FACTORS ASSOCIATED WITH THE IMPLEMENTATION AND ADOPTION OF ELECTRONIC HEALTH RECORDS (EHRs) IN SAUDI ARABIA

By

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A Dissertation Submitted to

Rutgers, the State University of New Jersey

Rutgers Biomedical and Health Sciences

School of Health Related Professions

In Partial Fulfillment of the Requirements

For the Degree of

Doctor of Philosophy

Department of Health Informatics

June, 2015

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On

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ABSTRACT

FACTORS ASSOCIATED WITH THE IMPLEMENTATION AND ADOPTION OF ELECTRONIC HEALTH RECORDS (EHRs) IN SAUDI ARABIA

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The scope of this study was to identify the extent of the relationship between the factors that associated with delay in the universal implementation of electronic healthcare records (EHRs) and how to effect on the quality and efficiency of work and acceptance of implementation EHRs System in Saudi Arabia hospitals. The Proposed research aimed at pinpointing the precise technological issues that affected on the EHRs system implementation in the Kingdom of Saudi Arabia, by focusing on those factors which are recognized to be barriers for such implementations. Using a questionnaire that was distributed to Ten Hospitals and the Directorate of Health Affairs in Saudi Arabia. These hospitals are King Fahad Hospital, Baljurashi Hospital, Aqiq Hospital, Psychiatric Hospital, Mandaq Hospital, Karra Hospital, Rehabilitation Hospital, Mikwah Hospital, Qilwa Hospital, Hajra Hospital, and General Directorate of Health Affairs. This study attempted to identify which barriers actually affect the implementation of EHR systems in Saudi Arabia. For a confidence interval of 5% at the 95% confidence level, 260 surveys needed to be sent out at the largest hospital, King Fahad Hospital, and the total surveyed sent out to all hospitals was 1754. Six groups of health care professionals participated in

this study: physicians, pharmacists, nurses, lab technicians, administration staff, and medical records staff.

Pearson correlation analysis and a t-test test were used on the collected questionnaire data to identify the association factors which are significant barriers to EHRs implementations in Saudi Arabia. Results indicate that there is a relationship between believes that privacy and security concerns were not a significant obstacle, whenever the facility had enough employees to ensure that the implemented EHRs was secure and that maintaining and updating EHRs systems was not too expensive they were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals .also the data show that no statistically significant difference between the belief that EHRs system maintenance as one of the four most important barriers influencing the success of EHRs and the belief that the implementation EHRs would increase the quality and efficiency of work in hospitals, The data also show that Despite that privacy and security concerns were not a significant obstacle and whenever the facility had enough employees to ensure that the implemented EHRs was secure will increase the quality and efficiency of work in hospitals. Also, of the six barriers recognized as being of inhibit to the implementation of EHRs systems, the four most commonly cited to be significant in Saudi Arabia by participants were lack of computer skills, adaptation to new technology, costs of the EHRs system, privacy and security concerns.

ACKNOWLEDGEMENT

First and foremost I would like to praise Almighty ALLAH (GOD) for giving me the strength, and enlightening my life and education to complete this work. “O Lord! Increase me in knowledge.”

Indeed, this Dissertation would not have been possible without guidance of many individuals.

I would like to express my thankfulness and appreciation to my advisor Dr. Syed Haque for his essential, outstanding guidance, support, and encouragement throughout my studying years. It has been great time to work with you. I’m honored to have been your student. Thank you Dr. Syed Haque for your support and kindness.

I would like to express my sincere appreciation to all the staff in the Health Informatics Department and to the committee members Dr. Shankar Srinivasan, Dr. Mittal, Dr. Shibata, and Dr. Frederik for their kindness, supportive, and advices during the dissertation process.

I would like to express my heartfelt gratitude to my beloved parents Saad Alhoraiti, and Saleha Alobzah, for their love and taking care of me throughout my life, for their patience, support , guidance , encouragement , prayers and believing in me during all my studying levels since I started elementary school until the Ph.D. Level. I love you so much and please forgive me to be away from you for long time. God Bless you all!

I would like to express all thanks, grateful to my brother. Dr. Mohammed Alhoraiti Alghamdi (Abu Saad), for his standing behind me all the time and offering me all his power, money, advices, experiences, guiding me to choose this major to have my Ph.D. in it, keeping me connected and updating me in knowledge of Biomedical Informatics gap in

Saudi Arabia and how is it important field to join and work on it. I really love it. Thank you so much for all your support and help.

I would like to express my genuine gratitude to my darling wife Saedah Aifan, for her love, encouragement, support, stand behind me, and been so patience through my life and study period.

Special thanks to my mother-in-law Mother Hassna Daf. Alzharani for her truth love, praying, generosity, and support. I love you so much and please forgive me to be away from you for long time!

I would like to express my thanks and appreciation to my brothers and sisters: Sharifah, Saadiah, Jamman, Abdullah, Saleh, Khaled, Fahad, and Fatimah for their support, love, offering their time to finish everything quite easy. Thanks for All.

To my gorgeous kids Eyad & Khaled, for filling my life with joy by their love, friendship, their spontaneous actions, and their attitudes. I love you. May ALLAH (GOD) bless you!

Special thanks and appreciation to Brother. Abdullah Alhoraiti Alghamdi and his wife Sister. Zahrah Aifan, and his kids Mohammed, Feras, and Waseem, for being so kind, love, and being generous with me all the time.

Special thanks and appreciation to Eng. Ali A. Aifan for his love, support, and help during all my studying period.

Special thanks and appreciation to Major. Turkey Alghamdi and his Wife Fatimah for their love, support and for their hospitality all the time.

Special thanks and appreciation to my sister–in-law Dr. Hanan Aifan and her family brother Osamah Alghamdi, and their kids Mohammed & Ahmed, for their love, support, visits, and helping me at all times.

Special thanks and appreciation to Brothers. Dr. Saleh Aifan, Dr. Saeed Aifan, Eng. Mohammed Aifan, 1st lieutenant. Faris Aifan, and Abdollhammed Aifan, for their love, support, and being proud of me all the time.

Special Thanks and appreciation to my nephew Mr. Abdullah Alobzah for his help and support during the studying period.

My deep thanks and pray to my little nephew who passed away by car accident on 2010: Mohammed S. Alobza, May Allah forgive him and reward him the highest level of the paradise, for his encouragement words when I obtained my Master degree "Congratulations & keep going forward". Oh Allah give him your Mercy! Ameen!

Finally, I would like to express my thankfulness, gratefulness to King Abdullah Al- Saud, May Allah forgive him and reward him the paradise. Ameen! By giving me the chance to study abroad and have great knowledge from one of the most advanced countries in the world the United States of America.

Dedication

I wish to dedicate this dissertation to my beloved father & mother who dedicated their life for me to have the best Knowledge.

Also,

I wish dedicate this dissertation to my darling wife and my sweet kids who dedicated their love and time for me to finish this research.

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CHAPTER I

I. INTRODUCTION

1.1 Background of the Problem

The Electronic Health Record (EHRs) is a system of managing patient information in an interoperable, easily accessible, and highly effective manner. It enables easy retrieval of important health information for patients regardless of their point of treatment. With EHRs, health physicians can access and evaluate the patients' history. With EHRs underpins accurate diagnosis and execution of proper actions to prevent instances of fatal medical errors. EHR (Ash & Bates, 2005; Podichetty & Penn, 2004). EHRs technology comes with a number of advantages that include monitoring and recording of diagnostic information, medical account, and disease symptoms among others. The EHRs system makes the clinician's workflow highly streamlined through automation and increased efficiency since one avoids the difficulty of fumbling through paper medical records that do not provide consistent information on the patients' medical history. The healthcare system monitors, records, and generates precise information about the progress of patients whilst suggesting feasible solutions to recurring or sustained symptoms. (Ash & Bates, 2005). Despite the aforementioned benefits that come with EHRs systems, numerous studies reveal that its implementation in Saudi Arabia is still in its infancy stages. Empirical research shows that even in the wake of rapid technological changes and globalization, the country faces major barriers in the

implementation of EHRs that either hamper or slow down the process (Ash & Bates, 2005; Podichetty & Penn, 2004).

The contemporary world is characterized by globalization that has been significantly heightened by enormous shifts and proliferation of technology, especially in information dissemination through highly interactive communication avenues. Nevertheless, various health industry players such as hospitals and healthcare centers in Saudi Arabia have continued to use outmoded paper medical records whilst its counterparts notably Sweden, the United Kingdom, Netherlands, and Australia have successfully integrated the EHRs systems in over half of its healthcare systems. However, the countries have not reached the interoperability objective of the EHRs that seeks to allow sharing of the patient's information amongst the various stakeholders in healthcare systems. Instead, the systems serve local practices. The United States remains at the forefront of the implementation of EHRs. However, it was not until President Obama's government brought in the Affordable Care Act (2010) that the country started embracing the system and replacing the traditional paper medical records. Numerous studies show that there was a need for the US to reduce and prevent medical errors that accounted for significant patient deaths annually systems (Ash & Bates, 2005; Podichetty & Penn, 2004). Many countries now follow suit to improve efficiency and accuracy in their healthcare systems. Many countries including Saudi Arabia still face challenges in the implementation of the healthcare electronic system. Substantial evidence suggests that paper medical records do not provide reliable and updated information on patients. Health physicians provide medical services based on patient history. In cases where this information is inaccurate and/or inaccessible, chances of medical errors due to improper

prescriptions remain high. This situation can result in adverse patient effects and/or fatalities (Poon et al., 2004). The EHRs provide real-time access to medical account concerning the patients; hence, they provide accurate guidance to health physicians in administering proper medication. Credible evidence from healthcare facilities where the EHRs was successfully implemented revealed that the system allowed multiple users to access patient records with ease as data was properly organized, legible, and complete (Helzner, 2002). In addition, enhanced information access correlated with the improved quality of patient care services. The players also reported reduced medical injuries resulting from medical errors (Wager et al., 2000).

The electronic health records systems in Saudi Arabia are a relatively new concept. The rapid advances in medical technology have created a gap in the ability of hospitals and patient care facilities to maintain and update their systems. The lack of centralized healthcare systems with a predetermined list of standard requirements to protect patient privacy and security issues in addition to the gap in computer literacy within the medical community has caused a delay in its implementation (Angst & Agarwal, 2009).

Patient files have historically been stored in paper-based files from which both patients and doctors have access. The internet and the freedom that it boasts is also intimidating to those who aren't familiar with its use. The culture of Saudi Arabia is such that fear of privacy and the possible unauthorized access to medical records especially among the female population prevent people from embracing this new technology (Angst & Agarwal, 2009).

The area of EHRs is still an emerging technology that is still not being used by all hospitals and patient care facilities globally. Though it is used almost universally in developed countries, countries are still struggling usually lack the financial resources to fund such a venture. Saudi Arabia features characteristics of both developed and developing, as parts of Saudi Arabia are indeed developed and prospering, the technology use of EHRs systems in Saudi Arabia is still in its infancy (Atherley, 2009).

Medical records have always been stored in paper-based files. Complex filing systems have been implemented in hospitals and doctors' offices in order to keep up with the increasing number of patient forms and files. Medical records take up extensive amounts of space, they also take time to organize and update. Tracking patients' medical history with paper-based filing systems is a tedious task. The implementation of electronic health records is an effective way to manage patient medical records. The benefits of utilizing electronic health records include the reduction in filing costs and an increase in the quality of patient care. Managing patient medical records is fast and efficient using electronic health records (Angst & Agarwal, 2009).

The challenges in implementing electronic health records include the risk associated with similar central database systems in which security and privacy is always an issue. Recent breaches in the central databases among large financial institutions has led to further discussion over the level of security required to adequately ensure that personal data remains secure (Hoffman & Podgurski, 2012). Also the security of such databases that contain accurate personal data is the target of hackers and fraudsters who attempt to access and steal personal data for impersonation for personal ad financial gain (Atherley, 2009).

The centralization of personal data into an information technology database prior to the confirmation of adequate security protocol increases the risk of security breaches (Electronic Health Data Breaches Remain Primary Concern despite Increased Use of Security Technologies and Analytics). The dangers of inadequate security in centralized databases have been demonstrated in the recent breaches of consumer information within some major retailers including Target. The relationship between the centralized databases within financial institutions is evident when researching the plausibility of using similar systems for patient data (Wang, Zhang, Xu, Yin, & Guo, 2013).

The initial cost associated with transitioning to a fully functional electronic health records system is very costly to large hospitals and medical practices. Financially, such upgrades may not seem feasible to some established medical facilities where IT budgets aimed at security is insufficient. Instead many hospitals and medical facilities are implementing a partial electronic health records system while maintaining paper-based filing systems (Morton, 2008).

In the private sector, hospitals and large patient care facilities are searching for ways in which to lower costs and improve patient care efficiency. The long term cost benefits of utilizing electronic health records systems results in a reduction in paperwork and an increase in the quality in patient care. At the same time it raises concerns over the security of patient data (Angst & Agarwal, 2009).

Each year millions of people all over the world die due to medical errors that could have been prevented. Medical errors account for billions of dollars a year to hospitals all over the world as well. These medical errors aren't only the result of poor medical training, but as a result of poor communication caused by faulty systems and processes

which cause people to make mistakes and fail to the correct the situation in time. The rising costs that these medical errors have caused are the result of many variables. The driving forces are that medical profession, doctors and nurses don't use electronic healthcare records to their advantage or don't use them to their full potential. Some doctors and nurses don't have access to these systems at all. There has been a lack of universal EHRs implementation around the world. Cost is an aspect that could be preventing many hospitals and medical facilities from adopting EHRs systems (Hoffman & Podgurski, 2012).

Many facilities are still relying on paper-based files. The lacks of information on paper-based charts don't allow clinicians to constantly update patient files without extensive paper-work and constant printing. Often times the information contained in the charts is outdated. Also the limited amount of transferability of paper files within a healthcare facility is limited as files can only be in one place at a time and cannot be shared with multiple healthcare professionals in different locations simultaneously. Also, it makes it nearly impossible for health professionals to receive the latest updates in patient files quickly. The ease of mobility with which electronic healthcare files can be transferred has resulted in an increase in their use and versatility (Morton, 2008). Electronic healthcare records allows physician to gain real time access to their patients files. This allows doctors and medical professionals to collaborate and track laboratory and diagnostic tests easily and efficiently. The slow implementation of electronic healthcare records has caused a reduction in the quality in patient care and productivity within hospitals and medical care facilities. Transitioning to electronic healthcare records is becoming more important than ever as health information in patient files is

increasing and the fact that many systems that hospitals use are more administrative than clinical and most healthcare organizations have been providing healthcare services that favor the organizational needs rather than that of the patient (Polito, 2011).

For years, patient medical information has been maintained in paper-based records. These records are usually handwritten and kept in files. Depending on the legibility of the handwriting of the physicians carrying out the examinations on patients; the information may not be helpful in the future (Kohn, Corrigan & Donaldson, 2000). Additionally, it is crucial to keep in mind that whenever the patient comes in for a checkup, the file is retrieved taking a lot of time and the physician scribbles on the same sheet of paper or adds a new sheet of paper. This further increases the shortcomings because the history is not consistent. It is extremely hard for one to make sense of fragmented information besides being ambiguous (Carter, 2008). Sometimes the file may experience mechanical destruction during retrieval and storage so that some information is torn off or is no longer legible. This renders the health record useless to a large extent. It is necessary to understand that even today; the paper records are the primary mechanism of collecting information from the patients although now this information is later fed into the computer. Paper-based records are usually bulky and pose storage problems in the healthcare facility. On the contrary, EHRs require minimal space for a computer. To sum up on the paper records in healthcare, there are several issues that are seen as paramount shortcomings of this style of records (Roukema et al., 2006). These include illegibility, ambiguity and fragmentation. Inaccessibility and bulk of storage are also disadvantages of this system.

Electronic health records (EHRs) provide easy access to patient data that can be transferred efficiently from one facility to another. Healthcare databases that store vast amounts of information allow physicians to monitor and record patient data during office visits and electronically, prescribe medication and tests as well as store and track test results. The case which patient data can be accessed and recorded makes it both efficient and once completely implemented cost effective (Wang & Guo, 2013). Hospitals and medical facilities in Saudi Arabia along with other developing countries have get to fully implement a universal EHRs database, putting them behind the developing world that have ceased to rely entirely upon paper based medical files. Paper-based patient files take up a lot of room and are inefficient as they can be easily filed incorrectly and can lead to mistakes if files are incomplete. One of the benefits of EHRs systems is the ability to track who has access to patient files and who has made which changes to each file as information is entered into data fields (Berg, 2001).

EHRs systems improve healthcare recording process. The ease in which patient data can be entered and tracked makes it an ideal solution for maintaining patient files. In addition to being easy to use, it is easy to track who has accessed files and changed data. The emphasis of the ease with which data can be accessed is a driving force in the adoption of EHRs worldwide. Patient files can be viewed by any authorized healthcare professional who has access to the EHRs database that houses patient files (Bergmann & Haux, 2007).

There is varied information in literature that emphasizes the different strategies of classification of medical errors within healthcare as a result of mistakes made by doctors and medical professionals. In the areas of healthcare services, severity of injury from

mistakes, legal definitions, typesetting, and type of individual involved in the case along with the strategies that lack the common framework, there have been increased numbers of mistakes that are due to poor record keeping. Different organizations and hospitals have attempted to organize their records and create their own systems for identifying and solving problems surrounding the lack of EHRs adoption. Feedback controls and the system controls are needed to track costs associated with EHRs systems (Bleich & Slack, 1992).

Saudi Arabia is the center of the Arab world, and it means different things to so many people, especially to the millions of followers of Islam. Each year millions of pilgrims go to Saudi Arabia to perform pilgrimage. To others, Saudi Arabia like the USA is viewed by many around the world as a land of opportunity, especially for the millions of people from Asia, Europe and the United States. Large numbers of people from around the world go to Saudi Arabia in search of work. As a result the Saudi Arabian government has increased its funding in order to improve healthcare. The extra funding has allowed both government and private hospitals and patient care facilities to open and flourish (Iakovidis, 2001).

Saudi Arabian hospitals have been able to offer an increased number to new treatment options to patients due to the increase in funding and government support which the healthcare system. Sophisticated treatments such as kidney and liver transplants open-heart surgery and advanced cancer screening and treatment options have increased the quality in the recovery of people suffering from the previously mentioned ailments (Jannadi & Hussain, 2008).

The newly sophisticated healthcare system has also improved the quality of healthcare that expatriates from different countries receive when they visit and/or work in Saudi Arabia. The majority of medical care is performed at government hospitals and public patient care facilities, but a growing number of private hospitals are increasingly offering more services. Many different doctors from different hospitals and patient care facilities may treat the same patients resulting in information becoming scatter throughout the healthcare system (Leech, 2004). Due to vast amounts of healthcare information that is being record for each patient, the storage and retrieval systems of patient medical files are inefficient. Some of the disadvantages of this health care system is that the systems that each facility uses are different and there isn't any integration. Physicians don't have access to complete patient files unless in a rare case a patient is treated at the same facility all the time. In addition, the lack of system integration has forced many patients to undergo the same diagnostic tests multiple times because the test results aren't put into a centralized EHRs system (Koeller, 2002). It is common for patients to be treated for the same ailment by several physicians. This is not only inefficient; it is also costly to both people and the government. There are many benefits to the use of EHRs systems. Many mistakes are made when a physician writes out a prescription because the pharmacist or other healthcare professional can misinterpret the handing to mean something else. When physician prescriptions are submitted electronically, it is less likely to be misinterpreted. Prescriptions can be sent electronically to the pharmacy and the physician has control over the medications that he prescribes (Jha & Bates, 2008). The ordering process is streamlined in real-time so that potential drug interactions or allergies are more easily identified. This also reduces the

time that it takes to locate patient charts. EHRs adoptions allows nurses and other medical care professionals to spend more time treating patients and less time inputting patient data in the system. Electronic files can be directly input into the system instead of have to maintain patient data and put it into the system at the end of the day. The reduction of administrative tasks would allow medical care professionals to increase the time spent treating their patients rather than performing miscellaneous administrative tasks (Iakovidis, 2000).

If all goes according to plan, EHRs will be fully functional and exchangeable by 2016. According to the Department of Health and Human Services (HHS) the number of hospitals adopting EHRs has increased from just 9 percent in 2008 to over 80 percent in April of 2013. Much of this growth can be attributed to incentives and requirements laid out in the Recovery Act of 2009 and the Affordable Care Act. The Health Information Technology for Economic and Clinical Health Act (HITECH Act), enacted under the Recovery Act of 2009, allocates $24.3 billion to promote and expand the adoption of health information technology (Murphy, 2011).

However, adoption of EHRs is not as simple as acquiring information technology. A set of meaningful use stages, developed by HHS, ensures quality and guides EHRs systems towards the ultimate goal of better patient outcomes. Meaningful use is determined by attaining certain milestones over time, as defined by HHS, that demonstrate improved quality, safety and efficiency — and reduce health disparities while engaging patients and improving care coordination through a secure and private records system (Walston & Al-Omar, 2008).

1.1.1 Differences between the Health Systems of Saudi Arabia and the United States

In the Kingdom of Saudi Arabia, public healthcare facilities provide free medication to its legitimate citizens. However, the private sector offers care services for a fee. In contrast, health insurance companies in the United States play a critical role in the issuance of medical cover to individuals. Hospitals in Saudi Arabia provide free services to patients based on the sectors within which they belong. As a result, only members of a particular sector benefit from the free healthcare services that are offered in the hospitals. For instance, military hospitals provide free services strictly to militants and their beneficiaries. Others who do not comprise the military can access services from the private facilities the across country for a fee unless they have been referred to the military hospitals by other health facilities. Hospital specialization in the Kingdom of Saudi Arabia is a common practice as the high-level facilities treat specific medical conditions. Consequently, patient referrals to the specialized hospitals are common in the country. One of the most prominent referral health facilities in KSA is the King Faisal Specialist Hospital and Research Center (KFSH&RC). The facility only handles illnesses that are related to tumors. The hospital deals with tumor-related conditions only. Patients who are diagnosed with such conditions are referred to the particular facility for specialized treatment.

In the United States, all the citizens are encouraged to enroll for health insurance to meet the expensive health services. Open enrollment is done annually. For instance, programs such as the Medicaid and Medicare facilitate the provision of reasonably priced medical services for the US population. The programs are aimed at making healthcare accessible to underprivileged groups in the country. These programs have been

operational since 1967. On the other hand, the Saudi Arabia government mandates the Ministry of Health to control care delivery in both public and private health facilities. The ministry works in conjunction with several other government agencies the National Guards hospitals, hospitals of the Ministry of the Interior, Ministry of Defense and Aviation, and the Royal Commission for Jubail and Yanbu to provide healthcare services healthcare services to employees and other citizens under special procedures. Recently, KSA began adopting the concept of health insurance coverage for the working class. The Saudi Arabian government passed a regulation directing all employed persons in the private sector to obtain health insurance from the employer companies.

