THE CHALLENGES OF USING INFORMATION COMMUNICATION TECHNOLOGIES IN THE HEALTHCARE SYSTEMS IN ETHIOPIA FROM PROVIDER'S PERSPECTIVES

by

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DECLARATION

I declare that **THE CHALLENGES OF USING INFORMATION COMMUNICATION TECHNOLOGIES IN THE HEALTHCARE SYSTEMS IN ETHIOPIA FROM PROVIDER'S PERSPECTIVES** is my own work and that all the sources that I have used or quoted have been indicted and acknowledge by means of complete references and that this work has not been submitted before for any other degree at any other institution

DEJENE KEBEDE CHALLA **30 November 2013**

Full names **Date**

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ABSTRACT

The adoption of eHealth is very slow despite evidences showing its benefits. This research examines the individual, clinical, technical and organizational challenges for eHealth adoption from healthcare provider's perspectives. A cross-sectional study design with a quantitative paradigm was used. The study was conducted on 312 doctors and nurses randomly selected from ten hospitals in Addis Ababa, Ethiopia. Most respondents viewed eHealth positively with no significant differences in terms of profession or gender. Computer skill, workload, patient interaction, management support, cost and infrastructure were the main concerns. Privacy and security were not the main concerns. Knowledge of eHealth applications and utilization was low, even for evidence-based medicine and online databases. Specialists and males were better aware of eHealth applications. The study showed that eHealth acceptance was good. Increasing eHealth literacy was recommended as a cost effective means for improving access to updated information to improve the quality of healthcare.

Key Concepts:

Information Communication Technology, Challenges of information communication technology, Information communication technology adoption, Using information communication technology, Individual challenges, Clinical challenges, Technical challenges, Organizational challenges, Healthcare providers' perspectives, Healthcare systems in Ethiopia.

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AIDS	Acquired Immunodeficiency Syndrome
AOR	Adjusted Odds Ratio
CDSS	Computerized Decision Support Systems
CI	Confidence Interval
CIM	Conceptual Implementation Model
CIS	Clinical Information System
COR	Crude Odds Ratio
CPOE	Computerized Provider (or Physician) Order Entry
DOI	Diffusion of Innovation
eHealth	Electronic Health
EHR	Electronic Health Records
eMAR.	Electronic medication administration record
EMR	Electronic Medical Records
FITT	Fit between the Individuals, Task and Technology
HEW	Health Extension Worker
HIM	Health Information Management
ICT	Information Communication Technology
IT	Information Technology
ITAM	Information Technology Adoption Mode
ITU	International Telecommunication Union
MDG	Millennium Development Goals
mHealth	Mobile Health
M-PESA	M for mobile, pesa for money in Swahili
NCHS	National Centre for Health statistics
NEPAD	New Partnership for Africa's Development
NHS	National Health Services
openMRS	Open Medical Record Systems
PACS	Picture Archiving and Communication Systems
PEOU	Perceived Ease of Use
PHR	Personal Health Record
PU	Perceived Usefulness
SAQ	Self-administered Questionnaires
SD	Standard Deviation
SPSS	Statistical Package for Social Science
TAM	Technology Acceptance Model
TRA	Theory of Reasoned Action
UNISA	University of South Africa
WHO	World Health Organization

CHAPTER 1

ORIENTATION TO THE STUDY

1.1 INTRODUCTION

The concept of using computers in healthcare dates back to 1950s. The period from 1955 to 1965 is called an experimental period when the interest in the application of computers in medicine had emerged (Blobel, Pharow, Zvarova & Lopez 2008). Robert S. Ledley, the first medical professional to use computers, developed an automatic medical decision support system in collaboration with Lee B. Lusted. In1959. Robert S. Ledley and Lee B. Lusted published “Reasoning Foundations of Medical Diagnosis”, an article which introduced the application of computers in operational research in medicine. His work also influenced the field of medical decision-making and resulted in the development of expert systems such as MYCIN and Internist-1 (Blobel et al 2008). In 1962, Akron Children’s Hospital in the United States of America (USA) collaborated with IBM to build the first computer-based patient information system which was used to centralize patient records, share patient information, eliminate paperwork and provide medication alert to nurses. In 1965, the National Library of Medicine converted Index Medicus, a comprehensive index of the world’s leading biomedical literature, into a computer-based version which was, later on, called Medline (Medical Literature Analysis and Retrieval System Online) (Software Advice 2013). In 1968, Dr Larry Weed introduced the “Problem-Oriented Medical Record” which allowed physicians to systematically collect and act upon the problems of the patients (Software Advice 2013). In 2008, with the advances in the web technologies, the idea of Personal Health Record (PHR) emerged to help healthcare consumers to access their own data online (Wynia, Torres and Lemieux 2010).

Since 1999, the term "eHealth" had gained popularity after it was first introduced at the 7th International Congress on Telemedicine and Telecare that was held in London (Mea2001). eHealth has been recognized as an umbrella term for combining earlier terms such as electronic medical records, telemedicine and telehealth and to reflect the growing spectrum of ICT applications in the healthcare (Mea 2001). The term “eHealth” is used differently from the term “medical technology”. While eHealth is commonly used for the deployments of Information Communication Technology (ICT), the term “medical

technology" is used to describe the application of a set of techniques, medicines, equipment and procedure in health care (Mea 2001, Catwell and Sheikh 2009).

Despite the widespread use of the term "eHealth" since it came into use in 1999, there had not been a commonly agreed upon, consistent and clear definition (Oh, Rizo, Enkin & Jadad 2005, Pagliari et al 2005). Oh et al (2005) did a systematic review of 51 definitions out of titles, reports, articles, references, letters, websites and abstracts in the bibliographic databases available between 1964 and 2004. The definitions mostly reflected positive attitudes of optimism and included terms such as benefits, improvements, enhancing, efficiency and enabling regarding the process of care. On the other hand, few of them suggested negative connotations such as adverse effects and disadvantages. Most of the definitions concentrated on the process of care, such as access to care, portability of care, communication and service satisfaction while about a quarter of them focused on the outcomes to be expected such as improving medical outcome, patient safety and cost-efficiency.

Oh et al (2005) identified two universal themes in most of the definitions: health and technology and recommended consensus on the precise definition to improve communications among stakeholders. In addition, since different eHealth components serve different purposes and target different user groups, Oh et al (2005) and Catwell & Sheikh (2009) suggested that any definition of eHealth encompass all the components of ICT applications in the healthcare and appreciate the context of use and the value they can bring to society in terms of safety and efficiency.

Silber (2003) defines eHealth as the application of information and communication technologies (ICT) across the whole range of functions that affects healthcare, starting from diagnosis to follow-up for ensuring responsive services tailored to the needs of the citizens. Healthcare responsiveness is based on the principles of access, choice, information, safety and value for money and equity. It must ensure the attractiveness of the healthcare system and meet the legitimate expectations of its consumers. It should be able to safeguard the rights of the individual to access adequate and timely care portraying the care-seeker as a consumer rather than as a patient. In responsive healthcare systems, the healthcare-seekers are expected to fully get involved in making decisions in the care process (WHO 2000).

The World Health Organization defines eHealth as the cost-effective and secure use of information and communications technologies in support of health and health related

fields, including healthcare services, health surveillance, health literature, health education, knowledge and research.

Pagliari et al (2005) provided a more comprehensive definition of eHealth as *"an emerging field of medical informatics, referring to the organization and delivery of health services and information using the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a new way of working, an attitude, and a commitment for networked, global thinking, to improve healthcare locally, regionally and worldwide by using information and communication technology."*

eHealth has various components such as tele-health, electronic medical records (or electronic health record), computerized decision support systems (CDSSs), computerized provider (or physician) order entry (CPOE), picture archiving and communication systems (PACS), mobile health (mHealth) , and ePrescribing (Black et al 2011).

Tele-health refers to the delivery of healthcare services by healthcare professionals using information and communication technologies for the exchange of valid information for 1) diagnosis, treatment and prevention of disease and injuries 2) for research and evaluation and 3) for the continuing education of health care providers. Tele-health is a useful eHealth application where distance is a critical factor. All is done in the interest of advancing the health of individuals and their communities by all means such as tele-monitoring devices (e.g., tele-radiology and tele-cardiology), tele-consulting, or tele-surgery (World Health Organization 2009).

The electronic medical records (EMR) or electronic health record (EHR) constitutes the core eHealth and a central component of an integrated health information system. Whilst there are a number of operational definitions, the US' institute of standards and technology defines EHR as a longitudinal collection of patient-centric health care information available across providers, care settings, and time (Black, Car, Pagliari, Anandan et al 2011). The terms EMR and EHR are commonly viewed as interchangeable synonyms because of lack of standardization of definitions across the health informatics sector (Boonstra and Broekhuis 2010, Archer and Cocosila 2011, World Health Organization 2012).

The WHO (2012) recommends EMR as a real-time patient health record with access to evidence-based decision support tools and tools other than clinical care for billing, quality management, outcome reporting, public health disease surveillance and reporting. EHR according to WHO (2012) is defined as a longitudinal electronic record of patient health information generated by one or more encounters and includes demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data, and radiology reports. EMR consists of clinical information while EHR consists of health information (Boonstra and Broekhuis 2010).

Computerized Decision Support Systems (CDSSs) is a clinical information system that integrates clinical and demographic patient information to provide support for decision making by clinicians (Black et al 2011).

Computerized provider (or physician) order entry (CPOE) systems is typically used by clinicians to enter, modify, review, and communicate orders; and return results for laboratory tests, radiological images, and referrals. CPOE can be integrated within EHRs and/or integrate or interface with CDSSs (Black et al 2011).

Picture archiving and communication systems (PACS) is a clinical information system used for the acquisition, archiving and post-processing distribution of digital images stored using an electronic, magnetic, or optical storage devices. PACS can integrate or interface with EHRs and CDSSs or be used as a stand-alone system (Black et al 2011).

ePrescribing refers to clinical information systems that are used by clinicians to enter, modify, review, and output or communicate medication prescriptions. It can also include stand-alone CDSSs for prescribing purposes only. ePrescribing systems can integrate or interface with EHRs or be an element of the broader CPOE system (Black et al 2011).

Mobile health (mHealth) is a rapidly expanding eHealth application in medical and public health services (Fee et al 2013). mHealth makes use of mobile technologies such as mobile phones, personal digital assistants (PDA) and PDA phones (e.g. BlackBerry, Palm Polit), Smartphones (e.g. iphone), enterprise digital assistants (EDA), portable media players (e.g. MP3-players and MP4-players, e.g., ipod), hand-held video-game consoles (e.g., Playstation Portable (PSP), Nintendo DS) and handheld and ultra-portable computers such as tablet PCs such as ipad and Smart books (Free, Phillips, Watson, Galli et al 2013, WHO 2009).

Other eHealth components include eLearning, continuing education, consumer health informatics, health knowledge management, Virtual healthcare teams, population health management and Healthcare Information Systems

Interoperability is another important component of eHealth that facilitates the exchange of data between different clinical units and different organizations through data exchange standards known as metadata standards, messaging standards and medical record standards (World Health Organization 2009).

Politicians and policy-makers unanimously agree that eHealth is beneficial for improving access, ensuring equity, increasing quality and cost-effectiveness. Therefore, given the favourable global political commitment, it is recommended that advocacy efforts be enhanced to create enabling environments by formulating and endorsing eHealth policies and strategies for ensuring access to adequate funding (World Health Organization 2005, Chaudhry et al 2006).

Several research studies show that eHealth is also positively viewed by healthcare providers, particularly by the adopters. These studies have disproved the popular view that healthcare providers are resistant to the use of ICT (Kemper, Uren and Clark 2006, Simon et al 2007, DesRoches et al 2008, Boonstra and Broekhuis 2010, Mair et al 2012).

Similarly, research studies indicated that eHealth was also positively viewed by consumers of eHealth. Ancker et al (2013) found that almost two-thirds of healthcare consumers, particularly, consumers whose doctor had an EHR believed that eHealth would improve the quality of healthcare.

1.2 BACKGROUND INFORMATION ABOUT THE RESEARCH PROBLEM

1.2.1 The contributions of eHealth to the healthcare systems

ICT has improved access to the healthcare and reduced disparities in accessing information (UNDP 2008). It has enhanced networking and has helped to bring together people around the world and their respective ideas into a collective-thinking. It has broadened the capacities of connected people for critical thinking and has enhanced global thinking by shifting an individual mode of concern into what affects the whole world (UNDP 2008).

The contribution of ICT in transforming the healthcare delivery has been recognized in many high income countries and has received a high level political commitment which has resulted in a significant investment. The £ 12.8 billion in the National Programme for Information Technology (NPfIT) for the National Health Services of the United Kingdom (UK) and the $ 38 Billion eHealth investment in the United States of America (USA) can be cited as major undertakings in eHealth (Jha 2009, Black et al 2011).

Low/middle income and high income countries benefit from eHealth in different ways. In low and middle income countries, eHealth applications like tele-health and mHealth, help to ensure access and healthcare equity by removing geographical barriers (Lewis et al 2012, PAHO/WHO 2013). On the other hand, in the high income countries, eHealth have been acknowledged to enhance the quality of care and yield substantial savings. For example, the savings that can be secured by reducing substantial loss of life and resources resulting from medical errors were estimated at up to $142 billion annually in USA (McCullough et al 2010, Lau et al 2012). The research study by Milstein, Green and Bates (2013) identified that electronic health record system could have a marked positive financial impact if the system could increase revenue, for example, by attending more patients or by improving billing systems. According to this research study, the five-year Return on Investment (ROI) was negative for the majority of practices, particularly for the smaller ones.

As mentioned previously, cost-efficiency is the main goal in high income countries, while in the low and middle income countries, ensuring accessibility is the main priority. In the low-and middle-income countries, the World Health Organization is promoting innovative approaches like tele-health and mobile health (mHealth). These technologies are expected to transform the healthcare delivery and improve access by overcoming geographical barriers (Lewis et al 2011, WHO 2011). The rapid advances in mobile technologies and the continued growth in coverage of mobile cellular networks are new opportunities for the integration of mHealth into healthcare systems (WHO 2011).

eHealth is reported to have a range of benefits to the consumers, the care providers and the health care systems. The benefits of eHealth to the consumers include increased satisfaction, improved communication with the caregivers and improved access. Benefits to the healthcare providers consist of improved data collection and retrieval, increased staff productivity, improved communication between the clients and other care-providers and improved access to updated medical information. Benefits to

the healthcare systems include reduced medical errors, reduced cost and improved quality of care. According to Sidorov (2006), both medical errors of omission and commission could be reduced because of the availability of alert reminders and proper documentations.

On the other hand, Castillo, Garcia and Pulido (2010) argued that health IT might reduce clinical quality through workflow disruption. The main sources of such problems were design defects such as inefficient interfaces, time-consuming data entry and decreased patient-doctor interactions. This would, in turn, decrease the societal value of health IT and its acceptance by the healthcare providers (McCullough et al 2010). Black et al (2011), in their systematic review, argued that the postulated benefits of eHealth were lower than what they had empirically demonstrated in their studies despite extensive promotion by policy makers and techno-enthusiasts. In addition, they concluded that there were no sufficient studies to verify the cost effectiveness and risks of implementing such technologies. The implementations of EHR have potential risks such as obsolescence (Boonstra and Broekhuis 2010, McGinn et al 2011), inadequate interoperability or interfacing (McGinn et al 2011), breach of privacy and security (Bates 2005, McGinn et al 2011, Mair et al 2012), inadequate designs and poor usability (Boonstra and Broekhuis 2010, McGinn et al 2011), increased adverse reactions and medication errors (Koppel et al 2005, Nebeker et al 2005) and loss of clinical productivity (DesRoches et al 2008).

Concerns about privacy and security were among the most frequently mentioned barriers by healthcare providers. Such concerns are assumed to hinder the shift from paper-based systems to electronic records (Bates 2005, McGinn, Grenier, Duplantie, Shaw et al 2011, Mair, May, Donnell, Finch et al 2012). Moreover, the breach of privacy and security in electronic systems could be more catastrophic than in paper-based systems. Therefore, a clear legislation governing privacy and security is a high priority in the implementation of eHealth (Chaudhry et al 2006, Black et al 2011, WHO 2012).

1.2.2 Contribution of eHealth to the global economy

Globally, eHealth is significantly contributing to the world economy. For example, Barack Obama and John McCain, in their presidential election campaigns of the United States of America (USA), stated the importance of a greater use of information technology to reduce the inflating medical costs (Christensen and Remler 2009,

McCullough et al 2010). The reduction of healthcare costs was supposed to be achieved mainly by reducing service inefficiency, medical errors, costly re-testing and omission of the appropriate care (SidorovIt 2006). According to the National Health Information Technology Coordinator (ONCHIT) established by the former President George W. Bush of the USA in 2004, it was estimated that the adoption of EHR systems could reduce healthcare costs by up to 20% of the inflating $1.9 trillion annual healthcare costs of the USA (SidorovIt 2006).

The global eHealth market is expected to grow at estimated to grow at a rate of 12 - 16% every year and reach 160 billion by 2015. Among the eHealth applications, telemedicine market is expected to grow at a rate of 18.6 % annually and reach $23 billion in 2015 from $9.8 billion in 2010, which is actually more than double in five years. The global mobile health applications market will reach $4.1 billion by 2014 compared to $1.7 billion in 2010. A third of all smartphone users are expected use mHealth applications in 2015. The number of remotely monitored patients will reach 4.9 million by 2016. The ECG monitoring equipment market will reach $1.25 billion by 2017 (Aerotel Medical Systems 2012). According to a report published by the European Commission, the European eHealth market is expected to grow by a compounded annual growth rate of 2.9 % and is expected to increase from 14.2 million euro in 2008 to 15.6 million euro in 2012 (European Commission 2010).

1.2.3 Global eHealth commitment

Substantial advocacy efforts have been made globally in order to support ICT initiatives in healthcare. In 1997, the World Health Assembly identified fostering the use of and innovation in science and technology for health as one of the essential functions of sustainable health systems (World Health Organization 1997).

The Millennium Declaration acknowledges ICTs as important tools to alleviate poverty, improve accessibility of education, healthcare and other government services. The roles of ICT in human development to achieve the Millennium Development Goals (MDG) are vast and diverse. ICT has the potential to ensure equitable distribution of knowledge by helping to transmit large amount of information to marginalized areas. It offers people with opportunities for greater access to livelihood, health care and education (UNDP 2004 and UNDP 2008). ICT helps in the creation of an environment in which people can develop their full potential to lead productive and creative lives in accordance with

their needs and interests. It expands the choices of people to lead the lives that give them value by creating a favourable environment for social and economic mobility (UNDP 2008). For example, in low income countries such as Kenya a mobile money platform, M-PESA (M for mobile, pesa for money in Swahili), which provides farmers with the latest market prices for crops can be mentioned as a useful platform for improving household economy by ensuring access to up-to-date information (Impact 2012). A study in rural Kenyan households showed that M-PESA had been extended to offer loans and saving products and increase household income by 5-30% (The Economist 2013).

In May 2005, the 58th World Health Assembly (WHA) adopted a resolution WHA 58.28 on eHealth calling the member states to leverage the benefits of eHealth in the pursuit of the Health-for-all vision to strengthen health systems and to improve quality, safety and access to healthcare (World Health Organization 2005). Member States were requested to take action to incorporate eHealth into their health plans by developing long-term strategies that promote international and multi-sectoral collaboration to improve the compatibility of eHealth solutions that will eventually benefit its citizens (World Health organization 2005).

In another forum, the Rockefeller Foundation held a Global Partnerships and Local Solutions Conference series during July and August 2008. The conference series convened some of the world's leading thinkers in eHealth to devise innovative methods of using new digital technologies that would help to improve health outcomes in developing countries (Rockefeller Foundation 2007).

1.2.4 Commitment by high income countries

Over the past decade, the political stimulus for change in almost all high income countries has become stronger because of many indisputable evidences that had increasingly shown that current paper-based systems were not delivering safe, high quality, efficient and cost effective healthcare in a sufficient manner (Open Clinical 2001). The responses given were positive by many high income countries which had planned to build integrated computer-based national healthcare infrastructures that were based around the deployment of interoperable EMR systems in the next 10 years.

The European Union had developed a health action blueprint in order to achieve trans-European health information systems by 2010. The Group of Eight industrialized

countries formed an initiative called Providing-for-Health Initiative (P4H), as an international platform for dialogue and collaboration on health systems issues, including e-health (Open Clinical 2001).

In May 2004, the government of the United States of America (USA) established the Office of the National Coordinator for Health Information Technology (ONC) by an executive order of President George W. Bush, the former President of USA. The aim was to bring America's hospitals and physicians into the digital era. At that time, absence of a national health information technology strategy, limited funding, public support and policy context were among the challenges to this effort. However, since the establishment of ONC, a considerable progress had been made toward the creation of a national health information infrastructure (Brailer 2010). The current president of the USA, Barack Obama, pushed for a substantial funding for eHealth under the American Reinvestment and Recovery Act (ARRA) which was enacted into law in February 2009 (Brailer 2010). eHealth provisions contained in the American Recovery and Reinvestment Act (HR 1) committed a significant amount of funding to the deployment of eHealth, nearly $21 billion, to improve US healthcare through technology (Gerber, Olazabal, Brown and Pablos-Mendez 2010). It was envisioned that a substantial amount of money would go into the users' pockets in the form of incentives till the end of 2014. However, starting from 2015, this plan would be replaced by penalty under the Medicare and Medicaid program for the providers who failed to use the technologies (Health Affairs 2010). The goal of the stimulus law was to expand the use of EHR so broadly that every American would have EHR by 2014. EHR is generated and maintained within the healthcare facility, and information could be shared among the networked settings through computers or mobile devices. Information from an EMR can also be accessible to the consumers (patients) through a personal health record (PHR), an EHR which is controlled by the individual consumer (Wynia, Torres and Lemieux 2010).

In 2002, the National Health Service (NHS) of the United Kingdom established the National Programme for IT (NPfIT) at a cost of £ 12.7 billion. NPfIT is said by NCH "the world's biggest civil information technology programme". The aim of NPfIT was to link the world largest eHealth system within all parts of the NHS (Robertson et al 2010:1).

Australia developed the Government's National E-Health Strategy for the period 2008-2012 which outlined four major strategic streams of activity: foundations, eHealth

solutions, change and adoption, governance (Open Clinical 2001). As part of the national eHealth initiative, Australia announced a $467 million for the period 2012-13 for the development of a lifetime electronic health record which is known as PCEHR - the Personally Controlled Electronic Health Record – as a major national EHR initiative launched in July 2012 targeting all of its citizens (Open Clinical 2001).

A eHealth initiative known as Canada Health Infoway has been established since 2001 with an aim of accelerating the implementation of an interoperable EHR across clinics, hospitals, pharmacies and other points-of-care in Canada. Health Infoway is as an independent, not-for-profit corporation formed through a partnership of federal, provincial, and territorial governments with the deputy ministers of health its members. It is funded by the federal government and as of March 2009, it has been granted $1.2 billion (Gerber et al 2010, Canada Health Infoway 2001).

1.2.5 Commitment in Africa and other low/middle income countries

The field of eHealth is relatively new in low and middle-income countries. Moreover, the scope of implementation is typically fragmented and uncoordinated (Lewis et al 2012). However, evidences indicate that technology-enabled programmes are emerging in all lower-income countries in all areas of healthcare services. Particularly, in the donor funded ones, with HIV/AIDS, general primary care, and maternal and child health taking the lead in terms of absolute numbers (Lewis et al 2012). The main reasons for the applications of ICT in healthcare in low and middle income countries were different from that in high-income countries. According to Lewis et al (2012), in low and middle income countries, ICT applications in healthcare were mainly used for increasing geographical access (42%), improving data management (38%) and facilitating communication between patients and physician (31%) (Lewis et al 2011). Other reasons reported were improving diagnosis and treatment, mitigating fraud and abuse (8%) and streaming financial transactions (4%) (Lewis et al 2011). The main eHealth application reported was phones (71%).

According to a research study done by Gerber et al (2010), many innovations were coming from the developing world. Several examples can be mentioned such as telemedicine networks in Bangladesh, e-pharmacy projects in Malaysia, low-cost and sustainable EMRs for HIV/AIDS in Kenya and Web-based communication tools to address maternal and child deaths in Peru. In sub-Saharan Africa, Rwanda had

emerged as eHealth leader to improve health outcomes (Gerber et al 2010). The Rwandan Ministry of Health launched a comprehensive nationwide eHealth. The plan had included the development and implementation of a national interoperable electronic health information system, roll out of EMRs and other digital systems, empowerment of community health workers with mobile phone–based communication and reporting capacities (Gerber et al 2010). Furthermore, in partnership with the ministry, the Kigali Institute of Science and Technology had been developing eHealth center of excellence that would serve as a national and regional locus for eHealth research, education, and capacity building (Gerber et al 2010).

In Africa, the New Partnership for Africa's Development (NEPAD) created an ICT arm called e-Africa Commission (later on called e-Africa Programme). The purpose of the establishment of e-Africa programme was to help the development of the ICT sector by working in collaboration with governments, companies and local people for the realization of positive change in the ICT sector. It is intended to help the expansion of ICT in all social sectors, enhance e-Services and make Africa digitally competitive (NEPAD 2010).

Some other countries in Africa are also moving ahead with ICT projects in healthcare under an initiative called Global South. These include Kenya, Uganda, Rwanda, South Africa, Nigeria, and Mozambique. Several of them are adopting Open Medical Record Systems, also known as openMRS (Hammond et al 2010). Other countries in Africa where OpenMRS has been implemented so far are Ghana, Lesotho, Zimbabwe and Tanzania. openMRS had been also implemented in some countries in Central and Latin America (Hammond et al 2010). OpenMRS teams use open-source, non-proprietary strategies in which the software programming code is available for everyone to see, enhance, use, and share. The focus is on creating medical record systems and implementation networks that enable systems development and self-reliance within resource-constrained environments (Hammond et al 2010).

1.3 BACKGROUND TO THE RESEARCH PROBLEM

Despite the availability of substantial evidences regarding the benefits of eHealth in transforming the healthcare and the commitments from politicians and donors, most research studies indicate that the progresses made so far have not been as expected. In contrast, other sectors such as retail sales, financial services and

telecommunications have greatly benefited from ICT to achieve service quality and cost savings (Sidorov 2006). However, many of the available research studies had not helped in successfully replicating to the health sector the approaches that were applied in the other sectors (Leonard 2004). According to (Westbrook et al 2009), the approaches so far used in many healthcare ICT projects had not been adequate to deal with the complex and collaborative nature of the medical and nursing practice. Therefore, they recommend for the development of innovative and transferable approaches that could specifically apply to the healthcare service.

Furthermore, the realization of its benefits to healthcare has been very slow and its implementation has been very challenging (Catwell and Sheikh 2009). The value of ICT in easing more complex tasks of patient care has not been yet understood well by healthcare providers (Westbrook et al 2009). As a result, the healthcare has fallen progressively behind other service sectors in terms of utilization of ICT, despite extensive efforts over the past 25 years (Catwell and Sheikh 2009).

As mentioned previously, like many other interventions, eHealth undertakings are not without risks. The majority of ICT related projects in healthcare have either partially or completely failed. The reasons for failure or low adoption have not yet fully understood (Christensen and Remier 2009; Gagnon et al 2009).

ICT implementation challenges in healthcare were indicated to arise from multiple and interrelated human and organizational factors (Gagnon et al 2009). At the individual level, adoption and implementation is affected by the characters of the learner, which includes socio-demographic and technical factors, experience, professional status, expectations, values and beliefs (Gagnon et al 2009). At group level, the medical constituency is supposed to be among the strongest and the most difficult to change (Westbrook et al 2009). Medical doctors and nurses who constitute the major professional groups have a high level of autonomy and operate in a hierarchical structure (Westbrook et al 2009). Therefore, the resulting modification in the roles and the responsibilities of the healthcare professionals and the delimitation of professional boundaries will represent a potential source of resistance and conflict during the process of implementation (Westbrook et al 2009). At the organizational level, structural and contextual characteristics of the healthcare organization, like hospital location and size, participation of healthcare professionals in decision making, and management

support have been identified to impact the integration of ICT into the systems (Westbrook et al 2009).

Westbrook et al (2009:6-7) recommended a socio-technical approach as a powerful paradigm to examine and interpret the workforce and the organizational complexities of the health sector. This approach involves social network analyses, organizational culture inventory and quantitative measures of the outcomes of ICT supported initiatives through the active contribution of the healthcare providers (Westbrook et al 2009).

In addition, any plan for the adoption of eHealth needs to be able to address these complex and interrelated individual, clinical, technical, organizational, policy and infrastructural challenges that may surface in the process of implementation. Creating enabling environments like policy and strategy, sustainable funding, ICT infrastructure and user-groups involvement are critical factors in successful implementations (Boonstra and Broekhuis 2010, WHO 2012).

In spite of the numerous adoption and implementation challenges, the healthcare sector in both developing and developed countries cannot escape the influences of the rapid advances of ICT (Villanueva et al 2010). For example, the implementation of the 58th World Health Assembly resolution on eHealth has posed a major challenge for the Member States of the World Health Organization, particularly in the African Region. African countries would face unique infrastructural challenges which could add up to human and organizational factors. The most basic ICT infrastructures are lacking and internet connectivity is limited. This is compounded by insufficient ICT-related knowledge and skills (World Health Organization 2006). Other challenges include high adult illiteracy rates, low primary and secondary schools and tertiary institutions' enrolment rates, low per capita incomes and other competing priorities. A high adult illiteracy rates could explain a challenge to implementation of beneficial eHealth technologies like mHealth. Literacy is an important attribute that would help to communicate individual health messages in writing. For example, meta-analyses and rigorous trials have shown the benefits of text messaging for improving the outcomes of patients' self-care and for undertaking telephone monitoring of chronic diseases such as diabetes and hypertension in low- and middle-income countries (Piette et al 2012). Addressing the challenges that exist in African countries, therefore, calls for concerted domestic efforts. This should be complemented by external investments for developing

infrastructure and increasing human resource capacities in eHealth and improving internet connectivity (World Health Organization 2005).

The global eHealth survey by the World Health Organization (2006) recommended for supportive eHealth policy, legal and ethical frameworks to address these challenges. Creating such enabling environment for eHealth would help to secure adequate funding from various sources for infrastructure development and for capacity building.

In Ethiopia, due to its ability to be tailored and customized to culturally and linguistically diverse users and due to its capacity for wider geographical coverage, eHealth could have an important role to address health disparities among underserved populations (Ahern, Kreslake and Phalen 2006). However, the current enabling environment for deploying ICT in healthcare is very low and is characterized by a poor ICT infrastructure and a lack of policy, legal and ethical frameworks.

According to Shiferaw and Zolfo (2012), eHealth initiatives in Ethiopia were very few and their implementations were fragmented and isolated. A review of telemedicine project implemented in Ethiopia from 2004 and 2006 indicated that telemedicine was at a premature stage and recommended for the development of enabling environments, multi-sectoral collaboration, effective human resource management and capacity building (Shiferaw and Zolfo 2012).

Out of the ten actions listed by WHO (2011) required for creating an enabling environment for health, only three of them, which include - National policy or strategy, private funding, multilingualism and cultural diversity had been so far implemented in Ethiopia. National information policy, national eHealth policy, procurement strategy, and public funding are still in the process of development (World Health Organization 2011).

Some of the other developments in ICT such as the establishment of the Ethiopian ICT Authority in 2003, eGovernment initiative since 2002, ‘Schoolnet’ and ‘Woredanet’ (named after an Ethiopian district) in 2002 could create favourable platforms for greater adoption of ICT (World Health Organization 2006).

Furthermore, very few research studies pertaining to the use of EHRs exist in Ethiopia. Like any other countries in low income group, Ethiopia will face the unique challenges pertaining to poor ICT infrastructure, insufficient ICT human resources and policy and legal frameworks for the deployment of eHealth (ITU 2011).

Studies indicate that, in low and middle income countries such as Ethiopia, ICT-enabled health programmes are mainly used to increase geographic access to health care and to improve data management (Lewis et al 2012). Furthermore, the rapid expansion of mobile networks and a strong community health extension programme in Ethiopia is an opportunity for leveraging the benefits of mHealth for community information systems which can be used in disease surveillance and referral. Community health information systems have been implemented successfully in several low- and middle-income countries (Piette et al 2012).

Efforts in eHealth are underway in Ethiopia and other African countries. Ethiopia has already begun to develop the national eHealth strategy since 2013. In 2013, the International Telecommunications Union (ITU) and the World Health Organization (WHO) organized an international three-day workshop in Addis Ababa to assist Ethiopia, Liberia, Malawi, Sierra Leone, Uganda and Zimbabwe to develop their national eHealth strategies.

According to the study conducted in 2011 by Vital Wave Consulting in Ethiopia, mHealth is growing to be a powerful tool to support community programmes. The study suggested a framework for implementing mHealth to connect mHealth practitioners with medical professionals, government and private partners. It was concluded from the study that If managed successfully, mHealth could be an effective tool for advancing the government's key health initiatives, particularly, women-centred community-based interventions (Impact 2013).

The mHealth technology was identified to strengthen the health extension programme in Ethiopia by helping the Health Extension Workers (HEWs) in 1) identifying and referral of mothers and newborns to the nearest health facility as early as possible 2) training and education of HEWs 3) ensuring proper supply chain management for adequate medicines, health kits and equipment 4) collecting, transmitting and receiving important public health data 5) consulting highly specialized healthcare professionals (Impact 2013).

Finally, the study suggested a multi-phased approach to implement mHealth and to address HEW information and communication needs. According to the study, the implementation of mHealth must ensure harmonization with other technology programmmes and initiatives since these interventions impact and interact with each other (Impact 2013).

Meanwhile, the Ethiopian government is making remarkable efforts in expanding ICT infrastructures throughout the country. The recent large scale investment amounting to $1.6 billion by the Ethiopian government to expand the country's mobile phone infrastructure and introduce a high-speed 4G broadband network in the capital, Addis Ababa, and a 3G service for the rest of the country has been assumed to lay a foundation for eHealth development, particularly, the expansion of new mHealth services in urban, rural and remote areas (eHealth News Africa 2013).

1.3.1 Statement of the research problem

The adoption and implementation of ICT have brought a significant challenge globally. In most cases, ICT projects in healthcare in the developed countries have resulted in wastage of a substantial amount of resources (Westbrook et al 2009, Leonard 2004).

Despite all the global challenges resulting from the absence of enabling environment in most low/middle income countries and potential risks of failure, eHealth systems are being increasingly adopted, particularly, in high income countries and emerging economies such as Brazil, China and India (WHO 2012). However, low-income countries in Africa still continue to face unique and significant challenges related to infrastructure, poor internet connectivity and limited ICT related skills. While some low-income countries were able to attract technical and financial resources to install limited patient information systems, these had required significant investments in terms of finance, skilled labour and technology (Kirigia et al 2005, WHO 2012).

Survey on telemedicine by WHO Global Observatory for eHealth (GOe) showed that cost, followed by infrastructural factors were the leading barrier to the implementation of telemedicine (WHO 2009). The survey did not identify significant differences between low and high income groups on additional information need for comprehensive policy and strategy development. However, high-income countries were more likely to require additional information on the cost and cost-effectiveness of telemedicine, while low-income countries were more likely to require information on the infrastructure necessary for telemedicine (WHO 2009).

