Managing Development for the Health Records to be Centralized Electronically, in UAE

إدارة التنمية للسجلات الصحية لتكون مركزية إلكترونيا ، في الإمارات العربية المتحدة

By

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ABSTRACT

Improving the healthcare is considered to be one of the major strategic issues that have to be planned by the countries to provide a healthy life for the citizens and residents. The age of the health information technology can be approximated to the appearance of the digital technology. Health providers always search for the ways that may improve the quality of healthcare by adopting electronic devices and services, which proved to be faster and more accurate in processing than the human beings.

Mistakes in the patients' data can affect the diagnosing process, and may tragically lead into a failure in providing the right medical care or even negatively affect patient's life. These mistakes are always related to the information contained in the patient records; because of missing information, or confusing details. Since the introduction of the electronic health records, solutions have been created to improve the availability of data and the security of information.

In the last few years, countries have initiated plans to improve the implementation of health records system to be digitally centralized. This transformation can create a powerful base of health information in the countries, and provide a wider accessibility that is not limited to a specific location or time. Governmental projects of this size always need a lot of attention to plan how to react according to the challenges which can be described as organizational changes, technical limitations, budget constraints or even user's resistance.

In this work, I investigate the current status of the health records systems in the United Arab Emirates. Then, I define the challenges in improving the health record system to be digitally centralized. Finally, I show how the centralized EHR project can be managed to control the technical implementation and organizational change.

الملخص

تحسين الرعاية الصحية تعتبر واحدة من القضايا الاستراتيجية الكبرى التي تسعى البلدان للتخطيط لها لتوفير حياة صحية للمواطنين والمقيمين. لذا ، يمكن أن ربط عمر تكنولوجيا المعلومات الصحية بظهور التكنولوجيا الرقمية. يبحث مقدمي الخدمات الطبية بشكل دائم على الطرق التي قد تؤدي إلى تحسين نوعية الرعاية الصحية من خلال اعتماد الأجهزة الحديثة والخدمات الإلكترونية ، والتي قد أثبتت بأنها أسرع وأكثر دقة من البشر .

يمكن للأخطاء في بيانات المرضى أن يؤثر على عملية التشخيص، وربما يؤدي الى فشل مأساوي في توفير الرعاية الطبية أوسلبا على على حياة المريض .هذه الأخطاء هي دائما تكون ذات صلة بالمعلومات الواردة في سجلات المرضى عندما تكون المعلومات ناقصة، أو التفاصيل مركبة .منذ بدء السجلات الصحية الإلكترونية، تم إنشاء حلول كبيرة لتطوير توافر البيانات وأمن المعلومات.

في السنوات القليلة الماضية ، شرعت بلدان خطط لتحسين تطبيق نظام السجلات الصحية لتكون مركزية رقمية.هذا التحول يمكن أن يخلق قاعدة قوية من المعلومات الصحية في الدولة ، وتوفر إمكانية توفر المعلومات دون التقيد بمكان معين أو وقت .المشاريع الحكومية بهذا الحجم دائما في حاجة إلى الكثير من الاهتمام لوضع خطة توضح كيفية التصرف وفقا للتحديات التي يمكن وصفها بأنها تغييرات تنظيمية ، قيود فنية ، قيود ميزانية ، أو حتى مقاومة المستخدم للتغيير .

ولذلك ، فإن هذا العمل يجري لمعالجة الوضع الراهن لنظم السجلات الصحية في دولة الإمارات العربية المتحدة .من ثم ، فإنه يقوم هذا العمل بتحديد التحديات التي تواجه تطوير نظام السجل الصحي لتكون رقميا مركزية في الحكومة . و أخيرا ، يقوم هذا العمل باظهار كيفية إدارة المشروع للسيطرة على التنفيذ التقني والتغيير التنظيمي .

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LIST OF ABBREVIATIONS

ANSI:	American National Standards Institute
CEO:	Chief Execution Officer
CIO:	Chief of Information Officer
CMO:	Chief Medical Officer
CMS:	Centers of Medicare and Medicaid Service
COO:	Chief Operation Manager
CQO:	Chief Quality Manager
DIC:	Dubai Internet City
EHR:	Electronic Health Records
EMR:	Electronic Medical Record
EPR:	Electronic Patient Record
GCC:	Gulf Cooperative Council
HAAD:	Health Authority of Abu Dhabi
HHS:	The US Department of Health and Human Services
HIS:	Heath Information System/Service
HIT:	Heath Information Technology
HL7:	Health Level 7 standards
ICT:	Information and communication technology
IHS:	Information Handling Services
JCI:	Joint Commission International
MCI:	Communication and Information Management
NHS:	National Health Service in UK
PESTEL:	Political, Economic, Social, Technological, Environmental and Legal Analysis
QDS:	Quality Data Set
SEHA:	means 'Health' in Arabic and it is Abu Dhabi Health Service Cooperation
SKMC:	Sheikh Khalifa Medical City
SWOT:	Strengths, Weaknesses, Opportunities and Threads Analysis
UAE:	United Arab Emirates
UHID:	Using Universal healthcare identifier
UK:	United Kingdom
US:	United States
WHO:	World Health Organization

CHAPTER 1: INTRODUCTION

1.1 General Introduction

For the last decade, information and communication technology (ICT) has played an important role in the healthcare all over the world. Sometime ICT acts as a facility in the medical organization and sometime it acts as the heart of the work-structure that works in parallel with all the tasks in the organization. Obviously, the Electronic Health Record System technology has received a lot of attention by governments in the last few years. As CNN Money (Goldman 2009) reported that President Barack Obama proposed a huge change to improve the health care in US by digitalizing the health records within a standardized structure. US placed immediate investments to ensure that the target hit within five years. Although the plan could cost at least $75 billion to $100 billion, as reported by Harvard, RAND and the Commonwealth Fund, Obama believes that electronic systems will boost the quality of health care, and declines costs to be as long-term saving plan.

United Arab Emirates (UAE) copes with technological development, to make from itself an important place that attracts large companies in the field of health information technology, communication and services. The Federal Research Division (WHO 2009) of the Congress in the UAE's country profile highlighted that UAE government have a great expenditures every year to establish high standards in the healthcare, and it manages multimillion-dollar programs to expand health facilities in hospitals and medical centers in the seven emirates.

It is noticeable that there is significant interest in the field of heath information technology (HIT) in the last few years. Several conferences were organized locally in this field like the "Middle East Electronic Health Records Summit 2011", and the "European, Mediterranean & Middle Eastern Conference on Information Systems 2010". Some articles was done as well, but only few discussed the Electronic Health Record

implementation in UAE; as it was seen that none of them considered the difficulties of transferring the current record system to be digitally centralized in all the Emirates within specific standards that ensure quality of work.

This dissertation illustrates some theories and case studies derived from books, papers, articles, journals and conferences. These resources are defining the technical, medical and managerial requirements to implement the EHR system. For example, the literature review discussed five major topics; and they are the definition of EHR, the EHR development in the last few years, the implementation of EHR in UAE, the relations between EHR implementing and healthcare quality, and the change challenges in EHR implementation.

Furthermore, this work explores the current status of the health record systems, and it studies the daily work complications reported by the clinicians, administrators and Information Technology staff. Then, it discusses the feedbacks given by medical and technological experts, who are working in UAE. These discussions were done through semi-structured interviews, to find the adoptability factors of the medical organizations for the EHR system during the implementation. These discussions also address the exact requirements for transferring the health record from the organization scope, to the centralized governmental-controlled scope within standardized structure to ensure quality. Therefore, the discussion topics during interviews included:

- Advantages of using the EHR system.
- Clinical and technical challenges observed by the healthcare providers.
- System impact on the patient workflow for medical procedures.
- IT work-structure within the organization during the implementation of EHR.

Moreover, this study is able to create a case study to demonstrate the experience of Abu Dhabi, the capital of UAE, with developing the health record system to be digitally centralized between several hospitals and health institutes. Case study structuring was based on information captured by interviewing the CIO of Sheikh Khalifa Medical City, and by reading a dissertation done by a master student in The British University in Dubai.

The case study provides an overview of the centralized EHR project in the UAE, its goals, progress, technical infrastructure and users' feedback.

Some of the data defined during the interviews and the case study were analyzed by using visualizations techniques to build information regarding three important aspects; the relation between EHR and JCI accrediting, users' resistance factors, EHR and patient workflow. The analysis extended to include all the research resources to define the macro and the micro strategic analysis by using the PESTEL and SWOT.

The dissertation starts by defining the mission and vision to generally review the current objectives and the future goals of the UAE government on developing the health record system to be digitally centralized. Furthermore, the core functions that control the projects were characterized to find the major managerial challenges of the project. However, Some models illustrates the way to control the three major issues in the project; they are the organization culture and the change management, the information technology infrastructure, and the governance. At the end, the conclusion summarizes the most important issues about the EHR in the UAE based on the topics discussed in this paper.

1.2   Motivation

In the UAE, the current record systems in the medical organizations are varied regarding to technology adoption. In some organizations, the technology is just a tool that used by some departments to accelerate the work, when others consider the technology as the core of the work-structure. This variation in the technological progressing level in the medical organizations makes introducing a shared structure for health information in UAE is particularly challenging specially during the implementation phase.