It was not until 2002 that the New Saudi Health System (NSHS) was implemented. The system sought health insurance for all expatriates and Saudi citizens who worked in the private sector. The uncovered citizen has a choice of seeking free health services in public facilities or visiting private sector for paid care. They can also purchase an insurance plan for private healthcare services. The aforementioned differences between the healthcare systems of KSA and the US underpin the feasibility of implementing EHRs in the country.

1.1.2 Hospitals in Saudi Arabia

The Kingdom of Saudi Arabia has an estimated population of more than 26 million people with an annual growth rate of approximately 2.2% million. The country has over 400 hospitals (249 are MOH, 39 government, and 127 private sector hospitals) that provide healthcare to the population. These hospitals provide jobs to over 500,000 people who come from more than 80 countries. The hospitals fall under different managements

under the Ministry of Health, Ministry of Defense, National Guard, universities, and/or private sectors.

A great percentage of KSA hospitals under the Ministry of Health have implemented the EHRs systems in their facilities such as King Fahad University Hospital in Riyadh, King Fahd Hospital in Baha, Baljurashi Hospital in Baha, , and Psychiatric Hospital in Baha. However, the King Faisal Specialist Hospital and Research Center (KFSH&RC) in Riyadh has full implementation of the EHRs system. The hospital began its EHRs implementation in1978. The financial and administrative departments were the first areas within which the system was implemented in the first years. A decade later, the implementation was taking place in the Laboratory and Pharmacy modules, which form the primary areas of focus on the electronic health systems. Presently, the hospital is implemented full Patient Record System (PRS) as part of a larger process of computerizing the operations of the facility. Various studies have revealed that the hospital has opted to retain the manual record system despite the enormous steps towards a complete EHRs system. In addition, many hospitals under the Ministry of Defense have realized partial and full implementation of the EHRs system in core units such as patient admission, laboratories, and pharmacies. The Ministry of Defense manages several hospitals notably the Riyadh Armed Forces Hospital among others. The King Fahad National Guard Hospital is the largest military hospital under the administration of the National Guard in the Kingdom of Saudi Arabia. The hospital specializes in advanced medical conditions. The country has advanced health facilities that deal with trauma and cardiac cases. However, despite having a basic EHRs system, the hospital replaced it by advanced CPR technology known as the Misys Healthcare System (MHS). This method

has significantly improved the delivery of healthcare in KFNGH because it has facilitated monitoring and recording to patient information. University hospitals in the country conduct research on various subjects while also providing healthcare services. However, they lack functional EHRs systems in their facilities. As a result, they depend on manual records for their research and patient care.

1.2- Objectives and Significance of Research

The scope of this study was to identify the extent of the relationship between the factors that associated with delay in the universal implementation of electronic healthcare records (EHRs) and how to effect on the quality and efficiency of work and acceptance of implementation EHRs System in Saudi Arabia hospitals. The major objectives of this research is to The scope of this study was to identify the extent of the relationship between the factors that associated with delay in the universal implementation of electronic healthcare records (EHRs) and how to effect on the quality and efficiency of work and acceptance of implementation EHRs System in Saudi Arabia hospitals.

The major objectives of this research are to:

1. Identify the technological issues pertaining to patient privacy including access authorizations to patient data.
2. Identify how education and computer literacy translates to a lack of universal EHRs implementation.
3. Identify the Security concerns regarding the use and access to EHRs Systems
4. Identify the High Cost of Implementation EHRs.

5. Identify the Resistance to New Technologies
6. Identify the EHRs system Maintenance and Down time
7. Identify the Adoption of New Technology
8. Identify the most fundamental barriers that consistently prevent the implementation of EHRs systems in the Kingdom of Saudi Arabia.

This research will discover the major underlying reasons that there is EHRs implementation delay and also helped to identify its causes. The implementation of a universal EHRs system design and compatibility programs will assist in the comprehensive care that patients receive in Saudi Arabian hospitals and patient care facilities. This will also allow medical professionals to use the information from this research to design programs that will assist in establishing policies and training materials for medical professionals. Furthermore, the expanded research is designed to probe for quality training issues in the areas of patient privacy concerns in addition to the computer training.

Whenever there is an issue with the advancement of technology especially in the medical field there is a need to search for its underlying causes. This research will assist in identifying the reasons that are preventing complete adoption of EHRs systems and compatibility issues. Privacy concerns along with the different vendor options and how it translates into smooth integration within hospitals need further research to measure their effectiveness.

1.3-Statement of Problem

The challenges of implementing electronic health records include security and privacy concerns along with the issue of cost effectiveness in securing databases. The privacy concerns affecting the implementation of electronic health records over paper-based filing systems is the risk of security breaches and identity theft that are not as common in paper-based filing systems.

The significance of researching the challenges affecting the implementation of electronic health records systems will allow researchers to evaluate methods of safeguarding patient privacy. It will also allow federal regulators to develop a uniformed set of policies and procedures concerning liability in security breaches. The relationship between the storage of confidential financial data and patient data in illegal activities is the topic of much recent debate and further research is needed in order to make decisions in future policies. The question of patient rights to privacy and whether patients should be able to place limitations on hospitals that are held responsible for the protecting patient data is also an issue that requires further research.

1.4 Research Hypothesis:

The purpose of this study is to understand the factors associated with delay the EHRs System implementation in Saudi Arabia. The study will provide valuable information about current uses and implementation of EHRs systems in Saudi Arabia, while also, investigating those factors and how to effect on the quality and efficiency of work and acceptance of implementation EHRs System which enhance such implementations. The study will include six groups of healthcare professionals:

physicians, pharmacists, Nurses, Technicians, Administration Staff, and Medical Records Staff. The major aim of this research is to examine to what degree a correlation exists between the acceptance implementation of EHRs systems and the following items:

- Lack of computer skills
- Cost Of EHRs Systems
- Adaption of the new technology
- Privacy and security concerns regarding the use and access of EHRs System
- EHRS maintenance
- Resistance to new technology

The hypotheses that are to be tested are as follows:

Hypothesis 1: Privacy concerns and the lack of authorization controls inhibit the acceptance of EHRs.

Independent Variables: 30_7, 31_5, 24, 18_4

Dependent Variables: 19

Hypothesis 2: Concerns about EHRs system support and maintenance inhibit the acceptance of EHRs.

Independent Variables: 18_5, 30_3, 30_4

Dependent Variables: 19

Hypothesis 3: Lack of Knowledge of the EHRs systems and lack of computer literacy skills inhibit acceptance of the implementation of EHRs systems in Saudi Hospitals.

Independent Variables: 5, 17

Dependent Variables: 19

Hypothesis 4: Perception of the costs of implementation of EHRs inhibit the acceptance of EHRs systems in Saudi Hospitals.

Independent Variables: 30_1, Q22, Q18_2

Dependent Variables: 19

Hypothesis 5: Health care specialists who identify EHRs system as being less secure and reliable than their paper-based counterparts or as not providing adequate certification and authorization measures are less probable to accept the adoption of EHRs systems.

Independent Variables: 25, 20, 26

Dependent Variables: 19

Hypothesis 6: Health care specialist who believe that the EHRs System improve current workflow are more likely to accept the adoption of EHRs systems.

Independent Variables: 16

Dependent Variables: 19

1.5 DEFINITION OF TERMS:

EHRs	The Electronic Health Records (EHRs) is a system of managing patients' information in an interoperable, easily accessible, and highly effective manner. It is easy to retrieval the health information for patients regardless of their point of treatment. With The Electronic Health Records (EHRs), healthcare physicians can access and evaluate the patients' history. This situation supports accurate diagnosis and finishing of accurate actions to prevent instances of fatal medical errors. EHRs technology comes with a number of advantages that included monitoring and recording of diagnostic information, medical account, and diseases symptoms among others. (Handler et al., 2003).
(HHS)	Department of Health and Human Services
(CPOE)	Computerized Physician Order Entry
(PDA)	Personal digital assistant
(MHS)	Misys Healthcare System
(NSHS)	New Saudi Health System
(PRS)	Patient Record System
(EMR)	Electronic Medical Records
(HIS)	Health Information System
(PMRs)	Paper Medical Records
(IOM)	Institute Of Medicine
(ASP)	Application Service Provider
(OPMR)	Online Personal Medical Records
(MOH)	The Ministry of Health

CHAPTER II

II. LITERATURE REVIEW

2.1 Description and History of Electronic Health Record

2.1.1 Description of EHRs

Electronic health records focus on patient data management from capture, storage, and retrieval whenever such information is needed. The system is designed to enhance interoperability and interaction between current and past medical history of patients. The EHRs systems can gather information from a broad range of divergent patient data sources including visit notes, reports from different physicians, lab and X-ray results, and information from health facilities. All EHRs systems have similar characteristics that are listed below (Carter, 2001),

- Their primary purpose is to manage patient data
- They utilize various methods of data entry including voice recognition, pen, and optical character recognition
- EHRs can network through LAN, internet, and/or wireless systems
- They are secured through encryption, passwords, and biometrics
- They support instant messaging
- EHRs allow flexible storage of clinical information in a way that permits movement from one system to another.

EHRs systems allow multi-functional capabilities whereby physicians can perform numerous tasks simultaneously. For instance, they enable physicians to have

real-time access to patient problem lists, prescriptions, and related adverse reactions and test results among other information (Barrett, 2003). The system also enables physicians to prepare documents and reports regarding the services they offer to patients during their visits and justification for clinical decisions. In addition, they also identify clinical issues using red flags that alert and remind physicians. In fact, alerts play a key role in the clinical practice as they can remind physicians of drug allergies. Furthermore, clinicians can make guided decisions on clinical issues upon access to comprehensive and steadfast databases and references that are provided by the EHRs system. The system provides a basis for standardization of disease management goals for patients with chronic conditions (Satinsky, 2004).

2.1.2 The History of EHRs:

With the emergence of computers in the 1960s, many industries welcomed and began integrating technology in their business activities. However, a substantial amount of literature reveals that the health care industry has been slow in the adoption of computer technology despite the innovation capabilities enhanced by information technology (IT). Service industries such as banking finance and telecommunications are some of the sectors that welcomed and embraced computer technology (Neil, 2000). Larry Weed, who introduced the conception Problem Oriented Medical Record into healthcare, first speculated the idea of recording patient information (Berner et al., 2005) .The idea sought to replace paperwork based recording of patient data as he envisioned a recording system that was to allow third party individuals to verify patient information independently. Nevertheless, despite the many benefits of EMR, its take-off were significantly slow. The idea of EHRs aimed at enhancing the reliability of information

and protection from data loss. The EHRs technology increases the storage space virtually while relieving physicians from paper charts. Due to proficient organization of patient data, the system has resulted in improved care delivery that has been characterized by reduced mortality rates in healthcare facilities that have realized its implementation. Efficient is also realized since medical errors are pointedly reduced due to proper management of health information. Today, the idea of EMR has been promoted through the proposal of healthcare systems to adopt EHRs. Healthcare leaders are encouraged to envision apt strategies that endorse note documentation, information coding, and interactive decision-making (McDonald, 1976). Notable forms of EHRs systems in different health facilities include the HELP system at the LDS Hospital in Utah, the COSTAR system at Massachusetts General Hospital, and the TMR system at Duke. Most of the systems date back to the 1970s and utilized techniques in workflow, exhibition, and user interface that formed the standardized basis of modern technology of the 21st Century (McDounal, 1976: Warner et al., 1972: Barnett et al., 1979). Despite these systems being a landmark discovery that can revolutionize healthcare systems, administrators failed to support them as some considered them as unbeneficial. Other managers were reluctant to spend enormous amounts of capital and labor in systems whose feasibility was skeptical. These arguments have been the active barriers to the successful implementation of EHRs up-to-date. In the 1970s, two approaches to health information system (HIS) applications emerged. The first approach was a concept of immense design whereby single, large time-shared computer were used to support a collection of applications (Shortliffe et al., 1990). The other one used a multi-machine model. However, these approaches were deemed impractical. Many systems at the time

lacked interoperability as they functioned from a stand-alone perspective. EHRs were meant for interactivity within healthcare settings. Physicians often preferred relying on their acquaintance and experience rather than the systems. The systems were incapable of providing fine-grained and comprehensive data on patients. In the1980s, there were notable technological advancements that supported the EHRs systems. This set of circumstances led to the development of affordable networking systems that underpinned the implementation of EHRs (Morris et al., 1995). Data interchange was amplified as the first version of the HL7 standard was developed. Massive research also intensified as attempts were made to apply the expert system methodologies in developing more suitable decision support systems for clinical needs. Research on various systems such as QMR, DXPLAIN, and ILIAD among others proved that integrating reminders and alerts into the EHRs systems lowered healthcare costs. Technology improved significantly from the 1980s onwards. There was continued the development of standards in the HL7 that focused on recording electronic data, which was easily shared and accessible (Santinsky, 2004). By the late 1980's, most healthcare institutions had realized the enormous achievements in the implementation of the EHRs systems. Interconnectivity was ensured by the installation of single terminal PCs that were located either in the office or hospital ward where health care workers retrieved essential patient test results including blood chemistry, microbiology, radiology, and biopsy reports. It included three major facets that included uses and users, technology, and policy and implementation. There was an increased need to revolutionize the EHRs systems with a view of promoting healthcare delivery (Santinsky, 2004).

2.1.3 The Advantages of Implementing a EHRs

The benefit of implementing a EHRs system would be the streamlining patient care through the ease of access to necessary patient information by primary care takers. The benefit of electronic information systems is that is allows vast amounts of information to be maintained and accessed by doctors and medical support staff in order to communicate patient care information quickly and accurately (Shamilyan,2008). There are many types of information systems that hold vast amounts of patient data from radiology reports, lab reports from blood tests and other medical tests to physical exam results and prescription medications (Young, 2000).

Patient data that is collected and stored electronically within general practitioner offices during routine visits can be used in conjunction with data collected from patient visits to specialists to improve communication between doctors who are treating the same patients(Swartz,2004).This information serves as valuable resources to supporting diagnosis and tracking patient care. Also patient laboratory and medical test results that from test prescribed from these doctors should not only be stored in the local databases, but also the hospital and medical care facility databases where these test were performed. The benefit of this the recoding process is that patient care data is automatically updated and kept track of to maintain updated records (Oriz & Clancy, 2003). Any diagnosis and patient symptoms should be recorded electronically including a doctor's notes that would complement any possible condition that the patient is experiencing as this could possibly assist in the diagnosis of rare conditions and could also be used to track possible symptoms that could have otherwise been overlooked (Leech,2004).

According to the 2003 IOM report, many healthcare providers were reluctant to implement electronic records, despite the above-mentioned limitations associated with PMR (Wang et al. 397). This reluctance can be attributed to the non-supportive management who, for varying reasons, prevent the implementation of EHRs in most healthcare facilities. Some of the reasons that managers lean on for non-implementation include lack of funds to facilitate the acquisition of the facilities and training in the use of the technology. Numerous studies have revealed that the lack of awareness of the merits that come with EHRs implementation prevents healthcare facilities from embracing the system. Empirical evidence shows that a great proportion of the healthcare providers do not see the benefits of EHRs since not all physicians are tech-savvy. Others are unwilling to undergo electronic training. However, the respondents failed to acknowledge that paper-based medical records hamper quality, accuracy, consistency, accessibility, interoperability, instant availability, and portability of patient information. For an effective campaign on the potential benefits that accrue due to the implementation of EHRs, there is a need to integrate the system into medical schools. New health physicians who will leave schools in the next few years should be competent in the use of the electronic system (Coffey et al. 55).

Saudi Arabia has a distinctive location in the Islamic world, where the two holiest places of Islam, Mecca and Medina, are located. Annually, around two million pilgrims throughout the world perform the hajj. For instance, there were 2.3 million pilgrims, 69.8% of whom came from overseas countries during the 2009 hajj season (Ministry of Health, 2009). The annual host of such an event is a significant challenge that needs an intended and structured effort across many organizations and departments to ensure

sufficient services, including healthcare services (Jannadi et al., 2008). During the hajj season, the healthcare services provide both preventive and medicinal care for all pilgrims, regardless of their nationality. For instance, in 2009, there were twenty-one hospitals, seven of which were seasonal. In addition, there were 157 PHC centers, of which 119 were seasonal. Annually, the Saudi government represented by the MOH, tries to improve and enhance the delivery of healthcare services to pilgrims (Jannadi et al., 2008). Nevertheless, it should be noted that all healthcare services provided during this season are free of charge for all pilgrims. This creates significant demand on the healthcare budget in particular, and therefore it has become necessary to look for new approaches to deliver better healthcare at a lower cost. Overwhelmingly, the finance for healthcare in Saudi Arabia is mainly provided from government revenue. The MOH is the main government financer of healthcare services in Saudi Arabia. The Saudi government expenditure on the MOH rose from 2.8% in 1970 to 6.2% in 200 (Ministry of Health, 2009). According to the World Bank, the total expenditure on public health during 2010 was 4.3% GDP (The World Bank, 2012).

The recording of patient data that is collected at specialized medical facilities that conduct laboratory tests, CT scans, MRIs and other specialized services can easily be forwarded electronically to any medical care professionals that are treating a specific patient. The easy transfer of such data would allow healthcare professionals to care for and quickly treat patients. The ability to pass information quickly allows healthcare professionals to collaborate and develop treatment programs for patients and track patient progress accurately by comparing notes on the same databased. The ability of doctors to access patient data through the use of authorization codes from an external network

allows EHRs systems to track who has accessed patient files and can alert database managers in the event of a security breach.

It is commonly known among healthcare professionals that patients often neglect to inform all of their doctors of the medications that they are taking. Many patients are being treated by not only their primary care physician, but also other specialists as well for different medical problems. Keeping track of all the medications that various doctors are prescribing them may not always be possible for patients to remember, let alone inform each doctor of any changes in their medications. Most patients will visit a single pharmacy to have prescriptions filled. The implementation of EHRs systems to track medications that are given to patients within doctors' offices, hospitals and pharmacies is essential to monitoring patient medication and any problems that could occur when combining different types of drugs. The dangers that come with the lack of patient knowledge could potentially lead to higher fatalities among patients that don't report all their medication. Hence the added benefit of implementing EHRs systems that are user friendly in order to ward off resistance. Patient safety is dependent upon doctors accessing patient data quickly and being able to effectively track treatment plans that are prescribed by all treating physicians.

The development of healthcare services in Saudi Arabia, in association with other factors such as improvement in the access of public education and more health awareness among the community, have contributed to the considerable enhancements in health pointers. However, it has been pointed out that, in spite of the variety of healthcare services providers, there are no apparent communication channels between them. This leads to duplication of efforts and a waste of resources in the healthcare sector (Alhusaini,

2006). For instance, there are significant opportunities for the healthcare domain to benefit from laboratories, equipment, training aids and well-qualified personnel from diverse countries. Nevertheless, the benefit of such opportunities is narrow within each domain, as a result of weak integration and coordination among these sectors. In order to address this issue of poor coordination among healthcare providers in Saudi Arabia and to provide the residents with well-updated, organized, affordable and comprehensive healthcare system, in 2002, a royal decree led to the establishment of the Council of Health Services. It was directed by the Minister of Health and included representatives of other government and private healthcare domains (Almalki, Fitzgerald & Clark, 2011). Although the Council aimed at enhancing the coordination and integration among all healthcare sectors in the country, there has not been significant progress in this regard. Today with the increasing realization of the major positive impact that technology can have on the quality of healthcare, many healthcare providers in Saudi Arabia have been increasingly relying on information and communication technology by implementing advanced information systems. However, this effort has not been accompanied by integration and coordination between these implemented systems. Therefore, this leads to diversity in the systems used among healthcare providers, which makes it difficult to create a standard national network and repositories for the health records.

Unfortunately this computerizing health care record for patients across Saudi Arabia has been challenging as only 30% of hospitals have computerized patient data files. It is only estimated that about 15 to 20% of physician offices have computerized patient data. Only a relative few hospitals have made the investment into EHRs systems

and still very few plans to implement new EHRs systems in the coming years according to several studies.

Accurate information regarding family health history is one of the criteria for the practice guidelines. Any medical information should be recorded accurately. Illnesses that do not seem important even to patients should be documented and in which case may ultimately allow physicians to make more accurate diagnosis or to begin screening for possible conditions as early as possible. A little documentation can go a long way and securing access for all treating physicians can assist in treating patients and increases the likelihood that any serious illnesses will be detected early.