The adoption of a resolution WHA 58.28 on the occasion of the 58th World Health Assembly to leverage the use of eHealth in the pursuit of health-for-all vision is a significant challenge to countries in African regions (World Health Organization 2005). However, given the current favourable global and regional commitment and growing

interest by bilateral and multilateral donors, most countries are recommended to launch a comprehensive legal, policy and strategic framework to guide and nurture from the potential benefits of ICT (Kirigia et al 2005). The critical healthcare inequity, inaccessibly and shortage of healthcare workers will also be a driving factor for health sector in Africa region to take advantage of the global support enhancing ICT use in healthcare to ensure universal access to quality healthcare services (Lewis et al 2012)

In spite of very encouraging global supports for ICT initiatives in healthcare, African countries, including Ethiopia will certainly continue to face challenges of different scope and magnitude in the process of adoption and implementation. This could be further constrained by the lack of sufficient evidences on the context-specific potential challenges. Policy-makers might not have sufficient evidences on the critical barriers and motivators for embarking on expensive eHealth initiatives. Lack of such evidences may cause failures, wastage of the scarce resources and dissatisfaction from the stack-holders involved (Leonard 2004). Understanding these challenges which can be modified to the local needs is, therefore, of significant value to reduce the risks of failures of expensive ICT project.

1.4 AIM OF THE STUDY

1.4.1 Research purpose

The purpose of this research is to describe and examine the individual, clinical, technical and organizational factors which may pose challenges to the adoption and implementation ICT in healthcare systems in Ethiopia from healthcare providers' perspectives.

1.4.2 Research question

The research question is "what are the individual, clinical, technical and organizational challenges for the adoption and implementation of ICT in the healthcare settings in Ethiopia from the healthcare providers' perspectives?"

1.4.3 Research objectives

1. Identify individual, clinical and organizational challenges that affect the adoption and implementation of ICT in the healthcare settings in Ethiopia from the healthcare providers' perspectives.
2. Investigate the relationship between ICT usage and individual, clinical and organizational variables among the health care providers in Ethiopia.
3. Compare ICT usage among individual and organizational challenges.
4. Make recommendations that should be taken into account when designing ICT intervention in health care settings in Ethiopia.

1.5 SIGNIFICANCE OF THE STUDY

Given the scarcity research studies on the challenges of ICT from a provider perspective in the Africa region, particularly in Ethiopia, this research will be a vital source of input for future development of a strategic plan and a policy and legal framework to leverage the benefits of eHealth. The study contributes by providing information on the factors that should be taken into account before embarking on any ICT initiatives in the healthcare services. The methods used in the study could also be adapted to undertake similar studies which would help to identify the potential barriers and facilitators during the implementation of ICT projects in healthcare.

1.6 Definition of Key terms

1.6.1 Knowledge:

The fact or condition of knowing something with familiarity gained through experience or association. Acquaintance with or understanding of a science, art, or technique. Theoretical orientation to one or more of ICT components used in the healthcare services (Merriam-Webster Online: Dictionary and Thesaurus).

1.6.2 Challenge

Individual, socio-demographic and organizational gaps or hindrances that affect the individual healthcare provider or the institution ability and skill for adopting or using ICT (Merriam-Webster Online: Dictionary and Thesaurus.

1.6.3 Information Communication Technologies (ICT)

ICT includes all digital and analogue technologies that facilitate the capturing, processing, storage and exchange of information via electronic communication. The term eHealth is increasing used to refer to ICT in the healthcare domain (Gagnon et al 2009).

ICT (information and communication technologies) is an umbrella term that includes any communication device or application, encompassing: radio, television, cellular phones, computer and network hardware and software, satellite systems and so on, as well as the various services and applications associated with them, such as videoconferencing and distance learning. ICTs are often spoken of in a particular context, such as ICTs in education, health care, or libraries. In the context of this study, it includes all applications related and used in healthcare (SearchCIO 2005).

1.6.4 ICT Familiarity

The fact or condition of knowing something with familiarity gained through experience or association. Acquaintance with or understanding of a science, an art, or a technique. Theoretical orientation to one or more of ICT components used in the healthcare services (Merriam-Webster Online: Dictionary and Thesaurus, Tiresias 2009).

1.6.5 ICT Challenges

Individual, socio-demographic and organizational gaps or hindrances that affect the individual healthcare provider or the institution ability and skill for adopting or using ICT (Merriam-Webster Online: Dictionary and Thesaurus, Tiresias 2009).

1.6.6 ICT usage

A uniform and a certain level of reasonable lawful practice mainly on the basis of presumed familiarity to any one or more of ICT component (email, internet, computers, tablets, etc) by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use (Merriam-Webster Online: Dictionary, Thesaurus, Tiresias 2009).

1.6.7 ICT availability

The degree to which an ICT system is physically present, known, operable and used. The state of being available of one or more of functioning ICT component (s). Availability is one of the six fundamental components of information security (http://en.wikipedia.org/)

1.6.8 ICT accessibility

The degree to which ICT is accessible by as many people as possible. Accessibility can be viewed as the "ability to access" the functionality, and possible benefit, of some systems. It is related to both legal and physical access by all people, including those living with disability (Tiresias 2009).

1.6.9 Direct patient care

Aspect of clinical practice involving interaction with the patient like consultation, prescribing and administering care and treatment provided personally by a healthcare provider (Mosby's Medical Dictionary 2009),

1.6.10 Healthcare providers

An individual that provides preventive, curative, promotional or rehabilitative health care services in a systematic way to individuals, families or communities. It includes medical doctors, health officers and nurses who practice in health care institutions regulated by national or state/provincial authorities through appropriate regulatory bodies for purposes of quality assurance (http://en.wikipedia.org/).

1.6.11 Private practitioner

A private hospital is a hospital owned by a profit company or a non-profit organisation and privately funded through payment for medical services by patients themselves, by insurers, Governments through national health insurance schemes, or by foreign embassies (http://en.wikipedia.org/). As an operational definition for the research purpose, a private practitioner is defined as a healthcare provider who has been working in a privately owned hospital for at least the last three months.

1.6.12 Public hospital practitioner

A public hospital or government hospital is a hospital which is owned by a government and receives government funding. This type of hospital provides preventive, promotive and curative medical care free of charge as a subsidized cost (http://en.wikipedia.org/). As an operational definition for the research purpose, a public health practitioner is defined as a as a healthcare provider who has been working in a public hospital for at least the three months.

1.7 FOUNDATION OF THE STUDY

1.7.1 Meta-theoretical assumption

Successful implementation of clinical Information Systems should follow multiple issues which are classified under four broad categories of principles: Computer technology, personal principles, organizational principles and environmental issues. According to Callen, Braithwaite and Westbrook (2008), this framework, although not presented as a model, was originally proposed by Linestone and has been refined by Ash, Gorman, Seshadri and Hersh (2004). There exist numerous models of user acceptance of ICT in information science literatures. Many of them focus on fit between the task, the clinical environment and the technology. One of them is the FITT model (Fit between the Individuals, task and technology) which is based on the interaction of the technology between the user and between the technology and the clinical environment. The organizational aspect of the FITT is included in the individual aspect (Callen et al 2008).

Among those frameworks, the Diffusion of Innovation (DOI) has received much attention in the study of ICT adoption in healthcare (Berwick 2003). DOI was developed by Roger (Callen et al 2008) and was based on extensive empirical work and explains the magnitude of the spread of new ideas, practices or objects among individuals or groups in a certain environment (Callen et al 2008). The diffusion of innovation theory (DOI) has been a key change theory which is applicable to healthcare in terms of introducing new and beneficial clinical practices, medicines, techniques and technologies (Callen et al 2008). This model suggests that there are three main sources influencing the adoption and diffusion of an innovation, namely perceptions of innovation, characteristics of the adopter and contextual factors. However, the DOI does not provide information on how to assess innovation characteristics (Berwick 2003).

Two other models for Clinical Information Systems evaluation which have been developed on behavioural theory are Technology Acceptance Model (TAM) and the Information Technology Adoption Model (ITAM). TAM (Technology Acceptance Model) which was developed by Fred Davis in 1986, has gained considerable support. The TAM has its roots in the Theory of Reasoned Action (TRA) which was formulated by Fishbein and Ajzen (1975 as cited by Jung and Loria 2010). The TAM has been widely examined, validated and replicated as a robust and powerful model for predicting user acceptance (Jung and Loria 2010). TAM focuses on the user's acceptance of technology and has been simplified over time and the attitudinal and normative components have been dropped from the model, leaving Perceive Ease of Use (PEOU) and Perceive Usefulness (PU) as the sole predictors of intention (Venkatesh et al 2003). TAM works on two key constructs: perceived usefulness (PU) and perceived ease of use (PEOU). According to Davis (1989 as cited by Jung and loria 2010) PU is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance." PU is expected to be influenced by perceived PEOU, "the easier a technology is to use and the more useful it can be." PEOU is "the degree to which a person believes that using a particular system would be free of physical and mental effort." PEOU is a process of expectancy; PU is an outcome of expectancy (Venkatesh 1999 as cited by Jung and Loria 2010).

The ITAM builds on the work of TAM and focuses on the individual user to predict adoption of voluntary ICT. ITAM focuses on the end user perceived value and ease of use of the technology. However, both models do not take into account the organization and clinical environment principles mentioned in the previous framework (Callen et al 2008).

Despite the existence of several other models, none of them has emerged as being successful in all situations. Most of them do not consider diversity and differentiation factors and do not acknowledge the complexity of the clinical environment. Therefore, Callen et al (2008) proposed another model, the Conceptual Implementation Model (CIM), which is established on the core theme of "Contextual difference". The three levels of the model and dimensions for consideration are organizational context, clinical or departmental context and individual context. It indicates that challenged pertaining to adoption and implementation of ICT would manifest at those three levels based on contextual differences. The CIM can be applied in an iterative manner during the pre-

implementation, implementation and post implementation phases to assist policy-makers, hospital managers, clinicians and IT professionals (Callen et al 2008).

After reviewing all the models previously discussed, the Conceptual Implementation Model (CIM) was applied in this study to describe and analyze individual, clinical, technical and organizational challenges. Under individual contexts, demographic factors, years of service, attitudes and perceptions were examined. At the clinical level, the challenges were described and analyzed from the perspectives of different professional groups such as doctors and nurses. Technical challenges included in the study were software and hardware, interoperability, privacy and security and technology types. Cost, leadership, management and organizational culture and health facility type, size and location were discussed as organizational challenges.

1.8 RESEARCH DESIGN AND METHODS

This research study applied a cross-sectional study design with quantitative methods. A cross-sectional study design is intended to collect information from the respondents on the dependent and independent variables at the selected sites and within a specific time period (Polit and Beck 2008). Descriptive statistics was used to determine the frequencies on the pattern of variables of interest and as analytic approach were employed to examine the interrelationship between the dependent and the independent variables collected. In this particular case, the interrelationship between ICT use and socio-demographic, technical and organizational challenges affecting the use were analyzed. Given the cross sectional time dimension, this type of researches are assumed to be easy, economical and efficient in collecting a large amount of data on a large number of study subjects in a reasonably short period of time. They result in less rigorous methodological and ethical challenges. They help to make practical recommendations that could be generalized to the target population and design appropriate intervention measures (Varkenvisser, Pathmanathan and Brownlee 2003).

1.9 SCOPE OF THE STUDY

The study was conducted among doctors and nurses practicing in five public and five private hospitals in Addis Ababa, the capital city of Ethiopia. Addis Ababa consisted of a disproportionately high number of qualified and highly specialized healthcare

professionals. The study focused on the perceptions of the healthcare providers on the challenges and the benefits of application of ICT in healthcare as well as their familiarity with some of the eHealth applications. Analyses were also made how certain predictor variables such as sex, age, profession, hospital type and access to internet had affected their perceptions toward eHealth. The main limitations were inability to generalize the findings to the national healthcare settings since the study was conducted only in hospitals in Addis Ababa. Another challenge was the scarcity of literatures on eHealth in Africa, in particular, in Ethiopia.

1.10 STRUCTURE OF THE DISSERTATION

This study comprises five major parts.

Chapter 1: Orientation to the study provides the introduction to the study, the background, and the statement of the problem, the research questions, the significance and purpose of the study, the scope of the study and definition of key terms. This chapter examined what eHealth; what the global, regional, national level ICT initiatives in eHealth and what the challenges of implementation and benefits offered by eHealth.

Chapter 2: Literature Review consists of seminal and current literatures on ICT initiatives in healthcare and challenges related to them. This chapter examines the global, sub-regional and regional ICT initiatives and the barrier and facilitators to adoption and implementation of eHealth.

Chapter 3: Research design and method elaborates on the chosen methodology. This chapter includes discussion on instrument design, sample and population, methods for data collection and analysis.

Chapter 4: The chapter on presentation, description and analyses of results discusses the description and analysis and results of the research in detail. Results are displayed in tables and graphs and interpretations are made.

Chapter 5: Conclusion and recommendations summarizes the study and discusses how the results could impact the implementation of eHealth. It makes recommendations and shows what is expected from the healthcare providers, professional associations, the Ministry of Health and the government for implementing new eHealth initiatives and sustaining the on-gong ones.

1.11 CONCLUSION

In chapter one, the researches briefly explained the history of the use of computers in healthcare, defined eHealth, elaborated its contents and described how it is viewed by healthcare providers, consumers and decision-makers. After introducing eHealth, the researcher discussed the current global status of eHealth, the reasons for high level investment, the risks of implementation of eHealth and difficulties for large-scale adoption. The contributions of eHealth at global, national and operational level were discussed. The global, regional and national level initiatives of eHealth in the low, middle and high income countries were highlighted. The high level global political commitments, particularly in high income countries, in spite of challenges in the process of adoption and slow implementation rates were discussed.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

The important points discussed in chapter one pertaining to the globally acknowledged benefits of eHealth as well as challenges for its wider adoption have established the ground to carry out the literature review. This literature review helps to understand the existing knowledge on eHealth in relation to individual, clinical, technical and organizational challenges.

Literature Review is a critical examination, synthesis and summary of the existing knowledge on a given subject to make informed choices about a research direction (Joubert and Ehrlich 2007, Polit and Beck 2008). Literature review involves a cycle of analytical work that encompasses a process of reading, thinking, understanding, organizing, analyzing, identifying patterns, synthesizing, evaluating and creating a new text (Badenhorst 2008). A literature review consists of three important sections: the introduction, the body and the conclusion. The introduction gives a quick idea of the topic of the literature, its central theme and organizational pattern. The body contains the discussion of sources organized chronologically, thematically, or methodologically. The conclusion summarizes what has been derived from the review (Joubert and Ehrlich 2007, Badenhorst 2008, Polit and Beck 2008).

In this section of the dissertation, the researcher has critically examined the relevant electronic and published sources that include journals, articles, conference papers and text books.

2.2 LITERATURE SEARCH STRATEGY.

With advances in technology and the availability of several sources of information, the ability to locate documents on a research topic is a crucial one (Polit and Beck 2008). Applying a search strategy would help to ensure a thorough and a systematic exploration for relevant study. High quality review is comprehensive, up-to-date, appropriate and reproducible (Polit and Beck 2008). Several approaches for searching

have been available and it has always been important to begin the search with some strategies in mind.

The primary sources of literature for this research were electronic databases. The search of an electronic database requires familiarity with the software used as it gives options for restricting the search for what is relevant and appropriate only. One of the important features of electronic databases is mapping which allows for searching using one's own subject related key words (Polit and Beck 2008). Furthermore, the use of subject heading (subject codes) of the database is something worthy to learn.

The search strategy involved systematic steps indicated below, adapted from Polit and Beck (2008).

The search strategy involved systematic search from PUBMED, Cochrane Database of Systematic Reviews, PLOS Medicine, BMC Medicine, the British Medical Journal database applying the *Key words* and phrases in linear perspective

2.2.1 Key words

Challenges: Challenges**,** Barriers
ICT: Information Communication Technology**,** eHealth**,** Electronic health records**,**
Healthcare providers: Healthcare providers**,** Doctors**,** Nurses

2.2.1.1 Search terms

1. Electronic health records & adoption & barriers & healthcare providers
2. ICT and adoption & barriers & healthcare providers
3. ICT & adoption & barriers & doctors & nurses
4. Electronic health record & adoption & healthcare providers
5. Electronic health record & adoption & doctors and nurses

6. Electronic health record & acceptance & barriers & healthcare providers
7. Electronic health record & acceptance & barriers & doctors & nurses
8. ICT & acceptance & barriers & healthcare providers
9. ICT & acceptance & barriers & doctors & nurses

An important part of the search plan is the concerns on decision about limiting the number of studies to be reviewed. To address this concern, it is important to establish a clear decision rule for selections stated as inclusion and exclusion criteria (Polit and Beck 2008). Reproducibility of these decision rules, which is the capacity to reach a similar conclusion by another diligent reviewer, is an important attribute of a quality criterion (Polit and Beck 2008). However, while constraining the review search is important, it is equally recommended to exercise caution not to be narrow-based, and therefore exclusion criteria should be rational and defendable. As mentioned in Polit and Beck, Conn and Rantz (2003) have noted the absence of "gold standard" criteria for determining the scientific rigor and validity and quality criteria widely vary from instrument to instrument.

2.2.1.2 Inclusion criteria

- Studies written in English.
- Qualitative or quantitative or mixed-methods studies with empirical study design, clearly stated data collection process and research strategies and measurement tools.
- Studies on users' perspectives and barriers and facilitators of eHealth implementation.
- Studies based upon an actual EHR implementation experience.
- Studies focusing on the use of ICT in patient care by healthcare providers. Those used for administrative purpose were excluded
- Studies written not later than 2000

2.2.1.3 Exclusion criteria

- All the studies not meeting the inclusion criteria mentioned above.
- Articles without empirical evidence
- Editorials, comments, position papers, and unstructured observations were excluded.

2.2.2 Summary of the research review

Ser.No	Author/Date	Sample size	Research objective	Finding
1.	Ammenwerth et al 203	Nurses (n=51)	Identify the level of user acceptance through time & factors affecting & acceptance of Computer-based Nursing-Documentation	Importance of computer experience and the fit between nursing workflow and the functionality of a nursing documentation system.
2.	Ancker et al (2013)	N= 1000 consumers	To determine whether consumers' attitudes toward EHR and HIE are associated with experience with doctors using HER	Most believed EHR and HIE would improve healthcare quality (66% and 79%, respectively). Respondents whose doctor had an HER were more likely to believe that these technologies would improve quality (for EHR, OR 2.3; for HIE, OR 1.7). However, 50% believed EHR would worsen privacy and security, and 18% believed EHR would improve privacy and security.
3.	Asaro and Boxerman (2008)		To measure the effects of the implementation of computerized provider order entry (CPOE) and electronic nursing documentation on provider workflow in the emergency department (ED).	For nurses, all direct and related care changed minimally from 56.9% to 55.3%, whereas for physicians the decrease was from 36.8% to 29.1%, approaching statistical significance at the 95% confidence level. Care planning time decreased significantly for nurses, from 9.4% to 6.4% (all care planning), whereas the decrease for physicians from 21.7% to 19.5% was not statistically significant.
4.	Asua et al (2010)	N= 605 nurses, GPs and pediatricians	To examine the psychosocial factors related to tele-monitoring acceptance among healthcare professionals and to apply a theory-based instrument	Perceived Usefulness, Compatibility, and Facilitators were the significant predictors of intention. Intention to use tele-monitoring was best predicted by healthcare professionals' beliefs that they would obtain adequate training and technical support and that tele-monitoring would require important changes in their practice.
5.	Bauer et al 2002	N = 30 residents (G1 =20, G3= 10). Usage of the system was recorded electronically each time a user logged on	To determine whether Internal Medicine residents would find the use of an expert system (i.e. Clinical Diagnostic Decision Support System)	A significant level of satisfaction with the system among residents. It frequently led the participants to consider novel diagnoses suggesting it had a positive educational impact
6.	Black et al 2011	53 papers	Assess the impact of eHealth solutions on the quality and safety of health care	There is lack of robust research on the risks & cost-effectiveness, evaluation should give careful attention to socio-technical factors for success.

7.	Boonstra and Broekhuis 2010	22 papers	To identify and analyze barriers perceived by physicians to the adoption and provide implementers with beneficial intervention options.	Physicians may face a range of organizational", ,Change Process, Financial, Technical, Time, Psychological, Social and "Legal" which should be treated as a change project and led by implementers or change managers
8.	Carayon et (2011)	N=21 Nurses(3 months), N=161 Nurses (12 months)	To assess intensive care unit (ICU) nurses' acceptance of EHR and examine the relationship between EHR design,	On average, ICU nurses were more accepting of the EHR at 12 months as compared to 3 months. They also perceived the EHR as being more usable and both. CPOE and eMAR (Electronic Medical Administration Record) as being more useful. Multivariate hierarchical modelling indicated that EHR usability and CPOE usefulness predicted EHR acceptance at both 3 and 12 months. At 3 months post-implementation, eMAR usefulness predicted HER acceptance, but its effect disappeared at 12 months. Nursing flow-sheet usefulness predicted EHR acceptance but only at 12 months.
9.	Castillo et al 2010	68 papers	Identify the critical adoption factors to use them as a guide to support their adoption process automatically.	Six critical adoption factors have been identified: user attitude, workflow impact, interoperability, technical support, communication among users, and expert support.
10.	Chisolm et al 2010	Emergency physician and nurses (n=71)	Identify perceived user satisfaction and commitment to use of Electronic Medical Records during the first year of implementation	Adoption is influenced by training and support, perceived usefulness, effort expectancy and social influences. User satisfaction and ease of use also increases through time and familiarization
11.	Darr et al 2003	18 physicians and 8 nurses, indepth interview	Identify the managerial implications of the perceptions hospital physicians and nurses hold toward the introduction of electronic medical records (EMRS). In-depth interviews were used with 18 hospital physicians and eight nurses	Senior physicians, most of whom held managerial roles, tended to emphasise managerial outcomes and to view positively. Junior doctors emphasised mostly negative occupational effects including limits to professional autonomy, heavier administrative burdens, and reinforcement of existing professional hierarchies. Nurses identified different domains and saw benefits for quality and administration of patient care.

12.	DesRoches et al (2008)	N=2,758 Physicians	Assess physicians' adoption of outpatient electronic health records, their satisfaction with such systems, the perceived effect of the systems on the quality of care, and the perceived barriers to adoption.	Physicians who use electronic health records believe such systems improve the quality of care and are generally satisfied with the systems. However, as of early 2008, electronic systems had been adopted by only a small minority of U.S. physicians, who may differ from later adopters of these systems. 2008 Massachusetts Medical Society
13.	Duyck 2008	n = 54. radiologists - technologists	To gain insight into the individual user acceptance of PACS by the radiology department staff	Both radiologists and technologists had positive attitude towards PACS and had strong intentions to use PACS
14.	Eley et al (2008)	n=4,330 nurses	To support policy planning for health, the barriers to the use of health information and computer technology (ICT) by nurses in Australia were determined.	Older nurses were more likely to report inadequate skill in IT and lack of confidence on the use of computers and lack of technical support as barriers than did younger nurses.
15.	El-Kareh et al (2009)	N = 86 primary care clinicians	To measure changes in primary care clinician attitudes toward an electronic health record during the first year following implementation.	The proportion of clinicians agreeing that the EHR improved the overall quality of care (63% to 86%; $p < 0.001$), reduced medication-related errors (72% to 81%; $p = 0.03$), improved follow-up of test results (62% to 87%; $p < 0.001$), and improved communication among clinicians (72% to 93%; $p < 0.001$) increased from month 1 to month 12.
16.	Gans et al 92005)	N=2,879	Identify adoption rate among medical groups	The majority of practices are finding the transition to EHRs difficult even if the physicians and nurses are fully supportive
17.	Garg et al 2005	n = 100	To assess the effects of computerized clinical decision support systems (CDSSs) and identify factors predicting benefit.	Many CDSSs improve practitioner performance. To date, the effects on patient outcomes remain understudied and, when studied, inconsistent.
18.	Georgiou et al 2009	Hospital doctors, nurses, managers, pharmacists, senior health executives (n=100)	Identify main concerns of a broad range of hospital staff about the implementation of a CPOE	Perceived Barriers on change in workflow practices, negative impact on the patient-physician relationship, lack of time to acquire knowledge about systems, change in practice, limitation of critical thinking

19.	Hellström et al (2009)	N =431	To evaluate experienced ePrescribers' attitudes towards ePrescribing for suggesting improvements.	A majority of the respondents regarded their EHR-system easy to use in general (81%) and for the prescribing of drugs (88%). Most respondents believed they were able to provide the patients better service by ePrescribing (92%), and regarded ePrescriptions to be time saving (91%) and to be safer (83%), compared to handwritten prescriptions.
20.	Hollingworth et al (2007)	all prescriber (n =27) and staff (n =42)	Assess impact of e-prescribing on work-flow	Prescribers at e-prescribing sites spent less time writing, but time-savings were offset by increased computer tasks. e-prescribing tasks took marginally longer than hand written prescriptions (12.0 seconds; 1.6 - 25.6, 95% CI). Nursing staff at the e-prescribing sites spent longer on computer tasks (5.4 minutes/hour; 0.0 - 10.7, 95%CI). E-prescribing was not associated with an increase in combined computer and writing time for prescribers. If carefully implemented, e-prescribing will not greatly disrupt workflow.
21.	Hsiao et al (2011)		Examine the trends in eHealth adoption in USA. Provide baseline information on physicians' readiness for meaningful use	EMR/EHR use in USA has increased from 18% in 2011 to 57% in 2011. About 36% meet the criteria for a basic system.
22.	Jha et al (2009)		To determine whether minority-serving providers adopt EHR systems at comparable rates to other providers.	Physicians from minority-serving practices identified financial and other barriers to implementing EHR systems at similar rates, Finally, physicians from high-minority practices had similar perceptions about the positive impact of EHRs on quality (73.7% vs. 76.6%, P = 0.43) and costs (46.9% vs. 51.5%, P = 0.17) of care. no evidence that minority-serving providers had lower EHR adoption rates, faced different barriers to adoption or were less satisfied with EHRs
23.	Jha et al (2009)		To determine whether minority-serving providers adopt EHR systems at comparable rates to other providers.	Physicians from minority-serving practices identified financial and other barriers to implementing EHR systems at similar rates, although these physicians were less likely to be concerned with privacy and security concerns of EHRs (47.1% vs. 64.4%, P = 0.01). Finally, physicians from high minority practices had similar perceptions about the positive impact of EHRs on quality (73.7% vs. 76.6%, P = 0.43) and costs (46.9% vs. 51.5%, P = 0.17) of care.

24.	Jha et al 2009	Mixed physicians (from all specialties). (n=1,345) mailed survey	Identify perceived barriers to adoption rates of adoption, satisfaction and comparison of use of EHR systems	**Perceived Barriers**:Start-up and on-going financial costs, training and productivity loss, lack of time to acquire knowledge about system, computer technical support. **Positive attitudes**: access to up-to-date knowledge, interactions with healthcare team, reduction of medication errors, improved efficiency of providing care, improved quality of care. **Negative attitudes**:Loss of privacy
25.	Jha et al 2009		Assess the presence of specific electronic-record functionalities and barriers to their implementation.	Larger hospitals, those located in urban areas, and teaching hospitals were more likely to have electronic-records systems. Respondents cited capital requirements and high maintenance costs as the primary barriers to implementation, although hospitals with electronic-records systems were less likely to cite these barriers than hospitals without such systems.
26.	Joos et al (2005)	N=46	Identify features of an EMR that contribute to user satisfaction and administered it in an adult primary care clinic.	Respondent's satisfaction with implementation was positively correlated with their perception about EMR speed (Spearman's rho = 0.3; p = 0.04), outside access (Spearman's rho = 0.5; p = 0.002), and EMR efficiency (Spearman's rho = 0.4; p = 0.008), and not correlated with EMR accuracy or communication.
27.	Kemper and Clark 2006	Primary care paediatricians. (n=526) mailed survey	Identify predictors, barriers and attitude among EMR uses and non-users	**Perceived barriers:** Cost, increase in physician workload, physician resistance. **Positive attitudes:** Improved documentation completeness, access to patient records, communication with outside providers, office productivity, confidentiality and security), long-term savings, improves quality of care. **Adoption Predictors:** Larger and networked paediatric practices.
28.	Kemper, Uren and Clark (2006)	N= 1000 paediatricians	To stuy barriers to the implementations of EHR among paediatrics practices.	Smaller and independent paediatric practices are commonly unlikely to adopt EHR. Cost of implementing and maintaining the systems are the main barrirs

29.	Kepler 2006	Primary care physicians (n=526)	Measure the penetration of electronic health records into primary care paediatric practices.	Electronic health records (EHR) are concentrated in larger and networked pediatric practices. Smaller and independent pediatric practices are unlikely to adopt electronic health records mainly because of implementation & maintenance cost, physician resistance, increased work load and lack of understanding. EHRs are widely perceived to improve quality of care by practicing general paediatricians
30.	Kossman 2008	Nurses (n=46) open-ended questions), interviews, observations	Identify perceptions of the impact of EHRs on work and patient outcomes	**Perceived Barriers:** speed, system downtime and lack of adequate IT resources. **Negative attitudes:** time-consuming, decreases time with patients, resulting in decreased quality of care. **Positive attitudes:** Increased access to patient information, increased efficiency, increased patient safety
31.	Lewis et al 2012	16 countries	To describe how ICT is being used by programmes that seek to improve private sector health financing & delivery in low & middle-income countries	Successful implementation requires more sustainable sources of funding, greater support for the adoption of new technologies and better ways of evaluating impact.
32.	Lin et al 2012	n = 115	Identify barriers, perceived threat and perceived inequity	Perceived threat shows a direct and negative effect on perceived usefulness. Perceived inequity reveals a direct and positive effect on perceived threat and on perceived usefulness.
33.	Linder et al (2006)	N = 501 primary care clinicians	1) to assess clinicians' EHR use, barrier and characteristics of the clinicians using and no-using EMR during patient visits	The most commonly reported barriers to using the EHR during patient visits were loss of eye contact with patients (62%), falling behind schedule (52%), slow computers (49%), inability to type quickly enough (32%), discomfort of using the computer in front of the patient (31%). Nurses were marginally more likely to be EHR non-users than physicians (39% versus 21%, respectively; p = .05).
34.	Lo et al (2007)	N = 157 observations pre and 146 observations post-adoption	To assess the impact of using an EHR on specialists' time.	Following EHR implementation, the average adjusted total time spent per patient across all specialties increased slightly but not significantly from 28.8 (SE = 3.6) to 29.8 (SE = 3.6) min.
35.	Loomis, Ries, Saywell & Thakker 2002	Family physicians (n = 618) mailed survey	Identify differences in attitudes, beliefs, and demographic characteristics of EMR users and non-users	**Perceived Barriers:** Data entry, cost, security and confidentiality, lack of understanding of benefits. Large differences in the perceptions users and non-users of EHR systems.

				Adoption Predictors: Urban area, hospital-based, fewer patient case load
36.	Mair et al 2012	37 papers	To systematically review the literature to identify barriers & facilitators & outstanding gaps in ehealth research	The published literature focused on organizational issues, neglecting the wider social framework when introducing new technologies.
37.	McGinn et al 2011	60 papers	Synthesize current knowledge of the barriers and facilitators influencing shared EHR implementation among its various users.	Despite important similarities between user groups differences between them demonstrate that each user group also has a unique perspective that should be taken into account.
38.	McManus and Wood-Harper (2007)	N= 214 projects in a variety of sectors that included 18 health care projects,	Identify at what stage in the project lifecycle projects are cancelled (or abandoned as failures), the average schedule and budget overrun and the major causal factors contributing to failure?	Management issues accounted for 65% of causal factors identified with failed projects. Technical causal factors account for 35% of the project failure rate
39.	Menachemi Powers & Brooks (2009)		to examine the relationship between physician IT adoption (of various applications) and overall practice satisfaction, as well as satisfaction with the level of computerization at the practice.	EHR users were 5 times more likely to be satisfied with the level of computerization in their practice (OR = 4.93, 95% CI = 3.68-6.61) and 1.8 times more likely to be satisfied with their overall medical practice (OR = 1.77, 95% CI = 1.35-2.32).
40.	Miller & Sim 2004	n=90 in-depth interview	Undertake qualitative study on the opportunities and barriers that ambulatory physician practices encounter when using EMRs for quality improvement	**Perceived Barriers:** High initial cost and Uncertain financial benefits, high initial physician time costs, difficulties with technology, difficult complementary changes and inadequate support, inadequate electronic data exchange. **Perceived Facilitators:** Financial incentives for quality, presence of an EMR champion.
41.	Murray et al 2011	Planners executors of e-health interviews (n=23)	To explore and understand the experiences of implementers their assessment of factors which promote or inhibit the successful implementation and integration	Implementers had rich understandings of barriers and facilitators to successful implementation of e-health initiatives, and their views should continue to be sought in future research.

42.	Neter & Brainin 2010	Digital-dial telephone household survey of the Israeli adult population (18 years and older, N = 4286)	Explore eHealth literacy disparities are in the search for health information on the Internet pertaining to such as socio-demographic characteristics and information search processes, and the outcomes of Internet use for health.	Respondents who were highly eHealth literate tended to be younger and more educated than their less eHealth-literate counterparts. No significant gender difference in eHealth literacy Respondents who were highly eHealth literate gained more positive outcomes.
43.	Patel V et al 2013	N = 10,889	To examine readiness and interest in meaningful use (MU) among primary care physicians and specialists, and identify factors that may affect their readiness to obtain MU incentives.	Physician EHR adoption rates increased in advance of MU incentive payments. Although interest in MU incentives did not vary by specialty, primary care physicians had significantly higher rates of adopting EHRs with the potential to meet MU. Addressing barriers to EHR adoption, which may vary by specialty, was found to be important to enhancing coordination of care.
44.	Poissant et al (2005)	N=23 papers	A systematic review of the literature to examine the impact of EHRs on documentation time of physicians & nurses	The use of central station desktops for computerized provider order entry (CPOE) was found to be inefficient, increasing the work time from 98.1% to 328.6% of physician's time per working shift (weighted average of CPOE-oriented studies, 238.4%).
45.	Pynoo 2012	n =46	to gain a better insight into the reasons why hospital physicians accept and use a Picture Archiving and Communication System (PACS)	The main motivation for physicians to start using PACS is effort expectancy; performance expectancy only becomes important after the physicians started using PACS.
46.	Rahimi et al 2009	n = 134 nurses and 176 physicians	Understand physicians' and nurses' attitudes and thoughts about implementation and use of the Computerized provider order entry (CPOE) systems.	The relative advantages of the CPOE system were estimated to be significantly higher among nurses (39.6%) than physicians (16.5%). Significantly more physicians (73.9%) than nurses (50.7%) reported that they found the system not adapted to their specific professional practice. Significantly more physicians (25.0%) than nurses (13.4%) want to return to the previous system.

47.	Rao et al (2011)	N = 5000 physicians from the the American Medical Association.	To examine variation in the adoption of EHR functionalities and their use patterns, barriers to adoption and perceived benefits by physician practice size.	physicians in solo or two-physician (small) practices reported using <2% of a fully functional EHR and 5% of basic while physicians from 11+ group (largest group) practices reported using 13% of a fully functional and 26% of a basic systems showing physicians in small practices to have significantly lower levels of EHR adoption
48.	Rousseau et al 2003	n = 75	To understand the factors influencing the adoption of a computerised clinical decision support system for two chronic diseases in general practice	Negative comments about the decision support system significantly outweighed the positive or neutral comments.
49.	Saleem et al (2005)	35 nurses and 55 physicians	Assess how computerized clinical reminders (CRs) can improve compliance with these practices in outpatient setting practices in preventive care and chronic disease management.	Clinicians did not perceive the CRs as being a core work activity and assumed to be time consuming.
50.	Scott et al (2005)	N=26 senior clinicians, managers and project team leaders	A qualitative study to examine user's attitudes to implementation of an HER system in Kaiser permanente Hawaii	Identified seven key findings: users' perceive decision flawed, software problems increased, the system reduced productivity, the system required clarification of roles and responsibilities, cooperative culture trade-offs, no single leadership style, the process foster a counter climate of conflict resolved by withdrawal.
51.	Simon 2007	Mixed physicians (from all specialities). (n=1,345). Mail survey	Compare EHR adopters vs. non-adopters and identify barriers and use predictors	Adoption Predictors: Larger practices, other than primary care, affiliated with hospitals, especially teaching hospitals, increasing years since medical school completion, seniority, understanding of EHR benefits. **Facilitators:** Incentives for quality of care. **Perceived Barriers:** inancial costs (start-up and ongoing), loss of productivity, lack of uniform standards, lack of time to acquire knowledge about systems
52.	Singh R et al 2013	N = 5,200	To conduct the first national assessment of HIT in rural primary care offices, with particular attention to EMR adoption, range of capabilities in use, and plans for adoption.	eHealth adoption and use in rural primary care offices does not appear to be lower than in urban offices. The situation, however, is dynamic and warrants further monitoring.

