence the use and adoption of eHealth in the healthcare sector, it is obvious that the healthcare sector already have the requisite professional characteristics to build a robust eHealth system. Most of the professionals are young, highly educated and have an appreciable number of years in their professional roles as evidenced in the socio-economic background of respondents. The healthcare sector can therefore leverage of these factors to relax the constraints impeding eHealth use and adoption.
- Corruption was observed to be a major hindrance in the implementation of eHealth in the healthcare sector. Though corruption is a hydra headed monster that is difficult to tame, the proper institution of eHealth, by itself, is an antidote against ravaging spread of corruption. However, while the eHealth system is under development, the Ministry of Health and indeed, health care administrators in the private health set up should institute proper audit, accounting and monitoring models that ensure that they get value for money in all transactions.
- Hospitals and clinics may embark on a programme that integrate their software into a singular operational entity that ensure that information is not held in silos or stand-alone departments, which naturally discourages knowledge sharing. The integration of the departmental software can ensure that patient privacy and security of information are preserved.

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APPENDIX 1: SURVEY QUESTIONNAIRE

STRICTLY CONFIDENTIAL FOR RESEARCH STUDY ONLY

TOPIC: ASSESSING THE EXTENT OF ADOPTION OF EHEALTH TECHNOLOGIES IN HEALTH INSTITUTIONS IN THE GREATER ACCRA REGION

Dear Respondent,
My name is Mr Agyenna Kesse-Tachi, a student of the Institute of Statistical, Social and Economic Research (ISSER), University of Ghana, Legon, Accra. My phone number is 0208727265. I am currently undertaking a survey to assess extent of eHealth adoption among hospitals and clinics in Ghana.

I would be pleased if you could kindly spare about 20 minutes of your time to answer the following questions in this survey, which will be conducted in strict confidence and in person only. Please kindly help me to complete this questionnaire in order to allow me to finish the work required for my Master of Philosophy in Development Studies at ISSER. The questionnaires containing your answers will be destroyed upon the completion of this study in December 2014. Reponses to the questions will only be reported in aggregate without identifying any particular person.

Thank you.

NB: (eHealth can operationally defined asthe use of ICT in health care - Khoja, Durrani&Fahim, 2008).

Instructions: Please tick [✓] the box that best represents your view or state where appropriate.

Number of Health Institution…….
Survey Code Number…….

Section A: Company background

1. How long have you worked in this health institution?.....
2. When was this hospital/clinic established?……
3. What does your hospital specialize in?
   a. General medical care [ ] d. Gynecology [ ] c. Surgery [ ] d. Pediatrics [ ] e. Others (specify)……..
4. What is the practice level of your institution
   a. primary healthcare provider [ ] b. Secondary health care provider [ ]
   c. Tertiary healthcare provider [ ]
5. Would the incorporation of ICT make the discharge of these activities easier and faster?
   a. To a very large extent [ ] d. To a large extent [ ] c. To some extent [ ]
   d. To a very small extent [ ] e. Not at all [ ]

Section B: Extent of e-Health adoption among hospitals in Ghana

6. Which of the following ICT devices and services do you use in the support of provision health services? Please tick as many as applicable.

a. Projection systems [ ]
b. Electronic devices (Digital video/photo cameras) [ ]
c. Video conferencing systems [ ]
d. Imaging devices (x-ray, tomography, MIR, ultra-sound machines) [ ]
e. Multimedia device (television, mobile phones, personal computers) [ ]
f. Internet [ ]
g. Telemedicine equipment [ ]
h. Teleconsulting equipment [ ]

7. What is the extent of eHealth adoption in your hospital?
a. To a very large extent [ ] d. To a large extent[ ] c. To some extent [ ]
d. To a very small extent [ ] e. Not at all [ ]

8. Rank the extent of adoption of the following eHealth tools using the following scale

Scale	**Ranking**	**Meaning**
Very High Use	5	I use eHealth tools daily and throughout the day
High Use	4	I use eHealth tools daily but not throughout the day
Moderate Use	3	I use eHealth tools more than 3 days a week
Low use	2	I use eHealth tools once a week or less
Very low use	1	I use eHealth tools infrequently
No use	0	I don't use eHealth tools at all