Clinicians are the medical workers directly involved with the patients, be they nurses, physicians, psychiatrists or psychologists. They might be operating in private practice or they may be in the public health sector. All medical facilities keep records on the patients they attend. The following are the benefits that EHRs may have for them in the course of their practice. Availability of a system of information that is easy to access and which is detailed pertaining to a patient will assist the clinician to make solid decisions about the patient's needs based on the past data like drugs administered, allergies found, reactions to certain drugs or procedures and effectiveness of initial treatments (Health & Medicine, 2006). Combining information technology, wireless networking technology and mobile computing technology in the form of a personal digital assistant (PDA) has been recently known to retrieve patient information quickly as physician orders, test results and lab tests can be ordered from anywhere. This reduces the time and costs associated with paper-work and could ultimately improve the quality of care. Personal digital assistants can also allow nurses and doctors to spend

more hands on time with patients instead of spending extra time completing redundant paperwork that must be entered manually into EHRs system. PDA has the ability to streamline the data recording process through the implementation of preset screen options and automatic patient data fillers. The latest technology offers PDAs in the form of tablet computers that can be used to handwrite notes that use handwriting recognition in order to fill in information fields which are stored in electronic patient files that be accessed by all treating physicians and nurses. For instance, if a patient had been treated in a certain healthcare facility for a particular disease and then he returns with the same complaint, the clinician, after referring to past medication given to the client, may choose to change the medication. They will find it easier to locate the patient's health records from the EHRs than from physical documents such as files, which can easily be misplaced or be concealed in huge volumes of files (Milewski, 2009). There have been recent technological advances that offer physicians and hospitals software interfaces that are designed to easily manage patient data through the use of computer, and PDAs. Much of the software can be used via the web and through local connections to access patient data in order to track patient care. Web based applications such as those used to by pharmacies and doctors' offices to order prescriptions and test for patients and to keep records of test results can be accessed from just about anywhere, allowing doctors to share information easily and design appropriate treatment plans for patients. Several types of software programs are available for use by doctors and hospitals with different advanced features. Software providers that offer options which include the ability to shares medical information virtually by recording patient logs that can be used to connect a group of care providers and organizations without data centralization or replacement of

existing information systems. Other information systems have the ability to record and track patient data that by allowing physicians to conduct exams in a point and click format that has preset options. The software then has the ability to use the assessment to produce a comprehensive evaluation history of a patient's medical conditions while minimizing the workload for treating physicians and increasing efficiency. Software advances have led to the ability of several programs to be able to store photos or pictures of scans electronically and keep track of patient vital signs such as blood test results, blood pressure, EKG results and temperature. Several privacy and integrity issues have been raised especially with the security issues that have surfaced within the financial sector. The increased amount of security breaches within the financial sector has been increased. The shortage of local healthcare professionals including physicians, nurses and pharmacists also stands as an obstacle for healthcare system reform in Saudi Arabia. Most of healthcare professionals are expatriates which leads to instability in the health workforce. It was pointed out by the MOH that the total health workforce in Saudi Arabia is about 248,000, where 125, 000 of them work in the MOH. Therefore, attracting more Saudis into the health professions, nursing in particular, is set as a priority in the health system reform. Another challenging factor faced by the MOH is funding healthcare service. As the total spending on public health provided by the government and health services are free, this lead to significant demands on the healthcare budget in particular. The high demands on the healthcare budget can be attributed to different factors including the rapid increase in the population of Saudi Arabia and the increasing cost of new technologies. To meet these challenges, the MOH has established a national strategy for improving the healthcare services in the country. In April 2009, this strategy

was permitted by the Council of Ministers. The strategy aimed to diversity fund sources, develop information systems, develop the human workforce, activate the administration and monitoring the MOH role over medical services, encourage the private sector to provide health services and distribute healthcare services equitably to all regions. The implementation of this strategy is to be done by the MOH in cooperation with other healthcare sectors, and the Council of Health Services will be responsible for supervising this implementation. Saudi government has achieved a great development over the last few decades despite facing significant challenges such as the increasing number of population and the hosting of around two million pilgrims annually in the Hajj season which requires great efforts to provide effective healthcare services. In order to improve the quality of healthcare provided, a great effort has been made to connect MOH hospitals, but lack of communication infrastructures and sufficient fund are the main barriers faced. A budget of SR 4 billion was allocated by MOH to establish a four year development programmed (2008-11) to develop e-health in public hospitals. Furthermore, a number of conferences have been held to emphasize the importance of health informatics. Nevertheless, there are good implementation of EHRs among healthcare sectors such as King Faisal Specialist Hospital & Research Centre (KFSH & RC). Another successful implementation of EHRs has been achieved at the National Guard Health Affairs (SANG-HA), one of the leading healthcare providers. There are different challenges that MOH need to overcome in order to increase the effectiveness of the healthcare services. Some of these major challenges are a lack of a unified system, the shortage of health workforce and doctors' attitudes to EHRs implementation. A national strategy has been established to meet these challenges which

to be implemented by MOH and under the supervision of the Council of Health Services.

2.1.4 Limitations of Traditional Paper Medical Records (PMRs)

The emergence of the Electronic Health Record (EHRs) systems rendered the traditional Paper Medical Records (PMRs) obsolete. In the twenty-first century, streamlined flow and sharing of patient information is vital for disease diagnosis, monitoring, control, and treatment. The use of traditional paper records is an impediment to the attainment of the above objective due to various limitations. At the outset, PMRs hinder availability and sharing of patient information amongst the health physicians since only one person can access it at a time. Therefore, a lot of time is wasted as the records move from one health facility to the other for the evaluation, particularly in the event of referrals. Manual documents are subject to misplacement due to poor handling habits by either the patients or physicians. In addition, delayed access to patient's data affects coding, billing, and reimbursement processes. Secondly, the quality of PMRs is not guaranteed since paper is fragile and subject to staining, tearing, and fading. Consequently, patient information in PMRs can be distorted or lost. This set of circumstances can lead to loss of vital patient data. In addition, due to multiple circumstances that are posed to the healthcare providers, fragmentation of information increases because there is little or no sharing of patients' historical records. Furthermore, handling of PMRs is tedious and costly. Such costs result from activities such as duplication, filing, retrieval, and supply of papers for copies, staffing for records management, distribution, and storage among others. The costs escalate in case of lost data. As a result, patients can be requested to undergo duplicate tests to obtain the lost

results. Additionally, PMRs limit productivity because a lot of time is lost during the search for paper charts and missing files. Delivering the paper records to different locations within the facilities also leads to time wastage.

2.1.5 Errors in the Contents of Paper Medical Records

PMRs often result in fatal errors that pose adverse effects on patient's' healthcare provision. As aforementioned, paper records are subject to loss and mishandling among other factors that lead to errors. There have been reports of medical errors that result in clinical injuries or fatalities. Medical faults can be attributed to the non-reliability of PMRs. Many researchers have revealed that paper medical records are prone to numerous errors that include omission, delays, and misplacement among others (Farshi, Jebreili, and Abdinia 367)

2.1.5.1 Omission

Sometimes, PMRs fail to provide complete patient information. Healthcare providers can forget or ignore to include some details due to the tedious process of recording medical information manually. Omission can have substantial effects later, when a different health care provider requires the data (Farshi, Jebreili, and Abdinia 367).

2.1.5.2 Delays

Delivery of paper records to different departments or facility locales can be delayed due to numerous factors such as distance, unavailability of papers for duplication, and/or busy photocopiers. However, electronic medical systems minimize delays since data can be shared instantly regardless of the distances involved.

2.1.5.3 Misplacement

According to Farshi, Jebreili, and Abdinia, PMRs can be misplaced or lost. Sometimes the patients are charged with the handling of the paper records (367). Sick people can misplace or lose them in case of unconsciousness or worsening conditions.

For instance, in a study that was conducted by the Institute of Medicine (IOM) on a sample of 1000 patient visits to five outpatient US Army facilities in 1997, the following data was obtained:

- 11.5% of the patients did not have any historical data available.
- Between 5% and 20% of the charts available had missing patients' information. For instance, 75% did not indicate consistent laboratory results and 25% of the handwritten data was incomplete and incomprehensible due to illegibility.
- 14% - 78% of laboratory results were sketchily indicated in the PMR, and some missing elaboration was noted.
- 12% - 51% of the patient visits did not have clear referral documents. As a result, diagnosis information was difficult to retrieve.
- 24% - 35% of the patients' records presented incomplete information despite the patients having gone through different facilities prior to visiting the army referral facility (Coffey et al. 54).

2.6 Web-Based Access to Electronic Health Records

In the wake of technological advancement, particularly in the IT sector, no one wishes to be left behind in the traditional way of doing things. The internet has sparked a revolution in the way humans share day-to-day experiences (Ilie, Courtesy, and Van

Slyke 8). The medical sector stands to benefit significantly if the technology is embraced in every activity that touches on the management of illnesses. The EHRs comes with a high level of interactivity amongst the patients and healthcare providers. The systems cheaply and easily avail vital medical information to all health stakeholders.

2.6.1 E-Health

Health e-commerce is a component of modern health practice in the 21st Century. Online presence is becoming an important development in the sector. For instance, e-health portals such as http://www.onhealth.com and http://www.medscape.com are open to all health stakeholders. The portals facilitate free and unlimited medical information and innovations in health practice for a better future. Health e-commerce connectivity initiatives include internet-accessible EMR systems and assessment of provider quality based on clinical outcomes (Wang et al. 400). The modern e-commerce healthcare services do not target consumers only but are also accessible to patients among other parties. In fact, the IOM report indicated that more than 60 million people access the web in search of medical information yearly. For instance, Hi-Ethics is a set of 14 principles that were developed by a group of internet healthcare companies that direct websites to adhere to several guidelines such as providing credible and up-to-date information besides ensuring high privacy and security of health data. The concept of the Online Personal Medical Records (OPMR) is based on an online software application that allows individuals to manage their health information and/or other peoples' health data under their authority. Patient information can be entered into the OPMR systems in two ways. At the outset, patients can enter the data individually. Secondly, data can be entered through a link to a third party's computer system such as a laboratory system or

physician's EMR system (Wang et al. 401). Most of the OPMR systems can only handle one problem at a time. Others can take up multiple data on various health issues concurrently. OPMRs that link up with EHRs systems deal with multiple problems. They can also be updated automatically through the EMR system to maintain a constant relevance. However, sometimes compatibility of various OPMR with EMR systems fails, especially in the event that patients' change their personal data handlers such as switching between health physicians. To increase compatibility modes, some technologies solutions have been put forward (Wang et al. 402).

2.6.2 Online Personal Health Records

Numerous studies have revealed that some technological such as the integration of speech recognition features in an attempt to make the usefulness of the EHRs a reality failed. However, the system focuses on the enterprise regardless of whether it is a solo practice or multi-specialty clinic, provided it can use the internet to retrieve data from different providers and data repositories such as laboratory and radiology reports. Confidentiality is among the most important concerns that patients raise regarding the e-health sites (Shah et al. 112). Although the EHRs systems aims at achieving interactivity and interoperability of healthcare practices for the benefit of patients, physicians, and service providers among others, the system can be intrusive in a way that a particular group of patients with peculiar diseases can feel targeted by some stakeholders as a way of promoting their products. Therefore, patients ought to be careful when uploading their confidential information on websites that are insecure. Security features should be flexible and configurable with respect to the preferences of the end users. There is a need for the health facilities to provide crucial information on the legal patient data handlers

to avoid losses in the event that the providers leave the business due factors such as insolvency, mergers, or change of business among others. The government should also play a part in the regulation of the operations of OPMRs to foster certainty and security of patient data (Shah et al. 114).

The continued use of traditional manual paper records is an impediment to the many benefits that come with the implementation of EHRs systems. Health stakeholders need to identify the existing obstacles to full application of EHRs with a view of addressing them accordingly. The aforementioned limitations of PMRs are undesirable. The government needs to increase subsidies even for the small healthcare facilities. It can also offer incentives to the private stakeholders. If the electronic health record systems are introduced in the Schools of Medicine, they will increase awareness and development of competent health professionals to safeguard the future of the medical services.

2.7 Barriers of the implementation of Electronics Health Records

The implementations of EHRs systems have faced many challenges in Saudi Arabia such as:

2.7.1 Lack of experience with the use of computer

The lack of computer proficiency among physicians, and healthcare staff, aging hardware in addition to the lack of software usability in EHRs software systems have contributed to the delay in the adoption of effective EHRs systems. There have been many studies documenting the causes behind the delay in the successful implementation of EHRs systems that have identified various reasons for the delay (Walston &Al-Omar, 2008).

Physicians and medical staff in Saudi Arabia don't all possess the computer skills necessary to operate EHRs systems. Furthermore the training needed to provide the computer skills that are needed to operate the software is quite time consuming due to the initial level of those who are to receive training. Also, complete implementation of these systems is time consuming even for hospitals that have staff with adequate computer skills. Hospitals and medical facilities also incur substantial costs when integrating new healthcare system software. These costs are important barriers to consider prior to integrating any new systems because additional costs in training and system customization must also be factored into the total costs. These issues are unique to the adoption of healthcare systems in developing countries (Mufti, 2000).

Identifying areas of training that are needed prior to the implementation of EHRs system would help to cut costs that are associated with unneeded training. Also hospitals that have more IT-support would experience an easier transition to the software integration. The initial time costs that are experienced coupled with the increased burden placed on physicians to learn new systems will decrease their use of hospitals information systems and lowers the potential for achieving quality improvements to healthcare.

Hospitals and medical facilities that order their software systems from large experienced vendors have a better chance of initial success of software implementation due to the increased IT-support systems that the vendors possess. Larger vendors have more resources at their disposal and they also have more hands on experience with assisting hospitals with software customization. Smaller vendors lack the support and resources that are needed to effectively aid hospitals in a complete introduction of EHRs system through customization (Hoffman &podgurski, 2012).

Solving software integration issues by making software designs more user friendly to healthcare professionals would increase the ease of transition. Challenges affecting the exchange of information between healthcare information systems between different hospitals and medical facilities raise another barrier for integration of healthcare information systems. The lack of integration makes it difficult to access clinical data such as lab reports, radiology and referral systems. The slow process of integration also increases the time that it takes to give patient care. Working between paper-based and electronic healthcare systems requires more time to enter data from external systems and also increases workflow (Benson, 2002).

EHRs systems require technological support structures from vendors, software creators and manufacturers. Smaller vendors are unable to provide all the services that larger hospitals and system integrations will need. Therefore conducting business with larger vendors that have the financial resources and supportive staff is more advisable to larger hospitals installing new EHRs systems. The complex support systems that are designed to assist in the EHRs implementation process. The final tuning and customization of hardware and software has to be performed in stages and not all as once in order to test the effectiveness of the system. The EHRs system has to be user friendly for physicians and staff to increase its effectiveness. Moreover as is the case with most developing countries, hospitals and medical facilities are known to have older computer system hardware due in part to limited funds available. The issue with interface usability is a major problem that has to be solved in order for any real progress to be made in seeing a universal EHRs system in place in Saudi Arabia. The difficulties that cause poor system execution include the both basic and advanced technology that physicians and

staff are unable to operate due in part to their limited computer knowledge. More advanced support software such as voice-recognition, touch screen and mobile devices that have sought to simplify the process, has only made it more difficult for users that are accustomed to using older forms of computer technology because there more to learn in the way of inputting data. Furthermore it is the staff and nursing who are usually responsible for inputting patient data into technology information systems. Hospital support staff and nurses haven't received the specialized computer software training that is required to operate advanced patient machinery. As is the case with most developing countries, due to limited funds and access to technology, not many professionals other than IT professionals have undergone training to work with advanced medical software as is usually provided on the job (Tian, 2011).

Healthcare professionals including doctors and staff are being forced to dedicate more time to training and system customization. The increased time that is being used for miscellaneous tasks could instead be used to focus on the quality of patient care and workflow design. Several previous studies have indicated that during the time of EHRs implementation, Saudi physicians have been burdened with extra work because of the need to learn new skills and also learn how to operate new software programs. The increased workload resulted in longer work days and reduced productivity for physicians (Mandle & Kohance, 2001). Also fewer patients were being seen each day while experiencing longer wait times at the same time.

In addition to the extra workload that physicians would be required to perform, hospital staff and nurses would be the ones who would manually transfer patient data into the EHRs system databases in the absence of dedicated IT professionals. The process of

transferring all patient files into EHRs systems would prove to be the most time consuming as hospitals have gone years accumulating paper-based patient data (Chassin &Donldson,1998) .Unless hospitals intended to use both EHRs and paper-based patient file systems, the manpower required to conduct such a task would be extensive.

Physician patient communication had been impaired during EHRs implementation as well. The increased time that physicians spend learning to use new EHRs software systems effectively has been shown to negatively affect physician-patient communication. Communication issues have also negatively affected patient satisfaction (Mcalister &Rhodes, 2010).

The lack of communication can contribute to a resistance in changing over to EHRs system. The possible negative effect on productivity could result in physicians and staff resisting the implementation of EHRs system. This resistance could make it nearly impossible to guarantee a successful implementation (Sheikh, 2011).

As with any corporate change, management will serve a critical role in whether or not the implementation is effective. Larger hospitals with more experienced managers will be more successful in transitioning from paper-based records to electronic records because they have the corporate leadership needed to guide their staff successfully through the transition (Breg, 2001).

According to this research study that was conducted in hospitals in Baha region in southern province of Saudi Arabia, to measure physicians' computer literacy skills, there was a lack of computer literacy among those who participated in the study. Those surveyed within the different hospitals in the region responded that they lack adequate

computer skills. This study was conducted as a result of the obvious lack of computer literacy among physicians in Saudi Arabia. The survey questioned the need for medical schools to require their students to use computer during their studies and also for Saudi Medical schools to find way to incorporate EHRs systems into their curriculum. This is seen as a major barrier to implementing a nationwide EHRs system as the professionals that would be leading the transition away from paper-based files don't have the computer literacy skills to lead the transition. Access to EHRs systems while in medical school is crucial to learning the ins and outs of EHRs systems.

Computerized Physician Order Entry (CPOE) refers to electronically entering medication orders or other physician instructions in place of paper charts. CPOE is one of the most important components of any EHRs as it can assist in reducing errors related to illegibility of handwriting or transcription of medication orders. Some of the most common errors that can be reduced through CPOE are prescribing errors, including wrong drugs, form, dosage or frequency; incorrect route; and contraindicated drug use and interaction (Fontan et al., 2003). In the CPOE system, orders are incorporated with patient information such as laboratory and prescription data and further they are automatically checked for potential errors or patient harm. In this respect, healthcare professionals should be able to digitally record all the information about the health of patients into their EHRs. This means that healthcare professionals should be able to access patients' EHRs and make changes in the records in respect to any change in the condition of the patient (Dolin, 2010).

Medical doctors have shown little interest in computerization. Many of the healthcare specialists who have been interviewed held that they were comfortable with

PMR systems since they were simple to use. They affirmed that an individual required no training to use papers. However, it is true that most of the healthcare providers have little or no computer skills that are paramount to the handling of electronic devices that are connected to the EHRs systems (Berger et al., 1999). Some of the medical physicians are aged. For this reason, they do not intend to undergo any training in computer technology despite the fact they are competent professionals in medicine. In facilities where EHRs systems were being implemented, issues such as the lack of knowledge to handle the advanced technology were common among the clinicians, even the middle aged anxiety (Igbarria & Parasuraman, 1989). Insufficient software knowledge together with minimal computer skills can lead to failure of the entire system. This set of circumstances can result in slow workflow and low productivity. Such occurrences can have adverse effects on the situations of the patient. The lasting solution to knowledge-related barriers is thorough training of entrant doctors to replace the aging and retiring traditional doctors. In this manner, the implementation will not discriminate the physicians based on age (Ilie, Courtesy, and Van Slyke 9).

2.7.2 Security concerns regarding the use and access to EHRs Systems

Other factors that are considered barriers to nationwide adoption of the EHRs systems in Saudi Arabia would be the concept of patient privacy. The security among software systems is a major problem in developing countries because their systems are not advanced enough to monitor hackers. Hospitals in Saudi Arabia don't always have the funds available to employ large number of IT professionals to monitor EHRs security systems. The increase in hackers and unauthorized access to patient information globally has raised issues all over the world whether or not all EHRs systems are safe to use

(Madsen, 2008). The ability for hackers and thieves to gain access to patient files is a very real issue that affects both developed and developing countries alike. The benefits and risks of implementing EHRs system must be carefully weighed, however it is becoming more common place to incorporate such technology that all those who don't are viewed as being outdated (Mandle &Kohane,2001).

EHRs are centrally managed where different personnel may have access to them. Thus, a patient's medical record may be easily accessed by different departments within a facility and even externally by other healthcare units. This means malicious usage of patient information can result. There is also the issue of manipulation of data, where a patient's information may be wrongly entered, leading to a wrong diagnosis and/or prescription of medication (Smaltz and Eta, 2007). Because EHRs usage is a relatively recent development in medical practice, there are insufficient rules governing the use and disclosure of personal information. This is a major challenge in the use of EHRs systems. For the EHRs system to succeed there needs to be an accountability and integrity in carrying out the different roles in medical practice. This will include accountability on the parts of the patient, clinician, other hospital staff, health management and insurance companies. While healthcare key players and governments may try to implement such measures, there are concerns that the number of personnel with access to EHRs would be so great and the patient base so huge that there would be mass breach of confidentiality and patient privacy (Bourne, 2009).

EHRs systems are diverse and the people in hospitals and medical facilities with access to patient data are overwhelming, therefore it is imperative for technology to be secured prior to execution. Basic computer security systems are insufficient to

safeguarding such personal data. As with financial institutions that provide information to customers electronically, the medical information that is stored in hospital databases must be available to all applicable parties. Not only will hospital physicians have access to patient data, primary care doctors, nurses and pharmacists must be granted access as needed as well. Placing safeguards including multiple authorization checks in place for different categories of patient data is important to maintaining patient privacy rights. Over the past several decades, the digital era has increased the mobility of information and its ease of access. Databases of information have allowed both the public and private sector to store data over the internet and cloud connections, making paper-based files obsolete. In an age of digital files, there are yet an increasing number of barriers that are preventing many medical facilities from adopting a fully functional electronic health records system. Patient privacy rights and issues over security requirements have prevented the universal digitization of patient data. Also patients' right to control access to their personal information and the lack of checks and balances has many people concerned over its long-term viability (Polito, 2011).

The decision over the safety and security of electronic health records is to be evaluated on a system wide basis which is dependent upon the level of security protocols that are put in place (Wang, Zhang, Xu, Yin, & Guo, 2013). Security software and the use of checks and balances within health organizations prevent the unauthorized access of confidential information. Organizational security methods that are employed through each hospital and/or medical facility including private doctors' offices protect patient data. Federal compliance through the Health Insurance Portability and Accountability Act (HIPAA) requires hospitals and medical professionals to safeguard patient data and

limit access. The continuous issues surrounding internal fraud and identity theft among those with access to confidential information has led to numerous studies across various disciplines over the requirements for internal security measures (Polito, 2011).

There are no clear set rules and regulations governing the creation, retention and sharing of patient information. First, there needs to be a harmonized way of creating a patient's file. This involves having a unique patient identifier that will apply across all healthcare providers. Secondly, there is a need for a standard layout for patient information collection across the healthcare profession (Menachemi, 2006). Thirdly, there must be a standard method of information sharing between the various hospitals or healthcare units when the need arises. Such circumstances include referrals, change of preference by the patient or even cases where certain healthcare units close down and patient information needs to be retained. There have been two approaches suggested to enhance health data sharing between hospitals. These were the centralized data server model and the peer-to-peer model of file synchronization. While both are viable, they are still rendered unusable because there is no standardized method or format of record creation (Waegemann, 2003). This means that even if the records would be passed to different units, the usability of these records would be limited.

The latest advances in information technology have made it possible for patient data to be centralized into large databases that have improved the efficiency of healthcare. The benefits of implementing electronic health records are extensive, but the associated risks raise concerns over privacy rights and security. In hospitals, centralized databases are increasingly becoming more efficient in identifying patients and limiting errors in patient treatment (Morton, 2008). Patients are able to receive fast and efficient care

through the application of electronic health records from the ease of accessing patient medical records to electronically sending prescriptions to pharmacies. Though there are many benefits to using electronic health records, there must be a balance.