53.	Ward et al 2008	79 papers	Assess attitudes of health staff to ICT in use and the factors influencing change	Attitudes of health care professionals can be a significant factor the acceptance and efficiency
54.	Xierali et al (2013)	N=2,412 Family physiciens	To examine the associations between demographic, geographic, and practice characteristics and EHR adoption.	EHR adoption rates for family physicians grew from 37% in 2006 to 68% in 2011. Practicing in a medically underserved location or geographic health professional shortage areas are negatively associated with adoption. Solo practices and small practices were less likely to adopt EHRs, whereas those in health maintenance organizations or with faculty status were more likely.
55.	Yen et al (2009)	N=85 observation periods	To determine the effect of computer physician order entry on paediatric emergency department (ED) care providers' allocation of time- whether the increase in time by ED care providers on the computer will decrease time spent with patients.	The addition of computer physician order entry to a paediatric ED increases time spent on the computer by both attending and resident physicians but not for emergency nurses. The addition of computer physician order entry decreases nurses' time talking with other staff for patient care.

2.3 THE CHALLENGES OF USING ICT FROM PROVIDERS' PERSPECTIVES

The following section of the literature review has two broad categories: challenges and enablers of eHealth. Initially, the challenges will be critically reviewed under six main themes: individual, professional groups, technical, eHealth type, organizational and national, followed by review of enabling factors.

2.3.1 Individual level challenges

2.3.1.1 Demographic factors

Ward, Stevens, Brentnall and Briddon (2008) in their literature review argued that the common generalization that age and gender were significant factors in attitudes towards the use of ICT with female and older users being less positive were not proved to be true.

The study by Simon et al (2007) on 1,345 physicians in Massachusetts indicated that there were no statistically significant demographic differences in proportion of ICT use

among the three groups of male users. The proportions of male physicians were 63.4% among high EHR users, 64.3% among low EHR users and 68.8% among non-adopters.

Similarly, in a research study in Israel, Neter and Brainin (2010) measured eHealth literacy among the adult population of 18 years and older using a 5-point Likert scale and found 50.7% of the women to be in the high group and 49.8% to be in the low groups showing that sex was not a significant factor in explaining different rates of eHealth use. Likewise, the eHealth literacy score of men (mean 3.35, SD 0.89) and women (mean 3.31, SD 0.88) did not differ significantly. In a postal survey by Menachemi, Perkins, Durme and Brooks (2006) on 756 licensed family physicians in Florida, routine use of EHR was 22.7% among male and 29.1% among female. However, the difference was not statistically significant between the male and the female users. DesRoches et al (2008) in the study on physicians in American Medical Association (AMA) did not also find sex to be a factor in explaining either adoption or non-adoption. In this study, the rate of non-adoption of any EMR system was found to be 83% in both sexes.

In contrast to the previous studies, an online survey by Villanueva et al (2010) on 2,199 registered physicians in Physician Association of Barcelona showed a significant difference on ICT use between male and female doctors. The proportions of ICT use was 66.5% among male doctors and 33.5% among female doctors.

In summary, the studies made by Menachemi et al (2006), Simon et al (2007), DesRoches et al (2008), Neter and Brainin (2010) showed that sex was not a significant factor in explaining the difference in eHealth literacy or adoption. These studies are in agreement with the argument made by Ward et al (2008) in that gender does affect ICT use in healthcare. However, Villanueva et al (2010) showed a significantly higher proportion of non-adopters among the female doctors.

Another demographic factor that is presumed to affect eHealth adoption and use is age. Menachemi et al (2006) showed that EHR use was significantly lower among doctors who were above 50 years of age. According to Menachemi et al (2006), EHR use was 43.4% among 40 years of age or less, 51.4% among 41–50 years of age, 39.8% among 51–60 years and 22.2% among 61 years and above. Similarly, a study published by National Centre for Health Statistics (NCHS) of USA in 2011 indicated that the age of physicians was a significant factor for the differences in adoption rates. It was found that

from among the physicians who were below the age of 50, nearly two-thirds (64%) were found to be adopters while only less than a half (49.0%) of those aged 50 and above were found to be adopters. A study by Xierali et al (2013) also showed that younger family physicians were much more likely to adopt EHRs than the older family physicians. According to a study by Xierali et al (2013), the adoption rate was 75.5% among those less than 40 years of age , 69.5% among 40 – 60 years of age and 57.3% among those who were 60 years and above showing a progressive reduction in proportion of use with increasing age. The differences were statistically significant between any of the two lower age categories and those 60 and above. Neter and Brainin (2010) found that the high eHealth literate group was significantly younger than the low eHealth literate group.

In summary, Menachemi et al (2006), NCHS (2011), Neter and Brainin (2010) and Xierali et al (2013) showed that age can be an explanatory factor for differences in the proportion of ICT use. In particular, doctors within the age group of greater than 50 years were more likely to be non-adopter and less eHealth literate than the younger age groups. Ward et al (2008) in their literature review argued that both gender and age did not affect eHealth literacy and use. Similarly, this literature reviews showed that sex was not significantly associated with the degree of ICT use. However, age on the contrary was significantly associated eHealth literacy and use with healthcare providers in the older age group being low adopter and less eHealth literate.

2.3.1.2 Years of service

According to Simon et al (2007), DesRoches et al (2008) and Eley et al (2008) healthcare providers with longer years of service were more likely to be non-adopters than those with shorter duration of service.

In the study made among physicians, Simon et al (2007) revealed that the mean length of service of ICT adopters after medical school completion was lower than the non-adopters (20.6 years vs. 24.3 years). Furthermore, the adopters were found to have been in their current practice for a shorter duration of time than the non-adopters (mean, 8.4 vs.12.0 years). DesRoches et al (2008) and Simon et al (2007) in their studies among physicians showed that the proportion of EMR adopters was significantly lower among physicians who had practiced for 30 or more years.

Eley et al (2008) found that Australian nurses serving more than 10 years had significantly a higher mean Likert scale for reporting barriers (0. 997 Vs. 1.333) indicating showing less interest to ICT use for patient care.

2.3.1.4 Attitude

An attitude to information systems refers to the user's interest, perceived usefulness and motivation in working with it (Castillo, Garcia & Pulido J. R. 20102010). Attitudes can be negative or positive. Negative attitudes were expressed as staff interference with sabotage and user resistance to adopt new ICT applications. Staff interferences with sabotages were estimated to account for the failure of almost half of the ICT Projects (Bonnie et al 2009). Negative attitude on part of the healthcare providers might arise from lack of understanding about the perceived benefits of the application in their practices (Kemper 2006). Ward et al (2008) and Chisolm et al (2010) suggested education and training to be part of the project to encourage positive attitudes towards ICT among healthcare providers.

Many perceptions of the system that were observed at the launch of implementation tended to persist during the stages of implementation. Similarly, managers who positively viewed ICT initiatives at the start of the project were also likely to remain positive throughout the period of implementation (Ward et al 2008, Chisolm et al 2010). As a result, Chisolm et al (2010) recommended that system implementation plans make efforts to ensure positive early impressions through training to achieve high user satisfaction.

Attitudes are also affected by the history of adoption. A study in Massachusetts showed that physicians who had already adopted electronic medical records reported barriers less frequently than those who had not adopted. Moreover, adopters reported a significantly higher level of satisfaction: 90% among fully functional system user and 79% among basic system users (DesRoches et al 2008). Positive attitudes were found to be significantly higher among the adopters than the non-adopters (Kemper and Clark 2006, Simon et al 2007, DesRoches et al 2008). Kemper and Clark (2006) found that only less than half of the physicians (48%) without an EMR believe that EMRs can improve patient care or clinical outcomes. Simon et al (2007) also demonstrated that adopters were found to have more positive attitudes towards eHealth than the non-adopters in all dimensions of healthcare such as cost, health team interaction, patient-

physician communications, privacy, access to updated medical information, efficiency of care and error reduction. Kemper, Uren and Clark (2006) found, more physicians (71.6%) who had adopted EMR reported EMR to be better in improving the quality of care and cost than the paper based system. Only 42.5% of the physicians who were non-adopters reported EMR to be better than the paper-based system.

Another factor associated with positive attitudes is system functionality. DesRoches et al (2008) found that, in most cases, physicians using the fully functional system (FFS) had significantly more positive attitudes to perceived benefits than those using the Basic Systems (BS). Those using FFS and BS reported respectively that EMR improved timely access to medical records (97% and 96%, p=0.52), helped in prescription refill (95% and 85%, p=0.02), improved quality of communications with other providers (92% and 86%, p=0.19), helped delivery of chronic care based on guideline (82% and 56%, p<0.001), improved quality of clinical decision (82% and 63%, p<0.001) and improved communication with patients (72% and 59%, p=0.03).

According to a research review by McGinn et al (2011), attitude on perceived usability and the usefulness were consistent predictors of EHR acceptance in the short as well as in the long terms. Sue et al (2010) also conducted a study of 605 nurses, GPs and paediatricians and found that perceived usefulness were significant predictors of intention to use eHealth applications. The study showed that healthcare providers who believed that the systems would benefit their clinical practices were twice more likely to have the intention to use. Perceived ease-of-use can be a facilitator where the system was reported to be user-friendly. It can also be a barrier where the system was not adopted to the needs or abilities of the users (Chisolm et al 2010).

While study by Simon et al (2007) demonstrated that adopters were found to have more positive attitudes towards eHealth than the non-adopters; the study did not show perceived benefits of computers to be affected by the degree of use. Therefore, both EHR high-users and low-users respectively showed no significant difference between them on the perceived benefits such as improved access to updated knowledge (96.6% vs. 91.8%), improved quality of care (94.0% vs. 80.2%), reduced medication errors (90.1% vs, 83.8%) and improved interaction with the healthcare team (88.6% vs, 81.7%).

Attitude is also affected by satisfaction with the system. Satisfaction with the system and positive attitudes can also increase over time with the increase in experience and through iterative system improvement (Chisolm et al 2010). Carayon et al (2011) showed that on a rating scale of 1 to 10, ICU nurses acceptance of EHR increased from 6.32 at 3-month to 6.91 at 12-month as they become more familiar with and more exposed to the technology. Carayon et al (2011) also showed that perceived usefulness computerized provider order entry (CPOE) and the Electronic Medication Administration Record (eMAR) was significantly higher at 12-month than it was at 3-month. El-Kareh et al (2009) showed that there was a significant increase in the proportion of clinicians agreeing that the EHR had improved the overall quality of care from 63% to 86% a year after implementation.

In conclusion, the research studies reviewed showed that positive attitudes towards EHR and acceptance developed with years of experience of using the system (Ammenwerth, Mansmann, Iller, & Eichstadter 2003, Moody et al 2004), previous practices of proper documentation (Ammenwerth et al 2003), history of previous use (DesRoches et al 2008), positive perceptions at the launch of the implementation (Ward et al 2008, Chisolm et al 2010) and familiarity with the system through time (Chisolm et al 2010).

2.3.1.5 Perception on workflow interference

Several studies revealed perceived interference with workflow to be detrimental for acceptance of innovations. Workflow interference was reported to lead to dissatisfaction with new applications (Castillo, Garcia and Pulido 2010). Therefore, Castillo et al (2010) suggested the proper consideration of workflow interference study during the planning stages in order to optimize the implementation of eHealth in the routine clinical care practices. Castillo et al (2010) showed that the workflow impact could modify the perceived usefulness of the innovation which could be critical in the persuasion stage of the decision process for system introduction. Concerns of health care providers with the use of computers during patient care were difficult data entry and typing (Boonestra and Broekhuis 2010), extra time to acquire new skills and the resulting time-cost (Miller and Sim 2004, Boonestra and Broekhuis 2010), increased work demands (Eley et al 2008) and increased time spent on computers (Lo et al 2007, Asaro and Boxerman 2008, Yen et al 2009).

According to a review done by Boonestra and Broekhuis (2010), data entry and typing had been difficult, time consuming and uncomfortable for physicians using EMRs. Furthermore, since these skills are not traditionally part of the medical practice, physicians are required to take a significant amount of time away from patient care to acquire the new skills (Boonestra and Broekhuis 2010).

Loss of clinical productivity and decreased job performance, particularly during the transition period, were perceived as barriers which have cost implications (DesRoches et al 2008, Boonestra and Broekhuis 2010). DesRoches et al (2008) identified concern about loss of productivity during transition by 35% of EMR adopters and 41% of the non-adopters. Actually, the degree of concern by the non-adopters was significantly higher than that of the non-adopters.

In a research study made by Eley et al (2008), increased work demands were among the principal barriers reported by the healthcare providers. In this study, 82.5% of the nurses reported that using computer was an extra demand to the already existing work. Miller and Sim (2004) identified that most physicians using EMRs spent more time per patient for months or even years after EMR implementation. The study also showed that the increased time costs resulted in longer workdays or fewer patients examined during the initial period of implementation.

Yen et al (2009) studied the effect of the introduction of computer physician order entry to a paediatric emergency department (ED). The time spent per patient increased from 5.0 minutes to 9.5 for the attending physician and from 5.5 to 14.3 minutes for the resident physicians. The increases in both cases were statistically significant. For nurses, on the other hand, the time spent per patient before and after the introduction did not differ significantly. However, their communications for consulting with staff about patient-care significantly decreased from 24.5 minutes before the introduction to 13.3 minutes after the introduction.

Asaro and Boxerman (2008) measured the effects of the implementation of computerized provider order entry (CPOE) and electronic nursing documentation on provider workflow. According to Asaro and Boxerman (2008), the time spent on computers significantly increased from 15.7% to 27.0% for physicians and from 9.5% to 25.7% for nurses. The time for direct patient care by nurses slightly decreased from 56.9% to 55.3%, while by the physicians decreased from 36.8% to 29.1%, but the

decrease was not statistically significant in both cases. In contrast, care-planning by nurses decreased from 9.4% to 6.4% and by physicians from 21.7% to 19.5% and the decrease was statistically significant for the nurses.

A study by Poissant et al (2005) on computerized provider order entry (CPOE) showed time inefficiency to be the major barrier to successful implementation. In this study, CPOE increased physician's work-time by three folds highlighting that a goal of decreased documentation time in an EHR project is not likely to be realized.

A study by Lo et al (2007) found that the average adjusted total time spent per patient across all specialties increased slightly from 28.8 to 29.8 minutes and concluded that EHR use in these specialty clinics did not result in a significant difference in clinic visit time.

Another concern raised in the study by Linder et al (2006) among 501 primary care clinicians (nurses and doctors) was loss of eye contact during patient care. According to Linder et al (2006), nearly two-thirds (62%) the respondents did not like the loss of eye contact with patients when using computers. A third (31%) of the respondents reported that using computers in front of the patient to be rude. Furthermore, nearly a third of them (32%) reported difficult typing and more than half of them (52%) complained that the computer would make to fall behind schedule.

In contrast to the previous studies which mentioned significant work flow interference, time-cost and increased work demand, other studies reported that the use of computers speeded up services (Hollingworth et al 2007 and Hellström et al 2009) and improved work efficiency and communication (El-Kareh et al 2009)

Hollingworth et al (2007) studied the impact of e-prescribing on workflow and found that e-prescribing took less time for writing, but time-savings were offset by increased computer tasks and they concluded if it is carefully implemented, It will not greatly disrupt workflow.

Hellström et al (2009) in did a survey in Sweden and showed that most physician respondents believed they were able to provide the patients better service by ePrescribing (92%), and regarded ePrescriptions to be time saving (91%) and to be safer (83%), compared to handwritten prescriptions.

El-Kareh et al (2009) showed that work efficiency improved after the providers had got acquainted with the system through time. For example, the proportion of clinicians who reported increased time spent on medical documentation reduced from 78% in the first month of implementation to 68% after 12 months of implementation showing significant improvements in perceptions. McGinn et al (2011) argues that the use of EHRs was often perceived as a facilitator which is positively influencing workplace efficiency and communication in studies related to health professionals, managers, and patients.

In summary, most of the studies mentioned showed a significant increase in the workload and time during computers use which could be detrimental to eHealth acceptance. However, it was suggested that with careful planning and implementation, the impact of workflow interference could be minimized (Hollingworth et al 2007, Castillo et al 2010). Another area to take into consideration to reduce workflow interference is to ensure fit-between-the-task and the technology. Fit-Between-the-task and the selected technology is important for user acceptance since poor fitness for use can have a negative effect on the time spent and the quality of patient care (Ammenwerth et al 2003).

2.3.2 Professional groups challenge

Different professional groups come with different concerns in the adoption and implementation of eHealth. The productivity offered by EHR can be viewed as both a facilitator and a barrier as in the case of a study done on nurses as an example. Nurses reported increased time spent with EHR and reduced time with the patient. Nevertheless, nurses at the same time perceived EHRs to improve workplace productivity due to better access to organized patient care information (Kossman 2005).

EHR was considered by some to be a threat to professional autonomy which had been very important in physicians' reaction towards EMR adoption. Physicians were concerned that the implementation of EMR might disrupt the traditional, hierarchy, roles and responsibilities within the medical constituency. Other concerns were changes in the working processes and loss of control over patient information where patient information might be shared with and assessed by others (Boonstra, Broekhuis 2010). Therefore, Mair et al (2012) emphasized the need to properly address the impacts of eHealth on the roles and responsibilities of healthcare providers during the process of adoption and implementation.

Senior physicians who hold managerial roles emphasized positive managerial outcomes of EHR. Junior doctors were concerned about negative occupational outcomes such as limitations of professional autonomy, heavier administrative tasks and reinforcement of existing professional hierarchies while nurses identified positive outcomes which could benefit the administration of patient care (Darr, Harrison, Shakked and Shalom 2003). Ward et al (2008) concluded that general practitioners (GPs) were concerned about technical issues related to the use of computers while pharmacists raised workload as a main barrier. In addition, senior physicians with managerial roles emphasized positive managerial outcomes than junior doctors who were concerned about negative occupational outcomes (Ward et al 2008 and Darr et al 2003).

Some physicians reported that eHealth might reduce patient-physician interaction and might subsequently result in a shift of the physician's role to a data entry clerk (Hellström 2009; Georgiou 2009). However, contrary to the physicians' perception, patients were found to be positive about physicians' use of computers during the care. Hsu et al (2005) and Wager et al (2005), however, suggested further research regarding the perceptions of patients on the use of computers during patient care.

Some experienced healthcare providers also felt that technology might result in limitation of critical thinking and unnecessary dependence, in which medical decisions had to be made by computers on behalf of the physician (Kossman 2008; Georgiou 2009).

A survey by National Centre for Health Statistics (NCHS) in 2013 showed that adoption is affected by speciality type. It was 58% among primary care physicians, 54% among the medical specialities and 48% among the surgical specialities. The difference in adoption between the primary care physicians and the surgical specialities was significant.

According to Rahimi et al (2009), nurses had more positive attitudes towards the use of eHealth applications than physicians. This study indicated that the perceived benefits of the CPOE system were estimated to be significantly higher among nurses (39.6%) than among physicians (16.5%). Similarly, Linder et al (2006) made study on 501 primary care clinicians (nurses and doctors) and found that nurses were more likely to be EHR non-users than physicians (39% versus 21%) respectively and the difference was statistically significant.

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To summarise, more primary care physicians than the other specialities (Linder al 2006, NCHS 2013) and more nurses than physicians showed positive attitudes towards eHealth applications. The barriers for using ICT in healthcare services vary between different professional groups (Darr et al 2003, Linder al 2006, Ward et al 2008, Rahimi et al 2009, NCHS 2013). The reasons mentioned by different professional groups were varied and included factors such as reduced time for patient care (Kossman 2005), disruption of the traditional roles and responsibilities and change in providers' role as data entry clerk (Hellström 2009; Georgiou 2009,Boonstra, Broekhuis 2010, Mair et al 2012), loss of professional autonomy and control over patient information (Boonstra, Broekhuis 2010), heavier administrative tasks (Darr, Harrison, Shakked & Shalom 2003) and limitation of critical thinking (Kossman 2008; Georgiou 2009). In addition, lack of adequate valid statistical data and success stories about EMRs to convince the non-users or the non-adopters could be perceived as a barrier (Boonstra and Broekhuis 2010).

2.3.3 Technical challenges

In addition to a range of interrelated individual and organizational issues, the implementation of eHealth should take into account the technical challenges such as the need for flexibility and usability, appropriate education and training and the need for the software to be 'fit for purpose' (Boonstra and Broekhuis 2010, McGinn et al 2011). Each user group of EMR has factors specific to their professional and individual priorities commonly related to technical concerns, ease of use, interoperability, privacy and security, costs, productivity, familiarity, motivation, patient and health professional interaction and workload (Boonstra and Broekhuis 2010).

2.3.3.1 Software or hardware

Technical limitations related to software or hardware such as speed, design, inappropriate development tools, improper documentation, weak test planning, unplanned downtime and obsolescence were most frequently cited as barriers that contribute to failures (Boonstra and Broekhuis 2010, McGinn et al 2011). According to a systematic review of McGinn et al (2011), technical concerns were mentioned by 42.3% (n= 52 studies).

Jose et al (2005) showed that physicians' satisfaction with the implementation of EMR was positively correlated with their perception of EMR speed (Spearman's rho = 0.3; p = 0.04), outside access (Spearman's rho = 0.5; p = 0.002), and EMR efficiency (Spearman's rho = 0.4; p = 0.008).

Fear of the possibility of record loss due to technical defects arising from computer crash, viruses and power failure was also raised as a concern by physicians in several research studies (Boonstra and Broekhuis 2010).

System flexibility is another challenge. The system should be flexible enough to support practices ranging from small solo practices to national integrated delivery networks and should be able to generate quality reports for a variety of health plans (Kaplan & Harris-Salamone 2009, McGinn et al 2011).

Another concern reported in the study done by DesRoches et al (2008), system obsolescence was mentioned as a major concern by 27% of those adopting EMR and 44% of those not adopting any EMR. In another study by Roa et al (2011) concerns on system obsolescence were mentioned by 47% of physicians of 1 – 2 practices, 41% of physicians of 3-5 practices, 40% of physicians of 6-10 practices and 34% physicians of 11+ practices. System obsolescence was found to be a more significant concern for practices not having any EMR and small practices.

To conclude, healthcare providers were mainly concerned about technical issues like the speed, the design, weak test planning, the flexibility and obsolescence the system which should be addressed during planning, development, testing and implementation stages (Jose et al 2005, DesRoches et al 2008, Bonnie 2009, Boonstra and Broekhuis 2010 and McGinn et al 2011).

2.3.3.2 Interoperability

Achieving interoperability to ensure communication between different technologies and software applications for the efficient, accurate, and sound sharing and use of data of clinical information is a key to making EHR use a cornerstone of practice and a fully standardized interoperability could save the nation $77.8 billion annually (Bates 2005). Interoperability represents a widely recognized obstacle because of the presence of the multitude of EHR/EMR software types with different packages that do not interoperate

well with each other, mainly because of lack of data exchange standards (Bates 2005, Boonstra and Broekhuis 2011).

Inadequate interoperability (interfacing) due to lack of standards, regulation, guidelines and technical specifications during health data exchange was generally perceived as a barrier in 19.2% (n= 52 studies) of the studies (McGinn et al 2011). eHealth standards include metadata standards, messaging standards and medical record standards(WHO 2009),

2.3.3.3 Privacy and security

Privacy and security was the one of the most frequently mentioned concerns because breach of security could be more catastrophic than in a paper-based system. This could undermine confidence in eHealth utilization and hinder the movement from a paper-based system towards electronic records (Bates 2005, McGinn et al 2011, Mair et al 2012). All user groups (physicians, other healthcare professional and managers) reported concerns over any factors that could compromise the security or confidentiality of patient (McGinn et al 2011). However, Simon et al (2007) showed privacy and security to be the least positively viewed benefits by both EHR adopters and non-adopters. Only less than a third of respondents, 29.9% high users, 32.9% low users and 23.0% non-adopters agreed that EHR could improve patient privacy. Kemper, Uren & Clark (2006) also showed privacy and confidentiality to be among the least positively perceived benefits, 64.4% among the adopters and 49.3% among the non-adopters. Studies by Kemper et al (2006) and Simon et al (2007) showed that non-adopters have statistically lower positive attitudes towards the security offered by EHR.

Concerns about privacy and security were high among physicians because of the legal consequences of inappropriate disclosure (Simon et al 2007, Boonstra & Broekhuis 2011). The concern was further aggravated by lack of clear security regulation and standards in some countries to protect the privacy of patients and the confidentiality of their medical information (Boonstra & Broekhuis 2011).

On the other hand, privacy and security concerns of patients were mixed. Five studies reported that confidentiality and security were of little concern among patient participants while four studies raised some concerns (McGinn et al 2011). Many of the studies indicated that the level of concern raised by the patients on privacy and security issues was less significant than that of the healthcare providers' (McGinn et al 2011).

On the other hand, a study by Ancker et al (2012) found that half of the healthcare consumers (patients) believed that EHR would compromise privacy and security.

2.3.4 Technology type

2.3.4.1 Picture archiving and communication systems (PACSs)

The implementation of a Picture Archiving and Communication System (PACS) in imaging departments had the most specific quantitative documentation and the highest rate of perceived benefits (Ward et al 2008). In a research study by Aldosari (2012) a Technology Acceptance Model (TAM) was used to assess the level of acceptance of PACS by staff in a radiology department indicated a high level of perceived usefulness with no significant difference with regard to age and gender. PACS was also found to be positively viewed by physicians, radiologists and technologists who had strong intentions to use it (Duyck et al 2008, Pynoo et al 2012).

2.3.4.2 Electronic Medical Records

EMR is the most challenging eHealth initiative with potentially lower user satisfaction and adoption rate. EHR, as a core clinical application, usually encompasses a variety of functionalities, which makes their implementations to be complex and prone to failure (Heeks 2002). However, after the system had started to be implemented, the likelihood of returning to a paper-based system was low (Ward et al 2008, Boonstra and Broekhuis 2010).

Incorporating the study of enablers and the inhibitors of technology usage intention prior to EMR initiatives will help to identify barriers to physicians' acceptance more effectively before leading to technology rejection and ensure a smooth implementation of any new technology (Lin et al 2012). Furthermore, implementation of a change management perspective could overcome the identified barriers (Boonstra and Broekhuis 2010)

A study among 431 Swedish physician respondents showed that the majority of the respondents (81%) regarded EHR-system easy to use. Similarly, 88% of the physicians in the group studied were generally satisfied with their specific EHR-system such as ePrescribing (Hellström et al 2009).

2.3.4.3 Clinical decision support systems (CDSS)

Garg et al (2005) indicated that CDSS was found to improve practitioner performance in 62 of the 97 studies included in the review and its use is highly recommended. However, CDSSs should be rigorously evaluated before widespread dissemination into clinical practice to ensure its reliability (Garg et al 2005). According to Ward et al (2008) attitudes to the use of clinical decision support systems were found to be mixed. Bauer et al (2002) found that staff were generally satisfied with the system and had discovered that it was of some benefit to their practice, whilst Rosseau et al (2003) found that negative comments about the decision support system significantly outweighed the positive or neutral comments.

2.3.5 Organizational level Challenges

2.3.5.1 Cost

Financial barriers for covering the start-up and the running costs and uncertainty over return on investment (ROI) were the most frequently mentioned organizational barriers for the implementation of eHealth (Audet et al 2004, Miller and Sim 2004, Jha et al 2009, Boonstra and Broekhuis 2010, McGinn et al 2011, Roa et al 2011).

Start-up and maintenance costs varied with the size of the hospital and the type of eHealth technology to be installed. In most practices, the start-up cost of implementation of an EHR ranges from USD 16, 000 – USD 36,000 per physician (Miller and Sim 2004).

According to Gans et al (2005), practices that had implemented EHRs found the average initial cost to be approximately $33,000 per physician (somewhat higher per physician for smaller practices and lower for larger practices), with maintenance costs of about $1,500 per physician per month. Based on a five-point Likert scale ranging from 1 (not a problem) to 5 (makes implementation very difficult), Gans et al (2005) identified that concerns over the lack of capital resources and loss of productivity during transition to an EHR system were the highest rated, at 3.54 and 3.21 respectively, among the top five barriers.

Cost concerns were mentioned in 19 (36.5%) of the papers reviewed by McGinn (2013). Cost concerns were more significant for solo and smaller practices than the larger

practices (Simon et al 2007, Rao et al 2011) and higher among the non-adopters that the adopters (Jha et al 2009).

Roa et al (2011), on their study on 5,000 physicians from American Medical Association (AMA), found that physicians in solo or two-physician (small) practices reported using <2% of a fully functional EHR and 5% of basic while physicians from 11+ group (largest group) practices reported using 13% of a fully functional and 26% of a basic systems showing physicians in small practices to have significantly lower levels of EHR adoption. The main concern mentioned were the amount of capital needed to implement which is reported by 68% and 53% and uncertainty about return on investment mentioned by 53% and 37% of small practices (1 or 2 physicians) and large practices (11+ groups) respectively with statistically significant difference between the two.

According to Jha et al (2009), financial constraints were mentioned by 71% of non-adopters and 45% of adopters while the uncertainty in return on investment was mentioned by 59% of non-adopters and 32% of adopters. The differences were statistically significant in both cases. This shows that non-adopters were more likely to mention cost as a barrier to adoption of ICT in healthcare.

Similarly, DesRoches et al (2008) found that concern on the amount of capital needed was mentioned by 47% and 66% of those having EMR and those not having EMR respectively, while concern on uncertainty about return on investment was mentioned by 33% and 50% of those having EMR and those not having EMR respectively. In both cases, the differences in concern were significantly higher among the non-adopters than non-adopters.

In another study by Kemper, Uren and Clark (2006), 50.5% the adopters and 78.8% of the non-adopters reported eHealth to be too expensive to implement. The difference between the two was statistically significant. Similarly, 48.0% the adopters and 64.6% and the non-adopters reported that eHealth applications were expensive to maintain. The difference between the adopters and the non-adopters was statistically significant. However, in the study, 75.5% of the adopters and 60.6% the non-adopters agreed to the prospect of long-term saving from the implementations of eHealth applications.

In conclusion, the literature review showed that cost was the most frequently mentioned barrier for adopting and implementing health, particularly among small and solo practices (Simon et al 2007 and Rao et al 2011), among non-adopters (Kemper et al

2006, DesRoches et al 2008 and Jha et al 2009). Similarly, a global survey on telemedicine by World HealthOrganization Global Observatory for eHealth (GOe) showed cost to be the leading barrier which was mentioned by 60% of the WHO regions. Other barriers were absence of legal and policy frameworks, culture not promoting ICT and poor ICT infrastructure (WHO 2009).

It can be concluded that the adoption of eHealth will be limited and will remain slow unless significant financial resources have been made available. Policy changes must include financial incentives to clinicians as pay-for-performance and reimbursements for the cost of investment and loss of productivity that could be encountered at the initial stages of implementation (Poon et al 2006).

2.3.5.2 Management and Leadership and organizational culture

Introduction of EMR system requires a significant change process of shifting from the traditional paper-based system. Therefore, establishing an EMR-friendly culture is required for the successful implementation and adoption (Boonestra and Broekhuis 2010). Furthermore, the healthcare settings comprise a mix of healthcare employees that add up to the complexity of change efforts which needs a visionary and action-oriented leadership (Lorenzi, Kouroubali and Bloomrosen 2008).

McCullough et al (2010) argued that leadership and management can be a source of variation of successes in eHealth implementations. In spite of the contribution of managerial inefficiency for a significant proportion of failures, most research on the EMRs had largely focused on technical issues, but rarely on managerial issues, taking for granted that managers would be committed to the implementation of EMR (Murray et al 2011, McGinn et al 2011, Lin et al 2012). Such oversight had prevented a better understanding of users' resistance to new technologies and the consequences of technology rejection from the management perspective (Boonestra and Broekhuis 2010).

A study McManus and Wood-Harper (2007) on 214 projects in a variety of sectors that included 18 health care projects identified that inadequate management practices accounted for nearly two-thirds (65%) of the factors associated with project failures.

Scott et al (2005) conducted a qualitative study to show that the implementation of Clinical Information Systems (CIS) required a high level of management skill. According

to the study by Scott et al (2005), the implementation of CIS could have implications on organizational culture by minimizing cooperation and inhibiting constructive feedbacks, if not designed properly. Scott et al (2005) also found that respondents who participated in the adoption of CIS emphasized the importance of leadership by recommending that while the initial system selection process could be participatory, the implementation phase should be led by a decisive hierarchical type of leadership to avoid exacerbation of implementation challenges and resistance.

Lorenzi, Kouroubali and Bloomrosen 2008 suggested a phased approach in the stages of implementation consisting of decision, selection, pre-Implementation, implementation, and post-implementation with each phase to address the specific key issues.

Miller and Sim (2004) emphasized the role of EMR champions/leaders in order to realize the benefits of eHealth and increase adoption rate. The early stage of the implementation, typically lasting anywhere from 6 months to a year often referred to as a shakedown phase, is the critical time that sets the ground for integration into a routine operation. This is a time when the loss in productivity and disruption in care processes could occur and technological systems might be abandoned. During this time, the roles of champions and leaders should be more intensified (Sykes, Venkatesh and Rai 2010).

2.3.5.3 Health facility size

In many studies, practice size has been a consistent predictor of the rate of adoption of eHealth. Physicians who work in larger medical practices are reported to have higher rates of EMR adoption and utilization than those in smaller practices (Audet et al 2004, Miller and Sim 2004, Simon et al 2007, DesRoches et al 2008, Boonstra and Broekhuis 2010,Roa et al 2011). The main reasons mentioned for the differences were the availability of extensive support and training in the use of EMRs and their capacity to afford the implementation cost (Simon et al 2007, Boonstra and Broekhuis 2010).

Audet et al (2004) undertook a mail survey on 1,837 physicians from an American Medical Association (AMA) found that the ICT use was 33% among physicians in a group of 50 or more and only 16% among those in solo practices. The study showed that those in the large practices were almost eight times more likely to adopt eHealth than physicians in solo practices which showed a significant difference in the rates of adoption.

A postal survey by Menachemi et al (2006) on 756 licensed family physicians in Florida on the status of eHealth adoption showed rates of 17.8% among solo practitioners, 19.6% among 2 – 9 physicians practices, 43.4% among 10 – 49 physicians practices and 64.0% among 50 or more physicians practices. Physicians in practice sizes of 50 or more physicians were more than 11 times more likely to use EHR than those in solo practices.

Simon et al (2007) also identified that practice size was strongly correlated with EHR adoption. The adoption rates were 52% among 7 or more physicians practices and14% in solo practices indicating the odds of practicing eHealth to be nearly four times more likely in larger practices than in solo practices.

A study made by Hing and Hsiao (2010) also showed physicians in practices with 11 or more physicians were more likely to use any EMR system (74.3 %) whereas physicians in solo practice were less likely to use EMRs (20.6 %).