Extent of Adoption	**5**	**4**	**3**	**2**	**1**	**0**
Projection systems						
Electronic devices						
Video conferencing systems						
Imaging devices (Xray, tomography, ultra-sound)						
Multimedia devices (Television, mobile phones etc)						
Internet						
Telemedicine equipment						

Teleconsulting equipment						

9. Which of the following eHealth solutions is applicable to your health facility? [Please tick as many as applicable]
   a. Patient record systems [ ]
   b. Web based disease Surveillance Image management systems [ ]
   c. Electronic prescription system [ ]
   d. Referral management systems [ ]
   e. Patient appointment systems [ ]
   f. Pharmaceutical/Prescriptive system [ ]
   g. Consultations and remote service system [ ]
   h. Administrative purposes [ ]
   i. Public Health Management [ ]
   j. Specialisation (Gynecological/pediatric) management [ ]
   k. Ward management [ ]
   l. Procurement and supply chain management [ ]
   m. Laboratory management [ ]
   n. Other, please specify ……

10. Rank the extent of adoption of the following eHealth solutions using the scale below

Scale	**Ranking**	**Meaning**
Very High Use	5	I use eHealth tools daily and throughout the day
High Use	4	I use eHealth tools daily but not throughout the day
Moderate Use	3	I use eHealth tools more than 3 days a week
Low use	2	I use eHealth tools once a week or less
Very low use	1	I use eHealth tools infrequently
No use	0	I don't use eHealth tools at all

Intensity of Adoption	**5**	**4**	**3**	**2**	**1**	**0**
Patient record system						
Web based disease Surveillance Image management systems						
Electronic prescription system						
Referral management systems						
Patient appointment systems						
Pharmaceutical/Prescriptive system						
Consultations and remote service system						

Administrative purposes						
Public Health Management						
Specialization (Gynecological/pediatric) management system						
Ward Management						
Procurement and supply chain management						
Laboratory management						

11. Which software(s) do you use in your health institution for eHealth operations?
    a. ……
    b. ……
    c. ……
12. What are the basic features of the most used of these software?
    a. ……
    b. ……
    c. ……

13. In which department is eHealth most used?
    a. Patient record systems [ ] d Consulting [ ] c. Pharmacy [ ] d. Wards [ ]
    d. Laboratory and diagnosis [ ] e. Administration [ ] f. Other, please specify
    ……
14. In which department is it least deployed?
    b. Patient record systems [ ] d Consulting [ ] c. Pharmacy [ ] d. Wards [ ]
    d. Laboratory and diagnosis [ ] e. Administration [ ] f. Other, please specify
    ……
15. Which category of health professional often use eHealth?
    a. Doctors [ ] b. Nurses[ ] c. Paramedics [ ] d. Administrators [ ]
    d. Lab Technicians [ ] e. Radiologist [ ] f. Other, please specify ……
16. Which category of health professionals least use eHealth?
    a. Doctors [ ] b. Nurses[ ] c. Paramedics [ ] d. Administrators [ ]
    d. Lab Technicians [ ] e. Radiologist [ ] f. Other, please specify ……
17. Has eHealth integrated the entire operations of your health institution?
    a. Yes [ ] b. No [ ] d. Do not know [ ]
18. This section aims at finding out your opinions about the following statements on the influence of eHealth adoption among health practitioners, using the scale below

Scale	**Ranking**
Strongly Agree	SA
Agree	A
Neither agree nor disagree	N
Disagree	D