Although it is challenging to introduce the centralized electronic health records system, the system can improve the quality of health in the national scale. By building a shared infrastructure for the health in the UAE, updating statistical reports may become much easier to get. These reports can accelerate the availability of accurate information about

the health in the country; therefore, the detection of unusual diseases' symptoms or special medical effects can be easier to be categorized according to areas, life styles, or even nationalities. Besides enhancing the clinical communication in the organization level, the system provides a unique medical identification for the UAE citizens and residents. When the patients can be nationally identified, the patients' information can be easily accessed in the whole country. This will not only save money and time, but also insure the information integrity to avoid medical mistakes during the diagnosing process.

1.3   Research Questions

The Aim of this research is to answer the following questions:
- What is the current status of electronic health record system in the United Arab Emirates?
- What are the challenges of developing the health record system to be digitally centralized?
- How can the centralized EHR project be managed to control change?

1.4   The Research Approaches Employed

To find the answers for the research questions, literature review, interpretative case study, and interviews were employed. The study iteratively passes through several stages which are Identify, Research, Appraise and Close. A detailed description of the research method is given in the next chapter.

1.5   Expected Contribution of this Research

This study could serve as the basis for developing the health record system in the United Arab Emirates to be digitally centralized. The author also wishes if this study can be as an advocacy tool for EHR implementation in the UAE health service, by addressing challenging and developing solutions based on strategic analysis.

CHAPTER 2: RESEARCH METHODOLOGY

2.1 Overview

This Research is closer to be qualitative than quantitative, because the purpose of the research is to contextualize and interpret the EHR adoption concept and find the challenges in integration and perspectives of understanding actors. Furthermore, the goal was to end with the concepts that explain emergence and portrayal of the challenges in naturalistic manner by searching for patterns and seeking for pluralisms, complexities, and write the description with mirror use of numerical indices.
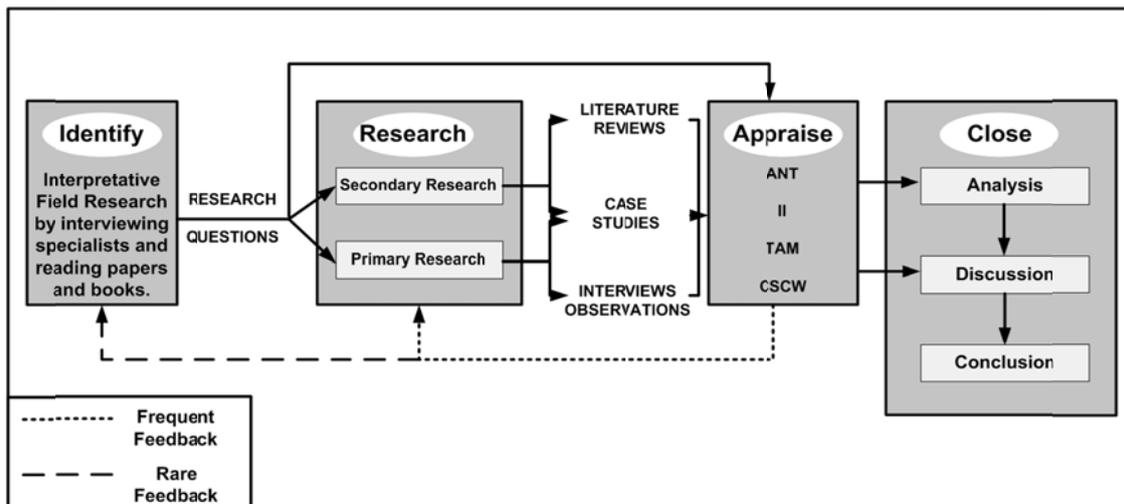
Figure 1: Summary of the research methodology

Figure (1) illustrates how the research passes through several stages which are Identify, Research, Appraise and Close. Identify stage includes studying the market needs, meeting IT specialists and reading books and papers which were recommended by the academic supervisor. Those events used the Interpretative Field Research techniques to shape the Research Questions which are the output of this stage. As shown in Appendix [A],

Interpretative Field Research techniques describe how the ideas and objectives are formed by the following:

- Iterating between meaning of interdependent parts, and the whole that they form as a unit.
- Reflecting social and historical background on research topic, so that the reader can see how the current situation under investigation emerged.
- Reflecting research materials constructed by social meetings.
- Relating details revealed by data interpretation with theories and general concepts.
- Directing research design by theoretical preconceptions.
- Shaping research design by possible people ideas and systematic believes.

Research stage cares about gathering the information from explicit and tacit resources by using Primary Research and Secondary Research. When the input of this stage is the Research Questions, the output is Literature Reviews, Case Study and Interview Observations.

Appraise stage compares between the output of the previous stage and the scope of the project which is described in the Research Questions by using the influence of four theories which are:

- The Actor Network Theory (ANT): social–technical concept maps simultaneously the relations between 'material' (between things) and 'semiotic' (between concepts) to align between the interest and needs of the people involved in social meetings.
- Computer Supported Cooperative Work (CSCW): technical concept based on understanding attributes of interdependent groups and the objectives of designing sufficient computer-based technology to support the cooperative work. CSCW should be dependable by insure:
    o Availability of the service whenever required.
    o Reliability of service by providing correct solutions.

- o Safety of service by avoiding and protecting from of disastrous consequences.
- o Maintainability of service whenever required.
- o Integrity of service by providing proper system state alteration.
- o Share-ability of service by providing some level of shared knowledge in the environment.
- The Technology Acceptance Model (TAM): social–technical theory models the acceptability of a technology based on two behavioral premises which are:
  - o The perceived usefulness by making the service useful for the people using it.
  - o The perceived ease of use of the technology by making the service easy for the people using it.
- Information Infrastructure: technical concept describes the basic requirements for any system structure that is meant to last to support the software and the users. The concept should have the following characteristics:
  - o Support multiple users, even if they are using the system differently to attain a common goal.
  - o Support a wide range of activities and enable the sense of innovation.
  - o Not limited to a number of users, vendors and stakeholders.
  - o Adopt change without changing the whole infrastructure by giving the ability for the new service to be connected to the old.
  - o Work within social environment to form a model of technological components and humans.

Usually, the output of Appraise stage act as an input for the last stage; but sometime, the output outlines further concepts to be found and looped again to the Research stage as a type of inquiry to be found in published resource (explicit), or to be captured during interviews (tacit). In some rarely cases, output outlines some missing objectives to be found and looped again to the Identify stage to form more Research Questions or Sub-Questions.

The final stage is the Close; it analyzes most of the information captured from the resources to form with all the other information several discussion topics and find the conclusion of the project.

2.2   Primary Research

It is the process of looking about data not exiting in printed or digital resources to gather data that reside in specialist mind and were structured over years of knowledge and experience. This research is formed as believes and actions of several peoples over years of experience and knowledge. Interviews, as a type of primary research, are the actions of communicating with focus groups to be able to collect qualitative information though questionnaires, discussions and observations. This process is visited more than once, but unlike the secondary research, it was in schedule form during of dependency on second parties (interviewees). Furthermore, this process was conducted under several heading such as the interviews and the case study.

Progress:

Figure (1) illustrates that the research questions were the trigger to rule the interviews cycle; because the process have to have enough data to initiate the proper questions. The questions were semi-structured based on headline points and open discussion as well; to be able to get the highest amount of experiences. As shown in Appendix [B], the selection of the interviewees was not random; they must have enough background about developing the health records systems, and their professional description had to be at least one of the following:

- Information technology specialist.
- Project manager.
- Hospital director.
- Ministry of Health employee.
- Physician.

Problem Encounter:

Interviews took long time to be prepared, because lots of secondary data had to be collected previously to develop and execute the plan. Sometimes, because of the limitation of human nature, the interviewee may potentially miss to mention information which could hold quite valuable ideas. Therefore, the semi-structured interview was chosen to make sure that important data were collected as much as possible. Scheduling the meetings was one of the obstacles; because of the big responsibilities on such professional people, especially who work in the medical fields. So the meetings were hard to be obtained and always limited in time. Furthermore, sometime the candidates were unable to provide some important information; because of the work security and confidentiality. To eliminate that, the person was informed by a letter before the meeting that the information is going to be used for academic purposes only and he/she was able to refuse answering any question to enhance transparency.

Accomplishment:

Although the interview scheduling and designing were hard to manage, they proved to be very helpful in remarking specific subjects that is hard to get. It highly controlled over how the information is collected. Unlike the secondary research, it can easily observe the exact research issues such as the objectives, the size of project, the time frame, and the geographical factors. One of the most important achievements is finding important areas of discussions that related to the project; especially when the questions related to user behavior or technical procedures.

2.3   Secondary Research

It is also called the Desk Research; because it is the process of looking about exiting resources to gather data that reside in published books, governmental journals, case studies, articles, international organizations standards and conferences. This process was visited several times during the project to find data about specific objectives that represented as queries built of combinations of keywords. Furthermore, this process was conducted under several headings such as literature reviews and case study.

Progress:

As shown in figure (1), the research questions were the trigger to rule the desk researches cycle. Desk researches were started by identifying the required set of search keywords which are: EHR, EMR, EPR, HIT, HIS, centralized, healthcare, health, clinical, medical, patient, hospital, physician, electronic, digital, adoption, implementation, acceptance, challenges, barriers, difficulties, gaps, organization structure, organizational change, software engineering, change management, UAE, Middle East and GCC.