Centralized databases allow hospitals and healthcare facilities to quickly access patient data in order to provide fast and high quality care to patients. The reduction in paper work allows doctors and medical professionals to improve the quality and efficiency of patient care. Concerns over the security of centralized electronic health records and the risk of security breaches of confidential information have been raised as a result of recent breaches of information among financial institutions (Wang, Zhang, Xu, Yin, & Guo, 2013). Databases that contain confidential personal data are the ideal target for hackers and fraudsters that target vulnerable databases for loopholes in security systems. Identity theft and the safety of inputting personal data into electronic systems have raised questions over how such practices should be regulated (Polito, 2011).

Adoption of electronic health records has long been debated, and minus the long term cost savings benefits of installing such a system would require patients to sacrifice their privacy and personal security. The misuse and management of personal information among the private sector IT security systems has become apparent with the security breaches among financial institutions including Citibank in 2011, and major retailers including Target in 2013, that suffered security breaches of confidential personal data that belonged to millions of customers (Electronic Health Data Breaches Remain Primary Concern Despite Increased Use of Security Technologies and Analytics).

The Ministry of Health (MOH) in Saudi Arabia holds responsibility for planning, managing and providing health policies and the supervision of health programs. It is also

responsible for monitoring health services in the private sector, as well as directing other government and private organizations on approaches to achieving the objectives of the government's health (Altuwaijri, 2008). In spite of these achievements, the healthcare system in Saudi Arabia faces various challenges that call for new approaches and polices by the MOH as well as effective collaboration with other sector.

The last official survey in 2010 placed Saudi Arabia's population at 27.1 million, compared with 22.6 million in 2004. It was estimated that the population growth rate was 3.2% per annum annually, for the period between 2004 to2010 (Central Department of Statistics and Information). Saudi citizens represent approximately 68.9% of the total population. It is estimated that 67.1% of the population is under the age of 30 years, while about 37.2% are under 15 years and an estimated 5.2% comprises the population over 60 years (as cited in Almalki, Fitzgerald & Clark, 2011). Estimated that, by 2025 Saudi Arabia's population will reach 39.8 million (United Nations, 2003). Therefore, there will be an increasing demand on the necessary services and facilities including healthcare services as a result of this unprecedented growth in the population, while simultaneously creating economic opportunities.

According to the 2013 HIMSS Security Survey, there is more work that is needed in order to safeguard patient data from inappropriate access by unauthorized individuals including hospital employees. According to the survey, despite improvements in database security, 19% of respondents had reported security breaches and 12% of organizations that responded had at least one reported case of identity theft. The survey also brought to light several barriers that are preventing the secure installation of electronic health records which include budgeting issues, and lack of leadership that is

dedicated to ensuring patient privacy. Hospitals and medical facilities aren't spending enough to finance adequate security programs in their IT departments. Only 52% of respondents reported a full-time leader that manages patient data security. Also 92% of respondents admitted to conducting a formal risk analysis annually compared to only 54% of organizations that have a tested data breach response plan (Electronic Health Data Breaches Remain Primary Concern despite Increased Use of Security Technologies and Analytics).

Anti-virus and anti-hacker security programs in addition to incorporating the latest security barriers and password use throughout all healthcare organizations should reduce the risk of both internal and external security breaches. Data integrity, accountability, access control and confidentiality are requirements of an effective security system. Electronic health records are at an increased risk of manipulation and abuse. The storage of patient data is also at risk of being illegally modified or lost as a result of lapses in security programs and database glitches (Wang, Zhang, Xu, Yin, & Guo, 2013).

The latest medical equipment and patient monitors allow hospitals to wirelessly monitor and track patient data and transmit information through networks. These wireless networks can be easily hacked into when security software isn't up to date. The increase in patient care providers who have access to patient data increases the risk of unauthorized access to confidential data. Patient monitors and wireless equipment are more prone to security problems resulting from framework design and negligence in managing network errors. The illegal hacking and downloading of data from a compromised system can be conducted through the use of operator commands that

include macro and Java Script to break through the computer network (Wang, Zhang, Xu, Yin, & Guo, 2013).

The electronic storage of patient data across different databases with the ability to link data in order to determine patient identity should be separated into different files in which authorized access is required for each file prior to viewing. There is an increased security risk within databases that neglect to employ multiple access barriers as unauthorized attempts to access information are not routinely activated (Wang, Zhang, Xu, Yin, & Guo, 2013).

Through the use of electronic health records public health officials are able to monitor public health threats and the spread of disease. Without the technology, the public would receive notices of disease outbreaks. The technology increases the speed in which health professionals can alert the government to possible threats to both locally and internationally (Hoffman & Podgurski, 2012).

The obvious benefits of using electronic health records, however the challenge with implementing it requires more research and development. Prior to deciding what kind of database programs should be used, patient privacy and security needs to be reviewed and addressed. The proposed research study is to identify and evaluate the challenges affecting the implementation of electronic health records over paper-based patient filing systems. The variables affecting the risk including lack of security and patient privacy issues will also be researched.

2.7.3 High Cost of Adopting EHRs

Most of the facilities where EHRs implementation has been accomplished have revealed that the system is capital intensive. In fact, the approximate minimum implementation cost ranged from $255,000 per facility for third party hosted solution to $260,000 for vendor hosted 'Software as a Service' (SaaS) in 2011. Given this high cost, most of the facilities management opts to maintain the PMRs since they are cheaper in the end. The initial cost of setting up the infrastructure, training, and maintenance are deemed the greatest obstacle to the adoption of EHRs systems in many health institutions in the US. The stakeholders claim that they are unaware of the benefits that come with the electronic systems, especially in the private sector. They also perceive that the overall driving force towards implementation of the systems is profitability of the healthcare facilities (Coffey et al. 56). EHRs have other additional costs due to software licensing, support, hardware maintenance, and internet connectivity among others. The EHRs connectivity costs vary depending on whether a facility acquires its server or subscribes to an Application Service Provider (ASP). Ownership attracts high up-front capital costs while the ASP approach costs are deemed minimal at both the installation stage and maintenance. Those who choose the contracted or (SaaS) pay a monthly fee for the services. EHRs-related costs include transition costs, system upgrading, management configuration costs, reviews, audits, IT policies, privacy, and data integrity. Others encompass telecommunications costs for added bandwidth (wireless services), software, and additional computing devices (both stationary and mobile) that are necessary for other users who form part of the health care service provision, technical, and clinical-technical support staff (Coffey et al. 54).

2.7.4 Resistance to New Technologies of (EHRs)

The greatest obstacle to EHRs implementation is resistance from health physicians. Most of them expressed a feeling of contentment with the use of PMRs. They affirmed that the use of the electronic system had a negative impact on the physicians' workflow (Ilie, Courtesy, and Van Slyke 2). For instance, one hospital reported a 20% loss in efficiency. Others claimed that the system was 30% slower than the PMRs. As a result, the healthcare providers had become dependent on traditional paper-based ordering. Any change was perceived as a source of inefficiency in the practice. In addition, some organizations claimed that it was uneconomical to pay for the training of community-based physicians who worked based on part-time arrangements besides their unwillingness to undertake the training. In some cases, the resistance of physicians to change turned into rebellion, which derailed the entire implementation process. The negative publicity resulted in failure of the management to adopt the EHRs. Some patients also expressed the fear of their confidential information falling into wrong hands. In fact, 22% of those interviewed were reluctant to accept uploading their confidential information regarding past medical history unless watertight security for their information was guaranteed (Ilie, Courtesy, and Van Slyke 7).

2.7.5 Electronic Health Record System EHRs System Maintenance and Downtime

The Maintenance and Downtime is factor that can influence the adoption of Electronic Health Records Systems (EHRs System) in Saudi Arabia. The government of this country has invested significant capital into its healthcare system, and much attention is paid to information technologies (Almalki, Fitzgerald, and Clark 784). In turn, EHRs System are critical for improving the time-efficiency of many hospitals.

These tools can significantly improve the performance of various medical institutions. For instance, they can be vital for improving internal audit within hospitals (Alsosari 496). Currently, these technologies have already been adopted by some Saudi hospitals (Alsanea 117). Nevertheless, the rate of adoption is not very high (Bah 1). Overall, the degree of adoption depends on various factors. For instance, one can speak about perceived ease of use and the skills of various medical workers who will rely on EHRs System (Shaker, Farooq and Dhafar 1). The problem is that in many cases, nurses or physicians may lack necessary competencies to apply EHRs System effectively. As a result, they cannot fully benefit from adopting such technologies (Shaker and Farooq 173). This is one of the challenges that should be taken into account. Additionally, the degree of implementation depends on the security of these technologies. At present, the risk of security breaches has not been completely eliminated, and the confidential data of patients can be transferred to unauthorized third-parties (Ozair 74). This is one of the risks that one should not overlook. Apart from that, it is important to provide clear evidence indicating that these tools can be effective. Hospital administrators in Saudi Arabia should see the improvements that these technologies can bring (Moja, Bertizzolo and Bonovas 12). In some cases, they may see the advantages of these tools, especially if the usability of this system is rather poor. Furthermore, it is critical to remove such a problem as downtime. This term is used to describe the period during which the system is not available to the users. This technical problem can significantly undermine the work of many medical institutions (Oral 100). In turn, the adoption of EHRs System is more likely to intensify provided that there are well-developed procedures for coping with such difficulties. If these procedures are absent, medical workers may not get access to vital

information as soon as possible. Among other important barriers, one should certainly distinguish lack of proper maintenance. In particular, hospital administrators may believe that they will not be able to address problems related to these technologies effectively. This is why they are unwilling to adopt them. This difficulty is relevant to Saudi Arabia and many other countries. Thus, one can argue that much depends on the ability of developers to support hospitals. In this context, maintenance also includes training which can be of great benefit to many medical workers.

Furthermore, the implementation of these technologies depends on the availability of software (Aminpour, Sadoughi, and Ahamdi 57). For instance, open-source software can be useful for modifying technologies, especially at the time when some technical problems have to be resolved (Aminpour, Sadoughi, and Ahamdi 57). On the whole, this discussion shows that the adoption of EHRs System can be influenced by different factors. In particular, one should speak about computer literacy skills of medical workers who will be the main users of these technologies. Additionally, it is critical to consider the ability of developers to reduce the downtime and provide support to medical institutions. If these issues are effectively addressed, the rate of adoption will increase significantly.

2.7.6 Adaptation of Electronic Healthcare Records (EHRs)

As a result of technological innovations in the past decades, many healthcare professionals are recognizing the need to improve the health information technology division of healthcare. According to Xierali et al. (14), incorporation of information technology in medical record promotes the quality of care and efficiency of the workflow. Lee, Kuo, and Goodwin (1) indicate that Electronic Health Records (EHRs) have

enhanced the collection, storage, and reporting of information regarding the patients. Moreover, the systems are useful in safeguarding policy compliance and decision-making within the healthcare institutions. Past research studies have reported that EHRs are efficient as they minimize errors during the entry of data in comparison to the conventional forms of record keeping. Although the use of EHRs is projected to transform the health information management systems within hospitals, Jones and Furukawa (1254) state that they are characterized by low rates of adoption. Particularly, smaller healthcare facilities have failed to recognize the significance of these systems in the health sector. As a result, federal governments in the developed world are faced with challenges in solving the digital divide associated with EHRs. Additionally, Abramson et al. (1156) report that governments are increasing the amount of funding to promote the implementation and adaptation of the EHRs. Such interventions are beneficial as they ensure that the benefits of the systems are felt across the healthcare sector (Granlien and Hertzum 198). In reference to Menachemi, Powers, and Brooks (184), another major barrier to the adoption of the systems is the characteristics of the healthcare providers. Specifically, the adoption and acceptance is dependent of the technological abilities, specialty, and age of the nurses and physicians.

According to King, Furukawa, and Buntin (2038), there is need to ensure that the adoption of the EHRs benefits all individuals across the population. The limitations concerning access to new technologies in some healthcare institutions hinder the adoption of the systems. Moreover, financial constraint is likely to affect the adoption of the system in such regions. Similarly, McAlearney et al. (463) note that the implementation phases of EHRs are costly and many facilities may require federal

support. In a research undertaken by these authors, the health professionals reported that they were worried about the transition from "old to new" recording systems (463). In this view, it is important to offer comprehensive training to the healthcare providers on the importance of incorporating the systems in the workflow (King, et al., 2038). Furthermore, Ginn, Shen, and Moseley (338) report that the perceptions of the management may limit the adoption of the systems. Such perceptions are determined by the financial implications of EHRs implementation. Thus, awareness campaigns by the ministry of health are crucial in educating the entire health sector on the importance of the EHRs. Angst and Agarwal (340) argue that issues relating to the privacy of the patient's records have been identified as obstacles to the implementation of EHRs. Therefore, ethical issues relating to privacy and confidentiality of the records should be incorporated into the training phases. All the aforementioned barriers have slowed the implementation and adoption of the Electronic Health Records systems throughout the healthcare sector. Therefore, policy makers and institutional managements have a vital role to play in determining how the barriers can be eliminated. Furthermore, all the personnel in the health sector should cooperate in enhancing the adoption of the EHRs.

CHAPTER III

III. METHODLOGY

3.1 Research Design and Collection Data:

Quantitative research method was conducted. Research articles and cases studies will be gathered from academic journals and university studies along with financial records from healthcare facilities will be analyzed for relevant data. Also relevant

academic articles, journals and reports from financial institutions utilizing central databases to store confidential information will be reviewed for security practices. Further evaluation over the need for the implementation of security practices and precautions that institutions have in place will be reviewed using relevant data that will be obtained either directly from the institution or through information databases.

There are two types of methods that are used to conduct quantitative research, primary and secondary research methods. The primary research method is used when there is not data from which to conduct research. The researcher obtains primary data by conducting interviews, sending out questionnaires and surveys and also collecting data samples from other scholars. There the data collected from primary sources can be customized to answer target research questions. The data is usually new and dissimilar from other sources. It has to be processed and analyzed before the researcher can make any sense of it. It also has to be strategically applied to the questions at hand. Secondary sources of data are those that have been obtained from outside sources. Secondary data is usually used as supportive data and May not related directly to the researcher's primary research topic, but can serve as a guide. When comparing the use of these two types of data, one has to identify the advantages and disadvantages of using either one. The collection and use of primary data usually takes more time to collect because questionnaires and surveys have to be created and then send out. Also participants have to be sourced and selected to ensure that the data obtained is relevant to the hypothesis. It is also more expensive to do because of the materials and software that are needed to collect and analyze the data. The secondary data research method is less time consuming and more cost efficient as the data has already been collected and analyzed.

Information gathered from scholarly articles and case studies on EHRs usage will be used to identify key factors supporting or in opposition to the research questions and hypothesis of this study. Key factors that are being questioned are the nature of concerns over patient privacy, computer skills and general communication. Results from research provide preliminary answers to research questions.

A survey is being conducted measuring barriers affecting the implementation of EHRs systems in Saudi Arabia. 11 health facilities in the Baha province of Saudi Arabia were sent a survey that is supposed of measure the level of EHRs implementation at their hospital and/or patient care facility, and potential barrier for is implementation. The major potential barriers to the successful implementation of EHRs implementation that the survey is testing for is educational level, computer knowledge, level of training given to employees, security and privacy issue concerns, Lack of EHRs awareness, Cost of EHRs systems, Resistance to new technologies, Confidentiality and privacy concerns, Security concerns regarding the use and access to EHRs Systems, and the EHRs system maintenance. An evaluation over the need for the implementation of security practices and precautions that institutions have in place will be reviewed using relevant data that will be obtained either directly from the institution or through information databases.

This study will be conducted using quantitative research method. Quantitative research methods including data mining, the collection and analysis of empirical data, and the modeling and analysis of data from case studies and other relevant documents. The proposed research method for this study is to analyze historical data and literature reviews including corporate hospital financial records in the search for budgeting practices. This research will also analyze case studies and possible data mining for

security breaches. However, In order to make the survey anonymous and respect the participants rights to privacy. The survey questions doesn't includes any personally identifiable questions. A survey was distributed to 11 Health facilities in Baha Province of Saudi Arabia in order to collect data by a survey on targeted research questions that measure, security concerns, technological skills among hospital employees and other relevant questions. The data will be evaluated for each Hospital/health facility to draw conclusions to research questions. The data that is collected from the surveys of the different hospitals/health facilities will be used to support or oppose the research hypothesis. The survey questions target to 3 categories as follow: 1- Demographics, 2- EHRs System Existence and availability, 3- Factors associated with implementation and adoption of EHRs System. A survey has been compiled as seen in the sample copy provided in Appendix A.

All computation were performed with SAS® released 9.2 running on IPM PC with windows/ XP operating system. The following SAS procedure were used to explore, manipulate, format and analyze the data: DATA STEPS, FORMAT procedure, CHART producer, FREQ procedure, and T-Test procedure. For continuous variables the method were used appropriate to analyze the data:

- Mean, SD for descriptive analysis.
- Correlation Analysis : Pearson correlation
- Correlation Analysis : Spearman correlation
- T-test

3.2 Demographics of Study Population:

In order to have a good sample analysis, this study focused on 11 different facilities in Baha province, which followed one administrative body and they are a clear representation of all hospitals in Saudi Arabia. These hospitals are King Fahad Hospital, Baljurashi Hospital, Aqiq Hospital, Psychiatric Hospital, Mandaq Hospital, Karra Hospital, Rehabiltaion Hospital, Mikwah Hospital, Qilwa Hospital, Hajra Hospital, and General Directorate of Health Affairs

3.3 Study Population:

The Survey was formulated in such a way as to collect information regarding to the hypotheses described in section 1.4. The survey questions used to give an acceptable answer to the questions related to the Factors Associated with Implementation and Adoption of EHRs. Therefore, the survey targeted to all the group belong to the health field, and deal with a different parts of a EHRs System. Hence, each group gets to work at least with one specific part of an EHRs System, statistics were derive individually for each individual group which helped to get more understand which group are more rise to resisting the adoption of EHRs System.

3.4 Pilot Study:

The survey shown in Appendix A was first evaluated by advisor to ascertain its structure and validity. The pilot study consisted of 1754 surveys which were distributed among the six group of health care staff, for 3 weeks to collect the data from the 6 groups (Physicians, Nurses, Lab Technician, Pharmacists, Medical records, and administrative staff.

3.4.1 Calculation of Sample Size (Power Analysis)

A power analysis was performed to ensure that a power of .8 was obtained as is standard in clinical psychology research (Cohen, 1992). At least 256 participants were necessary to achieve statistical significance of effects at small to medium effect size.

3.5 Data Analysis

All statistical tests were conducted at the 95% confidence level ($\alpha = .05$). Data analysis was performed in several steps. First, descriptive statistics were calculated. Tables and graphs were created for responses to each question in the questionnaire. Second the study hypotheses were investigated. The following is a description of the analysis performed for each study hypothesis:

Hypothesis 1: Security concerns and the lack of authorization controls inhibit the acceptance of EHRs by medical professionals.

Hypothesis 1 was analyzed using Pearson correlation analysis and a t-test test. The dependent variable for Hypothesis 1 was acceptance of EHRs, as measured by Question 19. Question 19 stated, "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. Two continuous and one categorical independent variable were used in the analysis. The two continuous variables were coded from responses to Question 27 and Question 32. Question 27 asked respondents to rank the obstacles the organization will face in implementing EHR. The rank of "Meeting Privacy and Security Standards" was coded into a continuous variable. For Question 32, respondents were asked to rate on a scale between strongly agree and

strongly disagree whether they believe "Our facility does not have enough employees to ensure that the EHR is secure." This was also coded into a continuous variable. The relationships between these two continuous independent variables and the dependent variable were analyzed using Spearman correlation. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Privacy and security concerns regarding the use and access of EHRs System" was coded as a dichotomous variable. A t-test was conducted to examine the relationship between this variable and the dependent variable.

Hypothesis 2: Concerns about EHRs system maintenance and support programs would inhibit the acceptance of EHRs by medical professionals.

Hypothesis 2 was analyzed using Pearson correlation analysis and a t-test. Hypothesis 2 stated that concerns about EHRs system maintenance and support programs would inhibit the acceptance of EHRs by medical professionals. The dependent variable for Hypothesis 2 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. Two continuous and one categorical independent variables were used in the analysis. The two continuous variables were coded from responses to Question 32. For Question 32, respondents were asked to rate on a scale between strongly agree and strongly disagree whether they believe "Maintaining and updating EHRs systems is too expensive" and "Our facility does not

have enough staff to maintain the system." This was also coded into a continuous variable. The relationships between these two continuous independent variables and the dependent variable were analyzed using Spearman correlation. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "EHRs system maintenance" was coded as a dichotomous variable. A t-test was conducted to examine the relationship between this variable and the dependent variable.

Hypothesis 3: Concerns about lack of knowledge of the EHRs systems and lack of computer literacy skills would inhibit the acceptance of EHRs by medical professionals.

The dependent variable for Hypothesis 3 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. The two continuous independent variables were coded from responses to Question 4 and Question 5. For Question 4, respondents were asked to report on a Likert style scale between very little and a great deal to the question "How much do you know about Electronic Health Records?" These responses were coded into a continuous variable. For Question 5, respondents were asked to respond on a Likert style scale between strongly agree and strongly disagree to "My computer skills are weak and I would ask someone to help me to do the computer-related work" These responses were coded into a continuous variable.

Hypothesis 4: Concerns about cost would inhibit the acceptance of EHRs by medical professionals.

The dependent variable for Hypothesis 4 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. The two continuous independent variables were coded from responses to Question 22 and Question 32. For Question 22, respondents were asked to report on a Likert style scale between strongly agree and strongly disagree with the statement "I think the EHRs system to be more useful in the health facility, but I think that the costs for a full implementation are too high" The response to this question was coded as a continuous variable. For Question 32, respondents were asked to rate on a scale between strongly agree and strongly disagree whether they believe "The cost of implementing an EHR system is too high." The response to this question was also coded as a continuous variable. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Cost of EHR system" was coded as a dichotomous variable. A t-test was conducted to examine the relationship between this variable and the dependent variable.

Hypothesis 5: Concerns about EHRs systems being less secure and reliable than their paper-based counterparts would inhibit the acceptance of EHRs by medical professionals.

The dependent variable for Hypothesis 5 was acceptance of EHRs, as measured by Question 20. For Question 20, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "In my opinion, I think that EHRs system will protect the privacy of our patients' more than paper-based medical records." The response to this question was coded into a continuous variable. For Question 25, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "I think the EHRs system is secured and trusted more than paper-based medical records" The response to this question was coded into a continuous variable.

Hypothesis 6: Those medical professional that believe that EHRs systems improve current workflow are more likely to accept the adoption of EHRs systems.