Strongly Disagree	SD

	SA	A	N	D	SD
Relative advantage and eHealth Usage					
Using the eHealth tools **improves** my efficiency at the work place					
Mistakes with eHealth diagnosis/treatment are easier to correct than manual ones.					
There are enough advantages of eHealth for me to consider using it					
Mistakes are more likely to occur with eHealth usage than with manual operations.					
eHealth**helps** me to better manage my time.					
Compatibility with eHealth Usage	SA	A	N	D	SD
I do not need eHealth in my work.					
eHealth makes health practitioners redundant.					
It is easier to work manually than with eHealth tools					
I worry about the privacy of patient information when using eHealth					
I worry that eHealth are not secure enough to protect patient information.					
Trialability and eHealth Usage	SA	A	N	D	SD
It was easy to use eHealth more frequently after trying them out.					
A trial convinced me that using eHealth was better than using manual systems.					
I do not need a trial to be convinced which eHealth tools are best for me.					
It did not take me much time to try eHealth before I finally accepted their use.					
It is better to experiment with eHealth before adopting them.					
Observability and eHealth Usage	SA	A	N	D	SD
I was influenced by what I observed as the benefits of using eHealth					
I observed others using eHealth and saw the advantages of doing so.					
Observing eHealth users before using same is unnecessary.					
I have seen how others use eHealth before using them.					
Complexity and eHealth Usage	SA	A	N	D	SD
eHealth is complicated to learn.					
eHealth is difficult to understand and use.					
eHealth is convenient to use.					
eHealth is confusing.					
It is easy to use eHealth even if one has not used them before.					

Section C: Factors driving e-Health adoption among hospitals in Ghana

19. To what extent do you believe that the following factors influence adoption of eHealth in Ghanaian hospitals and clinics? Use the scale below

Scale	Ranking
Very High Influence	5
High Influence	4
Moderate Influence	3
Low Influence	2
No influence	1

Factors	5	4	3	2	1
Health care provider characteristics					
IT experience and knowledge					
Years in practice					
Role					
Age					
Gender					
Medical practice characteristics					
Practice size (Number of physicians in the medical practice and number of patients)					
Location (Rural setting versus urban setting)					
Single/Multi-specialty (those in a multi-specialty group are more likely to adopt e-health than those in a single specialty					
Practice level (Distinction between primary, secondary and tertiary health care)					
Patient age range					
Voluntariness of use					
Perceived voluntariness (the degree to which use of the innovation is perceived as being voluntary, or of free will)					
Performance expectancy					
Perceived usefulness and needs					

Job-fit (Designed to simplify my work)					
It is cost saving					
Effort Expectancy					
Perceived ease of use					
Ease of use					
Complexity					
Social influence					
The organizational setting supports change					
Facilitating/inhibiting conditions					
Computer self-efficacy					
Computer anxiety					
Legal concerns					
Financial constrains					
Availability of ICT infrastructure					
Time cost					
Interoperability (the ability to make systems and organizations work together)					
IT support					
End user involvement					
Management commitment and support to change					
Professional autonomy					
Patient privacy concerns					

Section D: Constraints in eHealth adoption in Ghana

20. To what extent do you believe that the following constraints influence adoption of eHealth in Ghanaian hospitals and clinics? Use the scale below

Scale	Ranking
Extremely Important	5
Very Important	4
Moderately Important	3
Lowly important	2
Very Lowly important	1

Constraints	5	4	3	2	1
Provision of health services across wide geographic areas					
Lack of commitment and clear decisions on investments in technology					
Shortage of ICT skilled personnel (technical skills)					
Weak information technology infrastructure					
Resistance to change on the part of healthcare professionals					
healthcare professionals perception about technological complexity					
Security, privacy and confidentiality concerns					
High cost of acquisition especially at the initial stage					
Corruption					
Widespread ICT illiteracy among patients					
Ignorance about ICT solutions					
Inadequate budgetary allocation to the health sector					

21. Please list other constrains in eHealth adoption

……
……
……
……
……
……

22. How can hospitals increase the adoption of eHealth in Ghana?

Section E: Demographic Information of Respondents

23. Gender: [ ] Male [ ] Female

24. Age:…….

25. Identify your highest educational level completed
    a. Diploma [ ] b. Bachelor's degree [ ] c. Master's degree [ ]
    d. Doctorate degree [ ] e. Other, please specify ……..

26. What is your current professional role
    a. Doctor General practice [ ]
    b. Doctor Specialist [ ]
    c. Nurse [ ]
    d. Pharmacist [ ]
    e. Radiologist [ ]
    f. Hospital Administrator [ ]
    g. Other, please specify ……..