When the traditional search was based only on reading recommended sections of several books, the digital search went through several phases that started with explore phase which was done mainly in Google Scholar and some electronic libraries like: PubMed, WHO, IEEE, Springer Link, Wiley InterScience, Manchester University E-Library and Edinburgh University E-Library . The input of that phase was a combination of keywords formatted in query form. The criteria for selection of articles were based on the following:

- All have to be published between 2000 and the present time.
- Articles have to be cited by other publications.
- Authors have to be accredited for their studies.
- Organizations have to be authorized to publish.
- Standards and white papers have to represent the latest update.

After searching phase, resources were passed through several filters of rejection because of duplications, title review, abstract review and article review. Finally, the filtering phase indentified the suitable reading resources that reside in books, journals or websites.

Problem Encounter:

Secondary research mainly had difficulty to obtain relevant information on the topic about the topic area; because the "Centralized Electronic Records Systems" is relatively a new topic; it is restricted theoretically to "Implementation" and "Challenges", and geographically to "United Arab Emirates". To overcome the problem several search

queries were done through different search engines and electronic libraries to obtain the maximum number possible of resources that even partially related to the topic.

Accomplishment:

Although the problem encounter in searching and gathering the information, desk research provided valuable theories, views, case studies and standards. The method was fairly relevant to the project area and it could highlight key issues regarding the implementation of Electronic Health Records Systems. Nonetheless, it emphasized most of challenges about adopting health information system within medical organizations. At last, the method opened the door to another research questions to be answered in future, and relatively different in the scope of implementation.

CHAPTER 3: LITERATURE REVIEW

3.1   Definition of EHR

Ludwick and Doucette (2009b) defined the Electronic Health Record system as digitalized health information scheme that health providers use to record critical information about the patient; that affect in diagnosing medical problems during the operations, and it help in decision making actions. This information is divided into physical details like: weight, height, disabilities, allergies and virtual signs. In addition, it provides rich details about the medical history of the patient such as medication intake, lab results, radiology findings, previous surgery experiences, and physicians' notes.

Ludwick and Doucette (2009a) believe that the system scope is not only important during the operation time, but also may support medical organizations by providing time schedules, patients' bill information, and verity of management reports. Berner et al. (2005) agreed that EHR, as information system, uses a set of combined applications to provide health care and health related services. These services are described by Castillo et al. (2010) as the applications and processes that related to the EHR and support the workflow of the clinical operations in the medical organization and enable service quality improvements. They summarize these services to be medical prescriptions, digital order entry, electronic alerts, automated decision support and any services provide the healthcare information for physicians in central role.

Walport (2010) thinks that the EHR services are not limited to physicians in the medical environment, but also they provide great support to researchers in four major concerns; discovering new diseases and health factors, studying the efficiency of drugs and side effects, studying effectiveness of procedures, and Identifying patients' willingness to take part in a clinical study. Mogli (2009) agreed with the others in their definitions for the EHR and summed it up in the following words:

"In other words, the medical record can be defined as

What, Where, When, Who, How and Why of patient care."

Habib (2010) clarified that most of the time the terms EHR, EMR and EPR (Electronic Health Record, Electronic Medical Record, and Electronic Patient Record) are used interchangeably, but some resources have different definition for them. According to NHS, EPR can be defined as a periodic electronic record of single individual, provided mainly by one institution which makes it more patients centric. On the other hand, EMR can be defined as patients' medical information for particular department in a hospital or a collection of departments in an individual hospital site, so it is more medically focused. Furthermore, the Committee for European Normalization (HealthITComment 2007) defines EHR as a repository of information in a digital readable format regarding the health of a subject of care, and it is more generalizing the other two terms.

3.2   Development of EHR

Coiera (2003) think that the end of the last century was the born of computer-based medical record idea, because many difficulties associated with paper-based one. However, one of the most successful implementations of the EHR reported in 1990 and that includes only 25% of all the patient data in basic digital form, and other 75% remain in papers.

Abdulai (2009) concurred with Coiera (2003) that digital-based records actively participate in clinical care, because it takes part in the medication prescription. On other hand, reading the paper-based records is increasingly challenging the physician; due to availability of large number of drugs, risk of drugs interaction, dosage errors, and misunderstanding of handwritten orders. EHR doesn't only provide better reading criteria, but also it plays a part in providing alert and reminders to inform clinicians about the arrival of new details within task-specific views for the data. These views provide as well a better way for searching about data relevant to specific decision. Furthermore, EHR actively affords protocol-guided data entry, clinical auditing and outcome assessment.

However, Coiera (2003) did a comparison between the paper-based record system and the digital-based one, to show that since the creation of the paper-based system, clinicians find it easier to deal with. These types of records can include medical notes, patient files, transfer summaries, test results, and even radiology. They are easier to deal with because they are portable, they don't need any technical requirement or specific training, they provide freestyle in data entry, and they are relatively cheap.

On the other hand, Abdulai (2009) believe that paper-based system is cheap only for short terms; with longer periods it may became expensive because of paper and storage cost. Payne et al. (2006) agreed with Abdulai that money is not the only reason that makes EHR better that paper based records, but also it is superior in accessibility, reliability and add-ons. EHR can be available across several locations at any given time to authorized users, and it could be easily reached with few commands. When paper records can be simply damaged or lost, EHR always can be kept for longer periods and less influenced by the physical damage especially with availability of backup systems. Furthermore, paper-based system can only be a standalone system, when EHR can be integrated with many other health information systems that improve the workflow in the organization and improve the productivity.

Cedars-Sinai (iHealthBeat 2003) agreed with Han et al. (2005) that EHR is changing rapidly, and affecting as well the medical operations. As a data repository application, EHR is not only improve the way that the data is documented but also enable physician to link between the current and past notes, tests, procedures and medications; this with less retrieval time and without any location constrains. In addition, it provides well-structured framework that enhance the communication between physicians in the organization.

The vision of EHR, as stated by United States of America (Health Circles 2011), is to be centralized between healthcare organizations, by developing interoperability of the data. Interoperability also described (IEEE 1990) as the ability of the systems to exchange data by having the same structure of information without affecting the infrastructures of the systems. Ludwick and Doucette (2009a) defined the shared record system to an

application that digitally covers the information of the patients over wide area network from different data sources that distribute geographically. It also ensures security, availability and reliability of the information to achieve high quality in healthcare over the country.

Mogli (2009) agreed with Ludwick and Doucette that centralizing the information can provide pool of data for the researchers and governments to study healthcare issues such as birth issues, child growth, average ages, death rates, ration between diseases, relate medical problems to environmental factors and much more. Furthermore, Greenhalgh (2010) saw the future of EHR to be internet accessible by any individuals given the authority that includes the patient. Castillo et al. (2010) also imagine the EHR to be extended not only as a system that structure the medical information, but it also can be enforced by expert systems and workflow systems that build on data mining and learning tools to provide a source of knowledge for clinicians and health specialist. This knowledge doesn't only supply the best possible healthcare to the communities, but also it can benefit the humanity as a whole.

3.3   Implementation of EHR in UAE

Mogli (2009) visited World Health Organization (WHO) consultant from 1981-2008, in all the six Gulf Cooperative Council (GCC) Countries (UAE, Saudi Arabia, Kuwait, Bahrain, Qatar and Oman). He reported that the consultant saw the development of most medical records in less than 20 years, moving from almost no systematic medical record services to the foundations of national EHR. However, Mogli noticed variation in the progress in the GCC countries, so about five to ten percent of hospitals maintained high standards, when most of the them miss the fundamental planning and budgeting for the health record management.

In April 2006, Sheikh Mohammed bin Zayed Al Nahyan Said (King 2010) in the National Media Council:

"... Lauded the hospital's historical role in rendering medical services to citizens, noting that it had impressively continued for decades to render quality medical services for successive generations of UAE citizens..."

Regional Office for the Eastern Mediterranean reported in the Country Cooperation Strategy (WHO 2006a) that UAE is intended to develop the current strategy; to gather information for health to be used as policy guides of the future healthcare in UAE. The governmental concern was controlling the cost and quality of services; especially that health service in the country is provided by six different authorities, each has its own system and staff. UAE strategy defines the importance of identifying the critical health challenges facing health development within an environment that has rapid change socially, economically and technologically. That summarized to strengthening the organization of health services, planning health finance, providing required health resources for health, and health education. Therefore, WHO suggested that by supporting policies and capacity-building of health development in UAE, the strategic directions can be achieved through:

- Providing technical assistance by strengthening capabilities of the Ministry of Health.
- Improving human resources.
- Reducing the burden of diseases.
- Empowering health development.
- Enhancing health research that will assist in health development through supporting related policies and capacity-building.
- Improving the communication between the health authorities and between the health providers and the government.