Question 19 stated, "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety." This was a Likert style question coded into a continuous dependent variable. For Question 23, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "I prefer adopting new technologies with they are proven to increase quality and efficiency of workflow." The response to this question was coded into a continuous variable. This was the independent variable in the analysis.

CHAPTER IV

IV. RESULTS

4.1 DESCRIPTIVE STATISTICS OF THE DATA

4.1.1 RESPONSE RATE PER HOSPITAL

Hospital employees were surveyed from 10 hospitals in Saudi Arabia and the General Directorate of Health Affairs. Sample size calculation was performed at the 95% confidence level. We wanted a confidence interval of 5% at most for each hospital, so a sample size calculation was performed for Baljurashi Hospital, with the highest population.

In order to perform the sample size calculation, the calculator at http://www.surveysystem.com/sscalc.htm#one was used. The following formula was used to compute the number of surveys needed for each hospital:

$$N = \frac{\frac{Z\,p(1-p)}{c^2}}{1 + \frac{\frac{Z\,p(1-p)}{c^2}}{Q}}$$

In this formula N is the sample size.

P is the proportion, largest possible number for this is 0.5

c = confidence interval entered as a decimal. So, for 5% it is 0.05

Q is the total population, so for King Fahad Hospital Q would be 800 and for Aqiq Hospital it would be 220.

Z = is the Z value. For 95% confidence, it would be 1.68

For a confidence interval of 5% at the 95% confidence level, 260 surveys needed to be sent out at the largest hospital, King Fahad Hospital. Below is the number of

surveys sent out: the response rate, the total number of people employed at the facility, and the confidence interval for each hospital. Note, that each confidence interval is 5% or smaller. (See Table 1 and Figure 1).

Table 1

Sample and Response Rates by Hospital

Health Facility Name	Total Number Employed at Facility	Number of Surveys Needed	Sample Response	Response Rate
King Fahad Hospital	750-800	260	48	18.46%
Baljurashi Hospital	800-850	265	56	21.13%
Aqiq Hospital	200-220	140	76	54.29%
Psychiatric Hospital	200-240	148	26	17.57%
Mandaq Hospital	200-250	152	42	27.63%
Karra Hospital	100-150	108	37	34.26%
Rehabilitation Hospital	200-230	144	34	23.61%
Mikwah Hospital	250-280	162	31	19.14%
Qilwa Hospital	200-220	140	66	47.14%
Hajra Hospital	100-150	108	32	29.63%
General Directorate of Health Affairs	150-190	127	21	16.54%
Total		1754	469	26.74%

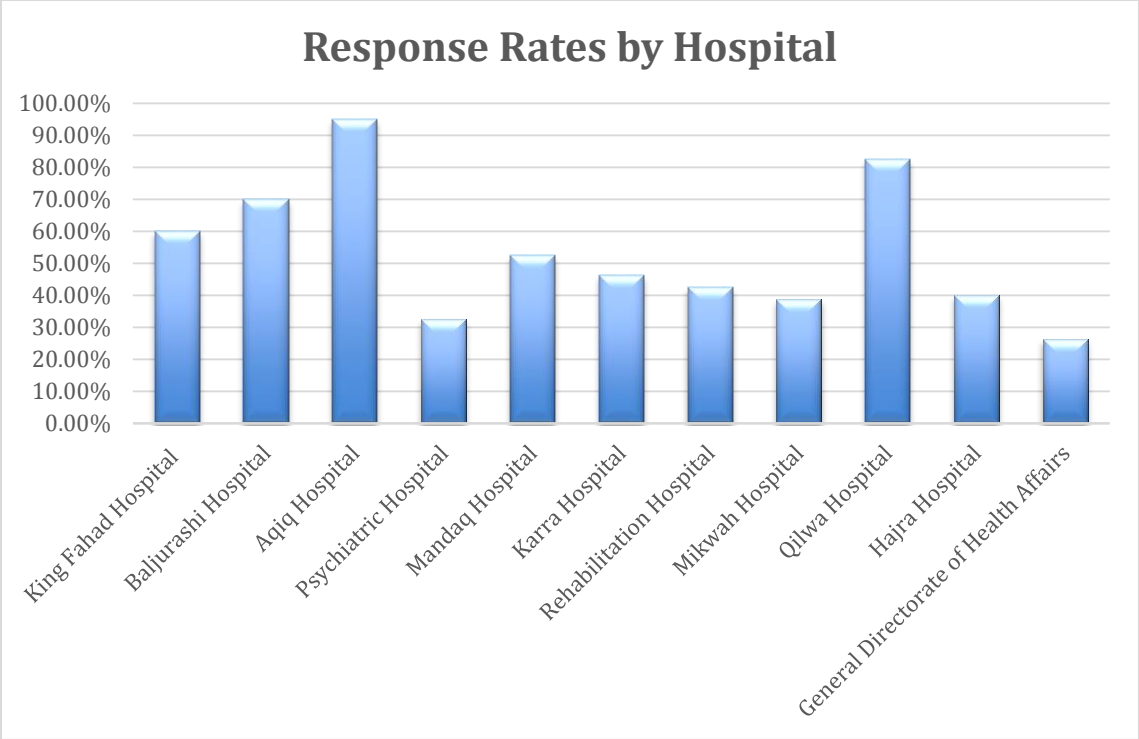

Figure 1.
Bar Graph of Response Rates by Hospital

4.1.2 RESPONSE RATE PER EDUCATIONAL LEVEL

Participants in the survey were asked to self-report their highest level of education obtained. Participants reported the following levels of completed education: (a) High School or below; (B) Two Year Diploma or Certificate; (c) Bachelor's Degree; and (d) Master's or Higher Education. Below are the number of participants and percentages of the sample by level of completed education for each hospital (see Table 2 and see Figure 2).

Table 2
Sample by Hospital and Education Level

Health Facility Name	Education Level							
	High School or Below		Two Year Diploma or Certificate		Bachelor's Degree		Masters or Higher Education	
	N	*%*	*N*	*%*	*N*	*%*	*N*	*%*

King Fahad Hospital	1	2.1%	8	17.0%	23	48.9%	15	31.9%
Baljurashi Hospital	3	5.4%	18	32.1%	16	28.6%	19	33.9%
Aqiq Hospital	13	54.2%	19	32.1%	33	28.6%	9	33.9%
Psychiatric Hospital	1	3.8%	5	19.2%	16	61.5%	4	15.4%
Mandaq Hospital	0	0.0%	9	21.4%	23	54.8%	10	23.8%
Karra Hospital	2	5.6%	11	30.6%	19	52.8%	4	11.1%
Rehabilitation Hospital	0	0.0%	9	27.3%	16	48.5%	8	24.2%
Mikwah Hospital	0	0.0%	5	17.2%	18	62.1%	6	20.7%
Qilwa Hospital	2	3.2%	8	12.7%	35	55.6%	18	28.6%
Hajra Hospital	2	6.5%	3	9.7%	21	67.7%	5	16.1%
General Directorate of Health Affairs	0	0.0%	4	19.0%	10	47.6%	7	33.3%

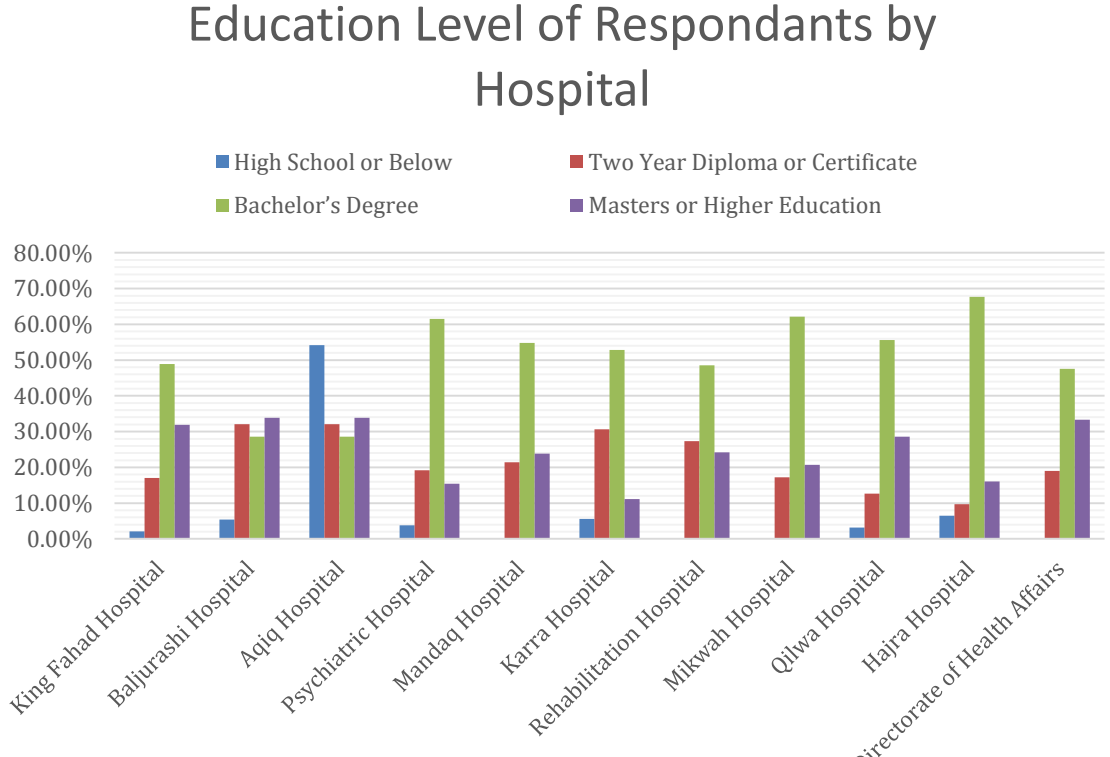

Figure 2: Bar Graph of Sample by Hospital and Education Level

4.1.3 RESPONSE RATE PER GENDER

Both male and female respondents were surveyed. A total of 292 male respondents and 157 female respondents participated in the survey. Below are the number of participants and percentages of the sample by gender for each hospital (see Table 3 and see Figure 3).

Table 3
Sample by Hospital and Gender

	Gender			
Health Facility Name	Male		Female	
	N	%	N	%
King Fahad Hospital	33	70.2%	14	29.8%
Baljurashi Hospital	42	79.2%	11	20.8%
Aqiq Hospital	40	62.5%	24	37.5%
Psychiatric Hospital	20	76.9%	6	23.1%
Mandaq Hospital	14	33.3%	28	66.7%
Karra Hospital	24	66.7%	12	33.3%
Rehabilitation Hospital	22	66.7%	11	33.3%
Mikwah Hospital	21	66.7%	10	36.9%
Qilwa Hospital	41	63.1%	24	12.7%
Hajra Hospital	20	64.5%	11	35.5%
General Directorate of Health Affairs	15	71.4%	6	28.6%

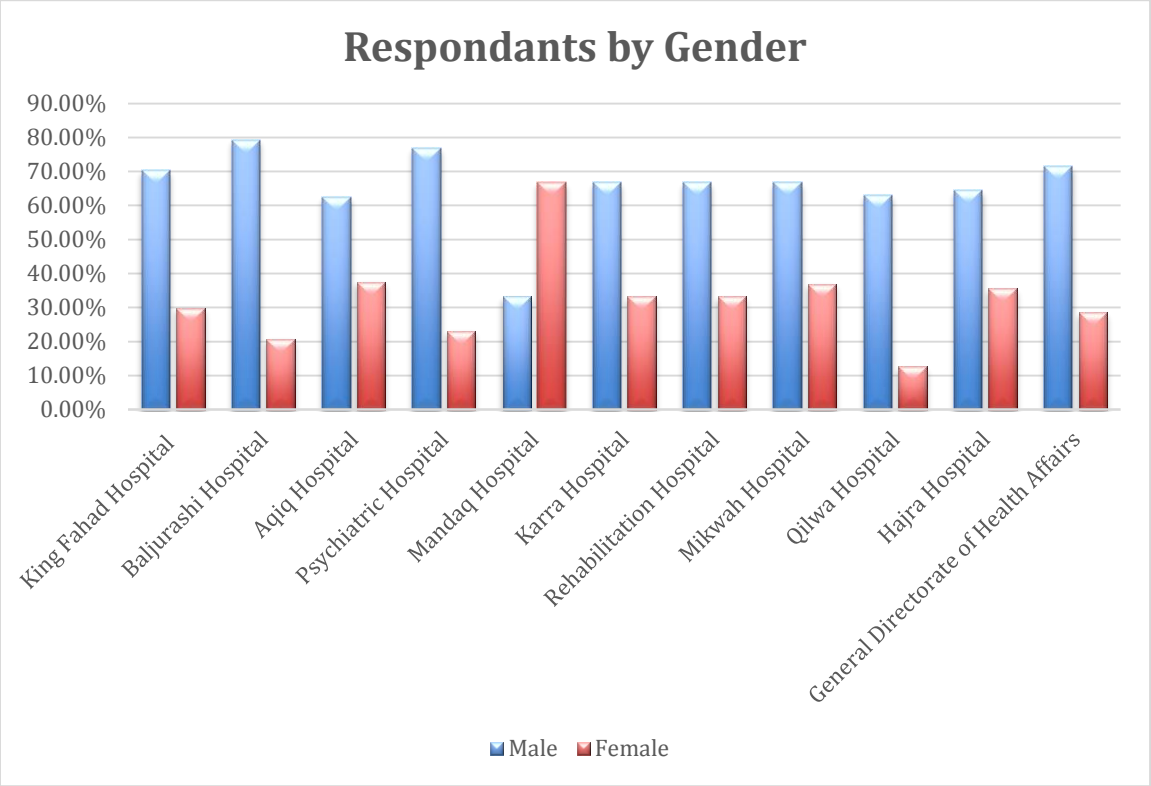

FIGURE 3: *Bar Graph of Sample by Hospital and Gender*

4.1.4 RESPONSE RATE PER HEALTH CARE PROFESSIONAL

Participants in the survey were asked to self-report their healthcare profession. Participants reported the following healthcare professions: (a) Physician; (B) Nurse; (C) Pharmacist; And (D) Lab Technician; (E) Administration Staff; And (F) Medical Records. Below are the number of participants and percentages of the sample by level of completed education for each hospital (see Table 4 and see Figure 4).

Table 4
Sample by Hospital and Healthcare Profession

Health Facility Name	Healthcare Profession											
	Physicians		Nurses		Pharmacists		Lab Technician		Administration Staff		Medical Records	
	N	%	N	%	N	%	N	%	N	%	N	%
King Fahad Hospital	14	29.2%	4	8.3%	4	8.3%	4	8.3%	8	16.7%	14	29.2%
Baljurashi Hospital	21	38.2%	8	14.5%	9	16.4%	6	10.9%	5	9.1%	6	10.9%
Aqiq Hospital	18	23.7%	22	28.9%	10	13.2%	6	7.9%	15	19.7%	5	6.6%
Psychiatric Hospital	8	30.8%	4	15.4%	4	15.4%	4	15.4%	3	11.5%	3	11.5%
Mandaq Hospital	9	21.4%	25	59.5%	2	4.8%	0	0.0%	3	7.1%	3	7.1%
Karra Hospital	5	13.9%	10	27.8%	5	13.9%	6	16.7%	5	13.9%	5	13.9%
Rehabilitation Hospital	11	33,3%	6	18.2%	2	6.1%	0	0.0%	7	21.2%	7	21.2%
Mikwah Hospital	5	16.7%	6	20.0%	3	10.0%	4	13.3%	4	13.3%	8	26.7%
Qilwa Hospital	21	31.8%	17	25.8%	2	3.0%	6	9.1%	8	12.1%	12	18.2%

Hajra Hospital	4	12.9%	4	12.9%	3	9.7%	3	9.7%	5	16.1%	12	38.7%
General Directorate of Health Affairs	4	20.0%	4	20.0%	1	5.0%	2	10.0%	7	35.0%	2	10%

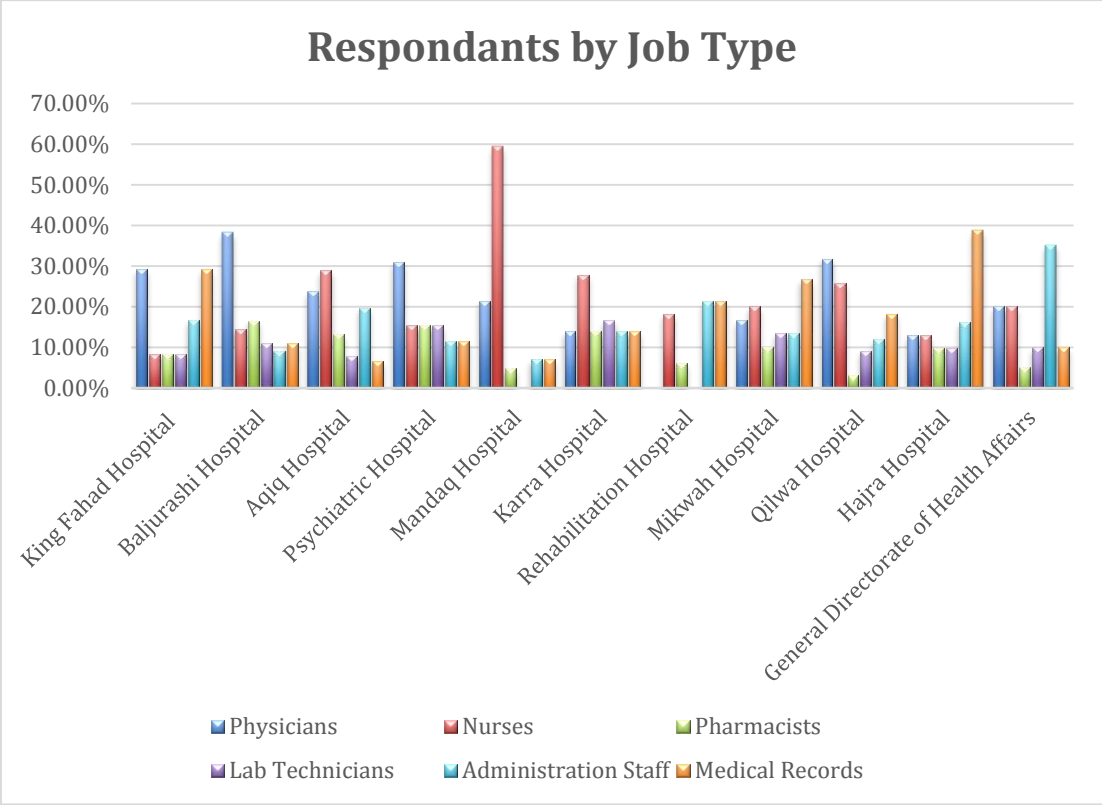

Figure 4
Bar graph of Sample by Hospital and Healthcare Profession

4.1.5 RESPONDENTS CHOICE FOR THE 4 MAIN BARRIERS

Participants were asked to report the four most important barriers to EHR systems implementation. Participants were given a list of the following six barriers. The list of barriers presented to participants were the following:

- Lack of computer skills

- Cost of EHRs system
- Adaptation to new technology
- Privacy and security concerns regarding the use and access of EHRs System
- EHRs maintenance
- Resistance to new technology

The four most commonly cited barriers by participants were lack of computer skills, adaptation to new technology, costs of the EHRs system, and privacy and security concerns. Table 5 displays the participants' choices by hospital.

Table 5
Ranking of Reported Barriers by Hospital

Barriers	Lack of Computer Skills	Adaptation to New Technology	Cost of EHR System	Privacy and Security Concerns	EHR System Maintenance	Resistance to New Technology
King Fahad Hospital	35 (72.9%)	37 (77.1%)	38 (79.2%)	36 (75%)	18 (37.5%)	20 (41.7%)
Baljurashi Hospital	38 (67.9%)	30 (53.6%)	20 (35.7%)	25 (44.6%)	23 (41.4%)	18 (32.1%)
Aqiq Hospital	64 (84.2%)	53 (69.7%)	34 (44.7%)	33 (43.3%)	38(50.0%)	40 (52.6%)
Psychiatric Hospital	20 (76.9%)	19 (73.3%)	17 (65.4%)	17 (65.4%)	8 (30.8%)	11 (42.3%)
Mandaq Hospital	29 (69.0%)	19 (45.2%)	19 (45.2%)	20 (47.6%)	10 (23.8%)	9 (21.4%)
Karra Hospital	20 (54.1%)	21(56.8%)	20 (54.1%)	18 (48.6%)	16 (43.2%)	14 (37.8%)
Rehabilitation Hospital	27 (79.4%)	24 (70.6%)	25 (73.5%)	24 (70.6%)	12 (35.3%)	11 (32.4%)

Mikwah Hospital	23 (74.2%)	21 (67.7%)	18 (58.1 %)	26 (83.9%)	15 (48.4%)	13 (41.9%)
Qilwa Hospital	18 (72.7%)	22 (33.3%)	17 (25.8 %)	36 (54.5%)	42 (63.6%)	25 (37.9%)
Hajra Hospital	26 (81.3%)	18 (56.3%)	27 (84.4 %)	19 (59.4%)	7 (21.9%)	13 (40.6%)
General Directorate of Health Affairs	12 (57.1%)	14 (66.7%)	13 (61.9 %)	12 (57.1%)	9 (42.9%)	8 (38.1%)
Total	349 (66.6%)	300 (57.3%)	289 (55.2 %)	173 (52.1%)	200 (38.2%)	185 (35.3%)

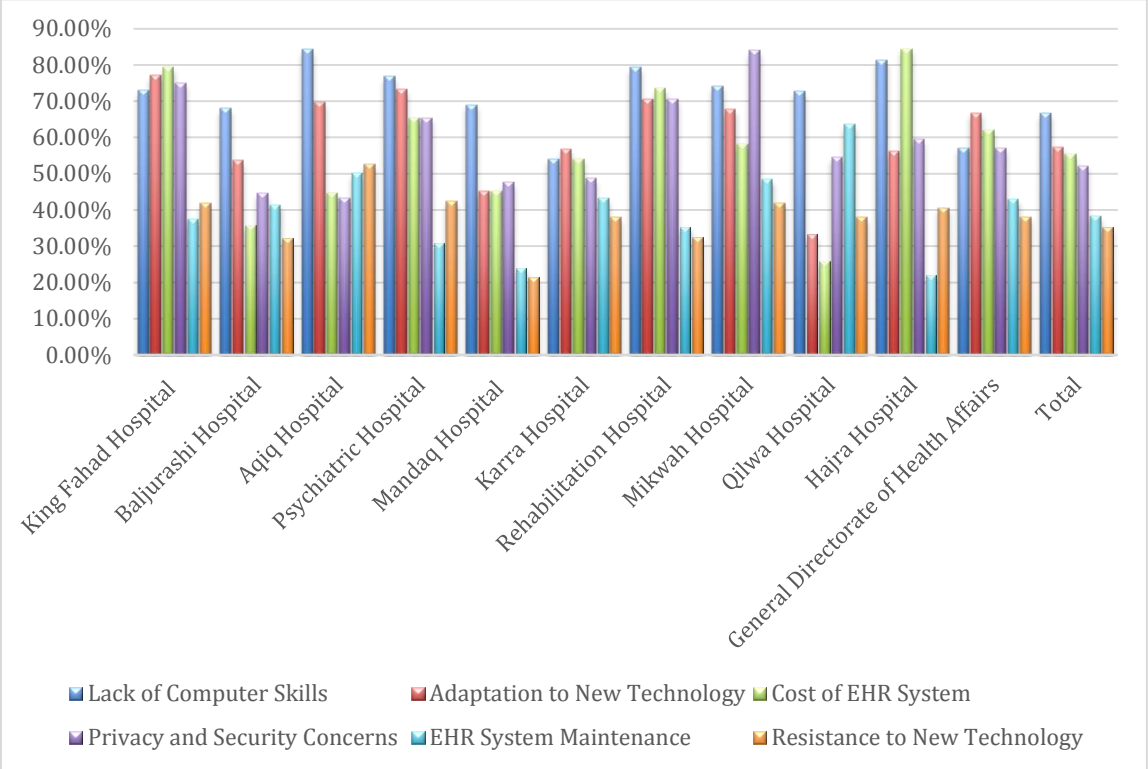

Figure 5.
Bar graph of Ranking of Reported Barriers by Hospital

4.1.6 IMPLEMENTATION OF EHRs

Participants were asked to report whether the EHRs system was implemented at their organization. There were 262 participants (57.5%) who reported that EHRs system was fully implemented at their organization, 93 participants (20.4%) who reported that an EHR system was partially implemented at their organization, and 101 participants (22.1%) who reported that that EHRs system was not implemented at all at their organization (see Table 6 and Figure 6).