27. Current place of work
    a. Hospitals Private practice [ ]
    b. Health Centrers/Polyclinics [ ]
    c. Government hospital/Teaching Hospitals [ ]
    d. Quasi-Public Hospitals/Clinics [ ]
    e. Private Clinics/Maternity Homes [ ]
    f. Others, please indicate…….

28. Number of years with the health facility……..

APPENDIX 2: DETERMINATION OF THE OPTIMAL SAMPLE SIZE

The formula for calculating the optimal sample size of houses is based on the work done by Yamane (1973). This formula is widely used for its simplicity and given as follows:

$\{n = N/1+N (e)^2\}$ where;

n = desired sample size,

N = total number of government, private and quasi government hospitals/clinics in the Greater Accra Region at the time of the survey and

e = margin of error (10%).

The optimal sample size (n) is therefore calculated from the equation as follows;

$\{n = N/1+N (e)^2\}$

$n = (469) / (1+(469)*(0.1)^2)$

$n = (469)/ (1+4.69)$

$n = 469/5.69$

n = 82.01. This is approximated to 82 health institutions.

Therefore the desired sample size was 82 health institutions. However the study targeted 15 respondents in each health institution, bringing the total number of respondents to 1,640. I was able to get responses from 810 health professionals and managers representing 49.2% % of the original sample size.

APPENDIX 3: SPSS PROGRAMME USED TO ANALYSE THE SURVEY DATA INVOLVING SIMPLE STATISTICAL ANALYSIS (FREQUENCY ANALYSIS AND DESCRIPTIVE ANALYSIS), CHI SQUARE ANALYSIS, MULTIPLE REGRESSION ANALYSIS AND LOGISTIC REGRESSION ANALYSIS.