The Ministry of Health in UAE reported (WHO 2006b) that the actions in enabling the environment for ICT in the health sector have been taken. As illustrated in figure 2, the shared foundation actions between sectors are started before 1995 and still continually

effective in developing the adoption of the health system; these actions are procurements strategies, public funding, citizen protection, and multilingualism and cultural diversity. The actions that directly related to implementation of the ICT in the health sector almost were started in 2000 and the majority of them are moderately effective. In addition, the Ministry defined plan to initiate several electronic health services nationally, but the implementation is moving slowly because of the restructuring processes required for the facilities of health care organization.
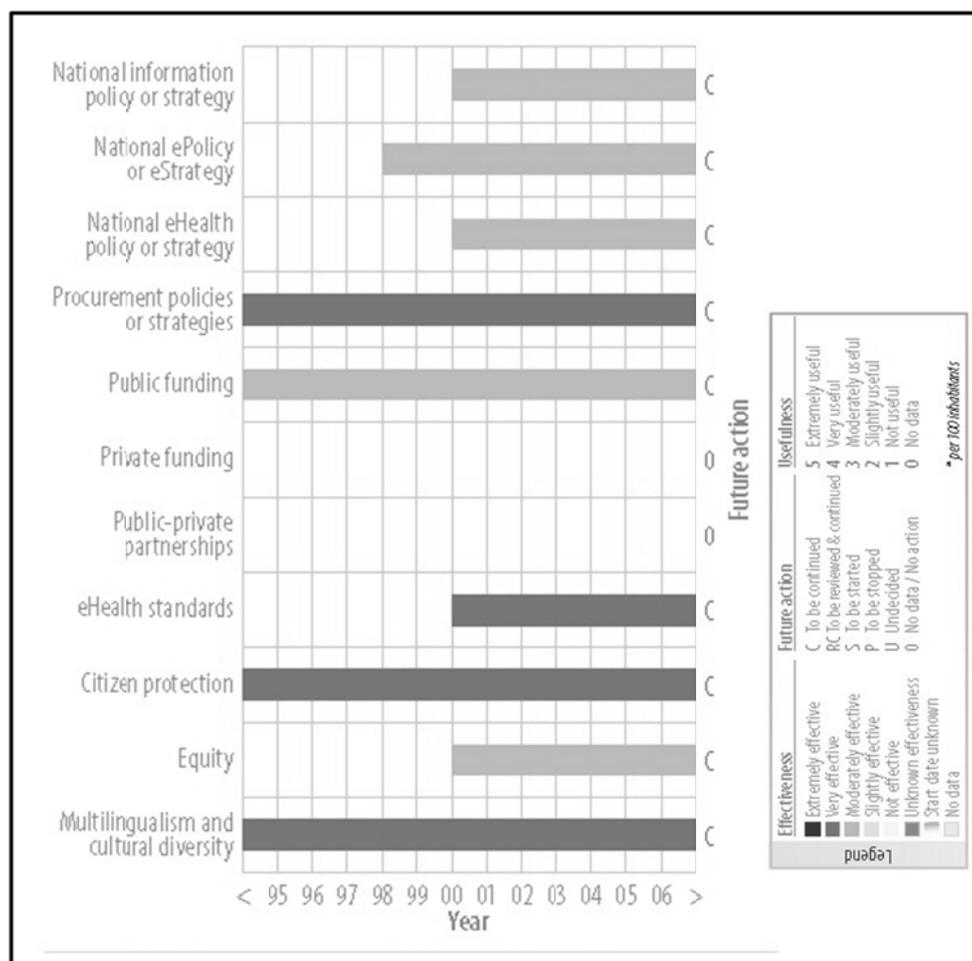
Figure 2: Enabling environment for ICT in the health sector: actions taken or planned within 2 years and their effectiveness rating

(The Work of WHO in the Eastern Mediterranean Region 2006, p. 298)

In 2011, WHO's publishing (UAE Government 2011) studied the implementation of ICT in the health sector, and found that UAE developed a national policy plan to reduce the cost of ICT infrastructure since 2000. But since 1994, licensing the facilities and medical professionals is considered to be a basic initiative in this field. UAE highlighted the regular control as the most important action in the provision of access.

During the initial phase, UAE was not only planning the technical procedures, but also it was promoting the development of electronic multicultural health content through introducing multilingual projects, translation support, and cultural adaptation. These promotion actions, lead to effective enhancement in the accessibility of health professionals to the online health content; noticeable improvements continue since 2000, when they started to create and provide health information for the general public electronically. Furthermore, to ensure that the human resources knowledge and skills matching the ICT improvement in healthcare sector, UAE started in 1996 to encourage the universities to adopt the ICT skills and courses within the curricula for the health sciences students. It also introduced several technical training for the healthcare professionals which rated to be very effective.

Some UAE national universities reflects the effort of the government in form of research and projects in the HIT field. Adel and Manar (2009) did a cooperative research to study the progress of spending on the implementation of new medical technology in the UAE. They found that buying new technology is the major source of spending from overall incremental health investments. Therefore, they suggested a solution that may solve the problem of the high cost system and improve the quality of services. The solution was to adopt the Open Source Software services, because of their availability without licensing fees. Furthermore, their research highlights the financial advantages of implementing the Open Source Software and defines the positive impacts on the quality of healthcare in UAE.

According to governmental strategy for 2011-2013 (UAE Government 2011), UAE Government considered giving high priority to expand the universal access of all citizens

and residents to healthcare services. To achieve this goal, UAE empowers the health technology to enhance the availability of healthcare services in the whole country. The country also seeks to reduce lifestyle diseases and increase the readiness of the health system to deal with epidemics and health risks. Last but not least, UAE intends to develop health insurance and implementing scheme, and improve the quality of healthcare by adopting global standards to achieve world-class healthcare services.

3.4   EHR and Dimensions of Healthcare Quality

Mogli (2009) generalized the purposes of using EHR to include continuality in patient care between several sections and assist reviewing quality of health procedures. In case of litigation, EHR can protect sides of the healthcare (patients, nurses, laboratory specialists, physicians and hospital). Furthermore, the organization can get several reports for the administrative processes internally and externally in a way that ensure security, confidentiality and privacy for the patients information can be supported with the system. Walport (2010) agreed with Mogli regarding the EHR purpose of use, but he clarified that the system will be useless, unless it guarantees safety of medical procedures and autonomy, protect patient privacy, and save human rights. Castillo et al. (2010) agreed with Razzaque and Jalal (2010), that the quality of healthcare can be achieved by using EHR, if the system reduces the medical errors, improves the cost to benefit ratio, eases data exchange and assists physicians in decision making.

EHR influence on the quality of health is not only noticed by the researchers, but also by nations and associations. The US Department of Health and Human Services (Health Affairs 2010) issued its first set of technical standards in July 2010 to structure health systems that insure security, reliability, and interoperability. More concern was given to "Interoperability" concept which is the major goal in maintaining exchangeability of information between healthcare providers to improve quality of service.

Centers of Medicare and Medicaid Service (HHS 2010), reported that healthcare quality of EHR can be measured by using the elements of Quality Data Set (QDS). These elements construct a model of information that describes clinical concepts (like: data flow attributes) in a structure. This structure is managed by several standards to monitor medical performance and outcomes, and to enhance interpretation and allocation of the data. Moreover, HHS technical standards can be incorporated with Information Handling Services (IHS 2008) to improve the analysis methodologies. IHS illustrated that EHR standards must address key objectives which are:

- Supporting administrative work related to the patient from registration to discharge or transfer.
- Managing the information content and structure.
- Using Universal Healthcare Identifier (UHID) that guides security to identity individuals while linking to the information.
- Fitting in the Emergency clinical operations.
- Managing electronic authentication within networked architectures.
- Coordinating laboratory services.
- Assisting health informatics.

On the other hand, the official journal of the European Union (Council Conclusions 2006) described the quality associated with any health system as a set of operating principles that controls by values shared across Europe. The first operating principle is the usability of the system, which can be developed by enhancing personal innovation, developing organizational governance, and maintaining suitable training. Safety of the system is the second, and that can be controlled within structured management, to improve the healthcare by monitor risk factors, and protect treatments from being misleading. The last principle is to enable care based on privacy and patient involvement, to provide transparent information to the authorized person of the system, to achieve better decisions. These principles are controlled by higher level values of the system; to be identified as to open for every one (universality), accessible in a good manner (equity), and stable whenever required (solidarity).

Since 1994, and over 80 countries, Joint Commission International (n.d.) has been working with health care organizations, ministries of health, and global organizations. This cooperation continuously improves the safety and quality of care within the international community by provisioning education, consulting services, and developing international accreditations and certifications.

In January 2011, the last edition of the JCI (2001) accreditation standards for hospitals stated the importance of controlling the quality of the health informatics. It clarified that the patient care became a complex procedure with high dependency on the communication of information. Therefore, one of the chapters is about Management of Communication and Information (MCI), and it focuses on standards that control the following issues (Appendix [C]):

- Communication with the community.
- Communication with patients and families.
- Communication between practitioners within and outside of the organization.
- Leadership and planning of information and communication.
- Quality of the patient clinical record.
- Aggregate data and information support patient care.

3.5   The EHR Design and Usability

In the previous section, the quality of EHR was discussed by various authors. All of them agreed that there is a strong relation between the quality and usability. Many authors refer to usability by two factors; how easy is using the application, and how the quality of using it can be obtained. When the second factor discussed in the previous section, this section concentrates about the first factor, ease of use, and design related issues.

Mogli (2009) saw the usability of EHR can be established when the design meets the user expectations. They summarize these expectations to:

- Simplicity in access the health information and all related clinical data that support the physician in decision making.
- Capability in managing medical results by multiple clinical and administrative users.
- Maintainability in orders without any location and time boundaries.
- Sustainably in securing the environment to protect user authorization and patient privacy.
- Ability to provide several reports and data entry templates in a simple manner for to help the users' workflow within the organization.

These expectations are not only from physicians and health organizations point of view, but also includes the anticipation of patients, researchers, teaching institutes, and national and international health agencies.