Table 6

Reported Implementation of EHRs

	N	*%*
Fully implemented (Yes)	262	57.5%
Partial implemented (Maybe)	93	20.4%
Not implemented at all (No)	101	22.1%
Total	524	100.0%

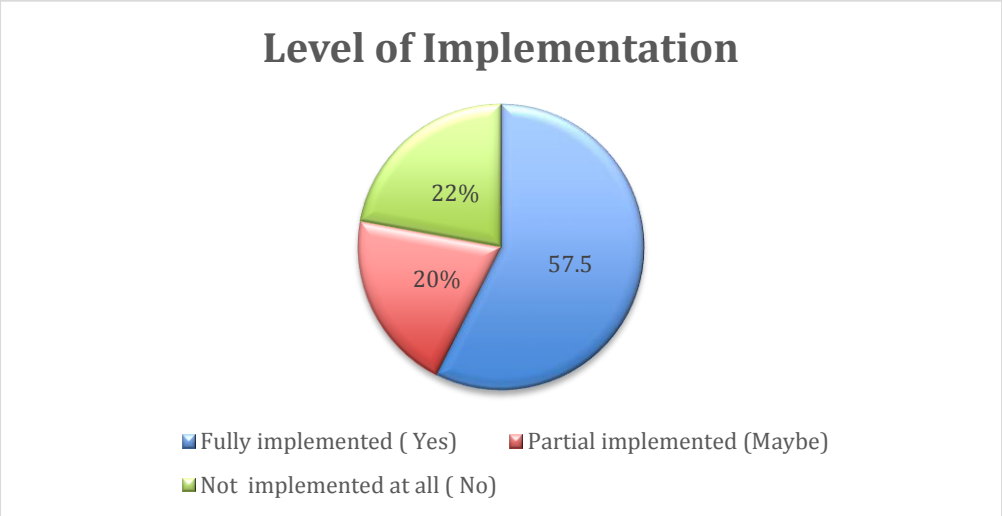

Figure 6: Pie Chart of the Number of Respondents by Level of Implementation of an EHR system

4.1.7 Respondent Rate by Computer Skills

Participants were asked to report their level of computer skills. Participants were presented with three choices, excellent, adequate and poor. Table 7 and Figure 7 summarize the participant responses by hospital.

Table 7
Self-reported Level of Computer Proficiency

	Excellent	Adequate	Poor
King Fahad Hospital	7 (14.9%)	33 (70.2%)	7 (14.9%)
Baljurashi Hospital	16 (29.6%)	32 (59.3%)	6 (11.1%)
Aqiq Hospital	12 (16.0%)	50 (66.7%)	13 (17.3%)
Psychiatric Hospital	2 (7.7%)	18 (69.2%)	6 (23.1%)
Mandaq Hospital	4 (9.8%)	34 (82.9%)	3 (7.3%)
Karra Hospital	6 (17.1%)	26 (74.3%)	3 (8.6%)
Rehabilitation Hospital	4 (12.1%)	16 (48.5%)	13 (39.4%)
Mikwah Hospital	3 (10.7%)	18 (64.3%)	7 (25.0%)
Qilwa Hospital	20 (30.3%)	35 (53.0%)	11 (16.7%)
Hajra Hospital	6 (21.9%)	19 (59.4%)	7 (21.9%)
General Directorate of Health Affairs	8 (40%)	12 (60.0%)	0 (0.0%)
Total	91 (19.6%)	298 (64.2%)	75 (16.2%)

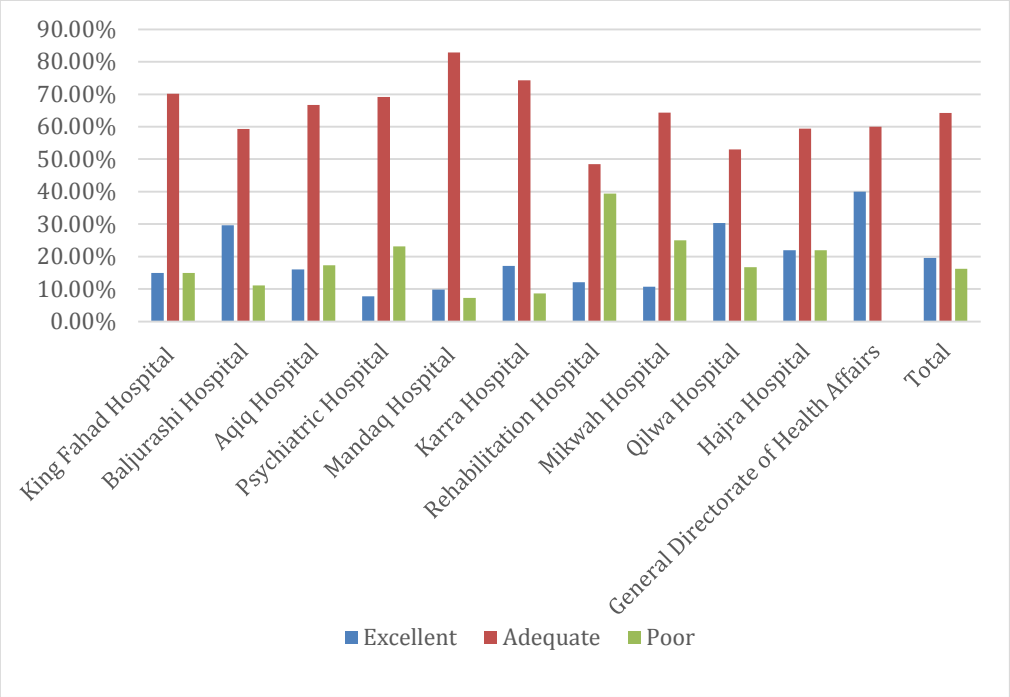

Figure 7: *Bar Graph of Self-reported Level of Computer Proficiency by Hospital*

4.1.8 Responded Rate of Knowledge about the EHR Systems

Participants were asked to report their level of knowledge of EHRs systems. Participants were presented with four choices, a great deal, a few things, a little, and very little. Table 8 and Figure 8 summarize the participant responses by hospital.

Table 8
Self-reported EHRs *system knowledge*

	A Great Deal	A Few Things	A Little	Very Little
King Fahad Hospital	8 (17.0%)	16 (34.0%)	9 (19.1%)	14 (29.8)
Baljurashi Hospital	11 (20.4%)	23 (42.6%)	7 (13.0%)	13 (24.1%)
Aqiq Hospital	14 (18.4%)	20 (26.3%)	33 (43.4%)	9 (11.8%)
Psychiatric Hospital	0 (0.0%)	8 (32.0%)	9 (36.0%)	8 (32.0%)
Mandaq Hospital	4 (9.8%)	15 (36.6%)	15 (36.6%)	7 (17.1%)

Karra Hospital	6 (16.7%)	12 (33.3%)	10 (27.8%)	8 (22.2%)
Rehabilitation Hospital	3 (9.1%)	10 (30.3%)	8 (24.2%)	12 (36.6%)
Mikwah Hospital	3 (10.7%)	15 (53.6%)	8 (28.6%)	2 (7.1%)
Qilwa Hospital	7 (10.6%)	25 (37.9%)	24 (36.4%)	10 (15.2%)
Hajra Hospital	5 (15.6%)	18 (56.3%)	4 (12.5%)	5 (15.6%)
General Directorate of Health Affairs	4 (19.0%)	10 (47.6%)	4 (19.0%)	3 (14.3%)
Total	66 (14.2%)	175 (37.6%)	134 (28.8%)	91 (19.5%)

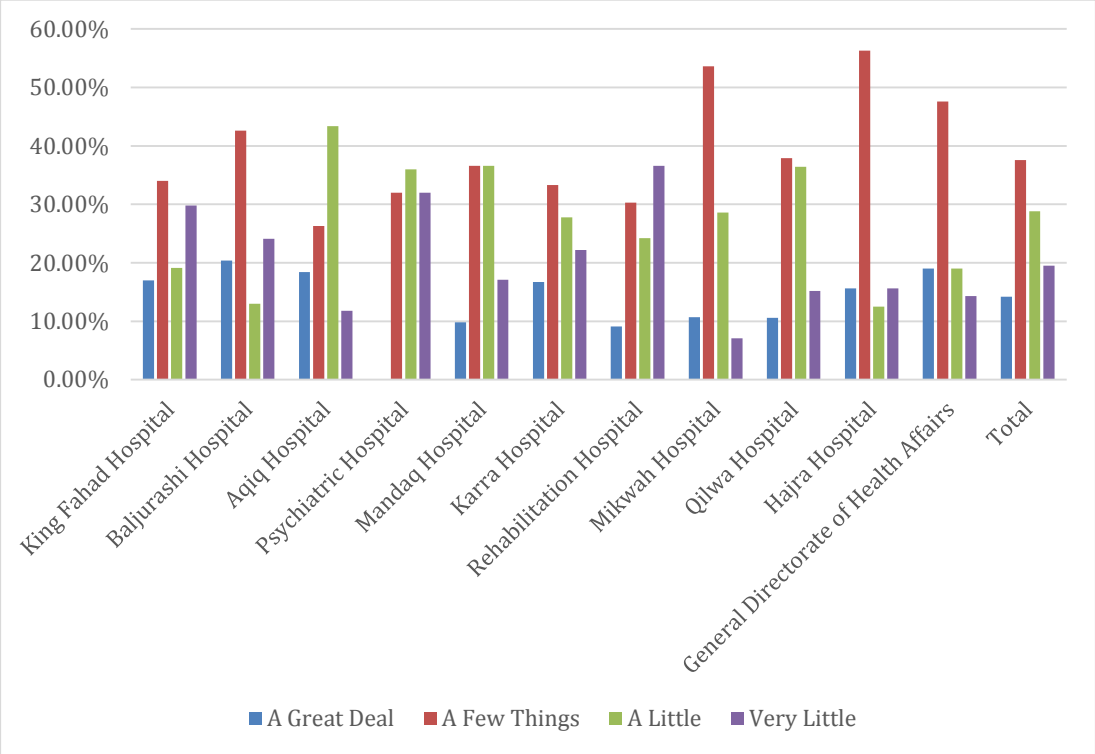

Figure 8: *Bar graph of Self-reported* EHRs *system knowledge*

4.1.9 Responded Rate of hours learning of new System

Participants were asked to report the number of hours they plan on spending to learn the new EHRs system. Participants were presented with four choices, four hours, 8 hours, 12 hours, or more than 16 hours. Table 9 and Figure 9 summarize the participant responses by hospital.

Table9
Self-reported Number of Hours Participants Plan to Spend Learning the EHRs *System*

	4 hours	8 hours	12 hours	16 or more hours
King Fahad Hospital	8 (18.6%)	8 (37.2%)	12 (30.2%)	6 (14.0%)
Baljurashi Hospital	29 (52.7%)	11 (20.0%)	10 (18.2%)	5 (9.1%)
Aqiq Hospital	16 (21.1%)	35 (46.1%)	21 (27.6%)	4 (5.3%)
Psychiatric Hospital	3 (11.5%)	8 (30.8%)	10 (38.5%)	5 (19.2%)
Mandaq Hospital	4 (35.0%)	8 (27.5%)	8 (27.5%)	4 (10.0%)
Karra Hospital	14 (38.9%)	8 (22.2%)	6 (16.7%)	8 (22.2%)
Rehabilitation Hospital	9 (26.5%)	15 (44.1%)	7 (20.6%)	3 (8.8%)
Mikwah Hospital	3 (9.7%)	9 (29.0%)	11 (35.5%)	8 (25.5%)
Qilwa Hospital	19 (28.8%)	14 (21.2%)	15 (22.7%)	18 (27.3%)
Hajra Hospital	2 (6.5%)	2 (6.5%)	12 (38.7%)	15 (48.4%)
General Directorate of Health Affairs	4 (20.0%)	4 (20.0%)	5 (25.0%)	7 (35.0%)
Total	85 (18.3%)	124 (26.7%)	133 (28.6%)	123 (26.5%)

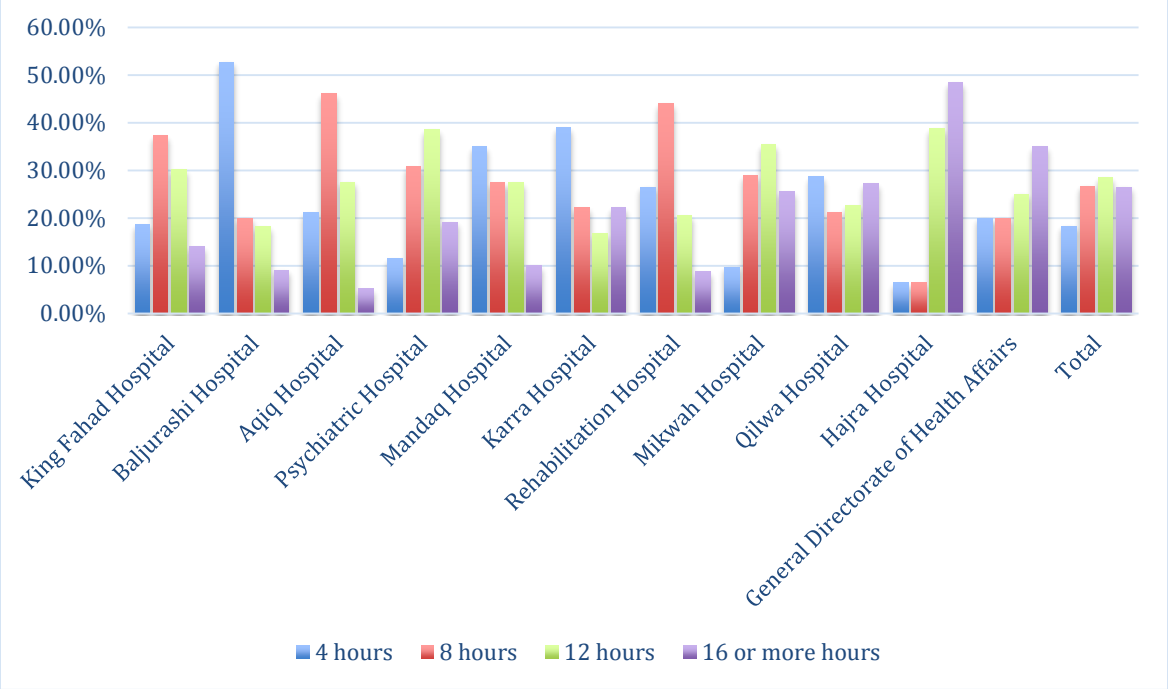

Figure 9
Bar Graph of Self-reported Number of Hours Participants Plan to Spend Learning the EHRs System

4.2 SUMMARY OF STATISTICS OF THE DATA

4.2.1 Summary Statistics for All Hospital

Based on the result of the sample frequencies, there were 469 participants in this study. For Hospital employees were surveyed from 10 hospitals in Saudi Arabia and the General Directorate of Health Affairs. All these hospitals participants average was = 9.77 with Standard Deviation SD = 3.13(see table10)

Min Value	1
Max Value	11
Mean	5.45
Variance	9.77
Standard Deviation	3.13
Total Responses	469

Table 10: Summary Statistics for Hospitals

4.2.2 Summary Statistics For Per Educational Level

Based on the result of the participants in the survey were asked to self-report their highest level of education obtained. Participants reported the following levels of completed education: (a) High School or below; (B) Two Year Diploma or Certificate; (c) Bachelor's Degree; and (d) Master's or Higher Education. All educational level participants average was =2.92 with Standard Deviation SD = 0.80 (see table 11)

Min Value	1
Max Value	4
Mean	2.92
Variance	0.64
Standard Deviation	0.80
Total Responses	467

Table 11: Summary Statistics for Education Level

4.2.3 Summary Statistics for Gender

Based on the result of the both male and female respondents were surveyed. A total of 292 male respondents and 157 female respondents participated in the survey. The participants average was = 2.92 with Standard Deviation SD = 0.80 (see table 12)

Min Value	1
Max Value	4
Mean	2.92
Variance	0.64
Standard Deviation	0.80
Total Responses	467

Table 12: Summary Statistics for Gender

4.2.4 Summary Statistics for Health Care Professional

Based on the result of Participants in the survey were asked to self-report their healthcare profession. Participants reported the following healthcare professions: (a) Physician; (B) Nurse; (C) Pharmacist; And (D) Lab Technician; (E) Administration Staff; And (F) Medical Records. Below are the number of participants average was = 3.14 and standard deviation SD=1.86 (see Table 13)

Min Value	1
Max Value	6
Mean	3.14
Variance	3.48
Standard Deviation	1.86
Total Responses	472

Table 13: Summary Statistics for Health professionals

4.2.5 Summary Statistics for the 4 Main Barriers

Participants were asked to report the four most important barriers to EHR systems implementation. Participants were given a list of the following six barriers. The list of barriers presented to participants were the following: Lack of computer skills, Cost of EHRs System, Adaptation to new technology, Privacy and security concerns regarding the use and access of EHRs System, EHRs maintenance and Resistance to new technology .the average four most commonly cited barriers by participants were lack of computer skills, adaptation to new technology, costs of the EHRs system, and privacy and security concerns' = M =.52 with SD = .50 (see Table 14)

Min Value	1
Max Value	6
Mean	0.52
Variance	0.85
Standard Deviation	0.50
Total Responses	462

Table 14: Summary Statistics for main 4 barriers of EHRs implementation

4.2.6 Summary Statistics for Implementation of EHRs

Based on the result of participants were asked to report whether the EHRs system was implemented at their organization. The mean was = 1.65and SD= 0.82 (see Table 15)

Min Value	1
Max Value	3
Mean	1.65
Variance	0.67
Standard Deviation	0.82
Total Responses	456

Table 15: Summary Statistics for Implementation of EHRs Implementation

4.2.7 Summary Statistics for Computer Skills

Based on the result of the Participants were asked to report their level of computer skills. Participants were presented with three choices, excellent, adequate and poor. The average was= 2.03 and standard deviation was = 0.60 (see Table 16)

Min Value	1
Max Value	3
Mean	2.03
Variance	0.36
Standard Deviation	0.60
Total Responses	464

Table 16: Summary Statistics for computer Skills

4.2.8 Summary Statistics for Knowledge about EHRs

Based on the result of the Participants were asked to report their level of knowledge of EHRs systems. Participants were presented with four choices, a great deal, a few things, a little, and very little. The average was= 2.46 and standard deviation was = 0.96 (see Table 17)

Min Value	1
Max Value	4
Mean	2.46
Variance	0.92
Standard Deviation	0.96
Total Responses	466

Table17: Summary Statistics for Knowledge about EHRs

4.2.9 Summary Statistics for Training Hours

Based on the result of the Participants were asked to report the number of hours they plan on spending to learn the new EHRs system. Participants were presented with four choices, four hours, 8 hours, 12 hours, or more than 16 hours. Table 18 summarize the participant Statistics for Training Hours.

Min Value	1
Max Value	4
Mean	2.37
Variance	1.13
Standard Deviation	1.06
Total Responses	465

Table 18: Summary Statistics for Training Hours

4.3 Determination the Relationship between Factors Associated With Implementation of EHRs in Saudi Arabia Hospitals.

4.3.1 Multiple correlation and T- test Analysis

Hypothesis 1:

Hypothesis 1 stated that security concerns and the lack of authorization controls inhibit the acceptance of EHRs by medical professionals. Hypothesis 1 was analyzed using Pearson correlation analysis and a *t*-test test. The dependent variable for Hypothesis 1

was acceptance of EHRs, as measured by Question 19. Question 19 stated, "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. Two continuous and one categorical independent variable were used in the analysis. The two continuous variables were coded from responses to Question 27 and Question 32. Question 27 asked respondents to rank the obstacles the organization will face in implementing EHR. The rank of "Meeting Privacy and Security Standards" was coded into a continuous variable. For Question 32, respondents were asked to rate on a scale between strongly agree and strongly disagree whether they believe "Our facility does not have enough employees to ensure that the EHR is secure." This was also coded into a continuous variable. The relationships between these two continuous independent variables and the dependent variable were analyzed using Spearman correlation. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Privacy and security concerns regarding the use and access of EHRs System" was coded as a dichotomous variable. A *t*-test was conducted to examine the relationship between this variable and the dependent variable.

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level (α = .025). The data revealed that those participants who believed that privacy and security concerns were not a significant obstacle were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(412)=.13, p<006.$ The data also revealed that those participants who believed that their facility had enough employees to ensure that the implemented EHR was secure were

more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals *r(425)=.13, p<.006* (see Table 19 and Figure 10).