Kemper, Uren and Clark (2006) performed a study on 1,000 paediatricians in the American Medical Association and found that the likelihood of planning to adopt an EHR was associated with increasing practice size - solo, 28.3%; small, 47.4%; large, 71.9% and the differences were statistically significant.

According to a study by NCHS (2012), the proportion of adoption progressively increased with increasing sizes of the practices. The adoption rates were found to be 29% among solo practices, 60% among 2-physician practices, 62% among 3-10-physicians practices and 86% among 11 or more-physicians practices.

It can be summarized that practice size is a consistent predictor of eHealth adoption with larger practices being 4 to11 times more likely to use eHealth (Audet et al 2004, Miller and Sim 2004, Simon et al 2007, DesRoches et al 2008, Boonstra and Broekhuis 2010, Roa et al 2011).

2.3.5.4 Health facility type

Villanueva et al (2010) conducted an online survey on 2,199 Physicians registered in Physician Association of Barcelona to identify Integrated Doctors (those who emphasized the use of ICT in their practices) and non-integrated Doctors. They found that the proportion of Integrated doctors and non-integrated doctors respectively were, 68.7% and 53.7% in hospitals, 21.0% and 37.4% in primary care services and 10.3%

and 8.9% in clinics. The proportion of integrated doctors compared to non-integrated ones was significantly higher the primary and hospital groups than those practicing in clinics.

In a study conducted by Simon et al (2007) on 1,345 physicians in all medical practices in Massachusetts, the proportion of physicians' adopters practicing in hospital facilities was 52% while the proportion of those practicing in non-hospital facilities was 20%. Physicians working in hospital based practices were twice more likely to adopt and use eHealth than non-hospital based practices.

Another factor is an academic status of the healthcare facility. McCullough et al (2010) argued that Academic hospitals had been the leading adopters of health IT and the setting for much of the health IT value literature. Simon et al (2007) found that the proportion of physicians adopters practicing eHealth in teaching hospitals was 40%, while in non-teaching hospitals was 14% showing that physicians practicing in teaching hospitals to be more than twice likely to adopt and use eHealth than those in non-teaching hospitals. The differences were statistically significant.

eHealth adoption is also affected by ownership type (Villanueva et al 2010, NCHS 2011, Xierali et al 2013). The survey carried out by National Centre for Health Statistics (NCHS) in 2011 showed that the level of adoption in public facilities was higher than those facilities owned privately. The adoption rate was found to be 49% in privately owned facilities, 69% in academic health centers and 73% in community health centres (NCHS 2011). Kemper, Uren and Clark (2006) also showed that the plan to adopt eHealth was also significantly lower among private and independent offices 49.3% than those which had any other affiliation (66.1%).

According to the study made by Xierali et al 2013 on family physicians in USA, the adoption rate varied significantly between the type of health facility (NCHS 2011, Xierali et al 2013).

Facilities under health maintenance organizations (HMO) had the highest rate of adoption, 100% according to NCHS (2011) and 94.6% according to Xierali et al 2013. Xierali et al (2013) found that compared to family physicians in private group practices where the adoption rate is 74.3%, physicians in the government facilities and teaching hospitals had higher adoption rates of 82.0% and 81.7% respectively. The adoption

rates were lower among physicians in solo practices (49.9%), among those working as administrators (50%) and among those working in small partnerships (71.1%).

The use of EHR among physicians working in the multi-speciality practices (35.3%) was found to be higher those working in single-speciality practices (20.0%) showing that physicians in multi-speciality practices adopts twice more likely than those in single-speciality practices (Menachemi et al 2006). Simon et al (2007) also found that the proportion of physicians practicing eHealth in multi-speciality practices was 35% while that in single-speciality was 20%.

In summary, eHealth adoption and implementation was found to be higher in primary hospitals than clinics (Villanueva et al 2010), in hospital facilities than in non-hospital facilities (Simon et al 2007), in teaching hospitals than in non-teaching hospitals (Simon et al 2007), public facilities than private facilities (Kemper et al 2006, Villanueva et al 2010, NCHS 2011, Xierali et al 2013) and in facilities under health maintenance organizations (HMO) than those which are not under HMO (NCHS 2011).

2.3.5.5 Health facility location

Gagnon et al 2010 argues that health care providers practicing in urban settings were more likely to adopt EHRs, suggesting a wider digital divide between rural and urban healthcare providers.

A postal survey by Menachemi et al (2006) on licenced 756 family physicians in Florida showed that EHR 23.3% of the users were from urban and 19.4% were from rural areas indicating that physicians working in rural settings were half times less likely to use eHealth applications. Jha et al (2009) surveyed all acute care hospitals that are members of the American Hospital and found that 10.3% of hospitals in urban and 4.3% hospitals in non-urban locations had adopted either basic or comprehensive EHR. Houser and Weech-Maldonado (2012) also found that fewer eHealth implementations within rural hospitals were 8% while it was 18% within urban hospitals. In both studies mentioned, the difference in the rate of adoption between the urban and non-urban location was found to be was statistically significant.

However, the differences in eHealth practices between urban and non-urban settings in other studies were not found to be statistically significant (Simon et al 2007, DesRoches et al 2008, Xierali et al 2013).

In addition, a national mail survey on 5,200 primary care offices conducted by Singh et al (2013) from 2007 to 2008 revealed that the use of eHealth in rural primary care offices did not appear to be lower than that in urban offices. According to this study, large rural and small rural offices were three times more likely than urban offices to use a broader range of EMR capabilities.

Sing et al (2013) argued that although some studies showed lower adoption in rural than in urban facilities, hospital types and practice size could be explanatory factors for the apparent difference rather than the location. Sing et al (2013) further justified that small practices were more common in rural locations. Moreover, rural settings were further constrained by lack of expertise and infrastructure further contributing to the low adoption rate. However, they concluded that the situation was dynamic and warranted further monitoring.

A study by Jha et al (2008) showed that there was no evidence that minority-serving (rural) providers had lower EHR adoption rates, faced different barriers to adoption or were less satisfied with EHRs. The study also showed that the difference in positive perceptions between minority practices and other providers was not statistically significant in terms of quality (73.7% vs. 76.6 %,) and costs of care (46.9% vs. 51.5%, P = 0.17).

To summarize, Menachemi et al (2006), Jha et al (2009) and Houser and Weech-Maldonado (2012) reported that physicians working in rural settings were less likely to use eHealth applications. However, the other studies disproportionately showed no significant statistical difference between rural and urban settings (Simon et al 2007, DesRoches et al 2008, Jha et al 2008, Weech-Maldonado 2012, Sing et al 2013 and Xierali et al 2013).

2.3.6 National level barriers

2.3.6.1 Absence of policy

eHealth policies and strategies can be used to outline the visions and objectives regarding the application, provision, control, standards, and ethics related to the national and international use of telemedicine solutions. They are enablers for eHealth adoption, potentially increasing the chance of successful implementation by providing frameworks and protocols for the planning and development of services as well as standards by which the progress and results of eHealth services can be better assessed

(WHO 2010, Khoja et al 2012). On the contrary, the absence of eHealth policies may cause failures in achieving the intended goals resulting in inappropriate gaps in health status and inequity (Khoja et al 2012).

According to a WHO (2010) second global survey report on eHealth, only 25% of responding countries reported that their country had a national telemedicine policy or strategy. The figure was the highest (40%) in the European Region and the lowest (between 10% and 15%) in the Eastern Mediterranean, South-East Asian and African Regions. Furthermore, despite the mention of the presence of national eHealth policies by the low income countries, the implementation of the policy was reported to be significantly low (10%).

2.3.6.2 Lack of Information

While the advantages of eHealth over the paper-based system had been acknowledged, the stakeholders who were interested in considering implementation reported that they would proceed only after getting additional information on how best they could implement to leverage the maximum benefits (Chaudhry et al 2006).

The report on the second global survey on eHealth by WHO (2010) showed a significant proportion of countries required additional information which was primarily related to resource requirements. The three leading information needs were cost and cost-effectiveness (70%), clinical importance (58%) and infrastructure needs (50%).

Furthermore, Mair et al (2012) suggested further researches on additional information pertaining to (1) eHealth's effects on roles and responsibilities (2) risk management (3) ways to engage with professionals and (4) ensuring that the potential benefits of new technologies are made transparent through on-going evaluation and feedback.

2.3.6.3 High cost

Globally, cost has been the most frequently cited barrier, by almost 60% of the WHO regions, for not implementing tele-health (WHO 2010). The survey showed that European and Eastern Mediterranean Regions were not the exceptions when it comes to cost. At least half of the responding countries in each income group felt cost to be a significant barrier. The barriers related to cost include the cost of equipment, maintenance, staff training, and transportation. The other barriers reported were the

doubt on the cost-effectiveness and benefits in improving healthcare quality compared to the traditional health service delivery models (WHO 2010).

2.3.6.4 Poor infrastructure

Infrastructure challenges such as unstable power supplies, insufficient communication networks, inadequate or unreliable Internet connectivity and lack of human resources with the necessary technical expertise were the second frequently cited barrier for developing countries in the global survey on eHealth (WHO 2010).

The Global IT Report the World Economic Forum (2012) shows a significant global digital divide between different income groups. Digital divide refers to inequalities between the advanced economies and the rest of the world in terms of access and use of information and communication technologies (ICT) and the resulting economic and social impacts. The Network Readiness Index (NRI) which measures the degree to which economies across the world leverage ICT for enhanced competitiveness was measured in the worst scale of less than 3.5 for the most portion of sub-Saharan Africa. In sub-Saharan Africa, despite an increase in mobile subscription, with 49 subscriptions per 100 populations, access to other technologies remains the privilege of a few. For instance, only 13 per-cent of individuals in sub-Saharan Africa use the Internet, 8% of households in the region own a personal computer (PC), and less than 4% have access to the Internet at home (World Economic Forum 2012).

2.3.6.5 Poor Cultural on information exchange

The adoption of eHealth requires a culture that promotes the use of eHealth technologies and the exchange of knowledge and skills with professionals and patients. In the absence of such a culture, the challenge in the change management would be prominent. Increasing awareness and advocacy on the benefits of the appropriate use of eHealth technology is very crucial in addressing resistance towards its application and accelerating adoption among healthcare professionals and patients (WHO 2010).

2.4 ENABLING FACTORS.

2.4.1 eHealth policy

eHealth policy is a new and rapidly expanding concept. It has been recognized as a unifying element in the implementation of eHealth. eHealth policy can be defined as “a

set of statements, directives, regulations, laws, and judicial interpretations that directs and manages the life cycle of eHealth" (Scott, Chowdhury and Varghese 2002).

If developed appropriately, an eHealth policy can help to clear the path for sound adoption and will enable countries with similar challenges to share resources and lessons learned across the international borders (Khoja et al 2012).

Only a quarter of the countries in the world have some form of eHealth policy, strategic plan, a road map or action plan. However, this is further compromised by low implementation rates of the available policies. Efforts are being made to increase the proportion of countries having eHealth to above 85 % in three years (WHO 2010).

The need for eHealth policies and strategies within countries was also emphasized during the World Health Assembly (WHA) resolution of 2005, WHA 58.28 which requested the member states to draw up long-term strategic plans for the development and implementation of eHealth (WHO 2005).

Khoja et al (2012) identified nine thematic areas that are needed to be addressed by eHealth policy: (1) networked care, (2) inter-jurisdictional practice, (3) diffusion of eHealth/digital divide, (4) eHealth integration with existing systems, (5) response to new initiatives, (6) goal-setting for eHealth policy, (7) evaluation and research, (8) investment, and (9) ethics in eHealth.

The themes proposed by Khoja et al (2012) covers multiple issues related to the development of eHealth policy 1) interoperability, standardization and intellectual property rights 2) management of health information in shared environments, policies for privacy, confidentiality and intellectual property rights, and guidelines for sharing knowledge and services 3) policies and guidelines to allow greater penetration of telecommunication companies by increasing access to technology, reducing cost and building local capacity 4) policy issues such as setting targets for increasing interaction between different groups of providers and users 5) policy categories and issues that can enhance the capability of institutions to implement eHealth successfully. 6) Policy in recognition of eHealth as part of the broader national development effort, recognizing eHealth as part of the global health agenda and encouraging a global commitment for funding 7) Policy categories and issues that can guide the process of evaluation and research to generate evidences for the adoption of eHealth. 8) Policy issues that can suggest business models for eHealth adoption. 6)

Ethical issues that must be considered during adoption of eHealth, such as managing health information on the Internet and ensuring the privacy of health information.

2.4.2 Involvement and participation of the healthcare providers

While there is a growing emphasis on problems related to eHealth systems' workability, relatively little attention is given on the ways of engaging healthcare professionals (Mair et al 2012). EHR adoption depends on groups' values towards the system (Gagnon et al. 2010). Studies also indicate that user involvement can explain a significant portion of perceived usefulness and acceptance of eHealth (Ernstmann et al 2009, Carayon et al 2013). It helps to represent the users' perspective which could contribute to the success and could help develop a sense of ownership of the system implementation (Leonard 2004, Ernstmann et al 2009). During the process of adoption and implementation, clinical leaders with experience or interest in informatics, in particular, could serve as liaisons with the other healthcare providers in receiving feedbacks and inciting interest in the new system (Doolan et al., 2003). Informal opinion leaders can significantly influence attitudes and perceptions of others in either positive or negative ways (Greenhalgh et al 2004). Social network analysis is suggested to analyse relationships between healthcare providers and to identify influential individuals who are critical to the successful implementation of IT systems (Anderson, 2002). Physicians are frontline user-groups of EMRs and can have a great impact on the overall adoption level of EMRs. Slow rate of adoption may suggest a strong resistance among physicians (Boonstra 2010). Physicians who had positively viewed the system were able to create a certain amount of peer pressure upon others (Doolan, Bates and James 2003).

2.4.3 Technical support

The availability of appropriate technical support and high-quality training materials are important predictors of intention to use. They are facilitators for successful system implementation and in the absence of technical support, change will be uncertain and adoption will be negatively affected (Castelo et al 2010, Asua et al 2012).

Simon et al (2005) showed that two-thirds of physicians mentioned a lack of technical support as a barrier for adopting EMRs and justified that one of the factors for the high adoption rates in larger physicians' organization to be the availability of more extensive systems for supporting and training clinicians in using their EHR.

According to Asua et al (2012), the intention to use a tele-monitoring system by healthcare providers (doctors and nurses) was predicted by their beliefs to obtain adequate training and technical support. The study showed healthcare providers would be more than twice as likely to use a tele-monitoring systems if they were provided with adequate training and technical assistance.

Ludwick et al (2009) noted that most vendors were not qualified to provide the required technical support. Furthermore, business failure and subsequent disappearance of the venders from the market was mentioned as a concern by physicians (Boonstra, Broekhuis 2010).

2.4.4 Incentives

The general perception that physicians are resistant to adopting EHRs is not accurate. Similar to any other sectors, there will be some laggards with technology. If the financial incentives are provided and the main barriers such as cost are addressed, physicians will be willing to make the transition (Bates 2005). DesRoches et al (2008) also showed that resistance from physicians was not a significant concern and only mentioned to be a major barrier by 27% of adopters and 29% of non-adopters.

The provision of personal incentives to healthcare providers has been suggested to raise the adoption rate of EMRs (Miller and Sim 2004; Vishwanath et al 2007). As a result, the American Recovery and Reinvestment Act (ARRA) of 2009 made available an estimated $14–$27 billion for health IT under the stimulus law to go in to physicians, hospitals and other health care providers in the form of incentive starting from fiscal year 2011. The individual financial incentive is so significant that a doctor, for example, will be able to receive up to $18,000 per year.

Contrary to the belief held by healthcare providers that EHR reduces patient-physician, most patients reported that EHRs did not affect their relationships with their physicians during the care process (Dagnone et al 2006). Patients, however, preferred personal patient-physician relationship rather than computers when critical health incidents were disclosed to them (Pyper et al 2004).

2.5 CONCLUSION

Chapter two reviewed the different challenges and the predictors of eHealth implementations in various healthcare settings from individual, organizational and national perspectives.

The Implementation of EHRs in medical practices represents a major change in physicians' unique working styles and relationships which they have developed over years. Therefore, the change process in itself is a challenge even though it could be addressed through good leadership. Problems occur during the change process, because of individual resistances, lack of incentives, lack of community level participation, organizational culture and lack of leadership.

The traditional view that attributes physicians' resistance to a slow progress in eHealth has not been proved to be true in this literature review. However, obvious concerns that have been reported such as cost, privacy and security, technical challenges and changing roles and responsibilities should be dealt appropriately.

While several studies did not show a significance of differences in sex, the older age group, particularly the extreme ones (60 and above), were found to be the least eHealth literate and adopter and ICT users. It was shown that positive attitude develops through time as the user gets familiarized with the system. Different professional groups had different concerns. However, some studies showed nurses had more favourable attitudes than the other professional groups. Despite the contribution of management and leadership to significant causes of project failures, this area had been given the least attention. Cost was consistently mentioned in several studies to be the main barrier to adoption and had been reported to be the cause of significant variation in the rates of adoption between small and large practices. Practice size was found to be a consistent predictor of eHealth adoption with larger practices being 4 to11 times more likely to use eHealth. The differences in the rates of adoption between urban or rural facilities were not consistent. Most studies did not show rural adoption rates to be lower than that of the urban and suggested other explanatory factors such as the cost of implementation and higher prevalence of small practices in rural areas for any differences between the urban and rural locations.

The primary barriers mentioned at national level for the implementation of eHealth were cost and infrastructure, particularly in the low and middle income countries. Other

barriers include absence of enabling factors such as eHealth policy and the absence of sufficient information on cost-benefit analyses.

The World Health Organization showed a lack of additional information, primarily on resource requirements, as a challenge for implementation of eHealth in all income groups.

Finally, successful eHealth implementation requires that organizational, technical, behavioural, cognitive, and socio-cultural factors be addressed comprehensively and systematically. Some research studies also recommended additional qualitative and quantitative researches on these factors in order to explore how failures could be redefined into successes and what approaches could be applied for the most beneficial impacts on the implementation.

CHAPTER 3

RESEARCH DESIGN AND METHODS

3.1 INTRODUCTION

Chapter two dealt with a review of existing literature from the previous studies pertaining to the research. Chapter 3 deals with details of the research design and methodology, sampling, data collection, data analyses ethical, considerations and reliability and validity of the research.

3.2 RESEARCH DESIGN

As mentioned previously, a cross-sectional study design with quantitative paradigm was used to collect information from the respondents. In a cross-sectional study design, data are collected at one point in a time. The studies in cross-sectional design can be descriptive or may include analytical components (Joubert and Ehrlich 2007, Polit and Beck 2008).

Cross sectional researches are easy, economical and efficient in collecting a large amount of data on a large number of study subjects in a reasonably short period of time. They help to evaluate the relationship between the predictor and outcome variable. However, they do not help establish correct temporal relationships between them (Joubert and Ehrlich 2007). They are useful in assessing knowledge, skill and the behavior that could be generalized to the target population and subsequently design appropriate intervention measures (Varkenvisser, Pathmanathan and Brownlee 2003).

Cross sectional studies result in less rigorous methodological and ethical challenges. Despite weaker evidences on causation, they establish the first step in assessing the relationship between certain individual characteristics (sex and age) and outcomes (Joubert and Ehrlich 2007).

In this study, descriptive statistics were used to figure out the frequencies on the pattern of variables of interest. Analytic approaches were applied to examine the interrelationship between the dependent and the independent variables.

Given the objectives of the research, a quantitative research paradigm was applied with the purpose of identifying, measuring and comparing the magnitude and the relationship of individual, socio-demographic, organizational factors that impact the implementation of ICT in the healthcare systems. Systematic analyses of the relationships between ICT use and different socio-demographic, clinical and organizational factors were made using the appropriate statistical tests.

Quantitative data gathering is considered to be a more efficient method of collecting much information in a structured way. It has the advantage of making generalizations for relevant interventions in the target population on which the study is conducted

3.3 RESEARCH METHOD

The study was conducted from 15 August to 20 October 2012 on 312 doctors and nurses from five public and five private hospitals in Addis Ababa, Ethiopia. The respondents were selected through simple random sampling methodology from the list of the names of healthcare providers working in these hospitals. Data was collected through self-administered questionnaires (SAQ) after receiving written consent from each of the respondents.

3.3.1 Population

The targets were healthcare providers (doctors and nurses) who had been providing continuous direct patient care in any health facility for a minimum of six months in the past.

The inclusion criteria were 1) being a doctor or a nurse including those who were specializing any of the medical or nursing fields 2) providing direct patient care for at least three months in the selected hospitals and 3) practicing a clinical care in any type of health facility for at least the previous six months .

On the other hand, those who had worked for less than six months in clinical practices, those who had worked for less than three months in the hospitals selected for the study, those with mainly administrative functions, those who had already retired, undergraduates and interns were excluded from the study.

3.3.1.1 Sampling

Sampling is the process of selecting a portion of a population to represent the entire population so that inferences about the population can be made (Polit and Beck 2008).

The study was made on respondents selected from ten hospitals, five government and five public hospitals in Addis Ababa Ethiopia. Convenience sampling was used for selection of the study sites (hospitals) because of the accessibility of these sites to the researcher. Convenience Sampling applies to immediate availability of the study subjects as one of the criteria for selecting study subjects (Polit & Beck 2008:341). However, the study sites were selected using convenience sampling methodology to be entirely in Addis Ababa where healthcare providers had better access to information sources. Consequently, the result of the study could not be generalized to all hospitals in Ethiopia. However, bias of the respondents was avoided by ensuring that the study subjects were carefully and scientifically selected from the sampling frame by strictly adhering to simple random sampling methodology (Joubert and Ehrlich 2007, Polit & Beck 2008:341). The respondents were selected using a simple random sampling methodology after receiving a complete list of medical doctors and nurses (sampling frame) who had been providing direct patient care in all of the ten hospitals selected for the study. The sampling frame was checked for completeness to ensure representativeness as failure to do so would result in sampling bias (Joubert and Ehrlich 2007).

3.3.1.2 Sample

The sampling size was calculated using a single proportion formula with maximum proportion (p) of 0.5 (50%) for expected response to perceived challenges; standard score (z) of 1.96 for 95% confidence interval level and desired precision (d) of 0.05 (5%). The formula for calculation of the sample size is $n= Z (\alpha/2)^2 \times P (1-P) / d^2$. As a result, the required sample size (n) was calculated to be $(1, 96)^2 \times 0.5(1-0.5)/ (0. 05)^2$ which is 384. For population < 10,000 the following population correction formula is used(Araoye 2004: 118–119)

$$nf = \frac{n}{1 + \frac{(n)}{(N)}}$$

n = 384, i.e. the desired sample size when the population is more than 10,000

N = 850, i.e. the estimate of the population size for the study

$$nf = \frac{384}{1 + \frac{384}{800}} = 260$$

The non-respondent rate was expected to be as high as **25%** which makes the final sample size of **324**.

Table 4. 1 Total population and number of respondents selected from each hospital.

Name of the hospital	Total population in the sampling frame	Number of respondents selected
Korea	76	36
Landmark	38	20
Gandi	66	38
Minilik	52	29
Ras desta	43	23
Yakatit	91	47
Zewditu	101	46
Tezenea	33	15
Betezata	66	36
Hayat	44	22
Total	610	312

3.3.2 Data collection

3.3.2.1 Data collection approach and Method

Data was collected through self-administered questionnaires (SAQ). SAQ method has advantages such as improving response rate, providing opportunity to clarify ambiguous questionnaire items, reducing interview bias, improving time and cost efficiency and ensuring anonymity.

The questionnaires were administered in English since English is widely spoken and used as a working language for routine patient care and communication among healthcare providers in Ethiopia,

3.3.2.2 Development and testing of the data collection instrument

The input from various literature reviews was significantly used to decide on what type of questions to be included in the questionnaires. The questionnaires consisted of basic demographic information like age and sex. Professional history like type of profession, specialization and the number of years in practice were included. Employment history included the type of employment, the type of health facility (private and public) and additional responsibilities and part-time clinical practices. The questionnaires also consisted of access to internet, frequency of access and any history of training on any eHealth application. Taking into account, the objectives of the study, ICT related questions in healthcare were identified and included. Those questions consist of questions on perceived benefit, perceived challenges and familiarity with any of the eHealth applications identified from the literature. Perceived benefits and challenges were measured using a Likert scale items rated from 1 to 5 (1=strongly disagree, 2=disagree, 3=undecided, 4=agree, 5=strongly agree).

Furthermore, additional questions on job satisfaction and recommendation on the future application of eHealth in Ethiopia were included. The questionnaires were grouped by sections of demographic information, professional history, employment history, perceived benefits and challenges from different perspectives (care process, patient, healthcare providers and organization). Skip pattern was applied when required. Some of the questions were provided explanation. Options for “others” category was included in the questionnaires.

3.3.2.2.1 Reliability

Reliability which is concerned with the extent to which a questionnaire produces the same results on separate occasions of use was ensured before applying the data collection instrument (Cook and Beckman 2006). There are different approaches to evaluate reliability. However, the findings many studies support the conclusion that the internal consistency approach using Cronbach’s coefficient is the most popular approach. An internal consistency is measured by Chronbach’s alpha value that ranges between 0 and 1. An internal consistency of at least 0.7 is commonly considered to be

acceptable while measures greater than 0.9 are considered to be excellent (Houser 2012). A low value of algae could be due to a low number of questions, poor interrelatedness between items or heterogeneous constructs. Similarly, higher ranges which are greater than 0.95 should also be interpreted cautiously as they may indicate redundancy of similar items. (George and Mallery 2010, Tavakol and Dennick 2011). Another approach to measure internal reliability is test-retest reliability (Dawson and Trapp 2000). It refers to the capacity of an instrument to produce the same measurement if the test is undertaken on different occasions. It is done by administering the same instrument to the same people on more than one occasion which may be somewhat difficult.

3.3.2.2.2 Validity

According to Cook and Beckman (2006), science basically rests on the adequacy of its measurement. Therefore, reliability and validity should be among the criteria used to assess the quality the study. Poor measures provide a weak foundation for research and clinical endeavors. Validity indicates how well the instrument measures what you have intended to measure (Cook and Beckman 2006). In order to ensure validity, the questionnaire was further refined along with selected domain experts (nurses and medical doctors) and was redesigned accordingly taking the different concepts of validity in to account. Furthermore, pilot study was done on ten randomly selected healthcare professionals (five doctors and five nurses) and then further modified accordingly.

3.3.2.3 Characteristics of the data collection instrument

SAQ was used to collect data from the respondents. The SAQ consists of Five-Point Likert Items rated as 1=strongly disagree, 2=disagree, 3=Undecided, 4=agree and 5=strongly agree. Likert scales, named after the psychologist Renisis, are the most widely used scaling techniques in various domains in responding to their level of agreement to statements (Polit and Beck 2008, De Winter & Dodou 2010). Likert scales typically consist of five or seven ordered response (Polit and Beck 2008, De Winter & Dodou 2010).

3.3.2.4 Data collection process

As a first step, one senior and experienced nurse was identified from each hospital and given an orientation on the questionnaires, the methodology and the ethical issues.

Pilot testing of the questionnaires was conducted on two doctors and two nurses from each hospital. The doctors and the nurses who were included in the pilot testing were, later on, excluded from the study. No major change was made after the pilot testing. However, the question on training on eHealth was reported as “yes” by the majority of the respondents. It was misunderstood as if it was asking for any type of training on health and, therefore, excluded from the analyses.

The questionnaire was administered after receiving of written consent from each of the respondents. Since the questionnaires were self-administered, an explanatory covering letter was attached to the questionnaires.

After the SAQ had been distributed in person, assistance visits were made while the respondents were filling questionnaires to ensure clarity and correct responses.

Each date the questionnaires were evaluated and the data collectors were given feedback. Respondents with missing questionnaires items were immediately contacted on the spot to help them complete the missing items.

The scientific rigor of the data collection was ensured firstly, by assigning well experienced senior nurse supervisors who were well respected by the other staff. Secondly, the data collectors have been given adequate training and have understood the items in questionnaires to help them provide adequate explanation when asked by the respondents.

3.3.2.5 Ethical consideration related to data collection

Basic ethical principles were considered in the data collection process. The principles that were followed were autonomy, justice, beneficence and non-maleficence as discussed below. The researcher made every effort to ensure that this is applied to the participants and the study institutions during the process of data collection.

Obtaining ethics approval is a standard practice in any research and reflects on the ability of the researcher to approach the participants with due respect and sensitivity. It might not determine, but reflect favourably on the credibility of the findings (Guyatt et al 2008). Any Research requires formal research ethics board approval to examine the research protocol and consent process. This procedure minimizes the potential risks for the participants such as loss of confidentiality, interview burdens, incentives

undermining voluntary consent, truthfulness of information provided to the participants, researcher's interference and the possibility of psychological trauma (Guyatt et al 2008).

The researcher first received an ethical clearance certificate from the University of South Africa (UNISA) health studies higher degree committee college of Human Science (Annexure A). Based on the ethical clearance certificate obtained from UNISA, the researcher formally requested the Addis Ababa City Health Bureau for support letters to the hospitals that were selected for the study (Annexure B). After reviewing the research proposal, the City Health Bureau wrote support letters to the hospitals (Annexure C). The letter from the City Health Bureau was given to each hospital to be endorsed by the management for the participation of their staff members in the research.

After endorsement, the list of all care healthcare providers providing direct patient care was obtained from all hospitals and the respondents were randomly selected from the list. Each selected respondent was contacted by the senior nurse data collector who explained the purpose of the study and the data collection instrument before administering the questionnaires. The participants were ensured that all the information they had provided would be kept confidential.

A written consent (Annexure D) was attached to each questionnaire which must be agreed before starting to complete the form. The participants freely decided to participate in the research study.

The main discomfort that would be expected was the busy time schedule of the health care providers. Most of them were not fully comfortable to handle activities which could disrupted their routine clinical care. However, the respondents were given sufficiently flexible time schedule for completion and return of the forms.

Respect for human dignity is the second ethical principle articulated in *the Belmont report* (National commission for Protection of Human subjects of Biomedical and Behavioral Research, 1979) (Joubert and Ehrlich 2007). The two main ethical conventions establishing respect for persons are treating individuals as autonomous agent and protecting persons with diminished autonomy. Autonomy ensures that human subjects are treated as autonomous agent and have the right to self-determination and the right to full disclosure (Joubert and Ehrlich 2007, Polit and Beck 2008)

The researcher ensured that the respondents had received adequate information on the purpose of the study as partial fulfillment of the requirement for Master of Public Health, the objective of the study, its importance to the healthcare systems and their right to withdraw. The study participants read the consent paper which is in a printed format and were able to freely decide either to participate or not to participate in the study without any pressure. They were also informed that they would not be prejudiced or harmed in any way if they decided not to participate. The consent was further reaffirmed during the reviewing and the administration of uncompleted questionnaires.

Beneficence is a fundamental ethical principle that seeks to maximize benefits and avoid or minimize harm upon study participants and requires that interviews that may result in emotional trauma to the respondents must be ended and appropriate intervention such as counseling and referral should be taken (Streubert and Carpenter 2007, Polit and Beck 2008). It was guaranteed that no information provided by the respondent was released to avoid harm to relationships with other staff members, favourable working environment and job security of the respondent.

Anonymity is the most secure means of protecting information and ensuring the right to confidentiality and privacy (Polit and Beck 2008). The researcher guaranteed anonymity by avoiding the identifying information like the names of the respondents and using coded questionnaires (Polit and Beck 2008). Upon completion, the questionnaires were checked for completeness and consistency and respondents returning uncompleted questionnaires were immediately supported to complete or correct on the spot (Polit and Beck 2008). A separate record was kept for the codes and identifiers. After data collection, all the questionnaires were kept with the researcher in a locked file and access to codes was restricted by keeping it separate from the questionnaires (Polit and Beck 2008). Privacy was ensured during data collection by distributing the forms individually, advising the respondents to complete the forms privately at a convenient location and time. The respondents were advised to complete the forms independently.

Justice refers to fairness in distribution to what is deserved and the principle of justice is violated when some benefit to the person who is entitled is denied without a good reason or some burden is imposed unduly (Joubert and Ehrlich 2007). The researcher informed the participants would not receive any material and financial benefits by being participating in the study. The participants were told that completing the questionnaire may take some 30 – 45 minutes, which could be a significant amount of patient care or

private activities. They were kindly requested to complete it at a more appropriate time that would not harm the patient or that would not significantly affect their private activities or their income.

As part of protecting the rights of the institutions, the hospitals were provided with formal requests from the city health bureau and the participation of their staff in the study was approved by the management. The study was undertaken at a convenient time and in a way that it does not negatively affect the workflow of the hospital.

3.3.3 Data analyses

After checking the data for completeness and consistency, data entry and analyses were performed using the SPSS statistical package for Windows (version 17). SPSS was used to compute most of both descriptive and analytic statistical methods. The functionalities of Microsoft Excel 2010 were extensively used to generate some descriptive statistics and graphs.

Descriptive analyses included a description of socio-demographic characteristics, perceived benefits and challenges of eHealth and familiarity with eHealth applications.

Bivariate analyses were computed using correlation indexes and contingency table. Some of the five-scale Likert scale data were changed to binary form in order to undertake bivariate descriptive analyses. Changing a five-scale Likert scale data to a binary does not decrease validity or the component structure of a test instrument (Grassi et al 2007). Analyses of Chi-square and crude odds ratio (COR) were made to examine the association between independent and dependent variables. Independent and dependent variables that were significantly associated ($P \leq 0.05$) were further retained for multivariate analyses with multiple logistics regression. Adjusted Odds ratio (AOR) was used to describe the outcomes of multiple logistics regression. Independent t tests were done to examine the difference between two continuous variables.

The questionnaires on perceived benefits and challenges entirely consist of a five-point Likert scale measurement. Extensive review was made on how to analyses Likert scale items. There exists disagreement amongst scholars about whether Likert data should be analyzed using parametric statistics or non-parametric statistics (Carifio and Perla 2008, De Winter & Dodou 2010). Norman (2010) argues that parametric statistics can also be used with Likert data. Boone, HN and Boone DA (2012) argued that the

numbers assigned to Likert-type items express a "greater than" relationship and since how much greater is not implied the items should fall into the ordinal measurement scale. Descriptive statistics recommended for ordinal measurement scale items include a mode or median for central tendency and frequencies for variability. AS explained in Polit and Beck (2008, 501), Beck and Gable (2001)used parametric tests to evaluate internal consistency reliability. De Winter & Dodou (2010) concluded that with for five-point Likert items, the t - test and Mann-Whitney-Wilcoxon (MWW) generally had similar power, except for skewed, peaked, or multimodal distributions and suggested that researchers do not have to worry about finding a difference whilst there is none in the population.

Analyses of Pearson's r Correlations were made to examine the strength of correlation between dependent variables. Pearson's r Correlation coefficient can be used either on an interval or a ratio scale (Polit and Beck 2008, 571). The interpretations of the strength of correlation between two variables was done based on what was suggested by Pallant (2007:132) as r = 0.10 to 0.29 small correlation, r = 0.30 to 0.49 medium correlation, r = 0.50 to 1.00 high correlations. Analytic results were reported together with 95% confidence interval and the level of significance.

3.4 INTERNAL AND EXTERNAL VALIDITY OF THE STUDY

According to Polit and Beck (2008:295), internal validity refers to the extent to which it is possible to make an inference that the independent variable is truly affecting the dependent variable. Selection and information bias are the most frequently encountered threats to internal validities in non-experimental studies (Polit and Beck 2008:295). In the study, selection and information bias was minimized by strictly applying the simple random sampling methodology. During analyses, comparison was made among those who had prior exposure to eHealth and those who did not have; between those facilities implementing and not implementing eHealth as both affect the knowledge and perception about eHealth.