Ryan (2006), president and chief operation officer of PMSCO Healthcare consulting in Harrisburg, believes that usability is the key factor for choosing the EHR system; great achievements can be accomplished by attaching certain functionalities and features to the systems. Some features can add variety of reports with ranking capability for the value of information packages provided based on previous practices. Other features can be described as user interface design that provides enough visualization by creating charts, graphs and statistics. Furthermore, supporting data entry is still one of the major physicians' requests that can be achieved by adopting forms filling features such as auto filling, scanning, digital handwriting, voice recognition, or at least structured documentation templates. On the other hand, from administrative point of view, Ryan said that the most important functionalities are those supporting quality management (like: patient per day analysis, medication per problem analysis, and operation tracking) and financial management.

Cover (2010) reported in the CNS news that the government believes that physician anticipate EHR to meet the basic functions that provide the necessary knowledge about the patients; this is basically why US started to shift the health record systems to be digitally centralized. The necessary knowledge can be medications list, vital signs, drugs intake, lab results, insurance status, social information, medical history, visits schedule, and all the required background regarding the medical status.

In contrast, Castillo et al. (2010) consider users' expectations need lot of time to be defined. Instead, usability can be perceived by building EHR that meet with healthcare standards, and by creating system based on software engineering concepts. The following step can be constructing the interfaces and templates by using the human-computer interaction theories. Only in the final stage, explanations can be provided to the user about how EHR can have positive impact on the workflow in an easy manner. This idea can be supported by enhance users' training, create several social communication committees, and employ the expert background by motivating high performance and inspire innovation. All of this within controlled environment to manage the core functions of implementing the EHR, which are scope, time, cost and quality.

According to Ryan (2006), the major design entity for the EHR is HL7; therefore, only the vendors that are approved by the Centers for Medicare and Medicaid can be selected to develop the system, because these centers meet the HL7 standards. Dickinson et al. (2004) defined Health HL7 as a non-profit standards development organization accredited by ANSI, and this organization aims to provide standards for exchanging, integrating, sharing, and retrieving the electronic health information. These standards can support clinical and management practice, and support the delivery and evaluation of health services.

Mogli (2009) agreed about the importance of interoperability between different systems that related to the EHR. Therefore, they think that developing software need enough preparation for all the domain functions that related to the medical organization; such as: outpatient, inpatient, emergency room, occupational therapy, intensive care unit, coronary

care unit, laboratories, radiology and imaging sections, pharmacies, nursing section, and quality department. Besides, some functions have to be created to cover everything related to physician's office; such as: clinical reminders, medical orders, documentation, search details and flowcharts. The developing plan must provide functions that support database administrators, web designers, technical support, system analyzers and any person who is technically involved. All these functions cannot be provided by a single system or an individual server therefore they may reside in different physical locations that programmed to support HL7 standards to be able to communicate with each other's as shown in the figure.
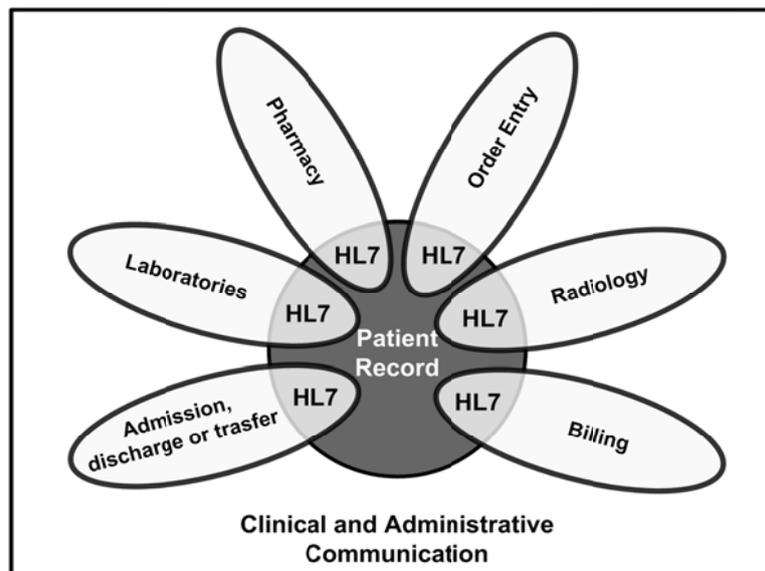
Figure 3: Standards dealing with data exchange in healthcare settings: HL7

(Mogli 2009, p.211)

3.6   Change Challenges in EHR Implementation

Although EHR have lot of benefits, the roadmap of the project has lot of challenges which may decline adoption level, slow down the implementation, increase payment rate or reduce appropriate healthcare delivery. In other words, the challenges have negative impact on the four main dimensions of the project which is scope, time, cost and quality.

Castillo et al. (2010), as mentioned in the previous sections, were able to allocate the advantages of adopting the EHR system within medical organizations and how they improve the quality of healthcare. However, they did not ignore the change challenges, and after they went through 68 selected articles published between January 1985 and December 2009, they summarized the challenges into user attitude, workflow change, support availability, communication capabilities, and technology characteristics.

In a different time in the year, Devine et al. (2010) and Walport (2010) published articles matched with observation of Castillo. They all agree that user's interests and believe, past experience, personal reaction toward change, and technical background and computer skills, may create major challenges that are identified in the organizations as the user attitude.

Moreover, Devine and Walport said that changing the procedures and processes of the daily work, to integrate of EHR into the routine clinical practice, will guide to lot of changes in the role of information technology. However, major changes in the organization workflow can directly affect the productivity of the clinicians and administrators. These changes can shape the organizational objectives and values, rules and regulations, or quality standards.

Furthermore, Devine believe that the cycle of challenges is continues, because it is altered with the availability of support and communication. This is why, the organization have to keep an eye on the way the experts communicates with other users and manage technical support to take a specific structure within environment. Directing the training

generates a great support for the communication as well, and that can be accomplished by:

- Monitoring the style of training and material provided.
- Controlling conversations between trainees.
- Managing trainer skills, schedule and timing.
- Controlling the number of trainees in each session.

From the IT point of view, many challenges are visible only by the technical teams; can be the ability of the current system to adopt the change and communicate with other systems for the present time and the future. This includes workstations, operating system, servers, electronic machines, network connections and hardware configurations. Technical challenges are not limited by environmental system structure, but also they are affected by the EHR human interface design and the efficiency of data entry tools. However, more difficulties in designing the system can be described as: the availability of technical documentation, the ability to manage the information, and the capability to secure data.

Bitner et al. (2010) agreed with Zandieh et al. (2008) that patient attitude cannot be disregarded because the balancing technology interaction and human communication to develop clinical environment can be challenging. These challenges appear as patient dissatisfaction when the medical organization changes to EHR because of they may concern about privacy from violation, worry from miss the right safety procedure by the clinical decision, upset by loss the direct eye contact with the physician or clinician staff or even react emotionally regarding using computer in the operational rooms.

Castillo et al. (2010) believe that the challenge factors are subjective. However, Payne (2006) and Ryan (2006) believe that the challenges have different impact from organization to another according to the number of staff, number of practice locations, and initial status of the system and computer configurations required. Vawdrey (2008) extended this idea to cover the effect of the following factors which are:

- Organizational and clinical leadership.

- Medical care and specialism.

- Staff background, size of the organization.

- Mandatory of usage.

- Visibility of standards.

- Time required changing.

- Amount of change in work culture.

- Quantity of data to be changed.

- The sensitivity of the data to be changed.

- Training delivery.

- Change budget.

From the government point of view, European Union remark (Council Conclusions 2006), that implementing the EHR become a regulation to be followed by nations, the challenges can be nationally described as disturb in the principles and values of the country. Therefore, several stages of standards have to be designed and reviewed, such as the individual finance and human rights have to be well studied to define the change in taxes and the role of health insurance companies. Moreover, a restructuring in the strategy have to be handled to manage the medical advances and technological developments for a long term.

Moreover, most of the authors agreed that the scope of the EHR project is clear and achievable, but other constrains (time, cost and quality) are varied because of the challenges impact. This constrains influence on each other, and they are directly related to the system adoption. For instance, Rogers (2003) said that implementation time can be decreased, if the money invested in a big scale project is high, and quality standards are well planned. Therefore, enough planning for money and standards can offer better training, enhance motivation, create better technical infrastructure, and improve communication and innovation. Nevertheless, this decreases the weight of challenges and increase adoptability of the organization to implement EHR system.

Granlien and Simonsen (2007) approved Kemper et al. (2006) assumption; that interoperability can decrease the cost of the EHR, boost the implementation time, reduce rework, and improve productivity. Therefore, interoperability may indirectly counter the clinicians' resistance, and consequently effect on the EHR adoption.

Ludwick and Doucette (2009a) studied seven leader countries in information system (Canada, the United States, Denmark, Sweden, Australia, New Zealand and the United Kingdom), that adoption rates of EHR systems are on the rise, and such systems can compromise performance of physician office at the initial stages, threaten users in the organization and may sometimes increase medical errors. Therefore, implementation process is as important as the system itself. With the good understanding about the implementation barriers, adopters can be more effective in improving the employment of EHR.

CHAPTER 4: STRUCTURED CASE STUDY

4.1   EHR Implementation in Abu Dhabi

One of the desk researches resources was a dissertation paper done by Mona Al Musabi (2010), Master student in British University in Dubai. The research was discussed how electronic medical record can support in improving the health services in Emirate of Abu Dhabi based on Tawam Hospital experience. She was able to address some benefits and challenges in implementing HIS in Abu Dhabi.