Table 19

Correlations between Acceptance of EHRs and Attitudes about Privacy and Security Concerns

	1.	2.	3.
1. Acceptance of EHRs Implementation (Question 19)			
2. Privacy and Security Concerns are not Obstacle (Question 27_5)	.134**		
3. Facility Does has Enough Employees to Ensure that EHR is Secure (Question 32_6)	.133**	.605***	

*Note.*p<.05, **p<.01, ***p<.05*

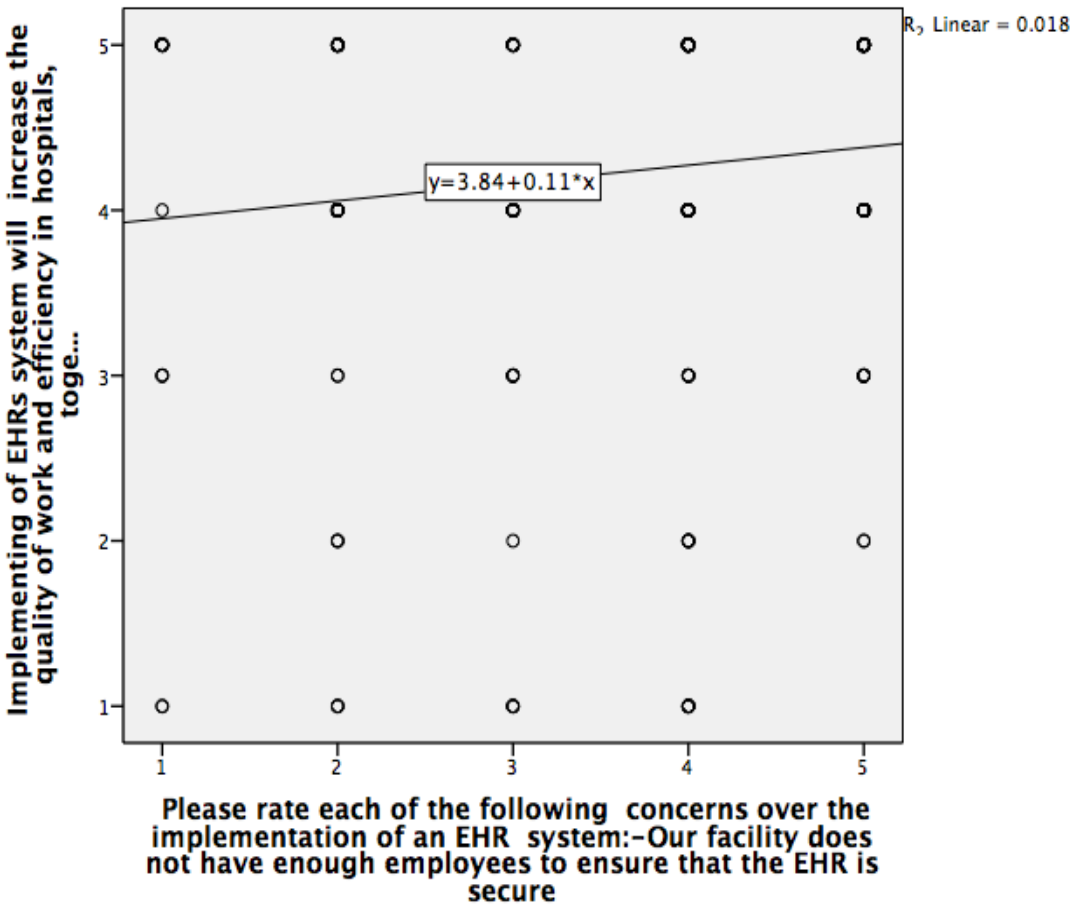

Figure 10: Scatterplots of Implementation of EHRs system with quality of work and efficiency in hospitals.

A t-test revealed that those participants who were more likely to select privacy and security concerns as one of the four most important barriers influencing the success of EHRs (Question 12_4) were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, t (313.74) = -3.67, p<.001 (see table 20) Hypothesis 1 was supported.

		t	df	Std. Dev	Sig(2tailed	Mean Difference
Implementing of EHRs system will increase the quality of work and efficiency in hospitals.	Equal Variance assumed	-3.907	460	1.151	0.000	-0.352
	Equal variances not assumed	-3.672	313.743	0.785	0.000	-00.352

Table 20: Independent Sample Test

Hypothesis 2:

Hypothesis 2 was analyzed using Pearson correlation analysis and a t-test. Hypothesis 2 stated that concerns about EHR system maintenance and support programs would inhibit the acceptance of EHRs by medical professionals. The dependent variable for Hypothesis 2 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. Two continuous and one categorical

independent variables were used in the analysis. The two continuous variables were coded from responses to Question 32. For Question 32, respondents were asked to rate on a scale between strongly agree and strongly disagree whether they believe "Maintaining and updating EHRs systems is too expensive" and "Our facility does not have enough staff to maintain the system." This was also coded into a continuous variable. The relationships between these two continuous independent variables and the dependent variable were analyzed using Spearman correlation. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "EHRs system maintenance" was coded as a dichotomous variable. A *t*-test was conducted to examine the relationship between this variable and the dependent variable.

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level (α = .025). The data revealed that those participants who believed that maintaining and updating EHRs systems was not too expensive were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(427)=.143$, $p<.003$. The data also revealed that those participants who believed that their facility had enough employees to the EHRs system was properly maintained were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(425)=.191$, $p<0.006$ (see Table 21 and figure 11).

Table 21

Correlations between Acceptance of EHRs and Concerns about System Maintenance and Support

	1.	2.	3.
1. Acceptance of EHRs Implementation			
2. Belief that maintaining and updating EHR systems is not too Expensive (Question 32_3)	0.143**		
3. Belief that their facility does have enough staff to maintain the EHR system (Question 32_4)	0.191***	0.737***	

*Note.*p<.05, **p<.01, ***p<.05*

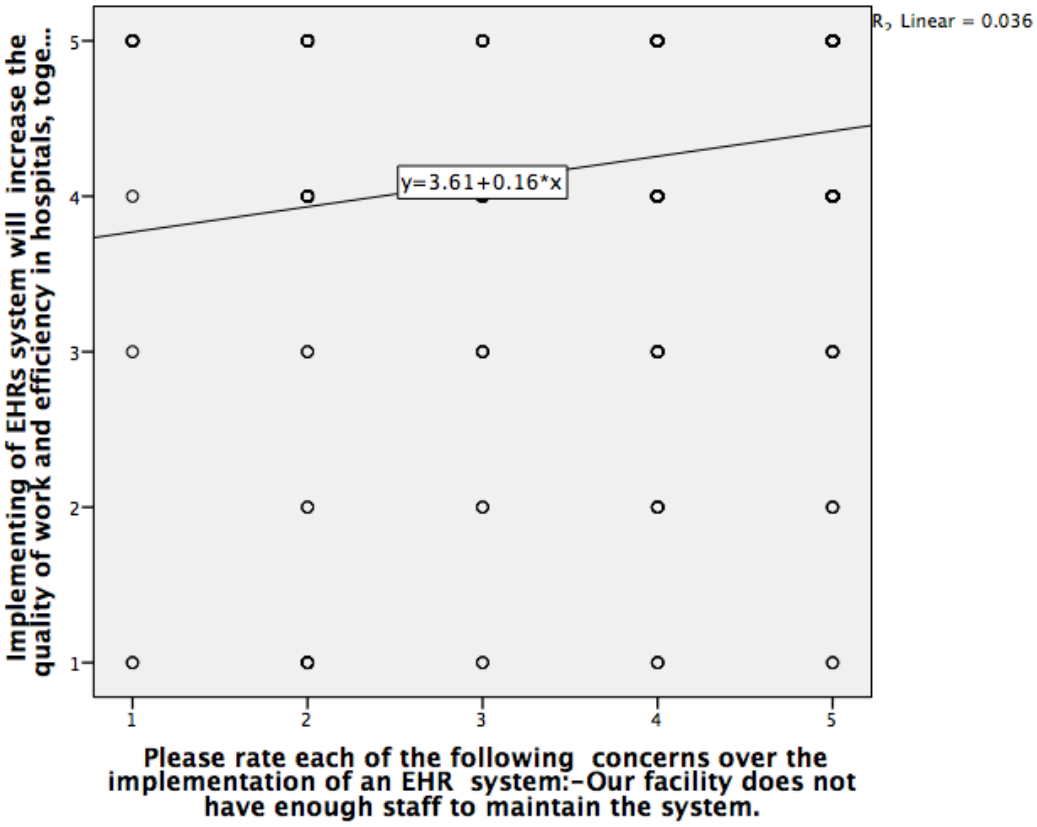

Figure 11: Scatterplots of Implementation of EHRs system and health facility does not have enough staff to maintain the system.

A t-test revealed that there was no statistically significant difference between the belief that EHR system maintenance as one of the four most important barriers

influencing the success of EHRs (Question 12_5) and the belief that the implementation EHRs would increase the quality and efficiency of work in hospitals, t(450) = -0.30, *p*=.76 (see Table 22). Hypothesis 2 was partially supported.

		t	df	Std. Dev	Sig(2tailed	Mean Difference
Implementing of EHRs system will increase the quality of work and efficiency in hospitals.	Equal Variance assumed	-0.299	460	1.017	0.765	-0.027
	Equal variances not assumed	-0.304	441.892	0.899	0.771	-0.027

Table 22: Independent Sample Test

Hypothesis 3:

Hypothesis 3 was analyzed using Pearson correlation analysis. Hypothesis 3 stated that concerns about lack of knowledge of the EHRs systems and lack of computer literacy skills would inhibit the acceptance of EHRs by medical professionals. The dependent variable for Hypothesis 3 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable. The two continuous independent variables were coded from responses to Question 4 and Question 5. For Question 4, respondents were asked to report on a Likert style scale between very little and a great deal to the question "How much do you know about Electronic Health Records?" These responses were coded into a continuous variable. For Question 5, respondents were asked to respond on a Likert style scale between strongly agree and

strongly disagree to "My computer skills are weak and I would ask someone to help me to do the computer-related work" These responses were coded into a continuous variable.

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level (α = 0.025). The data revealed that those participants who reported greater knowledge about EHRs were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(455)=.10$, $p<.023$. The data also revealed that those participants who reported better levels of computer skills were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(456)=0.21$, $p<.001$ (See Table 23). Hypothesis 3 was supported.

Table 23

Correlations between Acceptance of EHRs and Concerns about Computer Literacy Skills and Lack of Knowledge of EHRs

	1.	2.	3.
1. Acceptance of EHRs Implementation			
2. Self-report Knowledge of EHRs (Question 4)	0.106**		
3. Self-report Computer Skills (Question 5)	0.212***	0.302***	

*Note.*p<.05, **p<.01, ***p<.05*

Hypothesis 4:

Hypothesis 4 was analyzed using Pearson correlation analysis and a t-test. Hypothesis 4 stated that concerns about cost would inhibit the acceptance of EHRs by medical professionals. The dependent variable for Hypothesis 4 was acceptance of EHRs, as measured by Question 19. Question 19 stated "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing

better patient care, and safety". This was a Likert style question coded into a continuous variable. The two continuous independent variables were coded from responses to Question 22 and Question 32. For Question 22, respondents were asked to report on a Likert style scale between strongly agree and strongly disagree with the statement "I think the EHRs system to be more useful in the health facility, but I think that the costs for a full implementation are too high" The response to this question was coded as a continuous variable. For Question 32, respondents were asked to rate on a scale between strongly agree and strongly disagree whether they believe "The cost of implementing an EHR system is too high." The response to this question was also coded as a continuous variable. There was also a categorical independent variable that was coded from responses to Question 12. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Cost of EHR system" was coded as a dichotomous variable. A *t*-test was conducted to examine the relationship between this variable and the dependent variable.

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level (α = .025). The data revealed that those participants who reported they believed that although EHRs systems are useful in a healthcare facility, the costs of implementation were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(453)=.30$, $p<.001$. The data also revealed that those participants who believed that the costs of implementing an EHRs were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(433)=.16$, $p<.001$. (See Table 24 and Figure 12). Hypothesis 4 was supported.

Table 24

Correlations between Acceptance of EHRs and Attitudes Cost Concerns

	1.	2.	3.
1. Acceptance of EHRs Implementation			
2. Belief that Although EHR System is Useful in a Health Facility, the Costs of Implementation are Too High (Question 22)	0.30***		
3. Belief that the Cost of Implementing an EHR system is too high (Question 32_1)	0.16**	0.65***	

*Note.*p<.05, **p<.01, ***p<.05*

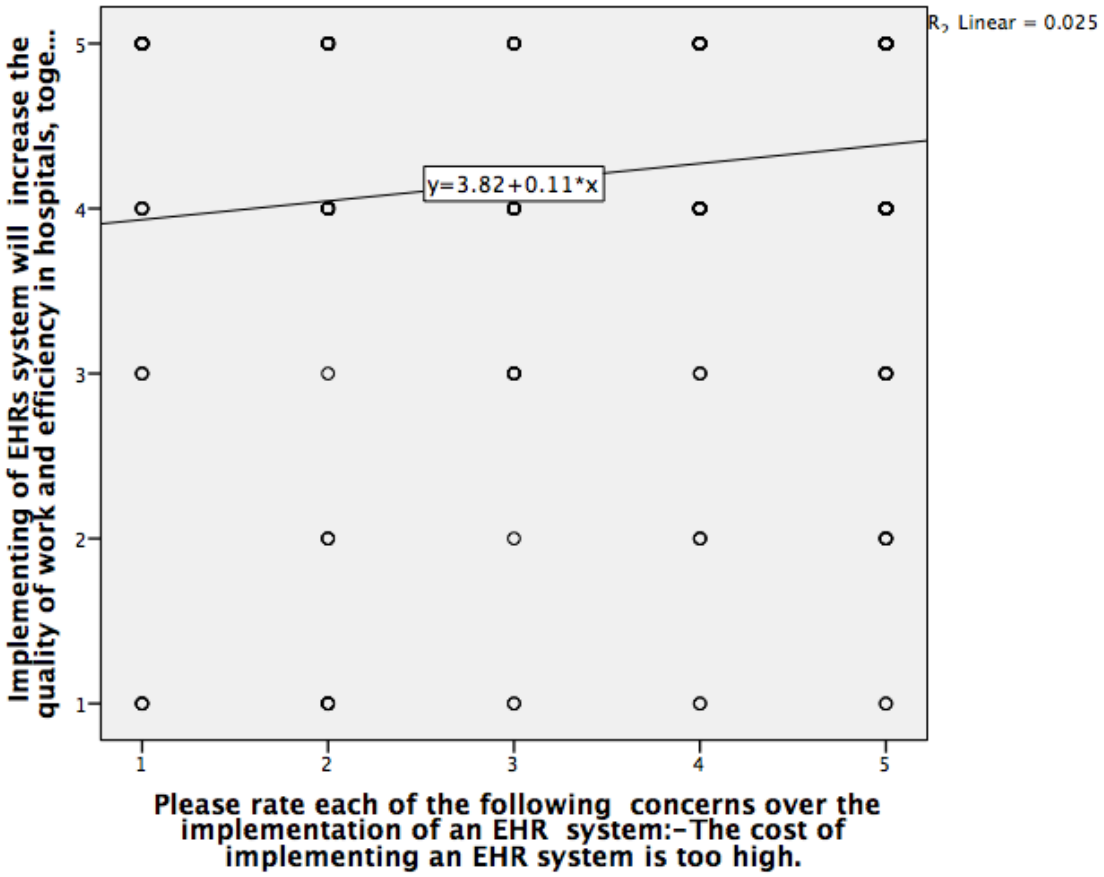

Figure 12: Scatterplots of Implementation of EHRs system and the cost of Implementation EHRs system.

A t-test revealed that there was no statistically significant difference between the belief that EHR system maintenance as one of the four most important barriers influencing the success of EHRs (Question 12_2) and the belief that the implementation EHRs would increase the quality and efficiency of work in hospitals, t(460) = -3.44, p = 0.001. (See table 25). Hypothesis 4 was supported.

		t	df	Std. Dev	Sig(2tailed	Mean Difference
Implementing of EHRs system will increase the quality of work and efficiency in hospitals.	Equal Variance assumed	-3.438	460	1.072	0.001	-0.314
	Equal variances not assumed	-3.287	323.718	0.877	0.001	-0.314

Table 25: Independent Sample Test

Hypothesis 5:

Hypothesis 5 was analyzed using Pearson correlation analysis. Hypothesis 5 stated that concerns about EHR systems being less secure and reliable than their paper-based counterparts would inhibit the acceptance of EHRs by medical professionals. The dependent variable for Hypothesis 5 was acceptance of EHRs, as measured by Question 20. For Question 20, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "In my opinion, I think that EHRs system will protect the privacy of our patients' more than paper-based medical records." The response to this question was coded into a continuous variable. For Question 25, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement

"I think the EHRs system is secured and trusted more than paper-based medical records" The response to this question was coded into a continuous variable.

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level (α = .025). The data revealed that those participants who reported they believed that EHRs would protect patient privacy better than paper records (Question 20) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=0.61$, $p<0.001$ (see Table 26). The data also revealed that those participants who reported they believed that EHRs are more secure than paper-based medical records (Question 25) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=.61$, $p<.001$. Hypothesis 5 was supported.

Table 26

Correlations between Acceptance of EHRs and Attitudes about Privacy and Security Concerns

	1.	2.	3.
1. Acceptance of EHRs Implementation			
2. Belief that EHRs protect privacy better than paper records (Question 20)	0.614***		
3.Belief that EHRs are more secure than paper-based medical records (Question 25)	0.488***	0.617***	

*Note.*p<.05, **p<.01, ***p<.05*

Hypothesis 6:

Hypothesis 6 was analyzed using Pearson correlation analysis. Hypothesis 6 stated that those medical professional that believed that EHR systems improve current workflow are more likely to accept the adoption of EHR systems. Question 19 stated,

"Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety." This was a Likert style question coded into a continuous dependent variable. For Question 23, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "I prefer adopting new technologies with they are proven to increase quality and efficiency of workflow." The response to this question was coded into a continuous variable. This was the independent variable in the analysis.

4.3.2 Multiple Regression Analysis.

The following dependent and independent variables were included in the regression model:

1. **Dependent Variable**
    a. **Acceptance of EHRS.** This is the degree to which the respondent believes that their institution should implement an EHR system. The question stated: "Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety". This was a Likert style question coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).
2. **Independent Variables**
    a. **Self-reported Computer Skills.** For Question 5, respondents were asked to respond to a Likert style scale between strongly agree and strongly disagree to "My computer skills are weak and I would ask someone to help me to do the computer-related work" These responses were coded

into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

b. **Meeting Privacy and Security Standards is a Hurdle to Implementation.** The belief that meeting privacy and security standards is a hurdle to implementation. Question 27 asked respondents to rank the obstacles the organization will face in implementing EHR. The rank of "Meeting Privacy and Security Standards" was coded into a continuous variable.

c. **Self-report Knowledge of EHRs.** This question assessed the knowledge of EHRs of the respondent. Question 4, respondents were asked to report on a Likert style scale between very little and a great deal to the question "How much do you know about Electronic Health Records?" These responses were coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

d. **Resistance to New Technology is a Barrier.** The belief that resistance to new technology is a barrier for implementation of EHRS systems. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Resistance to New Technology" was coded as a dichotomous variable, 1 for a yes response and 0 for a no response.

e. **EHR System Maintenance is a Barrier.** The belief that EHR system maintenance is a barrier. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of

EHRs. The response option of "EHR system maintenance" was coded as a dichotomous variable, 1 for a yes response and 0 for a no response.

f. **Adaptation of New Technology is a Barrier.** The belief that reluctance to adopt new technology is a barrier. Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Adaptation of New Technology" was coded as a dichotomous variable, 1 for a yes response and 0 for a no response.

g. **Cost of EHR system is a Barrier.** The belief that the cost of the EHR system is a barrier Question 12 asked respondents to choose the four most important barriers that affect successful implementation of EHRs. The response option of "Cost of EHR system" was coded as a dichotomous variable, 1 for a yes response and 0 for a no response.

h. **EHR is Useful, but Costs are Too High.** The belief that EHR is useful, but that costs are too high. For Question 22, respondents were asked to report on a Likert style scale between strongly agree and strongly disagree with the statement "I think the EHRs system to be more useful in the health facility, but I think that the costs for a full implementation are too high" The response to this question was coded as a continuous variable. The response to this question was coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

i. **Fear of New Technology is a Factor.** The belief that few of new technology is a factor. For Question 24, respondents were asked to

respond on a Likert scale between strongly agree and strongly disagree with the statement "Do you think the unsecured (fearing) of using technology to be the main barrier in implementing EHR system?" The response to this question was coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

j. **EHRs protect privacy better than paper records.** This the belief that EHRs will protect privacy of patients better than paper records. For Question 20, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "In my opinion, I think that EHRs system will protect the privacy of our patients' more than paper-based medical records." The response to this question was coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

k. **EHRs are more trusted than paper records.** The belief that EHRs are more trusted than paper records. For Question 20, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement "In my opinion, I think that EHRs system will protect the privacy of our patients' more than paper-based medical records." The response to this question was coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

i. **Preference to Adapt New Technology, when Proven to Increase Quality.** The belief that it is best to adapt to new technology when it is

proven to increase quality. For Question 19, respondents were asked to respond to a Likert scale style question with responses between strongly agree and strongly disagree with the statement **"**Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care and safety." The response to this question was coded into a continuous variable, with values from 1(strongly disagree) to 5(strongly agree).

Multiple regression analysis was performed to determine the relationship between these independent variables and the acceptance of EHRs. The model was statistically significant F (10,375) = 26.37, p <0.001 (see figure 27). The model accounted for 41.3 percent of the variation in the data. (See table 27).

Table 27: ANOVA.

Model	Sum of Squares	df	Mean Square	*F*-statistic	*p*-value
Regression	152.41	10	15.24	26.37	<0.001
Residual	216.71	375	0.58		
Total	369.12	385			

Each regression variable was analyzed for statistical significance. There was no statistically significant relationship between self-reported computer skills and acceptance of EHRs, β = 0.05, t (363) = 0.82, p =0.42. There was also no statistically significant relationship between the belief that cost of EHR system is a barrier and acceptance of EHRs, β = 0.08, t (363) = .83, p =.41. There was also no statistically significant

relationship between the belief that adaptation of new technology is a barrier and acceptance of EHRs, β = 0.14, t (363) = 1.93, p =0.05. There was also no statistically significant relationship between the belief that EHR system maintenance is a barrier is a barrier and acceptance of EHRs, β = -0.07, t (363) = -0.90, p =0.37. There was also no statistically significant relationship between the belief that resistance to new technology is a barrier and acceptance of EHRs, β = 0.12, t (363) = 1.54, p =0.13. There was also no statistically significant relationship between the belief that EHR is useful, but costs are too high is a barrier and acceptance of EHRs, β = 0.02, t (363) = 0.47, p =0.64. However, there was a statistically significant relationship between the belief that they prefer to adapt new technology, when proven to increase quality is a barrier and acceptance of EHRs, β = 0.34, t (363) = 7.15, p < .001. Those who believed that prefer to adapt new technology, when proven to increase quality is a barrier, were more likely to accept EHRs (increasing relationship, direct relationship).