External Validity concerns inferences about ability to generalize the relationships observed in the study to a broader group Polit and Beck (2008:301-302). A simple random sampling methodology was used to ensure representativeness and generalization of the findings. Most of the respondents who were randomly selected were able to fulfill the inclusion criteria. In order to ensure the maximum response rate,

the respondents were assisted during completion of the questionnaires. Those who could not complete and submit on the first day were followed and assisted on the spot to complete on the subsequent days.

The methodology described in the research proposal was strictly adhered to keep the scientific integrity of the research. The data quality (completeness and accuracy) was constantly checked. Ambiguous questions were explained to the responders during data collection period. The respondents participated in the study without any manipulation.

3.5 CONCLUSION

In chapter three, it was explained that the quantitative research paradigm was used for measuring the different variables related to eHealth and their interrelationship with individual, professional and organizational characteristics. A cross-sectional research design was chosen to collect data from randomly selected doctors and nurses respondents working in public and private hospitals in Addis Ababa using self-administered questionnaires (SAQ). It was explained that both descriptive and analytical methods were applied to compute the data using SPSS. The method for ensuring reliability and validity was explained. Methods of adhering to ethical standards during the study were explained.

CHAPTER 4

PRESENTATION, DESCRIPTION AND ANALYSIS OF RESEARCH FINDINGS.

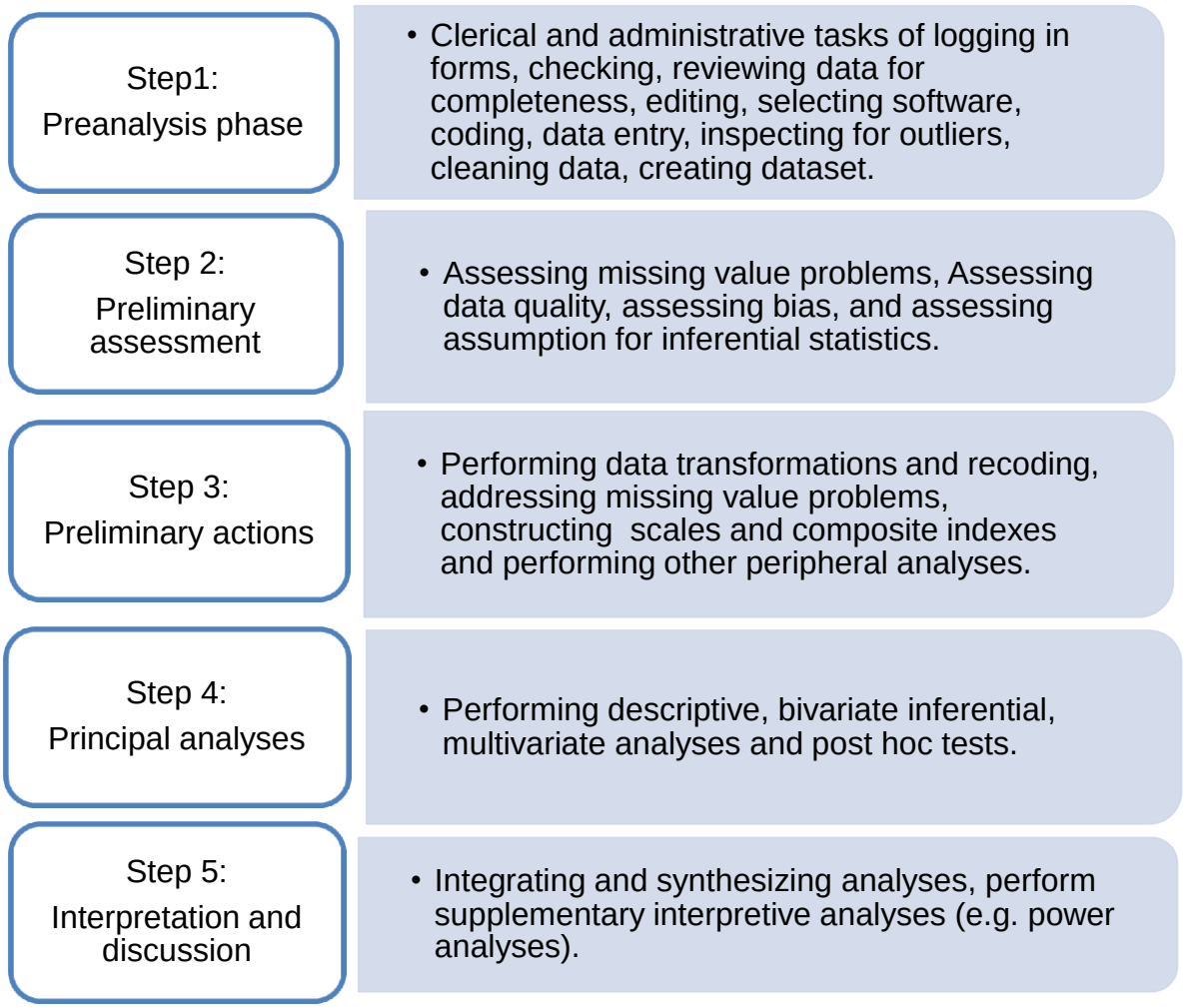
4.1 INTRODUCTION

The previous chapter described the research design methodology, sampling, data collection, data analyses ethical, considerations and reliability and validity of the research. In chapter four, the findings of the research, collected using self-administered Questionnaires (SAQ), were used to collect data from the respondents were presented in tabular and graphic forms followed by a description of the findings. Before the presentation of the results and description of the findings, that the quality of the data was checked using various statistical methods. The data quality check included checking for missing values, checking for outliers and checking for internal consistency and reliability. The variables analyzed included demographic, clinical, perceived benefits and perceived challenges with the adoption and implementations of ICT in healthcare and familiarity with the eHealth applications. The descriptive statistics were followed by bi-variate analyses using correlation and cross tabulation. Multivariate analyses were carried out using multiple logistics regression. The associations of the selected predictor variables were analyzed, discussed and interpretation was made in relation to the findings in the literature review and contrasting findings were discussed.

While analyzing quantitative data may progress as linear as expected, it is still important to follow systematic steps to ensure that critical steps are not missed and the different phases in the analyses are carried out in an organized manner (Polit and Beck 2008). The following framework adapted from Polit and Beck (2008) was used for this purpose.

4.2 DATA MANAGEMENT AND ANALYSES

4.2.1 Steps in analyzing quantitative data.



4.2.2 Checking for data quality

4.2.2.1 Checking for completeness

The pre-analyses phase involved thorough checking for data completeness, legibility and missing information. Some of the respondents were immediately contacted on the spot to reduce the number of missing values. Questionnaires with substantial problems such as incompleteness, illegibility and missing information were discarded. The statistical software, Statistical Package for Social Science (SPSS) version 17 was used for data analyses. After deciding on what code to be used for the variables, data entry was carried out while at the same checking for any missing values.

4.2.2.2 Checking for outliers

The standard deviation score was used to detect univariate outliers from the age of the respondents and the number of years in medical and nursing practices. Looking at the table below, none of the respondents' data on the two variables was found to be outside the standard deviation score of ±3.0 or beyond. Therefore, the possibility of outliers was ruled out for all 312 respondents.

Table 4.2 below shows the descriptive statistics indicating the degree of variability of the age of the respondents and their years of services.

Table 4. 2 Descriptive statistics of age and years of practice

Descriptive Statistics					
	N	Minimum	Maximum	Mean	Std. Deviation
Age	312	24.00	53.00	38.1827	5.45210
YearPractice	312	3.00	29.00	13.8974	5.20163
Valid N (listwise)	312				

4.2.2.3 Checking for internal consistency and reliability

In the table below internal consistency and reliability analyses was checked using Cronbach's Alpha.

Table 4. 3 Cronbach's Alpha scales of the sub-items

Item description	N of Items	Cronbach's Alpha	Mean	Standard Deviation
Perceived benefit to the care process	4	0.866	4.343	2.809
Perceived benefit to the patient	4	0.707	3.348	3.601
Perceived benefit to the healthcare providers	4	0.711	3.747	3.151
Perceived challenges to the care process	4	0.800	3.299	4.030
Perceived challenges for personal use	4	0.615	3.315	3.428
Perceived infrastructural and organizational challenges	6	0.608	3.956	3.876

At a first step, Cronbach's alpha was computed to measure the internal consistency reliability of the all sub-scales on perceived benefits and perceived challenges. The Cronbach's alpha measure in the above table indicated a range from 0.608 to 0.866 which is within a reasonable range of acceptance (Houser 2012). The item means and standard deviations also suggested a good amount of variability distribution away from

the mean score. When there is acceptable amount variability, the shape of the distribution will be closer to the normal distribution curve and kurtosis (peakedness) and skewness (left or right) is minimized.

4.2.2.4 Assessing and addressing missing data.

The extent of missing values in this study was around 5%, mainly with the Likert scale questions. According to Polit and Beck (2008), missing values can be addressed through missing data deletion or missing data imputation. The simplest form of data imputation is mean or median substitution. This approach is recommended when only a small proportion of the items is missing, which is the case in this study. For example, as mentioned in Polit and Beck (2008), Bennet and colleagues (2005), in their study on the effectiveness of nurse coaching in supporting healthy behavioural changes in older patients, were able to reduce the impact of missing data by substituting with the mean values for the items having 75% complete response. As a result of which they were able to address 100% of the missing values. In this study, some of the Likert item scale questions with missing values were substituted with the average Likert scale result of the corresponding question.

4.2.3 Testing assumption for statistical tests.

Parametric tests assume that variables are normally distributed. Frequency distribution can visually reveal whether the distribution is normal, skewed, multimodal, too peaked or too flat. Scatter plots help to determine whether the assumption of linearity and normality are met. Furthermore, with adequate sample size, skewness or peakedness can be detected using statistical indexes that can be computed by statistical software (Polit and Beck 2008).

4.2.4 Data transformation

Data transformation was carried out for sex, age, employee type, professional group, medical specialization and frequency of internet use in order to undertake multivariate analyses. The accuracy of data transformation was checked by comparing the values of newly created variables with the original one. Another method used for accuracy check was running frequency command.

4.3 Research results

A total of 312 usable responses were included in the analyses resulting in a response rate of 96.3%. The types of data collected were on individual healthcare provider demographic characteristics, years in practice, use of internet, perceived benefits of ehealth and perceived challenges of eHealth and familiarity of eHealth applications.

The respondents were randomly selected physicians and nurses who were working in five government and five private hospitals in Addis Ababa during 15 August 2012 to 20 October 2012.

Figure 4.1 below shows the distribution of respondents by hospital. The hospitals are categorized as private hospitals (left) and public hospitals (right).

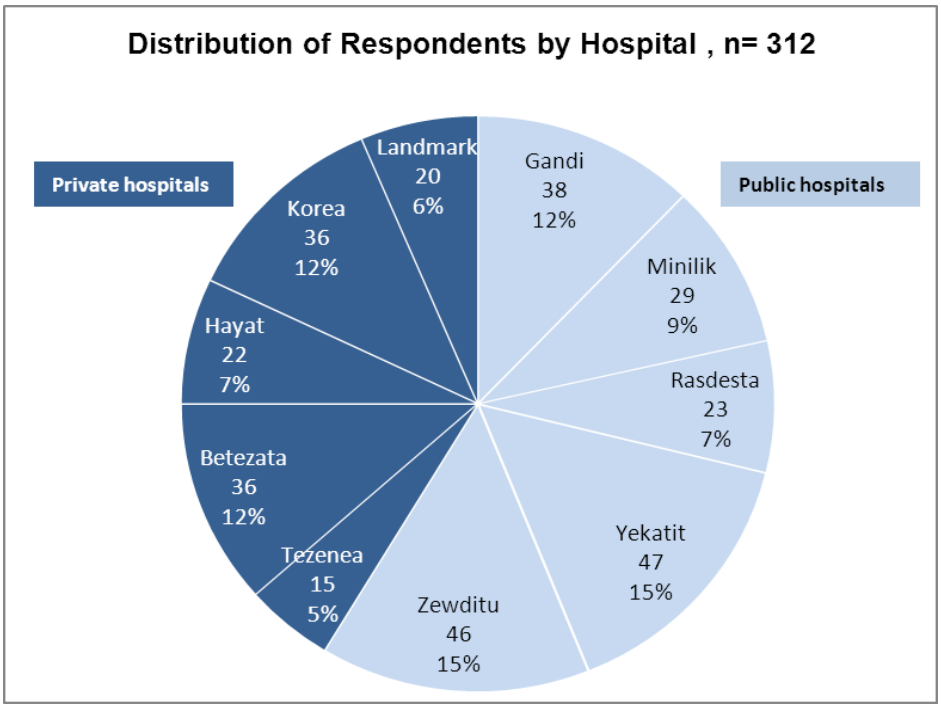


Figure 4. 1 Distribution of respondents by hospital

The distribution of respondents by hospital type is depicted in the figure 4.1 above. Out of 312 respondents, 182 (58.3%) were practicing in public hospitals funded by the government while the remaining 130 (41.7%) practicing in private Hospitals as full time employees.

4.3.1 Sample characteristics

4.3.1.1 Demographic characteristics of the respondents

Table 4.4 shows the sex and the age of the respondents. The age of the respondents is subdivided at an interval of 5 years.

Table 4. 4 Demographic characteristics of the respondents

Variables		Frequency	Percentage
Sex	Male	194	62.2%
	Female	118	37.8%
	Total	**312**	**100.0%**
Age	24 - 29	9	2.9%
	30 - 34	90	28.8%
	35 -39	83	26.6%
	40 - 44	97	31.1%
	45 - 49	23	7.4%
	50 - 54	10	3.2%
	Total	**312**	**100.0%**

Out of the 312 respondents, 194 (62.2 %) were male and 118 (37.8%) were female. Most of the respondents, 279 (89.4%) were below the age 45. The mean age of the male respondents was 39.1 with a standard deviation (SD) of 5.4 while the mean age of the female was 36.7 with an SD of 5.1. The mean age for the doctors was found to be 39.4 with an SD of 5.3 while that of the nurses was 35.5 with an SD of 4.9. The mean age of those respondents working in private hospitals was 39.4 with SD of 5.8 while that of those working in government was 37.3 with an SD of 5.0.

The significance of the analysis of the SD is to examine whether the respondents were randomly selected from among the lists in the sampling frame and whether they could be representative of the total population from which they were selected. In all cases, the SD showed that the age attribute was randomly distributed in terms of sex, profession and hospital ownership.

The graph in the next figure 4.2 shows the age group of the respondents segregated by sex with the male sex indicated on the lower portion of the bar and the female on the upper portion of the bar.

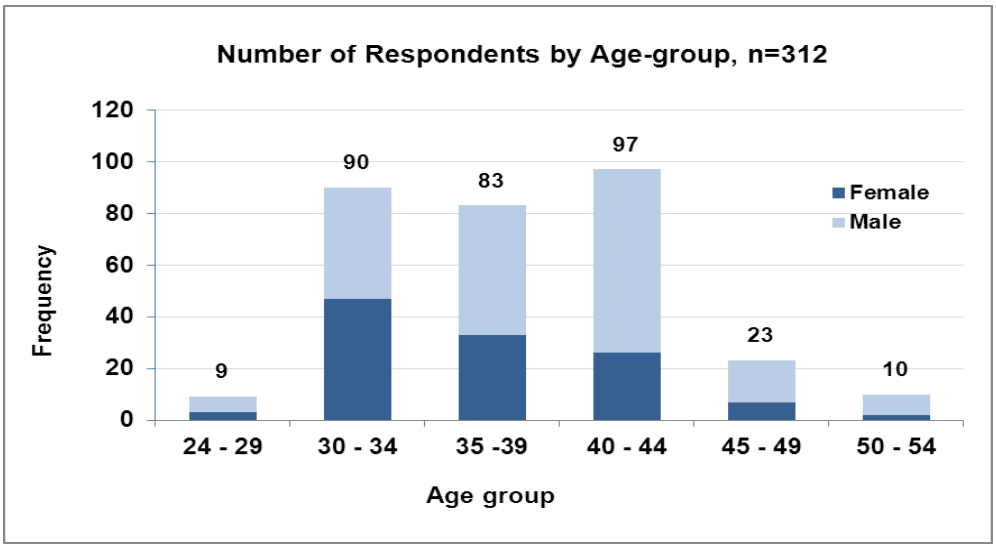


Figure 4. 2 Number of respondents by age groups

Figure 4.3 below is a histogram and frequency polygon of the age of the respondents. It also provides a graphical representation of the cumulative sum.

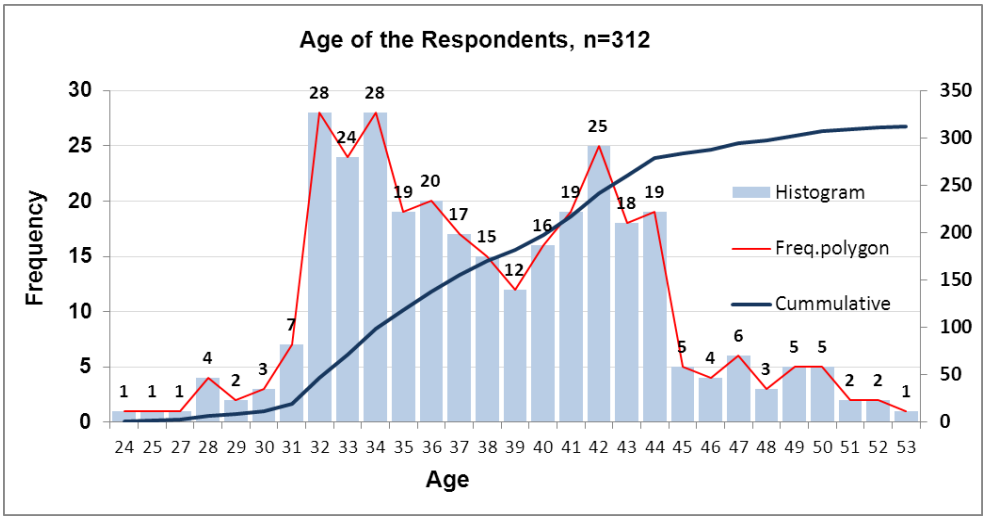


Figure 4. 3 Histogram and frequency polygon of the age of the respondents

The ages of the respondents were plotted on a histogram and a frequency polygon to verify the normality of the distribution. As shown in the figure 4.3, the age distribution was found to be symmetrical with two peaks (bimodal distribution). The two peaks in the bimodal distribution were within the age groups between 32 - 34 years and between 41- 45 years. The fact that the age group 32 – 34 years has the highest peak may show

the effect of the accelerated healthcare training that is going on in the country to meet the human resource demands for the expanding healthcare services.

The population distribution of the respondents is shown in the figure 4.4 below. Figure 4.4 has also significance in showing whether the respondents were randomly distributed throughout the total population of the nurses and doctors in the hospitals that were selected for the study.

Male %	Male n	Age (years)	Female n	Female %
0.0	0	24	1	0.3
0.0	0	25	1	0.3
0.0	0	27	1	0.3
1.3	4	28	0	0.0
0.6	2	29	0	0.0
0.0	0	30	3	1.0
1.3	4	31	3	1.0
4.2	13	32	15	4.8
3.2	10	33	14	4.5
5.1	16	34	12	3.8
3.5	11	35	8	2.6
2.9	9	36	11	3.5
3.5	11	37	6	1.9
3.8	12	38	3	1.0
2.2	7	39	5	1.6
2.6	8	40	8	2.6
4.2	13	41	6	1.9
6.7	21	42	4	1.3
3.8	12	43	6	1.9
5.4	17	44	2	0.6
1.3	4	45	1	0.3
1.0	3	46	1	0.3
1.0	3	47	3	1.0
0.6	2	48	1	0.3
1.3	4	49	1	0.3
1.3	4	50	1	0.3
0.3	1	51	1	0.3
0.6	2	52	0	0.0
0.3	1	53	0	0.0
62.2	194	Total	118	37.8

Figure 4. 4 The population distribution of the respondents by sex and age

The nature of age distribution is bimodal both male and female (Figure 4.4). However, the shapes of the distributions male and female were not exactly the same. Particularly, variation exists at the higher age groups which predominantly consisted of more older male respondents than older female respondents.

4.3.1.2 Professional history

Table 4.5 shows professional status, country where the respondents were taught medicine or nursing and numbers of years in practice.

Table 4. 5 Professional history

Variables		Frequency	Percentage
Profession	Doctor	153	49.0%
	Nurse	159	51.0%
		312	100%
Specialization status	Specialist	81	52.9%
	General practitioner	72	47.1%
	Total	**153**	**100%**
Country last taught medicine	Ethiopia	301	96.5%
	Foreign	11	3.5%
	Total	**312**	**100%**
Number of years in practice	0 - 4	5	1.6%
	5 - 9	64	20.5%
	10 - 14	101	32.4%
	15 - 19	99	31.7%
	20 - 24	32	10.3%
	25 - 29	11	3.5%
	Total	**312**	**100%**

Doctors accounted for 49.0% (153) of the respondents, while nurses accounted for 51% (159) were nurses. A total of 269 (86.2%) reported to be below 20 years in practice.

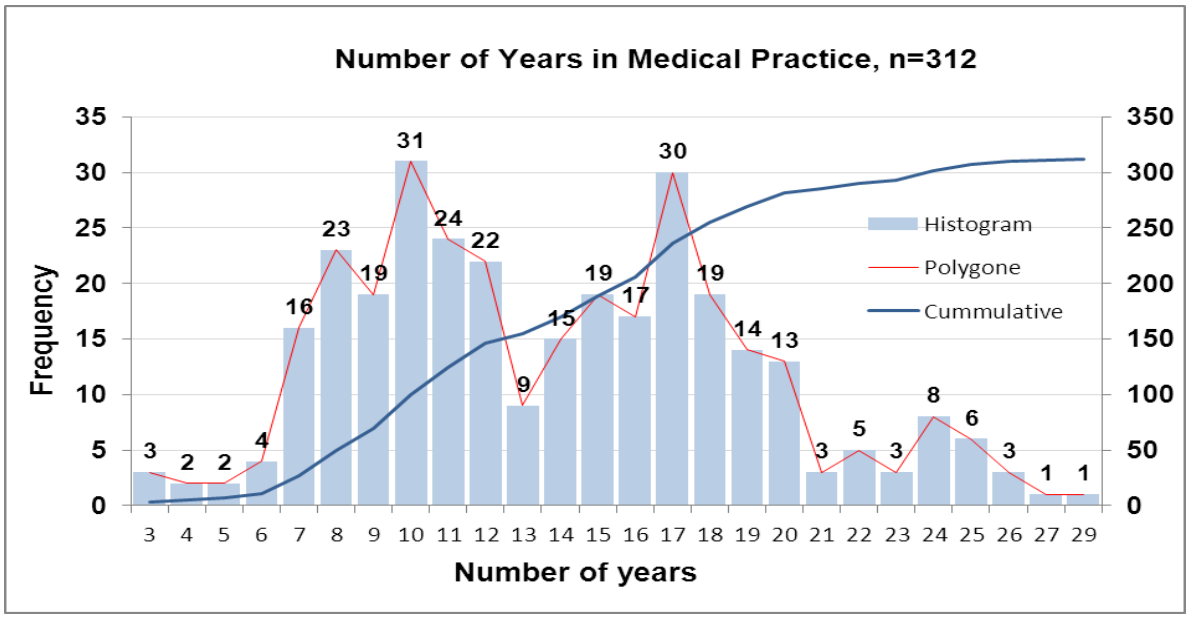


Figure 4. 5 Histogram and frequency distribution of years of practice

Similar to the age distribution of the respondents, the number of years in practice showed bimodal and symmetric distribution. Similar explanation given previously for age distribution can be given for the bimodal distribution of years in practice.

Table 4.6 shows the speciality of the medical doctors. The respondents were from nine medical specialities

Table 4. 6. Speciality among the physicians

	Speciality	Frequency	Percentage
1.	Surgery	12	14.8%
2.	Medicine	16	19.8%
3.	Pediatrics	9	11.1%
4.	Gyn/Obs	11	13.6%
5.	Ophthalmology	6	7.4%
6.	Radiology	13	16.0%
7.	Dermatology	1	1.2%
8.	ENT	7	8.6%
9.	Dentistry	6	7.4%
	Total	**81**	**100.0**

Out of 213 doctors, 81 (26.0%) were specialists from nine different categories. The four major specialities of the respondents were internal medicine (19.8%), Radiology (16.0%), surgery (14.8%) and Gyn/Obs 11(13.6%) radiology. Over 25% of the respondents were medical specialists, showing that the result of this study cannot be generalized to primary healthcare facilities in the other parts of the country which mainly consist of primary level healthcare worker such as general practitioners, health officers and nurses.

4.3.1.3 Employment History

Table 4.7 shows the employment history, which includes the ownership of the hospital in which they were practicing, the employment type, additional responsibility they had in the hospital they practiced.

Table 4. 7 Employment history

Variables		Frequency	Percentage
Hospital type	Public	182	58.3%
	Private	130	41.7%
	Total	**312**	**100%**
Current employment type	Full time	201	64.4%
	Not full time	111	35.6%
	Total	**312**	**100%**
Other health facility currently practicing	Public	19	6.1%
	Private	178	57.1%
	Charity	5	1.6%
	Public and Private	4	1.3%
	Private and Charity	17	5.4%
	Not in any	89	28.5%
	Total	**312**	**100%**
Additional activities like management, research, professional development	Yes	275	88.1%
	No	37	11.9%
	Total	**312**	**100%**

A total of 201 (64.4%) of the healthcare providers were full-time employees while the rest 111 (35.6%) were employed in others forms of employment like part-time and temporary assignments. Most of the respondent, 223 (71.5%) have reported to have worked in other health facilities in addition to the facilities where they were being employed during the interview. Over a quarter of them, 89 (28.5%) did not practice in any other health facility in addition to their regular hospital of employment. More than half of them 178 (57.1%) practiced in private health facilities in addition to their regular facility of employment. Further to the clinical practices, 275 (88.1%) responded to have other activities not related to direct patient care responsibilities like management, research and professional development.

4.3.1.4 Practices related to ICT and eHealth

Table 4.8 shows ICT and eHealth practices of the respondent which includes access to internet and history of training to any course related to eHealth.

Table 4. 8 Practice for ICT and health.

Variables		Frequency	Percentage
Access to internet in the hospital	Yes	282	90.4%
	No	30	9.6%
	Total	**312**	
Frequently of access internet	Every day	90	28.8%
	At least 3x in a week	57	18.3%
	Once in a week	142	45.5%
	2-3 x in a month	22	7.1%
	Once or less in a month	1	0.3%
	Total	**312**	
Ever taken any course related to eHealth	Yes	11	3.5%
	No	301	96.5%
	Total	**312**	

The majority of the respondents 282(90.4%) reported that internet was available in the hospital settings. Only 90 (28.8%) were more frequent internet users, able to access internet at least three times in a week. Less than half, 142(45.5%) of the respondents could access internet at least once in a week. The minority 23(7.4%) were able to access internet fewer than once per week. The result shows that the level of access to internet was very low despite the fact that the majority reported internet availability in the hospitals they were practicing.

4.3.1.5 Perceived benefits to the care process

Table 4.9 depicts four question items asking the level of agreement to benefits of ICT offers to the care process by the respondents.

Table 4. 9 Perceived benefit to the care process (n = 312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived benefit to the care process	**Mean**	**SD**	**Strongly Agree** n (%)	**Agree** n (%)	**Undecided** n (%)	**Disagree** n (%)	**Strongly Disagree** n (%)	**Total** n
Medical errors reduce	4.52	0.74	199 (63.8)	81 (26.0)	29 (9.3)	0 (0.0)	3 (1.0)	312
The quality of diagnosis improves	4.51	0.73	193 (61.9)	90 (28.8)	26 (8.3)	0 (0.0)	3 (1.0)	312
The quality of treatment improves	4.39	0.74	161 (51.6)	119 (38.1)	29 (9.3)	0 (0.0)	3 (1.0)	312
The quality of service improves	1.07	0.79	96 (30.8)	161 (51.6)	19 (6.1)	17 (5.4)	19 (6.1)	312

Generally, the majority of healthcare providers agreed to the perceived benefit of ICT in improving the care process and the service quality. For instance, most of them agreed

that ICT in health care helps to improve the quality of diagnosis 283(90.7%) and the quality of treatment 280 (89.7%) to reduce medical error 280(89.7%).

4.3.1.6 Perceived benefit to the patient

Table 4.10 depicts four question items asking the level of agreement to benefits of ICT offers to the patients by the respondents.

Table 4. 10 Perceived benefit to the patient (n = 312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived benefit to the patient	**Mean**	**SD**	**Strongly Agree** n (%)	**Agree** n (%)	**Undecided** n (%)	**Disagree** n (%)	**Strongly Disagree** n (%)	**Total** n
Medical cost reduces	2.70	1.34	44 (14.1)	60 (19.2)	20 (6.4)	135 (43.3)	53 (17.0)	312
Access to qualified care improves	4.04	1.03	106 (34.0)	158 (50.6)	18 (5.8)	13 (4.2)	17 (5.4)	312
Patient satisfaction improves	3.56	1.26	63 (20.2)	160 (51.3)	10 (3.2)	46 (14.7)	33 (10.6)	312
Communication with patients improve	3.10	1.29	37 (11.9)	127 (40.7)	14 (4.5)	97 (31.1)	37 (11.9)	312

The agreement on the benefit ICT provided to the patient was lower than what it provided to the care process. Only a third 104 (33.3%) of the respondents agreed that it would help to reduce medical cost and only half 164 (52.6%) agreed that it would help to improve communication with the patient during patient care. The most frequently agreed benefits for the patient were improving access to qualified medical care 264 (84.6) and improving patient satisfaction 223(71.5%).

4.3.1.7 Perceived benefit to the care provider

Table 4.11 depicts four question items asking the level of agreement to benefits of ICT offers to the care-provider by the respondents.

Table 4. 11 Perceived benefit to the care provider (n = 312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived benefit to the care provider	**Mean**	**SD**	**Strongly Agree** n (%)	**Agree** n (%)	**Undecided** n (%)	**Disagree** n (%)	**Strongly Disagree** n (%)	**Total** n
Medical staff work efficiently	4.30	0.79	141 (45.2)	135 (43.3)	28 (9.0)	4 (1.3)	4 (1.3)	312
Patient information is easily accessed	4.21	0.91	137 (43.9)	128 (41.0)	29 (9.3)	11 (3.5)	7 (2.2)	312
Interaction with health care team improves	2.58	1.33	40 (12.8)	55 (17.6)	12 (3.8)	143 (45.8)	62 (19.9)	312
Access to up-dated medical information improves	3.90	1.19	111 (35.6)	135 (43.3)	11 (3.5)	35 (11.2)	20 (6.4)	312

The majority 276(88.5%) agreed that ICT might improve efficiency of work of the care provider. Over three-quarters of them, 265 (84.9%) agreed that ICT would help to improve access to patient information and 246 (78.8%) agreed that it would improve access to updated medical information. However, less than a third 95 (30.4%) agreed to the benefit of ICT in improving interaction among the healthcare team.

4.3.1.8 Perceived challenges to the care process

Table 4.12 depicts four question items asking the level of agreement to the challenges of ICT to the care process by the respondents.

Table 4. 12 Perceived challenges to the care process (n = 312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived challenges to the care process	**Mean**	**SD**	**Strongly Agree**	**Agree**	**Undecided**	**Disagree**	**Strongly Disagree**	**Total**
			n (%)	n (%)	n (%)	n (%)	n (%)	n
Inconvenient to use with patient care	2.93	1.24	33 (10.6)	103 (33.0)	14 (4.5)	134 (42.9)	28 (9.0)	312
Increases work load	3.14	1.25	51 (16.3)	101 (32.4)	15 (4.8)	130 (41.7)	15 (4.8)	312
Reduces patient-providers interaction	3.44	1.26	84 (26.9)	89 (28.5)	23 (7.4)	112 (35.9)	4 (1.3)	312
Consumes time for patient care	3.69	1.34	117 (37.5)	90 (28.8)	14 (4.5)	72 (23.1)	19 (6.1)	312

Almost two-thirds, 207(66.3%) of the respondents reported that computer consumed time that would otherwise be used for patient care. Almost half (43.6%) of the respondents agreed that it was inconvenient to use it along with patient care. Similarly, nearly half (48.7%) of the respondents conformed to the question of increases work load by computers if used along with patient care. More than half (55.4%) of the respondents reported that the use of ICT reduces patient provider interaction.

4.3.1.9 Perceived challenges to personal use

Table 4.13 depicts four question items asking the level of agreement to the challenges of ICT to personal us by the care process.

Table 4. 13 Perceived challenges to personal use (n = 312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived challenges to personal use	Mean	SD	Strongly Agree n (%)	Agree n (%)	Undecided n (%)	Disagree n (%)	Strongly Disagree n (%)	Total n
Inconvenient data entry	3.7	1.21	107 (34.3)	89 (28.5)	33 (10.6)	80 (25.6)	3 (1.0)	312
Poor portability of ICT devices	3.41	1.31	88 (28.2)	81 (26.0)	30 (9.6)	98 (31.4)	15 (4.8)	312
Lack of skill on computers use	3.36	1.27	67 (21.5)	110 (35.3)	16 (5.1)	105 (33.7)	14 (4.5)	312
Reduced security of medical records	2.79	1.24	45 (14.4)	55 (17.6)	25 (8.0)	165 (52.9)	22 (7.1)	312

Nearly two-third 196 (62.8%) agreed that data entry was inconvenient with computers during patient care and over half of them 177(56.7%) were not confident of their skills in the use of computer during patient care. Only a third 100(32.1%) had concerns over reduced security of medical records. Over half 169 (54.2%) of the respondents had concerns over poor portability of ICT devices for patient care

4.3.1.10 Perceived organizational and infrastructural challenges

Table 4.14 shows six question items asking the level of agreement organizational and infrastructural challenges for adoption and implementation of ICT in healthcare.

Table 4. 14 Perceived organizational and infrastructural challenges (n =312)

			AGREE		DO NOT AGREE OR UNDECIDED			
Perceived infrastructural and organizational challenges	**Mean**	**SD**	**Strongly Agree** n (%)	**Agree** n (%)	**Undecided** n (%)	**Disagree** n (%)	**Strongly Disagree** n (%)	**Total** n
Poor ICT infrastructure	4.22	0.97	157 (50.3)	95 (30.4)	32 (10.3)	27 (8.7)	1 (0.3)	312
Poor connectivity	4.46	0.86	206 (66.0)	60 (19.2)	31 (9.9)	15 (4.8)	0 (0.0)	312
Financial limitations	4.37	0.95	193 (61.9)	61 (19.6)	40 (12.8)	15 (4.8)	3 (1.0)	312
Low acceptability by health staff	3.28	1.42	103 (33.0)	44 (14.1)	18 (5.8)	130 (41.7)	17 (5.4)	312
Lack of management interest	3.61	1.19	79 (25.3)	127 (40.7)	23 (7.4)	72 (23.1)	11 (3.5)	312
Lack of experts for IT support	3.8	1.18	98 (31.4)	134 (42.9)	15 (4.8)	50 (16.0)	15 (4.8)	312

The majority of the respondents agreed to infrastructural and organizational challenges like poor infrastructure 252 (80.8%), poor connectivity 266(85.3%) and financial limitation 254 (81.4%). Concerns over the lack of management support and the lack of management interest was reported by 206 (66.0%) of the respondents. A significant proportion of the respondents, 232 (74.4%) agreed that ICT expert support might be lacking during implementation of ICT in healthcare. Nearly, half of the respondents, 147(47.1%) reported that ICT might not be accepted by healthcare providers.

4.3.1.11 Familiarity with eHealth types

Table 4.15 shows question items asking about the familiarity of different eHealth applications by the respondents expressed as “heard”, “used” and ‘not heard or used.