During the interviews (primary research), meetings established with Sulaiman H. Sulaiman, CIO in Sheikh Khalifa Medical City, and Altaf Chaudhary, Clinical System Analyst in SEHA. They were generous to share great information about the process of creating effective and sustainable strategy for implementing EHR in Abu Dhabi.

However, the data captured during the secondary and primary research were able to create a case study about EHR implementation in Abu Dhabi. This case study provides overview about the adoption of HIS in Abu Dhabi, the capital of UAE. Then, it addresses the goals and objectives of establishing the EHR in the city. Furthermore, it shows how the project progress and how the infrastructure developed. Finally, it discusses the achievements of Abu Dhabi by reviewing some evaluation analysis.

4.2   Overview

Since 2007, health services in Abu Dhabi have controlled by two entities: Operationally by Abu Dhabi Health Company (SEHA) and Regulatory by Health Authority of Abu Dhabi (HAAD). In addition of controlling 40 Primary Healthcare Centers and Ambulatory Healthcare Services, these entities control seven Hospitals which are: Sheikh Khalifa Medical City (SKMC), Tawam Hospital, Al Ain Hospital, Mafraq Hospital, Corniche Hospital, Al Rahba Hospital, and Al Gaharbia Hospitals. Some of these

organizations employ companies in a form of outsourcing to control the management operations, although they are following HAAD health standards and SEHA organizational policies. This is exactly the case in SKMC which employ Cleveland Clinic, and Tawam which employ Johns Hopkins Medicine.

After 18 months of process evaluation for HIS suppliers from US, Europe, India and Australia, the US-bases "Cerner" Corporation came out as best solution that fit the goals. The selection was based on evaluating the code demonstrated by the venders in the form of pre-scripted realistic scenarios reflecting the purpose of the system. In addition, to make the evaluation more realistic, more than 400 users were involved in testing and selecting procedures.

Cerner Corporation is an international health care information technology corporation that rated as the best HIS provider in the US for more than 7 years. It provides complete solutions for medical organizations to digitalize, manage and integrate medical records, computerized physician order entry and record financial operations. The Middle Eastern branch based in Dubai and has expanded to Saudi Arabia, Qatar and Egypt.

4.3   Goals

Abu Dhabi health authorities (SEHA and HAAD) use EHR to collect essential information about health care facilities and activities to support decision making. The EHR have to fit the four industrial entities which are the scale of economy, health standards, legal policies and technology infrastructure. Furthermore, EHR have to be the system that supports the industry by ensuring the availability of information whenever and wherever required, and integrate with workflow of healthcare organization through all the procedures. Al Musabi described the goal of implementing the EHR to be the creation of a unique electronic record for any individual looking for medical procedure in the healthcare organization in the whole Abu Dhabi Emirate.

The outsource companies may also has other duties to develop the quality of care. For instance, Cleveland Clinic provides a nonprofit, multi-specialty academic medical center that fund approximately $ 273 Million in research to include around 78 healthcare centers that including 14 hospitals in US and Abu Dhabi, and have around 2,200 physicians, 40,000 employees, and 5.4 million patient visits per year.

To some up, the mission of Abu Dhabi is to provide compassionate and patient-centered care with the highest quality. Education and research improvement in the field of healthcare is also one of the mission objectives in Abu Dhabi. Moreover, the vision of Abu Dhabi leaders is to be recognized as a preeminent medical center that strives to provide outstanding patient experience, superior clinical outcomes, and high improved quality of life for the UAE citizens and residents.

4.4   EHR Project Progress

To adopt the system in the SEHA organizations, Cerner had to study the government policies, health community procedures and insurance plans; to decide the amount of change required to re-engineer the software and SEHA infrastructure, and to restructure the organizational culture.

Figure (4) illustrates Sulaiman's presentation that given during the Middle East Electronic Health Records Summit in March, 2011. The figure illustrates that the health information systems in Abu Dhabi were supported by two systems which are Meditech and Great Plains. These systems were localized in each organization independently to support registration, lab results, pharmacy stores, order entry, material management, financial operations (general ledger, account payable and payroll), billing control, and human resources operations. Meditech and Great Plains faced many problems in integrating between medical organizations. They also failed to fulfill the patients' medical records to provide clinical information that support the physicians.
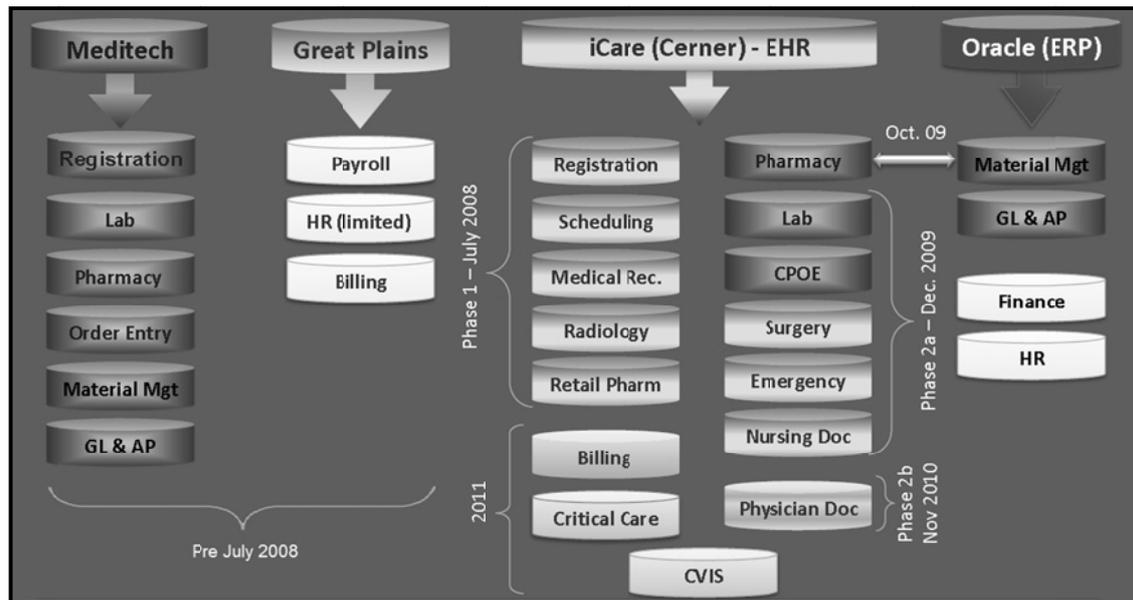
Figure 4: EHR implementation journey

(Sulaiman, 2011)

Furthermore, Figure (4) designates the progress of HIS in Abu Dhabi, which is described by Sulaiman as EHR journey that started in July 2008 and divided into two phases. The following list characterizes these two phases:

- Phase (1):
  - o The initial phase of EHR journey started in July 2008.
  - o Develop the essential functionalities of the system which are registration procedures, scheduling visits, medical record, radiology data storage and retail pharmacy control.
  - o This phase was only for developing and testing without implementation.
- Phase (2):
  - o Before the start of this stage, Oracle system was integrated with the EHR to support further functionality in data management, financial operations and HR operations.

o Divided into two parts.

- First part started in December 2009, and further functionality were developed and integrated into the EHR system which are lab results, computerized physician order entry, surgery procedure reports, emergency reports, nursing documentation, and pharmacy order reports.

- Second part started in November 2010 which represents the first use of the physicians to system and that by combining the physician documentation features with the EHR.

Sulaiman, as CIO, had to assemble the governance of the EHR implementation strategy by defining the project structure. He was on the top of that structure defining policies and rules of the project, providing approvals for procedures, and reporting to the Chief of Excusive Officer about the progress of the project. In the second level in the hierarchy, the HIS Steering Committee was responsible for designing the project procedures, directing implementation teams, assuring meeting policies and rules, and reporting the CIO. At the bottom of the pyramid, the implementation teams' duty was to implement and develop the system within a spiral software development model to go through project phases. Precisely, the teams were four, and they cared about the project implementation in terms of application, technology, training, and clinical transformation and communication.

Application team represented a group of programming specialists and software engineers, and they care about software parts of the project which are basically designing, building, testing, validating, integrating, interfacing, deploying, and supporting. Technology team work back to back with the Application team, because when the Application team care about the software, Technology team care about hardware and networking infrastructure of the system. Therefore, it is represent by a group of technicians and network engineers who provided desk service and desktop support, structure network wiring design in the facilities, deploy wireless connection, design security, and integrate computerized machines.

Moreover, Training team represented 50 trainers working within 12 training rooms to help all the parties in the organization to be familiar in using the EHR system by providing demonstrations and workshops controlled by scheduled criteria. Special connection established between the clinical transformation and communication team and the training team because they work in parallel most of the time to enhance user adoptability. Clinical transformation and communication team represented by a group of project managers and directors who worked on review and design the patients' workflow, and keep them involved in all processes by set the order of procedures which the patients pass through. Furthermore, this team concerned about reducing the variation in delivery of clinical care across different physicians to improve productivity and quality of work.