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crosstabs tables=extentofehealth by T3/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by T4/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by T5/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by O1/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by O2/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by O3/cells=rows colums/statistics=chisq corr.
crosstabs tables=extentofehealth by O4/cells=rows colums/statistics=chisq corr.
if extentofehealth=1 adoptionbyhospital=1.
if extentofehealth=2 adoptionbyhospital=1.
if extentofehealth=3 adoptionbyhospital=0.
if extentofehealth=4 adoptionbyhospital=0.
if extentofehealth=5 adoptionbyhospital=0.
compute length=2014-established.
if spec1=2 gynecology=1.
if spec1=0 gynecology=0.
if spec2=3 surgery=1.
if spec2=0 surgery=0.
if spec3=4 pediatrics=1.
if spec3=0 pediatrics=0.
```

if practicelevel=1 tertiarypracticelevel=0.

if practicelevel=2 tertiarypracticelevel=0.

if practicelevel=3 tertiarypracticelevel=1.

if currentplace=1 privatehealthcentre=1.

if currentplace=2 privatehealthcentre=0.

if currentplace=3 privatehealthcentre=0.

if currentplace=4 privatehealthcentre=0.

if currentplace=5 privatehealthcentre=1.

if gender=1 rgender=1.

if gender=2 rgender=0.

compute adoptiondevice=(extent1+extent2+extent3+extent4+extent5+extent6+extent7)/7.

compute
adoptionsystem=(extensity1+extensity2+extensity3+extensity4+extensity5+extensity6+extensity7+extensity8+extensity9+extensity10+extensity11+extensity12+extensity13)/13.

descriptives variables=extentofehealthadoptionbyhospitalgynecology length.

frequencies
variables=extentofehealthadoptionbyhospitaltertiarypracticelevelcurrentplaceprivatehealthcentre gynecologypediatrics surgery.

logistic regression adoptionbyhospital with
gynecologypediatricstertiarypracticelevelprivatehealthcentrergender age education years.

regression
variables=adoptiondevicegynecologypediatricstertiarypracticelevelprivatehealthcentrergender age education years/descriptives=corr/statistics=coeff r
tolcollinanova/dependent=adoptiondevice/method=

enter gynecologypediatricstertiarypracticelevelprivatehealthcentrergender age education years.

regression
variables=adoptionsystemgynecologypediatricstertiarypracticelevelprivatehealthcentrergender age education years/descriptives=corr/statistics=coeff r
tolcollinanova/dependent=adoptionsystem/method=

enter gynecologypediatricstertiarypracticelevelprivatehealthcentrergender age education years.

APPENDIX 4: THE RANDOMLY SELECTED HEALTH INSTITUTIONS FOR EACH CATEGORY OF INSTITUTIONAL TYPE BASED ON THE CLUSTER SAMPLING METHOD.

District	Facility Name	Type	Town	Ownership
Accra Metropolitan	Beach Community Clinic (Ga Mantse Community Clinic)	Clinic	James Town	Government
Accra Metropolitan	Kaneshie School Clinic	Clinic	Kaneshie	Government
Accra Metropolitan	Makola Government Clinic	Clinic	Makola	Government
Accra Metropolitan	Mallam Atta Market Clinic	Clinic	Mallam Atta	Government
Accra Metropolitan	New Town School Dental Clinic	Clinic	New Town (school compound)	Government
Accra Metropolitan	Nima Government Clinic	Clinic	Nima	Government
Accra Metropolitan	TUC Clinic	Clinic	Adabraka	government
Ga East	Madina RCH Clinic (near Market)	Clinic	Madina (Old road)	Government
Accra Metropolitan	Airport Clinic Ltd	Clinic	Airport	Government
Ga West	CDH Weija Clinic	Clinic	Marcathy Hill Junction	Government
Ga West	Kokrobite Community Clinic	Clinic	Kokrobite	Government
Ga West	Mallam Demonstration Clinic	Clinic	Mallam	Government
Ga West	NgleshieAmanfro Community Health Centre	Clinic	NgleshieAmamfrom	Government
Ga West	Osuwem Community Based Clinic (New site)	Clinic	Osuwem	Government
Accra Metropolitan	Port Health	clinic	Tema	Government
Accra Metropolitan	Stadium Clinic	Clinic	Osu	Government
Accra Metropolitan	The Achimota Clinic	Clinic	Mile 7 (New Achimota)	Government
Accra Metropolitan	Akai House Clinic	Clinic	Roman Ridge (near Jack and Jill)	Private
Accra Metropolitan	Akai House Clinic	Clinic	Osu	Private
Accra Metropolitan	Alajo Clinic	Clinic	Alajo	Private

Accra Metropolitan	Alfred Memorial Clinic	Clinic	AbosseyOkai	Private
Accra Metropolitan	Amazing Grace Clinic	Clinic	Kaneshie	Private
Accra Metropolitan	Atta Quarshie Morton Memorial Hospital	Clinic	Adabraka	Private