Table 4. 15 Familiarity with eHealth types (n = 312)

eHealth Type	Heard	Used	Not heard or used	Total
Electronic Patient Record Systems	132 (42.3)	1 (0.3)	179 (57.4)	312
Electronic Order Communic.Systems for Lab.	46 (14.7)	0 (0.0)	266 (85.3)	312
Electronic System to send or receive referral	52 (16.7)	0 (0.0)	260 (83.3)	312
Decision Support Systems (DSS)	219 (70.2)	5 (1.6)	88 (28.2)	312
Telemedicine	200 (64.5)	100 (32.3)	10 (3.2)	310
ePrescription	189 (60.6)	3 (1.0)	120 (38.5)	312
eAppointment Systems	67 (21.5)	0 (0.0)	245 (78.5)	312
Picture Archiving & Communic. Systems (PACS)	36 (11.5)	1 (0.3)	275 (88.1)	312
Tele-monitoring of outpatients at home	58 (18.6)	4 (1.3)	250 (80.1)	312
Videoconferencing for consultation	277 (88.8)	0 (0.0)	35 (11.2)	312
Evidence Based Medicine	267 (85.6)	36 (11.5)	9 (2.9)	312
Online Database	256 (82.1)	4 (1.3)	52 (16.7)	312

The respondents were asked to answer whether they had heard or used any one of the twelve eHealth types at any time in their professional practices. The knowledge and/or use of eHealth types in decreasing order of frequency were Evidence Based Medicine (97.1%), Telemedicine (96.8%), Video-conferencing for consultations (88.8%) online database (83.3%) and decision support Systems (71.8%). The least known were picture archiving and Communication. Systems (11.9%), Electronic Order Communication Systems for laboratory (14.7%), Electronic System to send or receive referral(16.7%),Tele-monitoring of outpatients at home (19.9%) and eAppointment Systems (21.5%). Electronic patient record Systems was familiar to less than half (42.6%) of the respondents.

Telemedicine was the most highly used eHealth type by nearly a third (32.3%) of the respondents. This was far followed by Evidence Based Medicine (11.5%). Experience on the use of other eHealth types at least once in professional practice was extremely low and ranged from 0% to less than 2%. For example, the use of online database in medical and nursing professional practice was only 1.3%.

4.3.1.12 Satisfaction with the current practices

Table 4.16 shows the general satisfaction of the respondents with their careers in their practices. Satisfaction with the current practice may help to reduce the negative

attitudes commonly expressed as staff interference with sabotage and user resistances which are accounting for failure of almost half of the ICT Projects (Bonnie et al 2009). Collecting information in job satisfactions may be used to explore how the introduction of a new system in to the healthcare practice may be viewed. It was assumed that the more the healthcare workers were satisfied the longer they would stay in the system. The longer they stay in the system, the more they get familiar with the system and the more the system will be acceptable (Carayon et al).

Table 4. 16 Satisfaction with current practice (n = 312)

I am generally satisfied with my job	Strongly agree	**113**	36.2%
	Agree	**154**	49.4%
	Undecided	**27**	8.7%
	Disagree	**11**	3.5%
	Strongly disagree	**7**	2.2%
	Total	**312**	**100.0%**

Table 4.16 shows that the majority of health staff, 267 (85.6%), reported satisfaction with the current job. Nearly half of them, 155 (54.2%), also reported that would like to stay for the next three or more years in hospitals where they are currently practicing.

4.3.1.13 Recommendation by the respondents for implementing eHealth

Table 4.17 shows to what extent the respondents recommend eHealth to be integrated into the care system and training in the medical curriculum.

Table 4. 17 Recommendation for implementing eHealth (n = 312)

Recommend in patient consultations & care	Mean	4.24	
	Strongly agree	165	52.9%
	Agree	87	27.9%
	Undecided	34	10.9%
	Disagree	23	7.4%
	Strongly disagree	3	1.0%
	Total	**312**	**100.0%**
Recommend in medical training	Mean	4.46	
	Strongly agree	189	60.6%
	Agree	85	27.2%
	Undecided	31	9.9%
	Disagree	7	2.2%
	Strongly disagree	0	0.0%
	Total	**312**	**100.0%**

Despite the mention of several challenges that could be barriers to the adoption and implementation of ICT in healthcare, the majority of the respondents 252(80.8%) agreed that health workers should use computers during patient care. Similarly, the majority, 274 (87.8%) also considered that ICT should be part of the healthcare training curriculum.

4.4 Analyses of the research findings

4.4.1 Bivariate Analyses

The relationships between two variables in the study were described using correlation indexes and contingency tables.

4.4.1.1 Correlation among the sub-items

Correlation matrix on items of perceived benefits and challenges were made in order to verify the inter-correlation among the items within the subscales. The nonparametric statistics Spearman rank correlation coefficient r_s was run to determine the relationship with an assumption that Likert-type items fall into the ordinal measurement scale.

Tables 4. 18 to 4.23 show how different sub items in the questionnaire were correlated with each other. Interpretations are given for each finding after presenting the table.

Table 4. 18 Correlation matrix for perceived benefit to the care process

Perceived benefit to the care process	Error reduces	Quality of diagnosis Improves	Quality of treatment improves	Quality of service improves
Error reduces	1.000			
Quality of diagnosis Improves	.900**	1.000		
Quality of treatment improves	.761**	.824**	1.000	
Quality of service improves	.407**	.435**	.402**	1.000

Correlations among variables within the category of *perceived benefit to the care process* were computed. From the table, it can be observed that all of the variables with this subscale were found to have medium to high levels of positive correlations. All of the correlations were statistically significant. The highest effect Spearman rank correlation coefficient was found to be between *quality of diagnosis improves* and *error reduces* ($r_s(312) = .900$, $p < 0.01$). The lowest was between quality of service improves and quality of treatment improves ($r_s(312) = .402$, $p < 0.01$, two-tailed).

Table 4. 19 Correlation matrix for perceived benefit to the patient

Perceived benefit to the patient	Cost reduces	Access to Care improves	Patient satisfaction improves	Communication with care provider improves
Cost reduces	1.000			
Access to care improves	.151**	1.000		
Patient satisfaction improves	.244**	.499**	1.000	
Communication with care provider improves	.425**	.249**	.531**	1.000

Similarly, correlations between scales on perceived benefit to the patient showed low to medium level of positive correlations all of which were statistically significant. The strongest relationship was the matrix was between "*communication with care provider* "improves and "*patient satisfaction improves*" ($r_s(312) = .531$, $p < 0.01$, two-tailed) while

the weakest was between "*access to care improves"* and "*cost reduces"* (rs (312) = .151, p < 0.01, two-tailed).

Table 4. 20 Correlation matrix for perceived benefit to the health team

Perceived benefit to the health team	Efficiency of care provider improves	Access to patient information improve	Interaction between healthcare team improves	Access to medical Information improves
Efficiency of care provider improves	1			
Access to patient information improve	.735**	1		
I Interaction between healthcare team improves	.317**	.184**	1	
Access to medical Information improves	.542**	.430**	.371**	1

Similarly, all correlations on the perceived benefits to the healthcare team revealed statistically highly significant relationships. The highest was between "*access to patient information improves"* and *"efficiency of care provider improves"* (r_s (312) = .735, p < 0.01, two-tailed) while the lowest was between "*interaction between healthcare team improves"* and *"access to patient information improve"* (r_s (312) = .184, p < 0.01, two-tailed)

Table 4. 21 Correlation matrix for challenge to the care process

Challenges to the care process	Inconvenient with Patient care	Increases work load	Reduces patient provider interaction	Consumes Providers time for patient
Inconvenient with Patient care	1.000			
Increases work load	.600**	1.000		
Reduces patient provider interaction	.406**	.665**	1.000	
Consumes Providers time for patient	.232**	.522**	.532**	1.000

All the correlations between scales on challenges to the care process indicated positive relationship between the subscales ranging from .232 to .665 which are highly significant.

Table 4. 22 Correlation matrix for perceived challenges to personal use

Perceived challenges to personal use	Inconvenient data entry	Poor portability of equipment	Low computer skill	Low security of information
Inconvenient data entry	1.000			
Poor portability of equipment	.480**	1.000		
Low computer skill	.403**	.188**	1.000	
Low security of information	.104	.243**	.337**	1.000

All the variables within the category of *perceived challenges to personal use* were all statistically significant except that between Low security of information and inconvenient data entry. The relationship ranged from as low as .188 to .480

Table 4. 23 Correlation matrix perceived challenges to personal use

Perceived organizational challenges	Poor infrastructure	Poor connectivity	Financial limitation	Low acceptability	Low manager interest	Low expertise support
Poor infrastructure	1.000					
Poor connectivity	.369**	1.000				
Financial limitation	.275**	.547**	1.000			
Low acceptability	.107	.205**	.254**	1.000		
Low managers interest	.269**	.165**	.135*	-.080	1.000	
Low expertise support	.309**	.257**	.277**	.084	.648**	1.000

From all correlation matrixes, the one on perceived organizational challenges showed diverse outcomes. Three of them (Low acceptability and poor infrastructure, low expertise support and low acceptability and low manager support and low acceptability) showed no significant relationship. The majority showed week relationships, the strongest were between low expertise support and low manager interest (r_s (312) = .648, $p < 0.01$, two-tailed) followed by Financial limitation and poor connectivity (rs (312) = .547, $p < 0.01$, two-tailed).

Table 4. 24 Descriptive statistics of the age and years of practice and care

Descriptive statistics	Age	Number of Years of Practice
Mean	38.2	13.9
Standard Error	0.31	0.29
Median	38	14
Mode	34	10
Standard Deviation	5.45	5.20
Sample Variance	29.73	27.06
Kurtosis	-0.38	-0.43
Skewness	0.32	0.38
Range	29	26
Minimum	24	3
Maximum	53	29
Sum	11913	4336
Count	312	312
Largest(1)	53	29
Smallest(1)	24	3
Confidence Level(95.0%)	0.61	0.58

Figure 4.6 shows the high positive correlation between age and the number of years in practice and care. The correlation between the two has significance in checking for data consistency as the age of the respondents is directly and positively related to the number of years of service. At a later stage, the age of the respondents had been dichotomized to study the relationships between age-groups and perceive benefits, challenges and familiarity with eHealth.

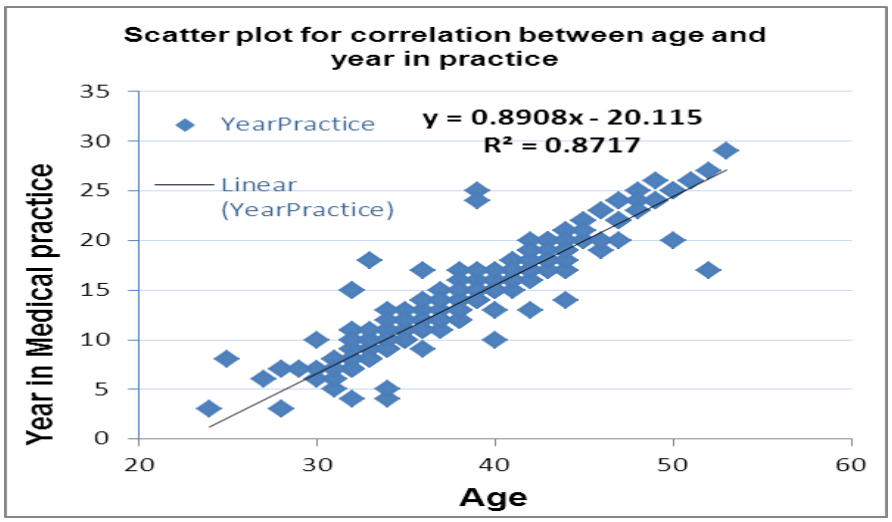


Figure 4. 6 Correlation between age and years of practice

Correlation between the age of the respondents and number of years in practice was computed and the two variables were plotted on the scatterplot for visual display of their

relationship. The Product-moment correlation coefficient (Pearson's r) was used because of the ratio scale measurement of the two variables and the output of descriptive statistics in the table below showed not major problems with regard to kurtosis (peakedness) and skewness (asymmetry). Furthermore, visual display of population pyramid showed fairly similar pattern of distribution between the two variables. The output of Pearson's 'r showed that the age and the number of years in practice was highly positively correlated r(312) = 0.934, p <.001) showing a logical consistency in the sampling methodology.

4.4.2 Cross tabulation

A crude bivariate analysis was made to identify differences in perceptions and familiarity with eHealth applications among various variables shown in the tables from 4. 25 to table 4. 30 below.

Table 4.25 shows seven study variables which are dichotomized to make bi-variate and multi-variate analyses

Table 4. 25 Description of dichotomous predictor variables

	Variable	Dichotomized variables
1	Sex	Male and Female
2	Age	< 35 year and >=35
3	Employee type	Government and private
4	Professional group	Nurses and doctors
5	Medical specialization	Specialists and others
7	Frequency of internet use	<Once per week and >= Once Per week

Tables 4. 26 up to 4. 31 show the independent variable which were dichotomized and their relationships with the ICT variables expressed as perceived benefits, perceived challenges and familiarity with eHealth application by the respondents. They are all presented in identical formats with their Crude Odds Ratios (COR), 95% CI and p values.

4.4.2.1 Relation of the sex of the respondents with outcome variables

Table 4. 26 Association of sex and eHealth variables

	Male n = 194	Female n = 118	COR	95% CI		P value
				upper	lower	
1. Perceived benefit						
1.1 To the care process						
Error Reduces	89.2%	90.7%	.85	.39	1.83	.67
Service quality improves	80.9%	86.2%	.68	.36	1.28	.23
1.2 To the patient						
Cost reduces	37.1%	27.1%	1.59	.96	2.61	.07
Access to care improves	84.0%	85.6%	.89	.47	1.68	.71
1.3 To the staff						
Efficiency or work	87.6%	89.8%	.80	.38	1.67	.56
Interaction with team	36.6%	20.3%	**2.26**	1.32	3.86	**.00**
2. Perceived challenges						
2.1 To the care process						
Time consuming	63.4%	71.2%	.70	.43	1.15	.16
inconvenient to use	43.3%	44.1%	.97	.61	1.54	.89
2.2 To personal use						
Inconvenient data entry	59.3%	68.6%	1.59	.96	2.61	.10
Low security	29.4%	36.4%	.73	.45	1.18	.20
2.3 To organization						
Poor connectivity	85.1%	85.6%	.96	.50	1.83	.90
Low acceptability	44.8%	50.8%	.79	.50	1.24	.30
Low expert support	72.7%	77.1%	.79	.46	1.35	.38
3. Familiarity(know, used)						
Electronic Patient Record	51.0%	28.8%	**2.6**	1.6	4.2	**.00**
Telemedicine	99.0%	93.2%	**7.0**	1.5	33.5	**.00**
Decision Support Systems	84.0%	51.7%	**4.9**	2.9	8.3	**.00**
Evidence Based Medicine	99.5%	93.2%	**14.0**	1.7	113.7	**.00**
Online Database	90.2%	72.0%	**3.6**	1.9	6.7	**.00**

Table above indicates that the majority of the sub-items selected under perceived benefits and perceived challenges did not show statistically significant differences in relation to sex. For example, 80.9% of the male respondents and 86.2% of the female respondents reported that ICT improves the quality of healthcare services (COR = 0. 68, 95% CI 0.36 - 1.28 p= 0.23). The only sub-item that showed statistically

significant differences in sex was improvement in interaction with health team under the benefit ICT offers to the healthcare team. Over, a third of the respondents, 36.6% of the male respondents and 20.3% of the female respondents said that ICT improves interaction among the healthcare team (COR = 2.26, CI 1.32 - 3.86 p= <.01)

However, sex difference in the familiarity with most of the eHealth applications was found to be statistically significant. The male respondents were found to be more familiar to eHealth applications than the female respondents (Crude Odds ratio (COR) in the range of 2.6 – 4.9, $p < 0.01$). For example, 51.0% male respondents and 28.8% female respondents reported to be familiar with electronic health records (COR = 2.6, 95% CI 1.6 - 4.2, $p < 0.01$).

Familiarity with telemedicine and evidence based medicine were excluded from analyses as more than 25% of the responses were less than five which is not recommended for analysing Odds ratio.

4.4.2.2 Relation of the age of the respondents with outcome variables

Table 4. 27 Association of age and eHealth variables.

	<=35 n = 99	>35 n = 213	COR	95% CI upper	95% CI lower	P value
1. Perceived benefit						
1.1 To the care process						
Error Reduces	82.8%	93.0%	.37	.17	.77	.01
Service quality improves	75.5%	86.3%	.49	.27	.89	.02
1.2 To the patient						
Cost reduces	31.3%	34.3%	.87	.52	1.46	.61
Access to care improves	77.8%	87.8%	.49	.26	.91	.02
1.3 To the staff						
Efficiency or work	81.8%	91.5%	.42	.21	.84	.01
Interaction with team	30.3%	30.5%	.99	.59	1.66	.97
2. Perceived challenges						
2.1 To the care process						
Time consuming	56.6%	70.9%	.53	.33	.88	.01
inconvenient to use	40.4%	45.1%	.83	.51	1.34	.44
2.2 To personal use						
Inconvenient data entry	51.5%	68.1%	.50	.31	.81	.00
Low security	24.2%	35.7%	.58	.34	.99	.04
2.3 To organization						
Poor connectivity	80.8%	87.3%	.61	.32	1.16	.13
Low acceptability	51.5%	45.1%	**1.29**	.80	2.09	.29
Low expert support	69.7%	76.5%	.71	.41	1.20	.20
3.Familiarity(know,used)						
Electronic Patient Record	36.4%	45.5%	.68	.42	1.12	.13
Telemedicine	94.9%	97.7%	.45	.13	1.60	.21
Decision Support Systems	66.7%	70.5%	.70	.41	1.17	.17
Evidence Based Medicine	96.0%	97.7%	.57	.15	2.17	.41
Online Database	80.8%	84.5%	.77	.41	1.44	.41

After classifying the ages into two categories (< = 35 years, younger age and > 35 years, older age), analyses was made to identify the difference in perception and familiarity with eHealth applications. Accordingly, the age group < = 35 showed less favourable perception in terms of the benefits to the use of ICT in healthcare, yet with significantly lower reports of challenges towards the implementation of eHealth. For example, 82.8% of the younger age group and 93.0% the older age group responded that medical error reduces with ICT applications in healthcare (COR = 0.37, CI 0.17 - 0.77, p = 0.01). However, the use of ICT in improving interaction among the healthcare team and challenges to personal use with regard to inconvenient data entry did not show a significant difference between the age groups.

Similarly, there was no statistically significant difference in familiarity with eHealth applications between the younger and the older age groups. For example, 36.4% younger respondents and 45.5% older respondents reported familiarity with electronic health records (COR = 0.68, 95% CI, 0.42 - 1.12, p = 0.13).

4.4.2.3 Relation of the hospital types with outcome variables

Table 4. 28 Association of hospital types and eHealth variables.

	Government n = 182	Private n = 130	COR	95% CI		P value
1. Perceived benefit						
1.1 To the care process						
Error Reduces	86.8%	93.8%	.43	.19	.99	**.04**
Service quality improves	77.2%	90.8%	.34	.17	.69	**.00**
1.2 To the patient						
Cost reduces	28.6%	40.0%	.60	.37	.97	**.03**
Access to care improves	80.8%	84.6%	.47	.24	.92	**.03**
1.3 To the staff						
Efficiency or work	84.6%	93.8%	.36	.16	.82	**.01**
Interaction with team	30.2%	30.8%	.97	.60	1.59	.92
2. Perceived challenges						
2.1 To the care process						
Time consuming	63.2%	70.8%	.71	.44	1.15	.16
inconvenient to use	38.5%	50.8%	.61	.38	.96	**.03**
2.2 To personal use						
Inconvenient data entry	58.2%	69.2%	.62	.39	1.00	**.05**
Low security	28.6%	36.9%	.68	.42	1.10	.12
2.3 To organization						
Poor connectivity	81.3%	85.3%	.44	.22	.89	**.02**
Low acceptability	51.6%	47.1%	**1.55**	.98	2.45	.06
Low expert support	75.3%	73.1%	**1.12**	.67	1.87	.66
3.Familiarity(know,used)						
Electronic Patient Record	40.7%	45.4%	.82	.52	1.30	.41
Telemedicine	95.1%	99.2%	.15	.02	1.19	**.04**
Decision Support Systems	74.2%	68.5%	**1.32**	.80	2.18	.27
Evidence Based Medicine	96.7%	97.7%	.69	.17	2.82	.61
Online Database	84.6%	81.5%	**1.25**	.68	2.27	.47

In the table 4.28 above, except for few variables on perception, respondents in the government hospitals facilities showed less favourable attitude towards the benefits of ehealth applications, however, with significantly lower reports of challenge to their implementation. For example, perceived benefit of ICT in reducing error was reported by 86.8% of government hospital respondents and 93.8% of private hospital

respondents. The difference is statistically significant (COR = 0.43, 95% CI 0.19 - 0.99, p < .05).

However, there was no statistically significant difference in familiarity with eHealth applications between government and private hospitals. For example, knowledge about electronic health records were reported by 40.7% of government hospital respondents and 45.4% private hospital respondents (COR = 0.82, 95% CI 0.52 -1.30, p = 0.41)

4.4.2.4 Relation of the profession of the respondents with outcome variables

Table 4. 29 Association of profession and eHealth variables.

	Doctors n = 153	Nurses n = 159	COR	95% CI		P value
1.Perceived benefit						
1.2 To the care process						
Error Reduces	89.5%	89.9%	.96	.46	1.99	.91
Service quality improves	82.2%	83.5%	.91	.50	1.65	.76
1.2 To the patient						
Cost reduces	30.7%	35.8%	.79	.49	1.27	.34
Access to care improves	85.0%	84.3%	**1.05**	.57	1.95	.87
1.3 To the staff						
Efficiency or work	88.9%	88.1%	**1.09**	.54	2.18	.82
Interaction with team	30.7%	30.2%	**1.03**	.63	1.66	.92
2. Perceived challenges						
2.1 To the care process						
Time consuming	66.7%	66.0%	**1.03**	.64	1.65	.91
inconvenient to use	42.5%	44.7%	.92	.59	1.43	.70
2.2 To personal use						
Inconvenient data entry	65.4%	60.4%	.79	.49	1.27	.36
Low security	30.1%	34.0%	.84	.52	1.35	.46
2.3 To organization						
Poor connectivity	84.3%	86.2%	.86	.46	1.61	.65
Low acceptability	41.8%	52.2%	.66	.42	1.03	.07
Low expert support	75.2%	73.6%	**1.09**	.65	1.81	**.00**
3.Familiarity(know,used)						
Electronic Patient Record	51.6%	34.0%	**2.08**	1.32	3.28	**.00**
Telemedicine	100.0%	93.7%	**1.07**	1.02	1.11	**.00**
Decision Support Systems	84.3%	42.4%	**3.62**	2.11	6.21	**.00**
Evidence Based Medicine	100.0%	94.3%	**1.06**	1.02	1.10	**.00**
Online Database	91.5%	75.5%	**3.50**	1.78	6.86	**.00**

There was no statistically significant difference between doctors and nurses for the majority of variables of perceived benefits and perceived challenges. For example, the

benefit of ICT in reducing errors was reported by 89.5% respondents in government health facilities and 89.9% respondents in private health facilities (COR = 0.96, 95% CI 0.46 - 1.99, p = 0.91). Similarly, no significant differences were observed between the respondents on perceived challenges.

However, differences in familiarity with eHealth applications were significant. The familiarity for various eHealth applications for doctors was higher than that of the nurses with COR in the ranges from 2.08 to 3.65 p = .000. For example, knowledge about electronic health records was reported by 51.6% of doctors and 34.0% of nurses (COR = 2.08, CI 1.32 - 3.28, p < .01) indicating doctors are twice more likely to be familiar with electronic health records.

4.4.2.5 Relation of specialization status with outcome variables

Table 4. 30 Association of specialization and eHealth variables.

	Specialists n =81	Others n =231	COR	95% CI		P value
1. Perceived benefit						
1.1 To the care process						
Error Reduces	86.9%	90.8%	.67	.31	1.46	.32
Service quality improves	81.9%	83.3%	.91	.47	1.76	.78
1.2 To the patient						
Cost reduces	34.5%	32.9%	**1.08**	.63	1.82	.79
Access to care improves	82.1%	85.5%	.78	.40	1.52	.46
1.3 To the staff						
Efficiency or work	88.9%	88.1%	**1.09**	.54	2.18	.82
Interaction with team	30.7%	30.2%	**1.03**	.63	1.66	.92
2. Perceived challenges						
2.1 To the care process						
Time consuming	66.7%	66.0%	**1.03**	.64	1.65	.91
inconvenient to use	42.5%	44.7%	.92	.59	1.43	.70
2.2 To personal use						
Inconvenient data entry	58.3%	64.5%	**1.08**	.63	1.82	.32
Low security	25.0%	34.6%	.63	.36	1.11	.11
2.3 To organization						
Poor connectivity	82.1%	86.4%	.72	.37	1.42	.35
Low acceptability	36.9%	50.9%	.56	.34	.94	**.03**
Low expert support	66.7%	77.2%	.59	.34	1.02	**.00**
3. Familiarity(know,used)						
Electronic Patient Record	61.9%	35.5%	**2.95**	1.76	4.95	**.00**
Telemedicine	100.0%	95.6%	**1.05**	1.02	1.08	**.00**
Decision Support Systems	84.5%	68.3%	**2.68**	1.39	5.14	**.00**
Evidence Based Medicine	98.8%	96.5%	**3.02**	.37	24.50	.28
Online Database	94.0%	79.4%	**4.10**	1.57	10.71	**.00**

The difference in perceived benefits and challenges and familiarity was analysed between specialist medical doctors and other categories of respondents which included nurses and general practitioners. There was no statistically significant difference with regard to perceived benefits and challenges between them. For example, perceived benefit in reducing medical error was reported by 86.9% specialists and 90.8% other categories of healthcare providers (COR = 0.67, 95%CI 0.31 - 1.46, p = 0.32). However, the differences in familiarity with ehealth application were found to be highly significant for all types of ehealth applications except evidence based medicine. According to analyses made, specialists were found almost three times more likely to be familiar with most of the ehealth applications. For example, familiarity with electronic

health records was reported by 61.9% of specialists and 35.5% of other categories of healthcare providers (COR = 2.95, 95% CI = 1.76 - 4.95, p < 01).

4.4.2.6 Relation of the frequency of internet use with outcome variables

Table 4. 31 Association of frequency of internet use and eHealth variables.

	>=1X//week N = 146	<1X/week N = 166	COR	95% CI		P value
1.Perceived benefit						
1.1 To the care process						
Error Reduces	83.6%	95.2%	.26	.11	.59	**.00**
Service quality improves	76.6%	88.5%	.42	.23	.78	**.01**
1.2 To the patient						
Cost reduces	17.8%	47.0%	.24	.15	.41	**.00**
Access to care improves	76.7%	91.6%	.30	.16	.59	**.00**
1.3 To the staff						
Efficiency or work	81.5%	94.6%	.25	.11	.56	**.00**
Interaction with team	11.0%	47.6%	.14	.07	.25	**.00**
2. Perceived challenges						
2.1 To the care process						
Time consuming	74.0%	59.6%	**1.92**	1.19	3.12	**.01**
inconvenient to use	40.4%	46.4%	.78	.50	1.23	.29
2.2 To personal use						
Inconvenient data entry	74.7%	52.4%	.24	.15	.41	**.00**
Low security	31.5%	32.5%	.95	.59	1.54	.85
2.3 To organization						
Poor connectivity	78.1%	91.6%	.33	.17	.64	**.00**
Low acceptability	39.0%	54.2%	.54	.34	.85	**.01**
Low expert support	71.2%	77.1%	.74	.44	1.22	.24
3. Familiarity(know,used)						
Electronic Patient Record	45.9%	39.8%	**1.29**	.82	2.02	.27
Telemedicine	95.2%	98.2%	.37	.09	1.44	.13
Decision Support Systems	64.4%	58.0%	.50	.30	.83	**.01**
Evidence Based Medicine	97.3%	97.0%	**1.10**	.29	4.19	.89
Online Database	76.7%	89.2%	.40	.22	.75	**.00**

The frequency of internet use was divided in to two categories as more frequent users (>= once per week) and less frequent users (< ones per week). The result on perception towards the ICT application in healthcare between frequent and less frequent users was interesting in that statistically significant positive perception was found among the less frequent users. For example, perceived benefit of ICT in reducing medical errors was reported by 83.6% more frequent users and 95.2% less frequent users (COR = 0.26,

95% CI 0.11 - 0.59, p < .01). However, the result of familiarity with eHealth applications was inconsistent in that it was insignificant for three out of the five applications.

4.4.3 Multivariate Analyses

The effects of multiple independent variables (predictor variables) were adjusted and studied using multiple logistics regression model after identifying the potential assumptions. The predictor variables which were significantly associated with the outcome variables at p < 0.2 were included in multiple logistic regression analyses.

4.4.3.1 Assumptions for formation of Logistic Regression Model

Sample size

Descriptive statistics was applied to each of the predictor and categories that have frequencies less than a value of five were excluded from the analyses. The independent Predictor variables were decided to be sex, age, number of years in practice, profession, specialization.

4.4.3.2 Analysis of the goodness of fit of the data framework

Multicollinearity

Table 4.32 shows the first step to check for multicollinearity in order to undertake logistic regression analyses

Table 4. 32 Correlation coefficient Matrix of the five independent variables

	Sex	Profession	No of Years in Practice	Age	Specialization
Sex	1				
Profession	-.477**	1			
No of Years in Practice	-.142*	.251**	1		
Age	-.178**	.305**	.765**	1	
Specialization	-.172*	.[a]	.144*	.115	1

Multicollinearity statistics was done to reduce errors in estimation of the impact of the independent variable over the dependent variables resulting from a high level of correlation. The presence of multicollinearity between the independent variables was initially checked using a correlation matrix.

From the correlation matrix, the highest effect Pearson's correlation coefficient was observed between age and the number of years on practice (r = 0.765**) followed by Profession and sex (r =-.477**) as depicted in table 4.33 below.

Table 4.33 shows the second step of to check Multicollinearity using tolerance and the Variance Inflation Factor (VIF). The SPSS output is directly copied and displayed in table 4.33.

Table 4. 33 Collinearity statistics for independent variables

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B		Collinearity Statistics	
		B	Std. Error	Beta			Lower Bound	Upper Bound	Tolerance	VIF
1	(Constant)	4.093	.297		13.792	.000	3.508	4.678		
	Q2.2_Sex	.060	.113	.037	.527	.599	-.163	.283	.972	1.029
	YoungOld	.259	.189	.162	1.370	.172	-.114	.632	.354	2.825
	PracticeYearLessTen	-.011	.219	-.006	-.048	.962	-.443	.422	.349	2.869
	Specialist	-.021	.130	-.012	-.163	.870	-.277	.235	.945	1.058

As it has been portrayed in table 4.32, preliminary statistical findings of the correlation matrix indicated the possibility of multicollinearity (r>0.75) between age and number of years in medical practice. However, since correlation matrix was not sufficient enough to make a conclusion, it was further assessed by examining tolerance and VIF. As it has been shown in the table, tolerance for all the variables exceeded 0.1 which indicates multicollinearity was not a problem. Similarly, VIF was not a cause of concern as all VIF values are less than five.

4.4.3.3 Logistics regression analyses of familiarity with ehealth applications

Table 4.34 shows the SPSS output of the direct logistic model output directly copied from the output table.

Table 4. 34 SPSS output of the direct logistic model

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	312	100.0
	Missing Cases	0	.0
	Total	312	100.0
Unselected Cases		0	.0
Total		312	100.0

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			FamiliarEHR		Percentage Correct
	Observed		1	2	
Step 0	FamiliarEHR	1	0	133	.0
		2	0	179	100.0
	Overall Percentage				57.4

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	.297	.114	6.732	1	.009	1.346

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	Q2.2	14.809	1	.000
		YoungOld	2.327	1	.127
		Q6.1	9.956	1	.002
		Q6.2.1	20.812	1	.000
	Overall Statistics		28.202	4	.000

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	28.712	4	.000
	Block	28.712	4	.000
	Model	28.712	4	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	397.005[a]	.088	.118

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	2.167	6	.904

Contingency Table for Hosmer and Lemeshow Test

		FamiliarEHR = 1.00		FamiliarEHR = 2.00		
		Observed	Expected	Observed	Expected	Total
Step 1	1	38	38.352	19	18.648	57
	2	14	13.648	10	10.352	24
	3	18	18.992	25	24.008	43
	4	20	18.932	25	26.068	45
	5	15	14.985	22	22.015	37
	6	15	13.350	33	34.650	48
	7	1	2.874	10	8.126	11
	8	12	11.867	35	35.133	47

Classification Table[a]

			Predicted		
			FamiliarEHR		Percentage Correct
	Observed		1	2	
Step 1	FamiliarEHR	1	51	82	38.3
		2	27	152	84.9
	Overall Percentage				65.1

Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	Q2.2	.719	.272	6.983	1	.008	2.053	1.204	3.501
	YoungOld	-.123	.268	.210	1	.647	.885	.523	1.495
	Q6.1	-.085	.310	.076	1	.783	.918	.500	1.686
	Q6.2.1	1.039	.335	9.642	1	.002	2.828	1.467	5.450
	Constant	-2.148	.783	7.518	1	.006	.117		

Hospital type

Case Processing Summary

Unweighted Cases[a]		N	Percent
Selected Cases	Included in Analysis	312	100.0
	Missing Cases	0	.0
	Total	312	100.0
Unselected Cases		0	.0
Total		312	100.0

Categorical Variables Codings

		Frequency	Parameter coding (1)
Q1.2_Hospital type	Government	182	1.000
	Private	130	.000

Block 0: Beginning Block

Classification Table[a,b]

			Predicted		
			ErrorReduceYN		Percentage Correct
	Observed		1	2	
Step 0	ErrorReduceYN	1	280	0	100.0
		2	32	0	.0
	Overall Percentage				89.7

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 0	Constant	-2.169	.187	135.112	1	.000	.114

Variables not in the Equation

			Score	df	Sig.
Step 0	Variables	YoungOld	7.534	1	.006
		Q1.2(1)	4.075	1	.044
		FrqPerWeek	11.393	1	.001
	Overall Statistics		26.283	3	.000

Block 1: Method = Enter

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	27.193	3	.000
	Block	27.193	3	.000
	Model	27.193	3	.000

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	179.151[a]	.083	.173

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	9.306	5	.097

Contingency Table for Hosmer and Lemeshow Test

		ErrorReduceYN = 1.00		ErrorReduceYN = 2.00		
		Observed	Expected	Observed	Expected	Total
Step 1	1	39	40.459	2	.541	41
	2	60	60.868	3	2.132	63
	3	16	16.289	1	.711	17
	4	57	53.986	1	4.014	58
	5	43	40.384	2	4.616	45
	6	42	42.687	9	8.313	51
	7	23	25.327	14	11.673	37

Classification Table[a]

			Predicted		
			ErrorReduceYN		Percentage Correct
	Observed		1	2	
Step 1	ErrorReduceYN	1	280	0	100.0
		2	32	0	.0
	Overall Percentage				89.7

Variables in the Equation

								95% C.I.for EXP(B)	
		B	S.E.	Wald	df	Sig.	Exp(B)	Lower	Upper
Step 1[a]	YoungOld	-1.183	.404	8.567	1	.003	.306	.139	.677
	Q1.2(1)	.963	.447	4.644	1	.031	2.619	1.091	6.288
	FrqPerWeek	-1.716	.450	14.552	1	.000	.180	.074	.434
	Constant	1.483	.984	2.271	1	.132	4.405		

Direct logistic regression was performed to assess the impact of a number of independent variables on the familiarity on eHealth applications. Some of the SPSS outputs generated are displayed above. The model contained four variables (sex, age, profession, specialization). The full model containing these predictors was found to be statistically significant $\mathbf{X}^2$ = (4, N =312) = 28.71, p = 0.000, indicating that the model was able to distinguish between the respondents who are familiar and not familiar with eHealth applications. The model as a whole explained between 8.8% (Cox & Snell R Square) and 11.8% (Nagelkerke R Square) of the variance and correctly classified 65.1% of the whole cases. As shown in the output table, two of the four independent variables (sex and speciality) were found to be statistically significant predictors of familiarity with eHealth applications. Accordingly, the male respondents were nearly twice more likely to be familiar to ehealth applications than the female respondents (Adjusted Odds Ratio: 2.053, 95% CI (1.204 - 3.501) p = .008). On the other hand,

medical specialists were found to be nearly three times more likely to be familiar with ehealth applications than the other category of respondents (Adjusted Odds Ratio: 2.828, 95% CI (1.467 - 5.450) p= .002).