4.5   Technical Infrastructure

Chaudhary drew a sketch during the interview to describe the IT structure of EHR in SEHA and it was looks like figure (5). He used the sketch to illustrate SEHA virtual connections between several hospitals and clinical institutes. Moreover, SEHA offers centralized oracle database servers protected in a separate supervised warehouse (Data Center) to hold the data created by Cerner users. Although Cerner gave the users the opportunity to communicate over virtual wide area network (WAN), every organization created a secure local area network (LAN) to support several services such as Exchange Service (Email), IP Telephony, IT Desk Service, Employee Portal Service, Oracle database service, and much more. The network infrastructure was done in cooperation with Injazat to connect the LAN between end machines that use Windows XP and Windows Server. Cerner had to be installed on Citrix platform which is compatible with all operating systems, and that provided and installed by iCare.
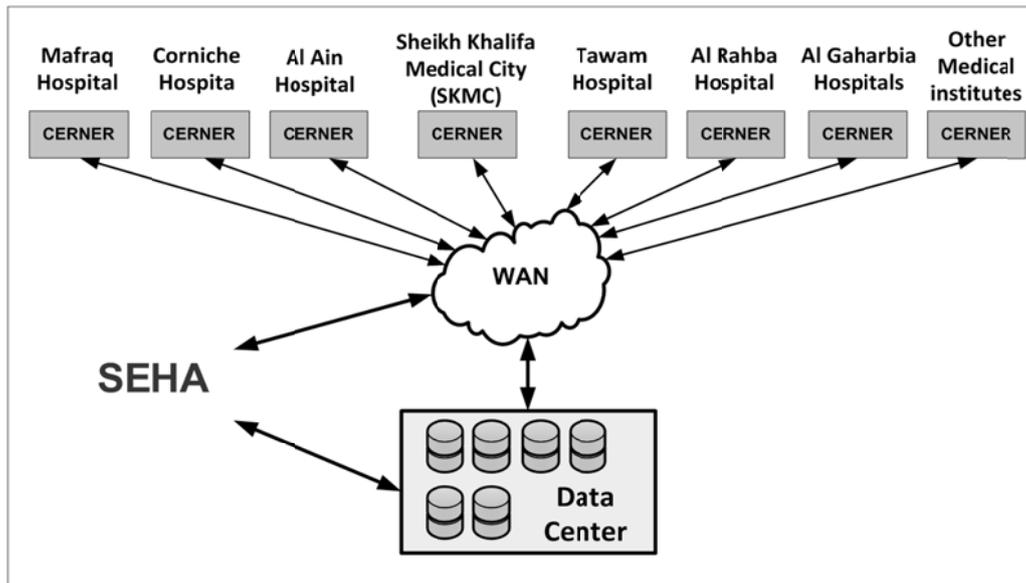
Figure 5: Chaudhary Sketch for the IT Infrastructure for EHR in SEHA

Chaudhary pointed that Cerner was developed to support HL7 standards; the HIS international standards that care about interoperability of healthcare delivery, optimize workflow and decrease ambiguity. However, it improves knowledge transfer among all of health organization stakeholders without compromising transparency, accountability, practicality or productivity.

Besides, Cerner can be consider as an intelligent system that return benefit to the medical organization in general and users in particular by providing several features, such as: auditing, usage monitoring, reports managing, data controlling and analyzing, smart interface interacting, and much more. The most important feature is to supply different user interfaces based on the user role; managers, administrators, clerks, physicians, nurses, pharmacists and lab supervisors each have different set of reports and functions to match with patient workflow procedure in the organization. Each user can use his account in any of the SEHA organizations. As a result, patient records are centralized, and Cerner controller as well.

According to Chaudhary, the EHR system had to be created in an environment that guarantees user security, patient privacy and confidentiality, and data availability. Therefore, data servers were kept in a secure Data Center, some local servers were also placed in secure server rooms. These systems are secured physically and logically by using:

- Rooms with electronic doors that open only with electronic keys and finger print. It is only authorized for administrators who were defined by the organization.
- Backup servers to ensure availability under any circumstances.
- Software and Hardware firewalls and Antivirus to protect against human or program intrusions.
- 24/7 Alert system that send the administrators SMS message whenever intrusion happened, or when the system monitors strange behavior in the network.
- Passwords policies which force the user to make it sophisticated. They are also programmed to expire every 90 days, to make certain that the user change them frequently.
- Routing protocols and packet switching to minimize the control segments in the LAN, and to increase security.

4.6   Evaluation

In 2010, Mona conducted a survey through 6 medical organization supervised by SEHA. The survey was created on Module-basis to describe the Cerner functionalities and features in the following HIS modules:

- Surgery
- Respiratory
- Rehab
- Radiology
- Profile
- Physician Documentation

- Laboratory
- Pharmacy
- Registration and Scheduling
- Nursing

The surveys were essentially designed to evaluate the health information systems in terms of the modules and functionalities to test the improvement rate provided by EHR healthcare services. After collecting the survey, summary of the evaluation was analyzed as shown in the figure (6). All rates varied between 3 and 4, out of 5. This rate represented an acceptable satisfactory rate of the users which is a good indicator to management that they were investing in the right direction.
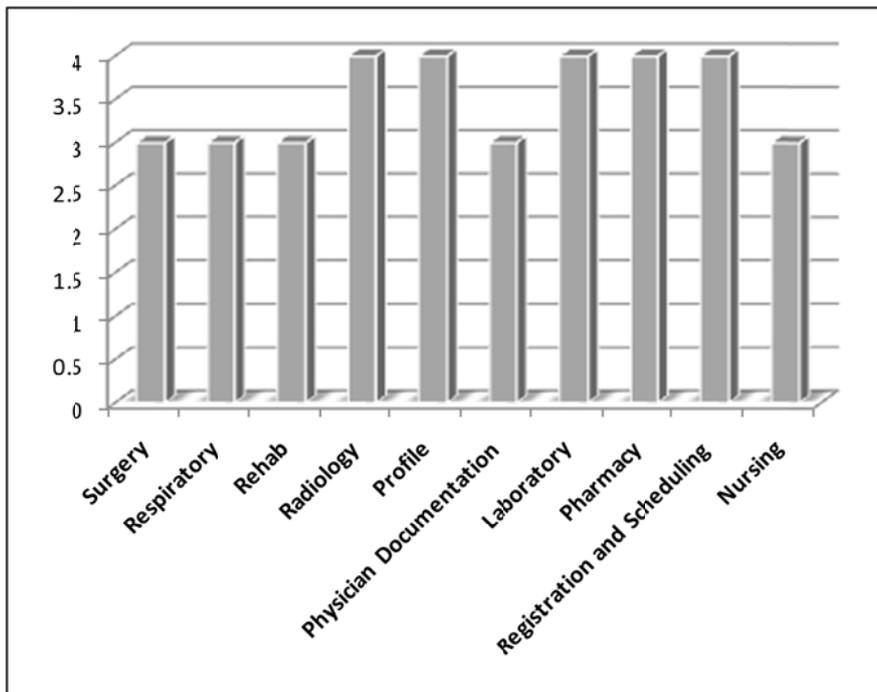
Figure 6: Summary of evaluation analysis

(Mona, 2010, P.49)

CHAPTER 5: INTERVIEWS

Interviews were conducted using semi-structured questionnaire with different health care providers and IT specialist address important advantages of using the EHR system, and they highlight major challenges in EHR project life cycle, starting from designing and end with executing. Furthermore, the interviews were able to express the relation between EHR implantation and the quality of healthcare in UAE by determine some of the major factors that influence the adoption of the system that described to be managerial, medical, technological and governmental.

5.1 Advantage of Using EHR

Hamdi assumed that the dilemma in using paper-based health records is to provide a secure place to hold the files that represents the health records. Additionally, it is not easy to locate a file when it is required, and even if it is found, it hard to deliver the right information because of thick files and unclear handwriting. Furthermore, Abu Hajaj believes that using papers is really costly in the long term. Besides, a lot of effort must be done to save the time wasted in saving the papers and categorizing them within large files to make it easier to be found as much as possible. In addition, Kaii highlighted a very important issue; it is the contamination which the papers may hold or bring during the process of recording and examining.

On the other hand, Abu Hajaj and Madi said that the current use of the EHR can provide secure storage for the patients' information and better reading for historical reports about the patient which improves diagnosing the diseases. Therefore, electronic form can be considered as good communication channel within the organization. Kaii agreed with them, and he also believes that the decision making activities are way better with the

EHR system, because the physician can easily validate data entered to the system, read lab results, link between different reports, and simply report defects.

5.2 EHR and JCI Accrediting

As observed from visiting health organizations in UAE, JCI is adopted as quality controllers and key performance indicators for the healthcare operations. As mentioned in the Literature Review section, the last edition the Joint Commission International Accreditation Standards for Hospitals (JCI) includes specific regulations to control the quality of Communication and Information Management (MCI). Therefore, candidates agreed that adopting JCI is fit exactly the scope of using EHR in a manner that guarantee healthcare quality. To get better image, a structured questionnaire were passed to them to find out the effect of implementing the JCI on the dimensional constrains of the EHR which are healthcare quality and EHR scope, time and cost. That is summarized in table (1), which illustrates the common agreement of all candidates.