Accra Metropolitan	Aviation Road Clinic	Clinic	Airport residential area	Private
Accra Metropolitan	Bostal Clinic	Clinic	Bostal Institution	Private
Accra Metropolitan	Castle Drive Clinic	Clinic	Osu	Private
Accra Metropolitan	Central Dansoman Clinic	Clinic	Dansoman	Private
Accra Metropolitan	Grace Baah Memorial Clinic	Clinic	Russia	Private
Accra Metropolitan	Kaneshie Market Clinic	Clinic	Kaneshie	Private
Accra Metropolitan	Mt Sinai Clinic	Clinic	Nyamekye (Darkuman)	Private
Accra Metropolitan	Nyaho Medical Centre	Clinic	Airport residential area	Private
Accra Metropolitan	Nima Clinic	Clinic	Nima	Private
Accra Metropolitan	Odorna Clinic	Clinic	Odorna (Adabraka)	Private
Accra Metropolitan	Oman Clinic	Clinic	Kaneshie (Sports Complex)	Private
Accra Metropolitan	Abora Clinic	Clinic	Asylum Down	Private
Accra Metropolitan	Su-san Clinic	Clinic	Sukura	Private
Accra Metropolitan	Swan Clinic	Clinic	Adenta	Private
Accra Metropolitan	Lighthouse Mission	Clinic	Tesano	Private
Ga West	The New Achimota Clinic	Clinic	New Achimota	Private
Tema Metropolitan	Abotare Clinic (Alternative Medical Centre)	Clinic	Betlehem (near Michael Camp)	Private
Tema Metropolitan	Adenta Clinic	Clinic	Adenta Estate	Private
Tema Metropolitan	Alberto Clinic	Clinic	Tema Community 11	Private
Tema Metropolitan	Amaganaa Clinic	Clinic	Adenta Estate	Private
Tema Metropolitan	Ashalebotwe Community Clinic	Clinic	Ashalebotwe	Private
Tema Metropolitan	Ashiyie Community Clinic	Clinic	Adenta	Private
Tema Metropolitan	Bethel Hospital	Clinic	Tema Community 9	Private

Tema Metropolitan	New Crystal Clinic	Clinic	Ashaiman	Private
Accra Metropolitan	Ghana Police Clinic	Clinic	37 Licencing Office	Quasi-Government
Accra Metropolitan	Acheampong Memorial Clinic	Clinic	La	Private
Accra Metropolitan	PML Hospital	Hospital	Paladium	Government
Accra Metropolitan	La General Hospital	Hospital	La	Government
Accra Metropolitan	Ridge Hospital	Hospital	Ridge	Government
Accra Metropolitan	Achimota Hospital	Hospital	Achimota	Government
Ga East	Pantang Hospital	Hospital	Pantang	Government
Tema Metropolitan	Tema General Hospital	Hospital	Tema	Government
Accra Metropolitan	Holy Trinity Medical Centre	Hospital	North Kaneshie	Private
Accra Metropolitan	Lakeside Clinic	Hospital	Tesano	Private
Accra Metropolitan	Lapaz Community Clinic	Hospital	AbakaLapas	Private
Accra Metropolitan	Motorway Clinic	Hospital	AbekaLapas	Private
Accra Metropolitan	North Ridge Clinic	Hospital	North Ridge	Private
Accra Metropolitan	Opoku Ware Clinic	Hospital	Dansoman	Private
Ga West	Holy Dove Hospital	Hospital	New Achimota	Private
Accra Metropolitan	Cocoa Clinic	Hospital	North Kaneshie	Quasi-Government
Accra Metropolitan	Police Hospital	Hospital	Cantoments	Quasi-Government
Accra Metropolitan	Trust Hospital (SSNIT Hospital)	Hospital	Osu	Quasi-Government
Accra Metropolitan	Kaneshie Polyclinic	Polyclinic	Kaneshie	Government
Accra Metropolitan	Dansoman Polyclinic	Polyclinic	Dansoman	Government
Accra Metropolitan	Korle-Bu Teaching Hospital	Teaching Hospital	Korle-bu	Private
Accra Metropolitan	Holy Cross Clinic & Maternity Home	Maternity Home	Lartebiokoshie	Private
Accra Metropolitan	North Teshie Clinic & Maternity Home	Maternity Home	Teshie	Private
Accra Metropolitan	St Gloria's Clinic & Maternity Home	Maternity Home	Agege (Karikari area)	Private

Ga West	God Cares Clinic & Maternity	Maternity Home	Asabaham (near Domiabra)	Private
Ga West	Savans Clinic & Maternity Home	Maternity Home	Weija	Private
Tema Metropolitan	Fiden Medical Centre (Formerly Eillen's Maternity Home)	Maternity Home	Tema Community 2	Private
Tema Metropolitan	Voice of the Lord Maternity Home & Clinic	Maternity Home	Lashibi	Private
Accra Metropolitan	Al-ayar Clinic & Maternity Home	Maternity Home	Akweteman	Private
Accra Metropolitan	AsareOdei Hospital and Maternity Home	Maternity Home	East Legon	Private
Accra Metropolitan	Dansoman Health Centre	Health Center	Dansoman	Government
Ga East	Madina Health Centre	Health Center	Madina (New Road)	Government
Accra Metropolitan	Omni Health Care	Health Center	Dzorwulu	Private
Accra Metropolitan	Megavest Medical Centre	Health Center	North Kaneshie	Private
Accra Metropolitan	TeshieNungua CHIPS Compound	CHPS	TeshieNungua	Government

NB: The coloured health institutions had questionnaires administered to them by the researcher.