4.5 OVERVIEW OF RESEARCH FINDINGS

4.5.1 Individual level challenges

4.5.1.1 Demographic factors

There was no significant difference in perception towards the benefits and challenges to the use of ICT in health. However, the male respondents were found to be in nearly twice more familiar to eHealth applications than the female respondents (AOR= 2.053, 95% CI, 1.204 - 3.501 p = 0.008). Most studies also showed that sex was not an explanatory factor for difference in attitude, ICT literacy or adoption of eHealth (Menachemi et al 2006, Simon et al 2007, Ward et al 2008, Neter and Brainin 2010). However, one study in Barcelona conducted by Villanueva et al (2010) showed that female doctors have a high proportion of low eHealth users than the male doctors.

The age group of less than or equal to 35 years were found to have less favourable perception towards the use of ICT in healthcare (AOR = 0.306, 95% CI, 0.139 - 0.677, p = 0.003). However, familiarity on eHealth application is not significantly different from the older age group of > 35years (AOR = 0.885, CI 0.523 - 1.495 p = 0.647).

Most studies showed that older age group, 50 and above, show low adoption rates and the ICT literate group was found to be younger than the ICT non-litrate group(Neter and Brainin 2010, NCHS 2011 Xierali et al 2013). However, in this study comparison was not possible because very few respondents exist in the age group above 50 years of age. In fact, there was no respondent above 60 years.

4.5.1.2 Attitude

There were high positive perceptions, particularly with regard to improvement to the care process like studies done in other countries. From the study, the majority of respondents agreed that ICT in health care helps would improve the quality of diagnosis (90.7%) and the quality of service (82.4%) and reduce error (89.7%). High level of positive attitude was observed in other studies which were conducted despite significant

differences between the adopters and the non-adopters (Simon et al 2007, DesRoches et al 2008).

However, improving interaction with healthcare team (30.4%), reducing medical cost reduction (33.3%) and improving communication with the patient (52.6%) were the least positively perceived benefits of eHealth. Research studies show that negative attitudes could be the cause of failure for several projects in healthcare. Negative attitudes demonstrated at the beginning of the project might persist and attitudes on perceived usefulness were reported to be consistence predictors of EHR acceptance (Bonnie et al 2009, Asua et al 2010, Chisolm et al 2010, McGinn et al 2011).

A recommendation by the respondents for adoption of eHealth in the healthcare system was very high. The majority of the respondents recommended the application of eHealth for patient consultations & care and most of them (86.9%) believed that health care providers benefit from ICT. Similarly, most of the respondents (87.8%) recommended eHealth to be included it in the healthcare training curriculum.

The study indicated that the high level of positive perception of the benefits of the application of ICT in healthcare among healthcare providers forms a favourable ground for future adoption of eHealth in Ethiopia.

4.5.1.3 Perception on workflow interference

Despite overall high levels of positive perceptions on the benefits of eHealth, between half and two-thirds of the respondents have reported work flow challenges related to the use of computers. For example, almost half (48.7%) of the respondents reported that computers increase work load and over half (55.4%) believe that computers reduce patient-providers interactions. Over two-thirds (66.3%) of the respondents believed that computers consume time for patient care.

Perceptions in workflow interference were also mentioned in other studies. For example, Eley et al (2008) reported that over, three-fourths (82.5%, n=4,330),of nurses respondents mentioned the computer as an extra demand to the already existing workload.

Linder et al (2006) found that over half, 52% (n=501), of primary care clinicians (nurses and doctors) complained that computers shall make to fall behind schedule. The non-

adopters were more concerned on the loss of productivity than the adopters (35% Vs. 41%) (DesRoches et al 2008).

Some studies revealed that perceived interference with workflow could lead to dissatisfaction with the use of computers and recommended proper consideration during implementation process (Lo et al 2007, Castillo, Garcia and Pulido 2010). However, Chisolm et al (2010) argued that positive attitude and satisfaction could develop through time, after getting familiarized with the system.

Other concerns in this study reported by the healthcare providers were inconvenient data entry reported by nearly two-third of the respondents (62.8 %) and lack of computers skill reported by over half of the respondents (56.7%). Healthcare providers having concerns over their on their computer skills were reported by a review conducted by Boonestra and Broekhuis (2010).

In fact, cost of implementation of eHealth has been even a significant concern by other studies done in high income countries (Audet et al 2004, Miller and Sim 2004, Jha et al 2009, Boonstra and Broekhuis 2010, McGinn et al 2011, Roa et al 2011).

4.5.1.4 Frequency of internet use

More frequent users, those using internet at least once per week, were found to be less favourable on the benefit of ICT towards healthcare services than the less frequent users (AOR = 0.180 95% CI, 0.074 - 0.434, p <0.01). However, there is no significant difference in familiarity to ehealth application between more frequent and less frequent internet users. While there are no published studies showing the difference on internet use and attitude towards the use of ICT in healthcare, several studies show that positive attitude was significantly higher among EHR adopters and significantly increases over time as the user gets familiarized with the system (Simon et al 2007, DesRoches et al 2008, Xierali et al 2013). This study shows that the use of internet does not predict positive attitude towards the application of ICT in healthcare systems.

4.5.2 Professional groups challenges

There were no statistically significant difference between doctors and nurses for the majority of variables of perceived benefits and perceived challenges. Similarly, after making adjustment through logistic regression, it was found that the differences in

familiarity with eHealth applications were not significant between doctors and nurses. (AOR = 0.918, 95% CI 0.500 - 1.686, p= 0.783).

A research study by Rahimi et al (2009) and indicated nurses to be significantly more positive towards CPOE system (39.6% Vs. 16.5% respectively). However, Linder et al (2006) indicated nurses are more likely to be EHR non-users than physicians (39% versus 21% respectively).

However, it should be noted that different professional groups have with different concerns, particularly with the changing roles and responsibilities occurring with the introduction of eHealth (Kossman 2005, Boonstra Broekhuis 2010). Therefore, Mair et al (2012) emphasized the need for properly addressing eHealth effects on the roles and responsibilities during the process of adoption and implementation.

No significant difference was found with regard to perceived benefits and challenges between specialized medical doctors and other category of healthcare providers.

Specialist doctors were found to be nearly three times more likely to be familiar with eHealth applications compared to other category of staff (AOR = 2.828, 95% CI, 1.467 - 5.450 p = 0.002).

The use of EHR among physicians working in the multi-speciality practices was higher than that among single-speciality practices (Menachemi et al 2006, Simon et al 2007).

4.5.3 Technical challenges

Contrary to other studies where privacy and security were the main causes of concern (Bates 2005, McGinn et al 2011, Mair et al 2012), this study showed that this dimension of care had not been the main cause of concern. Concern on technical challenge of privacy and security was reported by only by approximately a third (32.1%) of the respondents as a cause for concern. This is an indication that awareness on privacy and security should be a priority for healthcare providers in low income countries such as Ethiopia.

Another technical challenge which was reported by over half of the respondents (54.2%) was poor portability of ICT devices indicating the need to introduce portable devices like mHealth in the healthcare systems.

4.5.4 eHealth Technology Types Challenges

Knowledge of eHealth types in healthcare varied significantly from as low as 11.9% for Picture Archiving and Communication Systems to as high as 97.1% for Evidence Based Medicine. The study showed that there is a high awareness on the availability of free access initiatives like evidence-based medicine and online database. However, their utilization was found to be very low: 11.5 % for Evidence Based Medicine and 1.3% for Online Database. This is similar to the study by Smith et al (2007) that showed 90% (n = 333) of the respondents had heard about PubMed while for most of them 70% (n=305), textbooks still remained the main source of information.

The most commonly used eHealth application is telemedicine. The use of telemedicine in a professional practice is reported by nearly a third, 100(32.3%), of the respondents followed by evidence-based medicine reported to be used by nearly one-tenth,36(11.5%), of the respondents.. Experience of use of other applications was insignificant. Telemedicine was the major eHealth application implemented in Ethiopia and this has been the reason for the high level of familiarity by the respondents (Shiferaw and Zolfo 2012).

Telemedicine is believed to improve access to health care by removing geographical barriers. Therefore, there is a need to boost the availability and utilization of this eHealth application, especially among the Africans, the majority of who are living in remote rural areas (WHO 2010). According to the WHO universal access, eHealth needs to be a vision for all countries in the African Region and recommends each country to develop a road map in a strategic e-health plan that will, over time, enable its citizens to realize that vision(WHO 2005, WHO 2010).

4.5.5 Organizational level Challenges

4.5.5.1 Cost

Financials limitation was among the most significant concern reported by over three-fourth (81.4%) of the respondents.

Other studies also consistently mentioned cost as a reason for non-adoption most frequently mentioned organizational barriers to the implementation of eHealth (Audet et al 2004, Miller and Sim 2004, Jha et al 2009, Boonstra and Broekhuis 2010, McGinn et al 2011, Roa et al 2011). The concern over the cost of implementation was even found

to be significantly higher among the non-adopters than the adopters (Kemper et al 2006, DesRoches et al 2008, DesRoches et al 2008).

Therefore, Miller and Sim (2004) and Poon et al (2006) argued that the adoption of eHealth would be limited unless a policy publicity providing financial incentives to clinicians using eHelath or pay-for-performance reimbursement for investment costs and initial productivity loss is introduced.

Perceived organizational challenges were also mentioned by the majority of the respondents. These include poor infrastructure 252 (80.8%), poor connectivity 266(85.3%) and financial limitation 254 (81.4%).

4.5.5.2 Management and Leadership and organizational culture

A significant proportion, ranging from almost half to three-quarter of the respondents reported concerns related to management as challenges to adoption. This includes low acceptability by health staff (47.1%), lack of management interest (66.0%) and lack of experts in IT support (74.4%).

This study showed that 206 (66.0%) of the respondents had concerns over the management support and 232 (74.4%) perceived that the support that would be provided by ICT experts might not be adequate.

Studies indicated that as a result of the complex nature of healthcare setting and the major shift from the traditional paper-based system to an electronic system, implementation efforts required change management efforts with visionary and action oriented leadership (Lorenzi, Kouroubali and Bloomrosen 2008, Boonestra and Broekhuis 2010). This study also showed that management support would be required to ensure continual ICT support and acceptability by the healthcare providers in the process of adoption and implementation.

4.5.5.3 Hospital types

Respondents from private hospitals were found to be more positive towards the benefit of ICT on healthcare services than those working in government hospitals. (AOR= 2.619, CI, 1.091 - 6.288 p = 0.031). However, no statistically significant difference was found in familiarity wih eHealth application between the two groups. For example, familiarity with Electronic Health Record (COR = 0.82, 95% CI, 0.52 - 1.30 p=0.41).

Studies consistently show that adoption is affected by practice size with increasing rate of adoption as the practice increases in size (Audet et al 2004, Miller and Sim 2004, Simon et al 2007, DesRoches et al 2008, Boonstra and Broekhuis 2010,Roa et al 2011). However, few published studies exist to show differences in perception between private and public hospitals. According to a study by the NCHS of USA, public hospitals were found to have significantly higher rates of adoption than private hospitals (NCHS 2011).

4.6 CONCLUSION

In chapter four, the findings of the research were presented and described descriptive statistical methods. Further analyses were done using logistic regression models. It was found that the report perceived benefits of eHealth was high among all health care providers. No significant differences were found with regard to perceived benefits and challenges between different groups. Male respondents and specialist doctors were found to be nearly three times more likely to be familiar with eHealth applications compared to other category of staff. While a significant proportion of health workers positively recommend for further adoption of eHealth, the study also showed some concerns on benefits like improving interaction with healthcare team, reducing medical cost reduction and improving communication with the patient to be the least positively perceived benefits by the respondents. Workflow challenges like increased work load, reduced patient-providers interaction and reduced time for patient care were significant concerns reported by nearly half to two-third of the respondents. Privacy and security concerns of the respondents is lower than studies in other countries. The knowledge and use of most of eHealth applications is low. Despite many respondents reported knowledge about Evidence Based Medicine and Online Database, very few have ever used them.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 INTRODUCTION

The purpose of the research is to examine, describe and analyse the individual, clinical, technical and organizational factors that challenge the adoption and implementation ICT in healthcare systems in Ethiopia from healthcare provider's perspectives, investigate the relationship between these factors and ICT usage and finally make relevant recommendations that are required for the implementation of eHealth in Ethiopia.

This chapter summarizes the previous chapters and makes conclusion and recommendations based on the findings.

The main limitation of the study was the study location. The study was undertaken in Addis Ababa, as a result of which the findings could not be generalized at national level. The other limitation is little consideration given to the emerging eHealth component, mHealth, an important eHealth application which is gaining popularity and acknowledged to increase access to healthcare services by removing distance barriers of low and middle income countries. Lack of adequate literatures from low income countries, particularly from Ethiopia was also among the main limitations.

From the study, it can be concluded that improving eHealth literacy, particularly, for freely accessible evidence-based medicine and online database were areas which could be given priority and implemented without allocating significant resources. Efforts of expanding mHealth technologies which have been proved to be of significant value in countries such as Ethiopia should be enhanced. Further researches should also be considered in integration of mHealth in the comprehensive eHealth platform in future researches. The completion and adoption of the eHealth policy which has been already launched would be of paramount importance in attracting funding for the realization of eHealth in Ethiopia.

5.2 RESEARCH DESIGN AND METHODS

A cross-sectional study design with a quantitative paradigm was used with the intention of collecting information from the respondents. The study was conducted on 312

doctors and nurses who were selected through simple random sampling method from a list of healthcare providers in ten hospitals. Data was collected through self-administered Questionnaires (SAQ) which were administered after receiving written consent from the respondents.

5.3 SUMMARY AND INTERPRETATION OF THE RESEARCH FINDINGS

5.3.1 Individual level factors

The attitude towards eHealth was found to be positive among the majority of respondents. They believed that ICT in health would help to improve the quality of diagnosis and the quality of service and reduce errors. However, the benefits of eHealth in improving interaction with the healthcare team, reducing medical cost and improving communication with patients were less positively viewed by the respondents.

The study found no significant difference in perception towards the benefits and challenges in the use of ICT in health across all demographic variables. However, the male respondents were found to be in nearly twice more familiar with health applications than the female respondents.

5.3.2 Workflow interference factors

Almost half to more than two-thirds of the respondents reported workflow challenges with the use of computers. Workflow challenges were reported to increase workload, reduce patient-providers interactions and reduce time for patient care.

5.3.3 Professional groups factors

The differences in familiarity with eHealth applications were not found to be significant between doctors and nurses. However, specialist doctors were found to be nearly three times more likely to be familiar with eHealth applications than the other category of respondents.

5.3.4 Technical factors

Technical challenge such as privacy and security was not a significant cause of concern among the respondents in the study. Privacy and security concerns of the respondents were lower than what had been reported in the studies made in other countries. In this

study, a technical challenge of significant concern which had been reported by over half of the respondents was poor portability of ICT devices.

5.3.5 eHealth technology factors

Knowledge of eHealth types in healthcare varied from very low as in the case of Picture Archiving and Communication Systems to high for Evidence Based Medicine. While the awareness for the most of the eHealth application was relatively low, awareness on the availability of free access on-line database like evidence-based medicine was found to be high. However, their utilization was very low despite high awareness on their availability.

The experience of the use of telemedicine in the healthcare practices of the respondents was reported to be the highest of all the others eHealth applications. This is followed by evidence-based medicine. Experiences of the use of eHealth applications other than the two were reported to be very insignificant.

5.3.6 Organizational level factors

Financial limitation was one of the most significant concerns reported by the respondents. Furthermore, a significant proportion, ranging from almost half to three-quarter of the respondents reported concerns related to management as challenges to adoption and implementation of eHealth. These included low acceptability by health staff, lack of management interest and lack of experts for ICT support.

Respondents from private hospitals were found to be more positive towards the benefit of ICT in healthcare services than those working in government hospitals. However, there was no statistically significant difference in familiarity with eHealth application between respondents working in private and public hospitals.

5.4 CONCLUSIONS

While ICT in the healthcare settings is positively viewed by the healthcare providers, challenges such as inadequate computer skills, increased work load, reduced provider-client interactions, perceived lack of management support, finance and infrastructure are concerns that should be given the appropriate attention during the adoption and implementation process. Privacy and security was not the main concern by the respondents indicating the need for increasing awareness in this dimension of

healthcare among the healthcare providers. Familiarity with most eHealth applications was very low. The utilization of freely accessible evidence based medicine and online database was also very low. The study, however, showed that acceptance of eHealth by healthcare providers would not be a significant challenge if the concerns that were reported could be addressed at both the designs and implementation phases. Increasing awareness of evidence based medicine and online databases are the most cost effective measures to update knowledge of healthcare providers for the goal of improving quality of healthcare services.

5.5 RECOMMENDATIONS

Strategies for the implementation of the recommendations made in this research study require the coordinated efforts of the Ministry of health, the Ministry of Information and Communication, the Ministry of Education, professional associations, private and public hospitals and the healthcare providers.

Recommendation 1: Improve awareness of evidence based medicine and online databases.

The study demonstrated low level of use of eHealth applications such as evidence based medicine and online databases. It is recommended that national and facility level efforts be made to increase awareness and utilization of these facilities to help the healthcare providers to access free and updated information to improve quality of healthcare. Efforts could include organizing training programmes, developing easy-to-use user-guides, continuing education, orientation or plenary sessions by professional associations, the Ministry of Health or hospital management.

Recommendation 2: Improve eHealth literacy through in-service training and continual expert support.

The study showed that one the main concerns mentioned by a significant number of healthcare providers was inadequate computer skill and perceived challenge of inadequate expert support. Therefore, it is important that the hospital management in collaboration with the Ministry of Health organize adequate skill training and technical support throughout the implementation in any eHealth projects.

Improving eHealth literacy shall help the healthcare providers to increase their skills to efficiently access reliable and up-to-date scientific sources.

Recommendation 3: Promote ICT use and interest in eHealth by the healthcare providers.

The study showed that ICT use such as the internet and other eHealth applications was very low. Given this fact, different approaches could be applied to increase awareness of ICT applications among the healthcare providers. These efforts, for example, could include establishing eHealth departments and organizing ICT seminars and exhibitions.

The research also shows that a significant proportion of the respondents view eHealth positively. This interest can be further developed to increase technology acceptance. For example, informal opinion and expert leaders and eHealth champions can act as promoters for increasing interest among the healthcare providers in the use of eHealth applications. Therefore, it is important to make sure that these groups are involved right from the planning phase.

Recommendation 4: Expand ICT infrastructure

Successful implementation of eHealth requires adequate ICT infrastructures throughout the country. The present efforts of the government of Ethiopian to expand ICT infrastructures, particularly, mobile phone with a high-speed broadband network should continue as planned since this initiative is an important step in the introduction of eHealth in the healthcare systems.

Recommendation 5: Enhance the use of mHealth

Over half of the respondents reported poor portability of ICT devices. Nearly a half of the respondents also believed that the use of computers (desktop) was inconvenient during patient care. However, with the current rapid growth and advances of mobile applications which are more portable than the desktop computers, the government should enhance the existing effort of expanding mHealth in the community health extension programme. It is recommended to extend the application of mHealth technology to the other primary care and facility-based services such as health centers and hospitals.

Recommendation 6: Make eHealth part of the healthcare training curriculum.

Most respondents agree that ICT should be part of the healthcare training programme. The literature review also indicated that the fact that ICT was not part of the medical curriculum had negatively affected the adoption and the implementation of eHealth. Most healthcare providers consider that the use of ICT during routine patient care is inconvenient. For the majority of them, implementation of ICT requires the acquisition of new skills which take away a significant portion of the health care provider's time that could otherwise be used for patient care. It is recommended that the individual professionals and their professional association advocate for inclusion of ICT in the healthcare training for the Ministry of Education to formulate policies that enforce the inclusion of eHealth in both private and government training facilities.

Recommendation 7: Ensure that adoption and implementation are evidence based.

It is important for the Ministry of Health to examine the exiting condition and address socio-demographic, clinical, technical and organizational factors before any ICT intervention in healthcare. The result of the study should be used to undertake tailored interventions to improve the success of the adoption and implementation.

Recommendation 8: Develop enabling environments such as policy, standards, regulations, and partnerships

Policy, Standards, Regulations and Partnerships are enablers for eHealth adoption. They could potentially increase the chance of successful implementation by providing frameworks and protocols for planning and development of the required services. In addition, they help to ensure the availability of adequate funding and establish standards by which the progresses and the results of eHealth services can be better assessed. Therefore, the government should expedite the adoption of eHealth policy. It is important to make sure this policy, standards and regulations include the training of more professionals in medical informatics, the inclusion of eHealth in the curriculum and the provision of encouragements for facilities that will meaningfully apply eHealth.

5.6 CONTRIBUTION OF THE STUDY

This study reviewed the challenges of implementation of ICT in healthcare system in different countries globally. It also analyzed what the healthcare providers perceive as

benefits and challenges as well as their familiarity with these technologies. It gives indications on what challenges to be expected and how they could be addressed during the adoption and implementation of ICT in the healthcare systems in Ethiopia.

5.7 LIMITATIONS OF THE STUDY

Firstly, given rapid proliferation and acceptability of mobile technology, the questionnaire did not sufficiently consider this technology. One of the main concerns raised by the healthcare providers was poor portability of the ICT devices and the inconvenience of using computers during patient care. These concerns of poor portability could be addressed by mobile technologies which are not actually included in the research study.

Secondly, for the purpose of accessibility, the study was conducted in hospital settings in Addis Ababa and, therefore, the findings will better represent the view of the healthcare providers in the urban settings. Rural settings with a higher degree of challenges to ICT infrastructure are not represented adequately. Moreover, the study was conducted only in general hospital settings which are the second in the three-tier healthcare system of Ethiopia. It did not include tertiary (specialized) healthcare facilities.

Thirdly, the study mainly involved two categories of healthcare professionals, doctors and nurses. Other categories of healthcare providers such as pharmacists, laboratory technicians and x-ray technicians and key hospital management and administration staff who could be critical in successful adoption and implementation were not included.

Fourthly, most of the literatures were taken from the high income countries and a significant proportion of them were conducted on physicians. The literature review included few studies from low and middle income countries and few studies on other categories of healthcare providers other than physicians.

Lastly, in this study, it was not possible to compare the differences between adopters and non-adopters as almost all of the respondents were in the non-adopter category.

5.8 CONCLUDING REMARKS

With the advances in ICT, it is important that policy makers keep abreast with the transformative changes within the health systems and emerging technologies. It is recommended to make sure that eHealth applications be widely applied to improve quality, access and acceptability of the services.

Taking quality and patient safety as central points of concern, workable and acceptable ICT solutions should be explored within the context of the healthcare sector. Portable, easy to use and affordable technologies should be studied and applied with greater involvement of the management and the user group. Given the challenges related to the geographical access, human resource shortage, over-worked secondary and tertiary care facilities, developing countries like Ethiopia can greatly benefit from the application of ICT in the healthcare systems.

LIST OF REFERENCES

1. Accenture. 2010. *Overview of International EMR/EHR Markets Results from a Survey of Leading Health Care Companies.*

2. Aerotel Medical Systems. 2012. *eHealth Review: Global eHealth market to grow to $160 billion by 2015.* http://aerotel.blogspot.com/2012/05/ehealth-market-to-grow-to-160b.html.

3. Ahern, DK, Kreslake, JM & Phalen, JM. 2006. *What Is eHealth* : *Perspectives on the Evolution of eHealth Research.* J Med Internet Res 2006;8(1):e4

4. Aldosari, B. 2012. *User acceptance of a picture archiving and communication system (PACS) in a Saudi Arabian hospital radiology department*. BMC Medical Informatics and Decision Making, 12:44.

5. Ammenwerth, E, Mansmann, U, Iller,C & Eichstadter, R. 2003. *Factors affecting and affected by user acceptance of computer-based nursing documentation: results of a two-year study*. Journal of the American Medical Informatics Association, 10, 69–84.

6. Ancker JS, Silver M, Miller MC et al. 2012. *Consumer experience with and attitudes toward health information technology: a nationwide survey*. J Am Med Inform Assoc .

7. Anderson, JG, Aydin,C. 2005. *Evaluating the Organizational Impact of Healthcare Information Systems*. Springer Science plus Business Media.inc

8. Araujo, MT, Paiva, T, Jesuino, JC & Magalhaes, M. 2000. *General practitioners and neurotelemedicine.* Studies in Health Technology and Informatics, 78, 45–67.

9. Archer, N and Cocosila, M. 2011. *A comparison of physician pre-adoption and adoption views of Electronic Health Records in Canadian medical practices.* J Med internet Res e57

10. Asaro, PV & Boxerman,SB. 2008. *Effects of Computerized Provider Order Entry and Nursing Documentation on Workflow.* ACADEMIC EMERGENCY MEDICINE; 15:908–915.

11. Ash, JS, Gorman, PN, Seshadri, V & Hersh, WR. 2004. Computerized physician order entry in US hospitals: results of a 2002 Survey J Am Med Inform Assoc;11:95-99.

12. Asua,J, Orruño, E, Reviriego, E & Gagnon, MP. 2012. *Healthcare professional acceptance of tele-monitoring for chronic care patients in primary care.* BMC Medical Informatics and Decision Making 2012, 12:139.

13. Audet ,AM, Doty,MD, Peugh, J, Shamasdin, J, Zapert, K & choenbaum,S. 2004. Information Technologies : when will they make it into Physicians' Black bags. MedGenMed, 6(4).2

14. Badehrost, C. 2008. *Dissertation Writing: A research journey*. Pretoria: Van Schaik Publishers.

15. Balter, O. 2002. *A longitudinal study of attitude changes in a medical service organisation after an e-mail introduction*. Interacting with Computers , 14, 503 19.

16. Bates. 2005 . *Physicians And Ambulatory Electronic Health Records.* Health Affairs, 24, no.5 (2005):1180-1189.

17. Beck, CT & Gable, RK. 2001. *Item response theory in affective instrument development: An illustration.* Journal of Nursing Measurement. 9, 5 – 22.

18. Blobel, B, Pharow, P, Zvarova, J & Lopez, D. 2008. *eHealth: combining health, telematics, telemedicine, biomedical engineering, and bioinformatics to the age*. CeHR Conference 2007.

19. Berwick, DM. 2003. *Disseminating innovations in health care*. JAMA, 289:1969-1975.

20. Black, AD, Car, J, Pagliari,C, Anandan, C, Cresswell, K, Bokun, t, Mckinstry, B, Procter, R, Majeed, A & Sheikh, A. 2011. *The Impact of eHealth on the Quality and Safety of Health Care: A systematic Overview*. PLoS Medicine, 8(1).

21. Bonita, R, Beaglehole, R & Kjellström, T. (eds). 2006. *Basic Epidemiology. 2nd edition.* India. World Health Organization, 69-82.

22. Boone, HN & Boone, DA. 2012. *Analyzing Likert Data.* Journal of Extension,50(2).

23. Boonstra, A & Broekhuis, M. 2010. *Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions.* BMC Health Serv Res. 2010; 10: 231.

24. Bauer, BA, Lee, M, Bergstrom, L, Wahner-Roedler, DL et al. 2002. *Internal medicine resident satisfaction with a diagnostic decision support system (DXplain) introduced on a teaching hospital service.* Proc Amia Symp. 2002:31–5.

25. Brailer, DJ. 2010.*Guiding The Health Information Technology Agenda.* Health Aff April 2010 vol. 29 no. 4 586-595

26. Bramble, JD, Galt, KA, Siracuse, MV, Abbott, AA, Drincic, A, Paschal, KA & Fuji, KT. 2010. *The relationship between physician practice characteristics and physician adoption of electronic health records*. Health Care Manage Rev. Jan-Mar;35(1):55-64.

27. BusinessDictionary.com - Online Business Dictionary. www.businessdictionary.com (accessed 20 November 2013).

28. Burt, CW & Hing, E (eds) .2005. *Use of computerized clinical support systems in medical settings:* United States, 2001-03. Adv Data;353:1–5

29. Burt, CW & Sisk, JE. 2005. *Which Physicians and Practices Are Using Electronic Medical Records?* Health Affairs, 24(5):1334-1343.

30.

31. Callen, JL, Braithwaite,J, Westbrook, JI. 2008.*Contextual Implementation Model: A Framework for Assisting Clinical Information System Implementations.* Journal of the American Medical Informatics Association Volume 15 Number 2.

32. Canada Health Infoway. 2001. *Transforming health care in Canada through health information technology.* www.infoway-inforoute.com (accessed 12 November 2013).

33. Carayon, P, Cartmill, R, Blosky, MA, Brown, R, Hackenberg, M, Hoonakker, P, Hundt, AS, Norfolk, E, Wetterneck, TB & Walker, JM.2001. *ICU nurses' acceptance of electronic health records.* J Am Med Inform Assoc 2011;18:812e819

34. Carayon,P et al. 2013. *ICU nurses' acceptance of electronic health records.* J Am Med Inform Assoc;18:812e819.

35. Castillo, VHA, Garcia, M & Pulido, JR. 2010. "*A Knowledge-Based Taxonomy of Critical Factors for Adopting Electronic Health Record Systems by Physicians: A Systematic Literature Review*." BMC Medical Informatics and Decision Making 10: 60.

36. Catwel,L & Sheikh, A. 2009.*Evaluating eHealth Interventions: The Need for Continuous Systemic Evaluation*. Public Library Science of Medicine 6(8)

37. Chan, T, deLusignan, S & Brew, S .2004. *Overcoming the bariers to using information systems*. Nursing times. 100:49, 44-46.

38. Chaudhry, B, Wang, J, Wu, S, Maglione, M, Mojica, W, Roth, E, Morton, SC & Shekelle, PG. 2006. *Systematic Review: Impact of Health Information Technology on Quality, Efficacy, and Cost of Medical Care*. Ann Intern Med. 2006;144:742-752

39. Chisolm,DJ, Purnell, TS, Cohen, DM & McAlearney, AS, 2010. *Clinician Perceptions of an Electronic Medical Records during the first year of implementation in Emergency Services.* Pediatr Emerg Care; 26(2): 107–110.

40. Christensen, MC & Remier,D. 2009. Journal of Health politics, Policy and Law, Vol. 34, No. 6

41. Conn, V, & Rantz, M. 2003. *Research Methods: Managing primary study in meta-analyses.* Research in Nursing and Health, 26, 322 – 333.

42. Dagnone, RV, Wilson, R, Goldstein, DH, Murdoch, J, Rimmer, MJ & VanDenKerkhof, EG: *How do patients perceive electronic documentation at the bedside?* J Healthc Qual 2006, 28:37-44.

43. Darr, A, Harrison, MI, Shakked, L & Shalom, N. 2003. *Physicians' and nurses' reactions to electronic medical records.* Journal of Health and Management, 17, 349–59.

44. Davis, FD. 1989. *Perceived usefulness, perceived ease of use, and user acceptance of information technology*. MIS Quarterly;13(3):319–340.

45. DeLone, WH & McLean, ER. 2003*. The DeLone and McLean model of information systems success: a ten-year update.* Journal of Management Information Systems 19(4) pp. 9-30.

46. DesRoches, CM, Campbell, EG, Rao, SR, Donelan, K, Ferris, TG, Jha, A, Kaushal R, Levy DE, Rosenbaum, S, Shields, AE & Blumenthal, D. 2008. *Electronic health records in ambulatory care--a national survey of physicians.* N Engl J Med. 2008 Jul 3;359(1):50-60.

47. DeWinter,JCF & Dodou, D. 2010. *Five-Point Likert Items: t test versus Mann-Whitney-Wilcoxon.* Practical Assessment, Research & Evaluation, Vol 15, No 11

48. Doolan, DF, Bates, DW & James BC. 2003. *The Use of Computers for Clinical Care: A Case Series of Advanced U.S. Sites.* Journal of the American Medical Informatics Association. ;10:107

49. Duyck, P, Pynoo, B, Devolder, P, Voet, T, Adang, L & Vercruysse, J. 2008.*User acceptance of a picture archiving and communication system. Applying the unified theory of acceptance and use of technology in a radiological setting*. Methods Inf Med; 47(2):149-56.

50. eHealth News Africa. 2013. *Ethiopia's mHealth potential*. http://ehna.org/?p=417 (accessed 28 April 2014).

51. Edward, Y (ed). 2004. *Death March*, 2nd Edition. NJ USA: Prentice Hall.

52. Eley, R, Fallon, T, Soar, J, Buikstra, E & Hegney, D. 2008. *Barriers to use of information and computer technology by Australia's nurses: a national survey.* Journal of Clinical Nursing, 18, 1151–1158.

53. El-Kareh, R, Gandhi, TK, Poon, EG, Newmark, LP, Ungar, J, Lipsitz, S & Sequist, TD. 2009. *Trends in Primary Care Clinician Perceptions of a New Electronic Health Record.* Gen Intern Med. 24(4):464-8.

54. Ernstmann,N, Ommen,O, Neumann,M, Hammer,A, Voltz,R & Pfaff, H. 2009. *Primary Care Physician's Attitude Towards the GERMAN e-Health Card Project—Determinants and Implications.* 33, (3), 181-188.

55. European Commission. 2010. *Business Models for eHealth. Final Report* - ec.europa.eu/information_society/newsroom/cf/dae/document.cfm (accessed 27 April 2014).

56. Fishbein, M & Ajzen, I. 1975. *Belief, Attitude, Intention and Behavior: An Introduction to Theory and Research*. Reading, MA: Addison-Wesley.

57. Free, C, Phillips, G, Watson, L, Galli, L, Felix L et al. 2013. *The Effectiveness of Mobile-Health Technologies to Improve Health Care Service Delivery Processes: A Systematic Review and Meta-Analysis.* PLoS Med 10(1): e1001363.

doi:10.1371/journal.pmed.1001363

58. Gagnon, MP, Légaré, F, Labrecque, M, Fémont, P, Pluye, P, Gagnon, J, Car, J, Pagliari, C, Desmartis, T & Gravel, K. 2009*. Interventions for promoting information communication technologies adoption in healthcare professionals(review).* The Cocharane collaboration. John Wiley and sons, ltd.

59. Gagnon,MP, Ouimet,M, Godin,G, Rousseau,M, Labrecque,M, Leduc,Y & Abdeljelil,AB. 2010. *Multi-level analysis of electronic health record adoption by health care professionals: A study protocol.* Implementation Science. Biomed Central Ltd.

60. Gans, D, Kralewski,J, Hammons, T & Dowd, B. 2005*. Medical Groups' Adoption Of Electronic Health Records And Information Systems.* Health Affairs, 24, no.5 (2005):1323-1333.

61. Garg, AX, Adhikari, NK, McDonald, H, Rosas-Arellano, MP, Devereaux, PJ, Beyene, J, Sam ,J & Haynes RB. 2005. *Effects of computerized clinical decision support systems on practitioner performance and patient outcomes: a systematic review.* JAMA. 9;293(10):1223-38.