There was also no statistically significant relationship between the belief that fear of new technology is a factor and acceptance of EHRs, β = -0.02, t (363) = -0.48, p =.63. However, there was a statistically significant relationship between the belief meeting privacy and security standards is a hurdle to implementation and acceptance of EHRs, β = -0.05, t (363) = -3.12, p = .002. Those who believed that meeting privacy and security standards is a hurdle to implementation were more likely to accept EHRs (inverse relationship, negative relationship). There was also no statistically significant relationship between self-report knowledge of EHRs and acceptance of EHRs, β = 0.07, t (363) = 1.80, p =0.07. However, there was a statistically significant relationship between the belief that EHRs protect privacy and acceptance of EHRs, β = .44, t (363) =

8.75, $p < 0.001$. Those who believed that EHRs protect privacy were more likely to accept EHRs (direct relationship, positive relationship). There was also no statistically significant relationship between the belief that EHRs are more trusted than paper records and acceptance of EHRs, $\beta = 0.06$, t (363) = 1.80, p =0.07 (see Table 28).

Table 28

Variables in the Regression Model

Variable	Symbol	β	t	p-value
(Constant)	A	0.50	2.18	0.03
Self-reported Computer Skills	A1	0.05	0.82	0.42
Cost of EHR system is a Barrier	A2	0.08	0.83	0.41
Adaptation of New Technology is a Barrier	A3	0.14	1.93	0.05
EHR System Maintenance is a Barrier	A4	-0.07	-0.90	0.37
Resistance to New Technology is a Barrier	A5	0.12	1.54	0.13
EHR is Useful, but Costs are Too High	A6	0.02	0.47	0.64
Preference to Adapt New Technology, when Proven to Increase Quality	A7	0.34	7.15	0.001
Fear of New Technology is a Factor	A8	-0.02	-0.48	0.63
Meeting Privacy and Security Standards is a Hurdle to Implementation	A9	-0.05	-3.12	0.002

Self-report Knowledge of EHRs	A10	0.07	1.80	0.07
EHRs protect privacy	A11	0.44	8.75	0.001
EHRs are more trusted than paper records.	A12	0.06	1.21	0.23

- **Equation with all the variables:**

Acceptance of EHRs = 0.50 + 0.05*A1 + 0.08*A2 + 0.14*A3 -0.07*A4 + 0.12*A5 + 0.02*A6 + 0.34*A7 - 0.02* A8 -0.05*A9+ 0.07* A10 + 0.44* A11 + 0.06* A12

- **Equation with only significant variables:**

Acceptance of EHRs = 0.50 + 0.34*Preference to Adapt New Technology, when Proven to Increase Quality Factor -0.05* Meeting Privacy and Security Standards is a Hurdle to Implementation + 0.44* EHRs protect privacy.

CHAPTER V

V. DISCUSSION

5.1 Status of Current EHRs Implementations

Before addressing the barriers to EHRs implementation, analysis of the results regarding the current level of EHRs implementation are discussed. The results are displayed in Table 5 and Figure 5. There were 262 participants (57.5%) who reported that an EHR system was fully implemented at their organization, 93 participants (20.4%) who reported that EHRs system was partially implemented at their organization, and 101 participants (22.1%) who reported that that an EHR system was not implemented at all

at their organization. A majority of respondents reported that EHRs was fully implemented and only 22.1% of respondents reported that EHRs systems were not implemented at all at their hospital. Since there were more than 265 respondents in this study the sample size was large enough to conclude that these percentages accurately represent the percentages of the population.

5.2 Barriers to EHR implementation

5.2.1 Security Concerns Regarding the Use and Access to EHRs Systems

"Security concerns and the lack of authorization controls inhibit the acceptance of EHRs by medical professionals."

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who believed that privacy and security concerns were not a significant obstacle were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(412)=.13$, $p=.006$. The data also revealed that those participants who believed that their facility had enough employees to ensure that the implemented EHRs was secure were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(425)=.13$, $p=.006$. A t-test revealed that those participants who were more likely to select privacy and security concerns as one of the four most important barriers influencing the success of EHRs (Question 12_4) were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $t(313.74) = -3.67$, $p<.001$. Hypothesis 1 was supported by the data.

There was enough evidence to conclude that security concerns and the lack of authorization controls inhibit the acceptance of EHRs by medical professionals.

5.2.2 Concerns about EHRs System Maintenance and Support Programs

"Concerns about EHRs system maintenance and support programs would inhibit the acceptance of EHRs by medical professionals."

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who believed that maintaining and updating EHRs systems was not too expensive were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(427)=.143$, $p=.003$. The data also revealed that those participants who believed that their facility had enough employees to the EHRs system was properly maintained were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(425)=.191$, $p=.006$. A t-test revealed that there was no statistically significant difference between the belief that EHRs system maintenance as one of the four most important barriers influencing the success of EHRs (Question 12_5) and the belief that the implementation EHRs would increase the quality and efficiency of work in hospitals, $t(450) = -.30$, $p=.76$. Hypothesis 2 was partially supported. There was some evidence that concerns about EHRs system maintenance and support programs would inhibit the acceptance of EHRs by medical professionals.

5.2.3 Concerns about Lack of Knowledge of EHRs systems and Lack of Computer Literacy Skills

"Concerns about lack of knowledge of the EHRs systems and lack of computer literacy skills would inhibit the acceptance of EHRs by medical professionals."

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who reported greater knowledge about EHRs were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(455)=.10$, $p=.023$. The data also revealed that those participants who reported better levels of computer skills were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(456)=.21$, $p<.001$. Hypothesis 3 was supported. There was enough evidence to conclude that concerns about lack of knowledge of the EHRs systems and lack of computer literacy skills would inhibit the acceptance of EHRs by medical professionals.

5.2.4 Concerns about High cost of adopting of EHRs

"Concerns about cost would inhibit the acceptance of EHRs by medical professionals."

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who reported they believed that although EHRs systems are useful in a healthcare facility, the costs of implementation were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(453)=.30$, $p<.001$. The data also revealed

that those participants who believed that the costs of implementing EHRs were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals $r(433)=.16$, $p<.001$. Hypothesis 4 was supported. There was enough evidence to conclude that concerns about cost would inhibit the acceptance of EHRs by medical professionals

5.2.5 Concerns about Security and Reliability

"Concerns about EHRs systems being less secure and reliable than their paper-based counterparts would inhibit the acceptance of EHRs by medical professionals"

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who reported they believed that EHRs would protect patient privacy better than paper records (Question 20) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=.61$, $p<.001$. The data also revealed that those participants who reported they believed that EHRs are more secure than paper-based medical records (Question 25) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=.61$, $p<.001$. Hypothesis 5 was supported. There was enough evidence to conclude that concerns about EHRs systems being less secure and reliable than their paper-based counterparts would inhibit the acceptance of EHRs by medical professionals.

5.2.6 Concerns about Workflow

"Those medical professional that believe that EHRs systems improve current workflow are more likely to accept the adoption of EHRs systems."

Since, multiple Correlation tests were conducted, Bonferroni adjustment was used to analyze this hypothesis and all tests were conducted at the 97.5% confidence level ($\alpha = .025$). The data revealed that those participants who reported they believed that EHRs would protect patient privacy better than paper records (Question 20) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=.61$, $p<.001$. The data also revealed that those participants who reported they believed that EHRs are more secure than paper-based medical records (Question 25) were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals, $r(459)=.61$, $p<.001$. Hypothesis 5 was supported. There was enough evidence to conclude that those medical professional that believe that EHRs systems improve current workflow are more likely to accept the adoption of EHRs systems."

CHAPTER VI

VI. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

6.1 SUMMARY AND CONCLUSION:

The health care system of KSA stands to improve substantially upon successful implementation of the electronic health records system. EHRs help in data management, interoperability, information sharing, and decision making by health physicians. The

system also cuts data storage costs, minimizes information loss, and prevents medical errors that result in fatal injuries and deaths. The rapidly burgeoning population of the KSA requires a modern health care system to ensure efficient and effective disease control and monitoring.

The goal of this study was to explore the implementation and adoption of Electronic Health Records system (EHRs) in Kingdom of Saudi Arabia, together with the factors associated with the implementations and adoption. This study attempted to find EHRs system in Saudi hospitals and health facilities and the factors which affect or delay this implementation and adoption. Therefore, this research aimed examined the following major points relating to EHRs system in Saudi Arabia:

- What is the present status of implementing and adopting of EHRs system in the health facilities of Kingdom of Saudi Arabia?

- What are the factors associated with the implementation and adoption of EHRs system in the health facilities of Kingdom of Saudi Arabia?

- There were six groups of healthcare specialists who participated in this study: Physicians, Nurses, Pharmacists, Lab Technicians, Administration Staff, and Medical Records. All of these groups are working in 11 health facilities at Baha Province in Saudi Arabia: These health facilities are King Fahad Hospital, Baljurashi Hospital, Aqiq Hospital, Psychiatric Hospital, Mandaq Hospital, Karra Hospital, Rehabiltaion Hospital, Mikwah Hospital, Qilwa Hospital, Hajra Hospital, and General Directorate of Health Affairs.

- The research findings are as follows:

- There were 262 participants (57.5%) who reported that an EHR system was fully implemented at their organization.
- 93 participants (20.4%) who reported that an EHR system was partially implemented at their organization.
- 101 participants (22.1%) who reported that that an EHR system was not implemented at all at their organization.
- The study shows that health specialists in Saudi Arabia consider Resistance to New Technology EHR systems is not a significant obstacle.
- The study shows that health specialists in Saudi Arabia were believed that EHR systems improve current workflow are more likely to accept the adoption of EHR systems.
- The study shows that health specialists in Saudi Arabia participants who believed that privacy and security concerns were not a significant obstacle were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.
- The study shows that health specialists in Saudi Arabia were believed that maintaining and updating EHRs system was not too expensive were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.
- The study shows that health specialists in Saudi Arabia were believed that their facility had enough employees to the EHRs system was properly maintained were more

likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were reported greater knowledge about EHRs were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were reported better levels of computer skills were more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were reported they believed that although EHRs system are useful in a healthcare facility, the costs of implementation were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were believed that the costs of implementing EHRs were too high were less likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were reported they believed that EHRs would protect patient privacy better than paper records more likely to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

- The study shows that health specialists in Saudi Arabia were reported they believed that EHRs are more secure than paper-based medical records were more likely

to believe that the implementation EHRs would increase the quality and efficiency of work in hospitals.

This research study was showed that implementation levels of EHRs systems vary significantly between hospitals. Also, there were different among the health care professionals who participated in the study have a different opinion, view, and perception of the level about EHRs system implemented in their health care facility. However, there's general agreement among all participants of this study to the factors that delay the implementation of EHRs system in Saudi Arabia Hospitals. These obstacles factors seem to be the same trends existed in other countries. Participants identified Lack of experience with the use of computer, Security concerns regarding the use and access to EHR Systems, High Cost of Adopting EHRs, Resistance to New Technologies, EHRs system Maintenance and down time, and Adoption of New Technology to be significant barriers when it comes to EHRs implementation and adoption.

6.2 LIMITATIONS OF STUDY

The study is limited to the implementation and adoption of EHRs systems as affected by those factors associated to the implementation and adoption which act as major barriers to such implementations. Future research can study the effects of EHRs System implementation and adoption on the total quality of care as perceived by the patients. The study is also limited to Saudi Arabia healthcare Hospitals. The study can be extended to other countries which have implemented similar healthcare system.

The study is limited to 11 major health facilities, 10 hospitals and the General Directorate of Health Affairs in Baha Province in Saudi Arabia. Further research can be

done with small health centers or any health facilities, to study the impact of the implementation of EHRs system on different health institutions. Future research can investigate the quality of work, efficiency, properties, advantages, and any problems related to/and affect to EHRs System software.

6.3 Recommendations:

Various recommendations can be considered to support the implementation of EHRs in the Kingdom of Saudi Arabia.

1. Electronic Health Records are vital for hospital administration to improve patient outcomes by eradicating medical errors. Therefore, the KSA government needs to increase budgetary allocations for the public hospitals to support EHRs implementation. In addition, the government should support and create an ample environment to allow private hospitals to thrive in the implementation of the system.
2. The government needs to promote training and avail support forums through provision of appropriate literature on EHRs. The Ministry of Health can offer suck kind of literature by using the government health portal, as in the case of the US, where the public can access it easily. Additionally, the EHRs system should allow multilevel confidentiality such that health providers from the diverse health institutions gain access to patient information that is relevant to their responsibilities while preventing access to confidential data that other stakeholders are not supposed to view.
3. There should be a well-documented contingency plan that prevents frustrating scenarios in cases where the systems fail. Therefore, the government should

invest in thorough training for both IT professionals and physicians to allow successful integration of the systems and healthcare. This situation will ensure credibility, reliability, and accuracy of the EHRs systems. Consequently, regular system check, servicing, upgrading, and testing are recommended. Finally yet importantly, governments around the world should support the implementation of electronic health records to improve care delivery and patient safety in health institutions.

4. EHRs can only be successful if all the health providers understand how to use them. In this view, it is crucial to involve the healthcare providers from their creation to their implementation. This is likely to promote thorough understanding of the EHRs and enhance their application in the healthcare setting. Moreover, the system developers should incorporate the requirements of the health providers during EHRs development, as this would guarantee that they support and appreciate the systems.
5. EHRs departments should ensure that the healthcare professionals are well trained in using the EHRs. This can be done through the integration of motivational packages that include bonuses, incentives, and payment for time spent in training. Additionally, they should establish interdepartmental competitions that reward the departments that implement the systems effectively.
6. Similar to any other new systems in the workplace, there is the need to increase the level of awareness on EHRs. This guarantees that the workers fully understand the benefits of using the systems. Moreover, the awareness should be done through the application of a multi-stage approach that involves training on

the use of EHRs in the different levels of medical school. Integrating such training in the medical school curriculum would ensure that all the healthcare professionals are well educated on the systems when they join the workforce.

7. The incorporation of EHRs training in the medical school curriculum would ensure that the healthcare providers are conversant about their use in different departments. It is also likely to decrease the amount of resources and time that institutions spend on training the workers on the use of EHRs
8. The ministry of health should create teaching programs that focus on health information management. Such programs should be compulsory and introduced in medical schools and healthcare organizations. Furthermore, EHRs systems should be included in the curriculum. Such programs would ensure that the healthcare professionals are well educated on the use of EHRs systems. The incorporation of computer and information technology training in the programs would also be beneficial to the healthcare providers.
9. The presence of health informatics technicians in the health sector is crucial to the success of the EHRs. This is only possible through the incorporation of health informatics and other related courses in the different university levels. Consequently, there would be sufficient trained health informatics professionals who would assist in the development and implementations of the EHRs. The availability of the trained employees would also be crucial in troubleshooting challenges associated with the systems.
10. The implementation and management of EHRs is expensive. Thus, it is vital for healthcare organizations to have sufficient funding to safeguard the operation of

the systems. The ministry of health should also participate in the provision of funding to healthcare institutions and assist in paying the initial cost of implementation.

11. The hospital management should take into account the cost of developing and maintaining the EHRs when discussing and developing their annual budgets. Planning for the maintenance of the programs would be easier and reduce the financial burden on healthcare institutions.
12. Healthcare records should be confidential, and the users of the EHRs systems should be well educated on the ethical issues relating to the patient's information. The repercussions of abusing the information should be well outlined when training the healthcare professionals on the use of EHRs.
13. The healthcare institutions should be well prepared to reform their medical and managerial processes to incorporate the needs of the EHRs as this guarantees the survival and success of the systems.

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Appendix A

THE QUESTIONNAIRE FOR THE STUDY

Q1

What is your gender?

- Male
- Female

Q2

What is your educational level?

- High School or below
- Two Years Diploma or Certificate
- Bachelor Degree
- Masters and higher Education

Q3

What is your job title?

- Physicians
- Nurses
- Pharmacists
- Lab Technicians
- Administration Staff
- Medical Records

Q4

From the following list, which hospital (or Health Facility) do you work in?

- King Fahad Hospital
- Baljurashi Hospital
- Aqiq Hospital
- Psychiatric Hospital
- Mandaq Hospital

- Karra Hospital
- Rehabilitation Hospital
- Mikwah Hospital
- Qilwa Hospital
- Hajra Hospital
- General Directorate of Health Affairs

Q5

How much do you know about Electronic Health Records (EHRs) system?

- Very Little
- A little
- A few things
- A great deal

Q6

My computer skills are weak and I would ask someone to help me to do the Computer-related work

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q7

How many hours would you be willing to dedicate to learning this new system?

- 4
- 8
- 12
- 16 or more

Q8

As a health employee, I am planning to improve my computer skills through proper training to be more positive in my work.

- Strongly Agree
- Agree
- Neither Agree nor Disagree
- Disagree
- Strongly Disagree

Q9

Does Electronic Health Records (EHRs) System implemented in your facility?

- Yes
- Maybe
- No

Q10

Are there problems regarding the management of patients' health records at this time?

- Yes
- Maybe
- No

Q11

During implementation, to what degree patient volume be reduced during the initial weeks using the new Electronic Health Records (EHRs) System?

- up to 5 %
- 5% to 10 %
- 10% to 15 %
- 15% to 20%

Q12

In your facility, is the use of EHRs System?

- Optional
- Required
- I don't know

Q13

If you exchange or share patient care and or billing information with others locations or service providers, how do you transfer the information?

- Through EHRs System
- Manually
- Others

Q14

When a patient visit the emergency room, do you usually notify the patent's primary care physician?

- Yes
- I don't know
- No

Q15

If you notify the primary care physician when patients visit the emergency room, do the physicians have access to Electronic notifications and information?

- Yes
- I don't know
- No

Q16

What are your expectations of the new EHRs system?

- The EHRs system will improve productivity and office efficiency starting on day one
- The EHRs system will improve productivity and office efficiency over time
- The EHRs system is just a replacement for traditional paper-based patient folders
- The EHRs system is unlikely to improve productivity and office efficiency

Q17

Please rate your computer skills.

- Poor
- Adequate
- Excellent

Q18

From the following list, choose the most 4 barriers that affect the successful of EHRs implementation

- Lack of computer skills
- Cost of EHRs System
- Adoption to new technology
- Privacy and security concerns regarding the use and access of EHRs System
- EHRs System maintenance
- Resistance to new technology

Q19

Implementing of EHRs system will increase the quality of work and efficiency in hospitals, together with providing better patient care, and safety

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q20

In my opinion, I think that EHRs system will protecting the privacy of our patients more than
Paper-based medical records.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q21

EHRs system give patients easier control on who has the authorization to access to the information.

- Strongly Disagree
- Disagree

- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q22

I think the EHRs system to be more useful in the health facility, but I think that the costs for a full
Implementation too high.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q23

I prefer to adopting new technologies when it proven to increase the quality and efficiency of workflow.

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q24

Do you think the unsecured (fearing) of the using technology to be
main barrier in implementing EHRs System among health care staff?

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q25

I think the EHRs system is secured and trusted more than the paper-based medical records

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q26

I think EHRs System will be more useful to transferring the patients information and contact with other hospitals

- Strongly Disagree
- Disagree
- Neither Agree nor Disagree
- Agree
- Strongly Agree

Q27

Does your hospital or patient care facility currently have a computerized system which allows for?

	Fully Implemented Across ALL Units	Fully Implemented in at least one Unit	Beginning to Implement in at least one Unit	Have Resources to Implement in the next year	Do Not have Resources but Considering Implementing	Not in Place and Not Considering Implementing
Patient Demographics						
Nurses Note						
Physician Note						
Problem Lists						

	Fully Implemented Across ALL Units	Fully Implemented in at least one Unit	Beginning to Implement in at least one Unit	Have Resources to Implement in the next year	Do Not have Resources but Considering Implementing	Not in Place and Not Considering Implementing
Medication Lists						
Discharge Summaries						
Advanced Directives						

Q28

Does your hospital or patient care facility currently have a computerized system which allows for?

	Fully Implemented Across ALL Units	Fully Implemented in at least one Unit	Beginning to Implement in at least one Unit	Have Resources to Implement in the next year	Do Not have Resources but Considering Implementing	Not in Place and Not Considering Implementing
Laboratory reports						
Radiology reports						
Radiology images						
Diagnostic test results						
Diagnostic test images						

Q29

Does your hospital or patient care facility currently have a computerized system which allows for?

	Fully Implemented	Mostly Implemented	Partially Implemented	Implementation is in progress	Plan to implement when resources become available	Do not plan to implement
Clinical guidelines						
Clinical reminders						
Drug allergy alerts						
Drug-drug interaction alerts						
Drug-lab interaction alerts						
Drug dosing support						

Q30

Please rate each of the following concerns over the implementation of an EHR system:

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
The cost of implementing an EHR system is too high.					
Our facility does not have the resources available to fund a new program.					
Maintaining and updating EHR systems is too expensive.					
Our facility does not have enough staff to maintain the system.					

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Training our employees to use an EHR system is too expensive.					
Our facility does not have enough employees to ensure that the EHR is secure					
The security of patient medical information is a major concern.					

Q31

What is the biggest hurdle your organization will face in meeting in implementing an effective and meaningful use EHRs system? Please rate items in order of concern from 1 to 9, with "1" being the biggest concern, "2" the second biggest concern, and so on

	1	2	3	4	5	6	7	8	9
Implementing/upgrading to a certified EHR system									
Capturing /submitting Quality Measures									
Maintain and up-to- date Problem List									
Providing Medication reconciliation									
Meeting Privacy and Security Standards									
Producing Summary Records (Paper or CCD/CCR)									
Provide patients with access to data, and the tools to make informed health decisions									
Exchange meaningful clinical information among professional healthcare team									
Others									

Q32

Please rate each of the following perceived benefits that you believe will occur as a result of implementing of EHRs system

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
Improve workflow.					
Reduce medical errors.					
Reduce costs					
Reduce treatment time/ length of stay					
Increase revenue					
Minimize malpractice claims					