62. George, D & Mallery, P. 2003. *SPSS for windows step by step: A sample Guide & reference*.Boston; Allyn & Bacon.

63. Georgiou, A, Ampt, A, Creswick, N, Westbrook, JI & Braithwaite,J. *Computerized Provider Order Entry: What are health professionals concerned about? A qualitative study in an Australian hospital. International* Journal of Medical Informatics, 2009. 78(1): p. 60-70.

64. Gerber,T, Olazabal,V, Brown, K & Pablos-Mendez, A. 2010. *An Agenda For Action On Global E-Health.* Health Affairs, 29, no.2:233-236

65. Greenhalgh, T, Robert, G, MacFarlane, F,Bate, P & Kyriakidou, O. (2004). *Diffusion of innovations in service organizations: Systematic review and recommendations.* The

Milbank Quarterly, 82(4), 581-629.

66. Gund, A,Lindecrantz, K , Schaufelberger, M,Patel, H & Sjöqvist,BA. 2012. *Attitudes among healthcare professionals towards ICT and home follow-up in chronic heart failure care*. BMC Medical Informatics and Decision Making , 12:138

67. Guyatt, G, Rennie, D, Meade, MO & Cook, DJ. 2008.Users Guide to the Medical Litrature.Amanual of Evidence Based Practices. 2nd Edition. The McGraw-Hill Companies

68. Hackl, WA, Hoerbst, A & Ammenwerth, E. 2009. *The electronic health record in Austria: physicians' acceptance is influenced by negative emotions.* Studies in Health Technology & Informatics. 150: p. 140-4.

69. Hammond, WE, Bailey, C, Boucher P, Spohr, M & Whitaker, P. 2010*. Connecting Information to Improve Health*. Health Aff February 2010 29:284-288.

70. Heeks, R. 2002. *Information systems and developing countries: failure, success, and local improvisations.* Information Society. 18 (2):101–12.

71. Hellström,l, Waern ,K, Montelius,E, Åstrand,B, Rydberg, T & Petersson,G. 2009. *Physicians' attitudes towards ePrescribing--evaluation of a Swedish full-scale implementation.* BMC Medical Informatics & Decision Making, 9: p. 37.

72. Hing, E & Hsiao, CJ. 2007. *Electronic medical record use by office-based physicians and their practices:* United States, Natl Health Stat Report. 2010 Mar 31;(23):1-11.

73. Hollingworth, W, Devine, EB, Hansen, RN, Lawless, NM, Comstock, BA, Wilson-Norton JL, Tharp, KL & Sullivan SD. 2007. *The Impact of e-Prescribing on Prescriber and Staff Time in Ambulatory Care Clinics: A Time Motion Study.* J Am Med Informatics Association, 14:722-730.

74. Houser, J. 2012. *Nursing Research. Reading, Using, and Creating Evidence. Jones and*

Bartlett Learning International. United states of America

75. Houser, SH & Weech-Maldonado,R. 2011. The Impact of Geography on Hospital Electronic Health Records Implementation in Alabama. Implications for Meaningful Use. Applied Clinical Informatics.p270.

76. Hsiao,CJ, Hing, E, Socey, TC & Cai, B. 2011. *Electronic health record systems and intent to apply for meaningful use incentives among office-based physician practices: United States, 2001-2011.* NCHS Data Brief. 2011 Nov;(79):1-8.

77. Hsu,J,Huang, J, Fung, V, Robertson, N, Jimison, H & Frankel, R. 2005. *Health information technology and physician-patient interactions: Impact of computers on communication during outpatient primary care visits.* Journal of the American Medical Informatics Association, 12(4), 474-480.

78. Impact. 2012. *Global Health News & Commentary: Ethiopia's mHealth Framework* http://blog.psiimpact.com/2012/04/ethiopias-mhealth-framework/ (accessed 29 April 2014).

79. ITU. 2011. http://www.itu.int/ITU-D/ict/facts/2011/index.html (accessed 29 April 2014).

80. Jamoom, E, Beatty, P, Bercovitz, A, Woodwell, D, Palso, K & Rechtsteiner E. 2012 *Physician Adoption of Electronic Health Record Systems: United States. NCHS Data Brief. No. 98*. Centers for Disease Control and Prevention. National Center for Health Statistics (NCHS).

81. Jha, AK, DesRoches, CM, Campbell, EG, Donelan,K,Rao,SR, Ferris,TG, Shields A, Rosenbaum, S & Blumenthal, D. 2009. *Use of Electronic Health Records in U.S. Hospitals.* N Engl J Med; 360:1628-38.

82. Jha, AK, Bates, DW, Jenter, C, Orav, EJ, Zheng, J, Cleary, P & Simon SR. 2009. *Electronic health records: use, barriers and satisfaction among physicians who care for*

black and Hispanic patients. J Eval Clin Pract. 15(1):158-63

83. Joos, D, Chen, Q, Jirjis, J & Johnson. KB. 2005 .2005. *An Electronic Medical Record in Primary Care: Impact on Satisfaction, Work Efficiency and Clinic Processes.* AMIA 2006 Symposium Proceedings.

84. Kirigia, JM, Seddoh, A, Gatwiri,D, Muthuri, LH & Seddoh, J. 2005*. E-health: Determinants, opportunities, challenges and the way forward for countries in the WHO African Region.* BMC Public Health, 5:137

85. Joubert, G & Ehrlich, R (eds). 2007. Epidemiology. *A research manual for South Africa.* 2nd edition. Cape Town,SA. Oxford University Press,77-93

86. Jung, ML & Loria, K. 2010. *Acceptance of Swedish e-health services:case report.* Journal of Multidisciplinary Healthcare:3 55–63.

87. Kaplan, B & Harris-Salamone, KD. 2009. *Health IT Success and Failure: Recommendations from Literature and an AMIA Workshop.* Journal of American Medical Informatics Association. 16(3): 291 - 299

88. Kawamoto, K, Houlihan,CA, Balas,EA & Lobach, DF. 2005. *Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success.* BMJ ;330:765.

89. Kemper, AR, Uren, RL & Clark, SJ. 2006. *Adoption of Electronic Health Records in Primary Care Pediatric Practices.* PEDIATRICS Volume 118, Number 1.

90. Khoja, S, Durrani, H, Nayani, P & Fahim, A. 2012. *Scope of Policy Issues in eHealth: Results From a Structured Literature Review*. Journal of Medical Internet Research. 14(1).

91. Koppel, R, Metlay, JP, Cohen, A, Abaluck, B, Localio, AR, Kimmel, SE et al. *Role of Computerized Physician Order Entry Systems in Facilitating Medication Errors.* JAMA

2005;293:1197–1203.

92. Kossman, SP & Scheidenhelm, SL. 2008. *Nurses' perceptions of the impact of electronic health records on work and patient outcomes.* CIN: Computers, Informatics, Nursing. 26(2): p. 69-77.

93. Lai, TYY, Leung, GM, Wong, IOL & Johnston, J.M. 2004. *Do doctors act on their self-reported intention to computerize? A follow up of population-based survey in Honk Kong.* International Journal of Medical Informatics. 73, 415-431

94. Leonard, KJ. 2004. *Critical success factors relating to healthcare adoption of new technology. A guide to increase the likelihood of successful implementation* Journal of Medical Systems.

95. Lewis, T, Christina, S, Lagomarsino, G & Schweitzer J. 2012. *E-health in low- and middle-income countries: findings from the Center for Health Market Innovations.* Bull World Health Organ 2012 May;90(5):332-40

96. Lin, C, Lin, IC & Roan, J. 2012. *Barriers to physicians' adoption of healthcare information technology: an empirical study on multiple hospitals.* J Med Syst,36(3):1965-77

97. Linder, JA, Schnipper, JL, Tsurikova, R, Melnikas, AJ, Volk, LA & Middleton, B 2006. Barriers to Electronic Health Record Use during Patient Visits. Proc AMIA Symp, :499-503.

98. Lo, HG, Newmark, LP, Yoon, C, Volk, LA, Carlson, VL, Kittler, AF, Lippincott ,M, Wang, T & Bates, DW 2007 *Electronic Health Records in Specialty Care: A Time-Motion Study.* J Am Med Inform Assoc, 14:609-615.

99. Loomis, GA, Ries, JS, Saywell, RM JR & Thakker, NR. 2002. *If electronic medical records are so great, why aren't family physicians using them?* Journal of Family

Practice, 51, 636–41.

100. Lorenzi, NM, Kouroubali, A, Detmer, DE & Bloomrosen, M. 2008. *How to successfully select and implement electronic health records (EHR) in small ambulatory practice settings.* BMC Med Inform Decis Mak. 2009; 9: 15.

101. Ludwick, DA & Doucette, J. 2009. *Primary Care Physicians' Experience with Electronic Medical Records: Barriers to Implementation in a Fee-for- Service Environment.* International Journal of Telemedicine and Applications.

102. Mair,FS, May,C, O'Donnell,C, Finch,T, Sullivan, F & Murray, E. 2012. *Factors that promote or inhibit the implementation of e-health systems: an explanatory systematic review.* Bulletin of the World Health Organization 2012; 90:357-364.

103. McCullough, JS., Casey, M, Moscovice, I & Prasad, S. 2010. *The Effect of Health Information Technology On Quality In U.S.* Hospitals. *Health Affairs*, 29, no.4:647-654.

104. McGinn, CA, Grenier, S,Duplantie,J, Shaw,N, Sicotte,C,Mathieu,L, Leduc,Y, Légaré, F, & Gagnon, MP. 2011. *Comparison of user groups' perspectives of barriers and facilitators to implementing electronic health records: a systematic review.* BMC Medicine , 9:46

105. McManus, J & Wood-Harper, T. 2007. *Understanding the sources of information systems project failure. Manag Serv* (Autumn): 38–43.

106. Mea, VD. 2001. *What is eHealth (2): The death of telemedicine*. J Med Internet Res 2001;3(2):e22

107. Menachemi, N, Perkins, R, Durme, DJV & Brooks, RG. 2006. *Examining the adoption of electronic health records and personal digital assistants by family physicians in Florida.* Informatics in Primary Care 2006;14:1–9

108. Menachemi, N, Powers, TL & Brooks RG. 2009. T*he role of information technology usage in physician practice satisfaction.* Health Care Manage Rev. 34(4):364-71

109. Menachemi, N, Langley, A & Brooks, RG. 2007. *The use of information technologies among rural and urban physicians in Florida.* Journal of Medical Systems. 31(6): p. 483-8.

110. Merriam-Webster Online: Dictionary and Thesaurus www.merriam-webster.com/dictionary/ (accessed 12 November 2013).

111. Miller, RH & Sim, I. 2004. *Physicians' Use of Electronic Medical Records: Barriers and Solutions.* Health Affairs , 23(2):116-126.

112. Milstein, JA, Green,CE & Bates, DW. 2013. *A Survey Analysis Suggests That Electronic Health Records Will Yield Revenue Gains For Some Practices And Losses For Many.* Health Aff March 2013 vol. 32 no. 3 562-570.

113. Moffat, MO, Moffat, KJ & Cano, V. 2001. *General practitioners and the Internet—a questionnaire survey of Internet connectivity and use in Lothian.* Health Bulletin (Edinburgh), 59, 120–6.

114. Moody,LE, Slocumb, E, Berg, B & Jackson, D. 2004. *Electronic records documentation in nursing.* Computers, Informatics, Nursing: CIN 22, 337–44.

115. NEPAD. 2010. NEPAD e-Africa Programme. http://www.nepad.org/regionalintegrationandinfrastructure/infrastructure/ict (accessed 18 January 2013).

116. Nebeker, JR, Hoffman, JM, Weir, CR, Bennett, CL and Hurdle, JF. *High Rates of Adverse Drug Events in a Highly Computerized Hospital*. Arch Intern Med 2005;165:1111 1116.

117. Neter, E, Brainin, E. 2010. eHealth Literacy: *Extending the Digital Divide to the Realm*

of Health Information. J Med Internet Res 2012;14(1):e19

118. New health investments in the 2010–11 Budget. http://www.budget.gov.au.

119. Norman, G. 2010. *Likert scales, levels of measurement and the "laws" of statistics*. Adv Health Sci Educ Theory Pract;15(5):625-32. doi: 10.1007/s10459-010-9222-y. Epub.

120. NCHS Data Brief. 2011. *Physician Adoption of Electronic Health Record Systems: United States.* Number 98, July 2012.

121. Oh, H, Rizo, C, Enkin, M & Jadad, A. *What is eHealth?: a systematic review of published definitions.* World Hosp Health Serv. 2005;41(1):32-40.

122. Open Clinical. 2001. *Knowledge Management for Medical Care* http://www.openclinical.org/ (accessed 27 April 2014).

123. Pagliari, C, Sloan, D Gregor, P, Sullivan, F, Detmer, D , Kahan, JP, Oortwijn, W & Steve MacGillivray, S. 2005. *What is eHealth (4): A Scoping Exercise to Map the Field.* J Med Internet Res 2005;7(1):e9.

124. PAHO/WHO 2013 http://www.paho.org/ict4health/ (accessed 06 November 2013).

125. Patel, V, Jamoom, E, Hsiao, CJ, Furukawa, MF & Buntin M. 2013. Variation in electronic health record adoption and readiness for meaningful use: 2008-2011. J Gen Intern Med. 2013 Jul;28(7):957-64.

126. Piette, JD, Lun, KC, Moura ,LA, Fraser, HSF, Mechael, PN, Powell, J & Khoj, SR. 2012. *Impacts of e-health on the outcomes of care in low- and middle-income countries: where do we go from here?* Bull World Health Organ 2012 May;90(5):365-72

127. Polit, DF & Beck, CT (ed). 2008. *Nursing Research: Generating and assessing Evidence for nursing practices.* 8th edition. New Delhi, India. Wolters kluwer pvt.ltd, 272-278.

128. Pizziferri, L, Kittler, AF, Volk, LA, Honour, MM, Gupta, S, Wang, S, Wang, T, Lippincott, M, Li, Q & Bates, DW. 2005. *Primary Care Physician Time Utilization Before and After Implementation of an Electronic Health Record: A time-motion Study*. Journal of Biomedical Informatics, 38(3):176-188.

129. Poissant, L, Pereira,J, Tamblyn, R & Kawasumi, Y. 2005. *The Impact of Electronic Health Records on Time Efficiency of Physicians and Nurses: A Systematic Review.* Journal of the American Medical Informatics Association Volume 12 Number 5

130. Poon, EG, Jha,AK, Christino,MM, Honour,MM, Fernandopulle,R, Middleton,B,Newhouse,J, Leape,L, Bates,DW, Blumenthal,D & Kausha, R. 2006. *Assessing the level of healthcare information technology adoption in the United States: a snapshot.* BMC Medical Informatics & Decision Making, 6: p. 1.

131. Porteous, T, Bond, C, Robertson, R, Hannaford, P & Rieter, E. 2003. *Electronic transfer of prescription-related information: comparing views of patients, general practitioners, and pharmacists.* British Journal of General Practice, 53, 204–9.

132. Pynoo, B, Devolder, P, Duyck, W, vanBraak, J, Sijnave, B & Duyck, P. 2012. *Do hospital physicians' attitudes change during PACS implementation? A cross-sectional acceptance study.* Int J Med Inform 81(2):88-97

133. Pyper, C, Amery, J, Watson, M & Crook C. 2004. *Patients' experiences when accessing their on-line electronic patient records in primary care.* Br J Gen Pract 2004, 54:38-43.

134. Rahimi, B,Timpka, T, Vimarlund,V, Uppugunduri. S & Svensson, M. 2009. *Organization-wide adoption of computerized provider order entry systems: a study based on diffusion of innovations theory.* BMC Medical Informatics and Decision Making 2009, 9:52.

135. Rao, SR, DesRoches, CM, Donelan, K,Campbell, EG, Miralles, PD & Jha, AK. 2011. Electronic health records in small physician practices: availability, use, and perceived benefits. JAMIA;18:271–5

136. Rockefeller Foundation. 2007. *Making the ehealth Connection, Sign on signatories* http://www.ehealth-connection.org/ . New York (NY).

137. Rogers, EM (ed). 2003. *Diffusion of Innovations*, 5th Edition. New York:A Division of Simon and Schuster,inc.

138. Rousseau, N, McColl, E, Newton, J, Grimshaw, J & Eccles, M. *Practice based, longitudinal, qualitative interview study of computerised evidence based guidelines in primary care*. BMJ. 2003 Feb 8;326(7384):314

139. Saleem, JJ, Patterson, ES, Militello, L, Render, ML, Orshansky, G & Asch SM. 2005. *Exploring Barriers and Facilitators to the Use of Computerized Clinical Reminders.J Am Med Inform* Assoc 12:438-447. PubMed Abstract | Publisher Full Text | PubMed Central Full Text OpenURL.

140. Scott, JT, Rundall, TG, Vogt, TM & Hsu, J. 2005. *Kaiser Permanente experience of implementing electronic medical record: a qualitative study*. BMJ Volume 331.

141. Scott, RE, Chowdhury, MF & Varghese, S. 2002. *Telehealth policy: looking for global complementarity. J Telemed Telecare* ;8 Suppl 3:S3:55–7.

142. SearchCIO. 2005. *ICT (information and communications technology - or technologies)*. http://searchcio-midmarket.techtarget.com/definition/ICT (accessed 12 November 2013).

143. Shiferaw,F & Zolfo,M. 2012. *The role of information communication technology (ICT) towards universal health coverage: the first steps of a telemedicine project in Ethiopia.* Global Health Action, Vol 5 (2012).

144. Simon, SR, Kaushal, R, Cleary, PD ,Chelsea, AJ, Volk, AL,Poon, EG,Orav, J,Helen, GL, Williams, DH & Bates, DW. *Correlates of Electronic Health Record Adoption in Office Practices: A Statewide Survey.* J Am Med Inform Assoc.

145. SidorovIt, J. 2006. *Ain't Necessarily So: The Electronic Health Record And The Unlikely Prospect Of Reducing Health Care Costs.* Health Aff July 2006 vol. 25 no. 41079-1085.

146. Silber, D. 2004.The case for eHealth. http://www.eipa.eu/UserFiles/File/Free%20Publications/2003_E_01.pdf (accessed 27 April 2014).

147. Simon, SR, Kaushal, R, Cleary, PD, Jenter, CA, Volk, LA, Orav, EJ, Burdick, E, Poon EG & Bates DW. 2007. *Physicians and electronic health records: a statewide survey.* Arch Intern Med. 12;167(5):507-12.

148. Singh, R,Lichter, MI, Danzo, A, Taylor, J & Rosenthal, T. 2011.*The Adoption and Use of Health Information Technology in Rural Areas: Results of a National Survey.* The Journal of Rural Health 28 (2012) 16–27.

149. Smith, S, Bukirwa, H, Mukasa, O, Snell, P, Adeh- Nsoh, S & Mbuyita, S. 2007. *Access to electronic health knowledge in five countries in Africa: a descriptive study.* BMC Health Services Research 2007, 7:72.

150. Software Advice. 2013. *History of Electronic Health Records (EHR)* | *A Timeline of EMR History* .http://blog.softwareadvice.com/articles/medical/ehr-timeline-113/ (accessed 04 May 2014).

151. Steven, R, Simon, SR, Kaushal, R, Paul, D. Chelsea , A et al. 2007. *Correlates of electronic health record adoption in office practices: a statewide survey.* Journal of the American Medical Informatics Association.. 14(1): p. 110-7.

152. Sykes, TA, Venkatesh, V & Rai, A. 2010. *Explaining physicians' use of EMR systems and performance in the shakedown phase.* J Am Med Inform Assoc 2011;18:125e130.

153. Tavakol,M & Dennick,R. 2011. *Making sense of Cronbach's alpha*. International Journal of Medical Education. 2011; 2:53-55 Editorial ISSN: 2042-6372.

154. The Economist. 2013. *Why does Kenya lead the world in mobile money?* http://www.economist.com/blogs/economist-explains/2013/05/economist-explains-18 (accessed 29 April 2014).

155. Thomsett, Rob. 2002. *Radical Project Management.* Prentice Hall, NJ, USA.

156. Tiresias. 2009. *Making ICT accessible.* http://www.tiresias.org/accessible_ict/what.htm (accessed 12 November 2013).

157. UNDP. 2004. *Technical Paper. ICT and Human Development: Towards Building a Composite Index for Asia Realising the Millennium Development Goals.* ELSEVIER A Division of Reed Elsevier India Pvt. Ltd.

158. UNDP. 2008. *Mozambique. National Human Development report. The role of Information Technologies in achieving the millennium Development Goals.*

159. Varkenvisser,CM, Pathmanathan, I & Brownlee, A.2003. Designing and Conducting Health Systems Research Projects. WHO1 20-12-2003

160. Venkatesh V, Morris, MG, Davis ,GB & Davis, FD: *User acceptance of information technology: Toward a unified view.* MIS Quarterly 2003, 27:425-478.

161. Venkatesh, V. 1999. *Creation of favourable user perceptions: exploring the role of intrinsic motivation.* MIS Quarterly.; 23(2):239–260.

162. Villanueva, F, Hardy, M, Torrent, J & Ficapal, P. 2010. *The integration of Information and communication Technology in to medical practice. International.* journal of Medical informatics 79. 478-491.

163. Vishwanath, A & Scamurra ,SD. 2007. *Barriers to the Adoption of Electronic Health Records: Using Concept Mapping to Develop a Comprehensive Empirical Model.* Health Informatics Journal 13(2):119-134.

164. Wager, KA, Ward, DM, Lee, FW, White, AW, Davis, KS & Clancy, DE. 2005. *Physicians, patients and EHRs.* Journal of the American Health Information Management Association, 76(4), 38-41.

165. Walter, Z & Lopez, MS. 2008. *Physician Acceptance of Information Technologies: Role of Perceived Threat to Professional Autonomy.* Decision Support Systems , 46(1):206-215.

166. Ward, R, Stevens, C, Brentnall, P & Briddon J. 2008. *The attitudes of health care staff to information technology: a comprehensive review of the research literature.* Health Info Libr J , 25:81-97.

167. Westbrook,JI, Braithwaite,J, Gibson,K, Paoloni, R, Callen,J, Georgiou,A, Creswick,N & Robertson,L. 2009. *Use of information and communication technologies to support effective work practice innovation in the health sector: a multi-site study*. BMC Health Service Research, 9:201.

168. Wiegers, KE (ed). 2005. *Software Process Improvement Handbook: A Practical Guide.* OR, USA: Process Impact, Inc.

169. Wikipedia.http://en.wikipedia.org/ (accessed 12 November 2013).

170. Wong, R & Bradley EH. 2009. *Developing patient registration and medical records management system in Ethiopia.* Int J Qual Health Care.(4):253-8.

171. World Economic Forum. 2012. *The Global Information Technology Report. Living in a hyperconnected World.* http://www3.weforum.org/docs/Global_IT_Report_2012.pdf (accessed 27 April 2014).

172. World Health Organization. 1997. *Health-for-all policy in the 21st century.* Geneva.

173. World Health Organization. 2000. *The world health report 2000 - Health systems: improving performance*.

174. World Health Organization. 2006. *Global observatory for eHealth. Building foundation for eHealth.*

175. *World Health Organization. 2009. The second global survey on eHealth. Global Observatory for eHealth*

176. World Health Organization. 2010. *TELEMEDICINE Opportunities and developments in Member States Report on the second global survey on eHealth Global Observatory for eHealth series* - Volume 2

177. World Health Organization.2011. *Atlas eHealth country profiles: based on the findings of the second global survey on eHealth.* Global Observatory for eHealth Series, 1.

178. World Health organization 2012. *Management of patient information Trends and challenges in Member States Global Observatory for eHealth series - Volume 6*

179. Wynia, MK,Torres G.W & Lemieux J. 2010. *Many Physicians Are Willing To Use Patients' Electronic Personal Health Records, But Doctors Differ By Location, Gender, And Practice.* Health Aff February 2011 vol. 30 no. 2 266-273

180. Xierali,IM, Phillips,RL, Green, LA, Bazemore, AW & Puffer, JC. 2013. *Factors Influencing Family Physician Adoption of Electronic Health Records (EHRs).* J Am Board Fam Med 2013;26:388 –393.

181. Yen, K, Shane, EL, Pawar, SS, Schwendel, ND, Zimmanck, RJ & Gorelick MH. 2009. *Time Motion Study in a Paediatric Emergency Department Before and After Computer Physician Order Entry.* Annals of Emergency Medicine Volume 53, Issue 4.

ANNEXURE I. UNISA ETHICAL CLEARANCE

UNISA university of south africa

UNIVERSITY OF SOUTH AFRICA
Health Studies Higher Degrees Committee
College of Human Sciences
ETHICAL CLEARANCE CERTIFICATE

HSHDC/27/2012

Date of meeting: 14 March 2012 Student No: 4262-151-8

Project Title: The challenges of using information communication technologies in the health care systems in Ethiopia from provider's perspectives.

Researcher: Dejene Kebede Challa

Degree: Masters in Public Health Code: MPCHS94

Supervisor: Prof T Mgutshini
Qualification: PhD
Joint Supervisor: -

DECISION OF COMMITTEE

Approved [√] **Conditionally Approved** [ ]

Prof E Potgieter
CHAIRPERSON: HEALTH STUDIES HIGHER DEGREES COMMITTEE

Dr MM Moleki
ACTING ACADEMIC CHAIRPERSON: DEPARTMENT OF HEALTH STUDIES

PLEASE QUOTE THE PROJECT NUMBER IN ALL ENQUIRES

ANNEXURE II. LETTER OF APPLICATION FOR ETHICAL CLEARANCE FROM ADDIS ABABA HEALTH BUREAU.

TO: ADDIS ABABA REGIONAL HEALTH BUREAU

P.o. Box 30738
Addis Ababa

04 June 2012

Subject:Ethical clearance to carry out a research for academic purposes

Dear Sir/Madam

I am currently planning to conduct a study on a research entitled "THE CHALEGES OF USING INFORMATION COMMUNICATION TECHNOLOGIES IN HEALTHCARE SYSTEMS IN ETHIOPIA FROM PROVIDERS' PERSPECTIVES." The research is conducted as part of partial fulfilment for the award of the degree of MPH DEPARTMENT OF HEALTH STUDIES at the UNIVERSITY OF SOUTH AFRICA.

I would, therefore, kindly request your good office to provide me with permission to carry out my research in the following hospitals under your Authority.

1. Gandhi
2. Minilik
3. Ras-Desta
4. Yekatit
5. Zewditu
6. Tezenea
7. Betezata
8. Hayat
9. Korea
10. Landmark

A have attached the Ethical clearance from the university and a 17-page proposal for your reference.

Thank you in Advance for your support

Sincerely,

Dejene Kebede

ANNEXURE III. ETHICAL CLEARANCE FROM ADDIS ABABA HEALTH BUREAU

Reference AAHB/9233/227
Date June, 20, 2012

Gandhi
Minilik
Ras-Desta
Yekatit
Zewditu
Tezenea
Betezata
Hayat
Korea
Landmark

Subject: Permission for conducting research in your Hospital

This letter is to support Dejene Kebede in his research titled as THE CHALEGES OF USING INFORMATION COMMUNICATION TECHNOLOGIES IN HEALTHCARE SYSTEMS IN ETHIOPIA FROM PROVIDERS' PERSPECTIVES. Study proposal was duly reviewd and approved by the Ethical Committee of Addis Ababa Regional Health Bureau, and the principal investigator is informed with the copy of this letter to report any change in the study procedure and submit an activity report to the Ethical committee as required.

Therefore, we request you to provide your support during his reaserch

With regard

CC

Dejene Kebede
Addis Ababa
Ethical Clearnce Committee
Health Bureau

ANNEXURE IV. LETTER SEEKING CONSENT FROM RESPONDENTS

UNIVERSITY OF SOUTH AFRICA
DEPARTMENT OF HEALTH STUDIES
RESEARCH CONSENT FORM

Number:_____ Name of Hospital:_____

Dear Hospital staff

My name is Dejene Kebede. I am conducting a research on health care providers regarding the implementation of Information Communication Technologies (ICT) in health care services. The research would help identify the challenges that could be faced during the adoption and the implementation of ICT in the health care services in Ethiopia. Furthermore, the findings will be used to assist the current ICT initiatives and/or to design future ICT projects in Ethiopia. Your opinion experience and comments are very useful in this regard. You are kindly requested to give accurate view of your experience and perception pertaining to implementation of ICT in the health care services in Ethiopia.

Your name was selected at random form list other health care providers in the hospital. The questionnaire is completely anonymous. Therefore, you are not requested to put your name on it or identify yourself in anyway. I hope that you will feel free and comfortable to give your honest opinion. If you do not feel comfortable to answer any particular question, please fill free to ask for clarification.

The participation in the study is completely voluntary. It will take nearly 15 minutes to complete the form. I understand the tight and busy work schedule you have for assisting people. Therefore, you can fill the form any time that is convenient and return it at the end of the day or on the next day. Should you have a tighter schedule, I am still flexible to collect the completed for at your earliest convenience.

Thank you in advance for you cooperation and precious time.

Participant signature or thumb print _____ Date_____

Data collector name _____ Signature _____Date _____

Supervisor Dejene kebede Mobile +251 911 407350 Email: kebededejene@gmail.com

ANNEXURE V. QUESTIONNAIRES

The Challenges of Using Information communication Technologies (ICTs) in the health care systems in ETHIOPIA FROM provider's perspectives.

Participant/respondent

1.1	Name of the Hospital	
1.2	Location of the hospital	

2.1	When were you born? (EC)	19 ____ ____		1
2.2	Sex	M☐	F☐	2

3.1	What year was your medical school completed?		19 ____ ____	1
3.2	Where were you last taught medicine?	Ethiopia ☐	Foreign ☐	2

4.1	When did you join this hospital?	19 ____ ____	1
4.2	What is your employment type?	Full-time ☐	1
		Part-time ☐	2
		Temporary assignment ☐	3
		_____(Specify)Others ☐	4
4.3	Other than this hospital, what types of health facility are you currently practicing?	Public ☐	1
		Private ☐	2
		Charity ☐	3
		_____(Specify)Others ☐	4

5.1	What is your profession?	Doctor ☐	1
		Health officer ☐	2
		Nurse☐	3
		_____Specify)Others☐	4
5.2	What is your area of specialization?		1
5.3	What other activities do you undertake besides patient care in this hospital?	Teaching ☐	1
		Management/Administration ☐	2
		Research ☐	3
		Professional development ☐	4
		Work in another health facility ☐	5
		_____Specify)Others☐	6

6.1	What is your clinical unit in the hospital?	General OPD ☐	1
		Specialized OPD ☐	
		Inpatient ☐	2
		Operation theatre (General surgery) ☐	3
		Operation theatre (Obstetrics) ☐	
		Labor ward ☐	4
		Maternal health (ANC,PNC)☐	5
		Intensive care unit ☐	6
		Physical rehabilitation unit ☐	7
		HIV clinic ☐	8
		Diagnostic units (CT-scan, MRI, etc.)☐	9
		_____Specify)Others☐	10

7.1	Do you have access to	Yes ☐	No ☐	4

	internet in this hospital?		
7.2	How frequently do you access internet?	Every day ☐	1
		At least three times in a week ☐	2
		Once in a week ☐	3
		Two or three times in a month ☐	4
		Once or less than once in a month ☐	5
7.3	For what purpose do you frequently access internet?	professional academic journals ☐	1
		Clinical practice databases and web pages ☐	2
		International news ☐	3
		Interaction with patients ☐	4
		Email/social medias different from clinical practice ☐	5
		_____Specify)Others ☐	6

Please read the following and mark whether you have 1) Heard about them or 2) Used them or 3) Neither heard or used them.

		Heard about it	Used it	Not heard or used
8.1	Electronic patient record system	☐	☐	☐
8.2	Electronic order communication system for laboratory exams	☐	☐	☐
8.3	Electronic system to send and receive referral letters	☐	☐	☐
8.4	Decision Support System (DSS)	☐	☐	☐
8.5	Telemedicine	☐	☐	☐
8.6	ePrescription	☐	☐	☐
8.7	eAppointment system	☐	☐	☐
8.8	Picture Archiving and Communication System (PACS)	☐	☐	☐
8.9	Tele-monitoring of outpatients at home	☐	☐	☐
8.10	Videoconferencing for consultation	☐	☐	☐

Please read the following statements concerning the possible positive impacts that the use of eHealth system may have in your practice. Please mark in the respective boxes based on your agreement boxes as strongly agree, somewhat agree, somewhat disagree or strongly disagree with each of them

		Strongly agree	Some what agree	Some what disagree	Strongly disagree	Do not know
9.1	Medical errors reduce	☐	☐	☐	☐	☐
9.2	The quality of diagnosis improves	☐	☐	☐	☐	☐
9.3	The quality of treatment improves	☐	☐	☐	☐	☐
9.4	Medical staff work efficiently	☐	☐	☐	☐	☐
9.5	Patient information is easily accessed	☐	☐	☐	☐	☐
9.6	Medical cost reduces	☐	☐	☐	☐	☐
9.7	Interaction with health care team improves	☐	☐	☐	☐	☐
9.8	Access to up-dated medical information improves	☐	☐	☐	☐	☐
9.9	Access to qualified care improves	☐	☐	☐	☐	☐
9.10	The quality of service improves	☐	☐	☐	☐	☐
9.11	Patient satisfaction improves	☐	☐	☐	☐	☐
9.12	Communication with patients improve	☐	☐	☐	☐	☐

Please read the following statements concerning the possible negative impacts that the use of eHealth system may have in your practice. Please mark in the respective boxes based on your agreement boxes as strongly agree, somewhat agree, somewhat disagree or strongly disagree with each of them

10.1		Strongly agree	Some what agree	Some what disagree	Strongly disagree	Do not know
10.2	Computers use is inconvenient	☐	☐	☐	☐	☐
10.3	Computers use increases work load	☐	☐	☐	☐	☐
10.4	Computer us reduces patient-providers interaction	☐	☐	☐	☐	☐
10.5	Computers use is time-consuming	☐	☐	☐	☐	☐
10.6	Health workers should use computers during patient consultations and care	☐	☐	☐	☐	☐

Please read the following . Mark how the of possible barriers for the implementation of the common eHealth system in your practice. Please mark in the respective boxes based on your agreement boxes as strongly agree, somewhat agree, somewhat disagree or strongly disagree with each of them.

		Strongly agree	Some what agree	Some what disagree	Strongly disagree	Do not know
11.1	Poor ICT infrastructure	☐	☐	☐	☐	☐
11.2	Inconvenient data entry	☐	☐	☐	☐	☐
11.3	Poor portability of ICT devices	☐	☐	☐	☐	☐
11.4	Poor connectivity	☐	☐	☐	☐	☐
11.5	Financial limitations	☐	☐	☐	☐	☐
11.6	Low acceptability by health staff	☐	☐	☐	☐	☐
11.7	Reduced security of medical records.	☐	☐	☐	☐	☐
11.8	Lack of skill on computers use	☐	☐	☐	☐	☐
11.9	Lack of management interest	☐	☐	☐	☐	☐
11.10	Lack of experts to provide IT support	☐	☐	☐	☐	☐

		Strongly agree	Some what agree	Some what disagree	Strongly disagree	Do not know
12.1	The use of computers should be included in the medical training	☐	☐	☐	☐	☐
12.2	Health care providers could benefit from ICT.	☐	☐	☐	☐	☐

13.1	How long do you think will continue to work in this hospital.	Less than one year ☐
		One year ☐
		Two years ☐
		Three years ☐
		More than three years ☐

		Strongly agree	Some what agree	Some what disagree	Strongly disagree	Do not know
13.3	I am generally satisfied with my job.	☐	☐	☐	☐	☐