Quality Standards		Healthcare Quality	EHR		
			Fit Scope	Save Time	Save Money
Accreditation Standards for Hospitals (JCI)	[MCI.1] The organization communicates with its community to facilitate access to care and access to information about its patient care services.	✓	✓	✓	
	[MCI.2] The organization informs patients and families about its care and services and how to access those services.	✓	✓	✓	
	[MCI.3] Patient and family communication and education are provided in an understandable format and language.	✓	✓	✓	
	[MCI.4] Communication is effective throughout the organization.	✓	✓	✓	✓
	[MCI.5] The leaders ensure that there is effective communication and coordination among those individuals and departments responsible for providing clinical services.	✓	✓	✓	✓
	[MCI.6] Information about the patient's care and response to care is communicated among medical, nursing, and other health care practitioners during each staffing shift and between shifts.	✓	✓	✓	
	[MCI.7] The patient's record(s) is available to the health care practitioners to facilitate the communication of essential information.	✓	✓	✓	

[MCI.8] Information related to the patient's care is transferred with the patient.	✓	✓	✓	✓
[MCI.9] The organization plans and designs information management processes to meet internal and external information needs.	✓	✓	✓	
[MCI.10] Information privacy and confidentiality are maintained.	✓	✓		
[MCI.11] Information security, including data integrity, is maintained.	✓	✓		
[MCI.12] The organization has a policy on the retention time of records, data, and information.	✓	✓	✓	
[MCI.13] The organization uses standardized diagnosis codes, procedure codes, symbols, abbreviations, and definitions.	✓	✓		
[MCI.14] The data and information needs of those in and outside the organization are met on a timely basis in a format that meets user expectations and with the desired frequency.	✓	✓		✓
[MCI.15] Appropriate clinical and managerial staff participates in selecting, integrating, and using information management technology.	✓	✓		✓
[MCI.16] Records and information are protected from loss, destruction, tampering, and unauthorized access or use.	✓	✓	✓	✓
[MCI.17] Decision makers and other appropriate staff members are educated and trained in the principles of information management.	✓	✓		
[MCI.18] A written policy or protocol defines the requirements for development and maintenance of internal policies and procedures and a process for managing external policies and procedures.	✓	✓	✓	
[MCI.19] The organization initiates and maintains a clinical record for every patient assessed or treated.	✓	✓	✓	✓
[MCI.20] Aggregate data and information support patient care, organization management, and the quality management program.	✓	✓	✓	
[MCI.21] The organization supports patient care, education, research, and management with timely information from current sources.	✓	✓	✓	
JCI standards other than MCI	✓			

Table 1: Common agreement of all interviewees regarding the relation between the MCI standards and the core functions of the EHR project.

Furthermore, Revanker, Functional Consultant in iCT Health FZ LLC, added that when the information privacy and confidentiality are maintained (MCI.10), one of the IT implementation challenges will be solved by securing the sensitive patient information and protecting organization data. Moreover, when the organization uses standardized diagnosis codes, procedure codes, symbols, abbreviations, and definitions (MCI.13), the data will be organized to consequently improve reporting, data integrity and data analysis.

Halabi, CEO of NoLimit ITS, agreed with Revanker. He also appended that one of the visionary goals is to provide secure data to enhance medical research, which can be met when the organization communicates with its community to facilitate access to care and access to information about its patient care services (MCI.1). He summarized that the MCI standards can be a great source to create policies that control the EHR implementation; not only to meet JCI accreditations requirements, but also to achieve EHR mission and vision that guarantee the quality of healthcare.

5.3   Medical Challenges

Although EHR provides great benefits on health organizations and improves the healthcare, still some users, specifically physician, resist to use the system. In the literature review, the resistance factors were summarized to be the following:
- Age of the user, which indirectly indicates to the user's years of experience in the medical field.
- User's computer skills and experience in the technology fields in general, not only for the EHR system. For example, a physician can be great clinically but never used a computer.
- User's specialty in the medical field (dentistry, ophthalmic, neurology…).

- Health sector and work nature (nursing, ER, surgery, management, finance, insurance…).

- Application interface which represents the way the system designed to interact with the users, based on the purpose of use.

- Features provided by the application which represent the way the system designed to handle daily work requirements.

- Mandatory of using the system that assigned by the government or the high management of the organization.

- Size of the organization which means the physical area covered, either by huge building or several distributed branches. This directly refers to the number of the employees in the organization.

- Country rules and regulations that are assigned by the government or the high management of the organization.

- Limited time constrains (training time, implementation time…).

- Emotional attitude that means users just don't like to change.

- Quantity of data to be used per day, which directly refer to the number of patients per day.

- Data sensitivity that gives the user uncomfortable feeling if the system used is not secure.

- Training style in terms of the content, information delivery and resources.

- Historical experience with technical supports, how did they manage change? How did they response to user requests? How did they communicate with other organizations?

Table (2) illustrates the influence of the users' resistance factors in the UAE environment, and that based on the information captured during the interviews with the six experts in the medical field in UAE. The rows represent the resistance factors influenced on the user's adoptability for EHR, and columns represent experts' notes.

Resistance Factors	Al Adham	Vidmar	Shediac	Kaii	Abu Hajaj	Madi
Age of the user.		✓		✓	✓	✓
User computer skills	✓	✓	✓	✓	✓	✓
User specialty in the medical field.	✓					✓
Health sector and work nature.						✓
Application interface.		✓	✓			
Features provided by the application.		✓				
Mandatory of using the system.						
Size of the organization.					✓	✓
Country rules and regulations.	✓					✓
Limited time constrains		✓	✓	✓		✓
Emotional attitude.						
Quantity of data to be used per day.		✓		✓		✓
Data sensitivity.	✓					✓
Training style	✓	✓	✓	✓		✓
Historical experience with technical support.			✓		✓	✓

Table 2: Users' resistance factors based on the structured questionnaire

According to Vidmar and Shediac, Institute Administrators in SKMC, the factors have great impact on the user behavior toward the system. Therefore, the system adoptability may be resisted and consequently appear as negative user behavior. This has direct impact on the organization in general, and the healthcare system in particular.

However, Shediac described the situation as a nightmare specifically when user fail to meet the required performance, refuse to communicate, reject orders, or turn over; because of frustrating in coping the organizational change. Furthermore, she said that the healthcare quality is the most important part in the EHR equation, so managers must create strategies to manage resistance risk and reduce the impact of this challenge during implementation. She said that idea of issuing financial rewards or penalties cannot be a solution, because it cannot be permanent and it can bring a bad culture to the medical environment.

According to Vidmar, financial rewards just add more cost on the project which is already expensive. Additionally, it is not a good option to make the users feel that they are extra paid for doing their work specially the people who are working in health have to be mature enough to understand the importance of the system. Sulaiman totally agreed with Vidmar, and he defined the penalties idea as a bad idea, because it doesn't only create a panic environment, but also it directly affects the communication in the organization, because the physician work transparency can decline. Therefore, Sulaiman said:

"… The last thing the hospital may need is to loss communication with users, because the hospital must be part of users' experiences and learn from them … Whatever the experience is, bad or good, it can help to achieve better exercises …"

Shediac believes in SKMC strategy to encourage the users, improve communication and enhance the adoption. The strategy was following the implementation through all it is phases and it was enriching technical skills training, educating the users about the advantages of the system to control the emotional reactions and creating social meetings to share experiences. Furthermore, SKMC spots the light on people who are giving good

examples about using the system by acknowledging them as "Super Users". These strategic actions built transparent culture between the user and the organization, which in consequently improve the adoptability.

Unfortunately, the user resistance was not the only clinical challenge reported. The interaction between the physician, patient, technical assistant, nurse and EHR system within the operation room was a complicated issue too. According to Vidmar, in the initial stage of implementation the users, especially physicians, found difficulties in interfacing with the system to read test results and provide notes, when this data created by another users. Furthermore, It was reported to Vidmar that the skills in using the EHR at initial stage (November 2010) was 60% of the targeted performance, but now it is increased to 85%. Therefore, these challenged fortunately eliminated with time, but it is slow in some departments more than others specifically those deal with sensitive operations like: Emergency Room (ER), Anesthesia Care, Intensive Care, Surgery Room and Recovery Room.

Perez, Operation Manager in SKMC, see that the communication between the physician and patient become weak after using the EHR, because the doctor became busy reading notes, check test results or record medical information on the computer. However, the doctor losses the eye contact with patient during communication and that makes capturing the information less accurate, and the patient less confident. Perez summarized patients complains about this issue by saying:

" ... Patient complains that the doctors ignore them and busy playing with the

computers... "

Furthermore, Perez noticed that when the physician tried to overcome this problem by spending less time in front of the machine to have better communication with the patient, several mistakes and errors were happened; such as: incomplete patient information, duplication in data entry, or even loss sensitive data. Therefore, the organization had to study well how the room design can affect the communication during operations. The room design describes the location of the computers, other machines, patient chair,

patient testing bed, and physician desk. The solution that SKMC followed was to allocate 250 Workstation on Wheels (WOW), 190 wall-mounts, and 150 tablet PCs in the SKMC; these devices were very expensive and need special attention in way they are used and maintained.

Therefore, from the open distributions with several candidates, the best solution is to distribute supporting devices wisely in organization for the departments and rooms that need more attention than others. Otherwise, the physician is left with one of the following techniques to be adopted:

- Use assistant to provide the required help is documenting the test notes. It is costly for long term adoption. As a result, they can be helpful through the initial stages or other situations defined by the organization.
- Read the information before the patient come to the operation room and use paper template, to be entered afterwards to the EHR system. If the feeding is done by doctor so that means doubling the effort and time, otherwise it can be done by data entry clerk which is consider insecure and may violated the patient privacy.

5.4   Technical Challenges

As shown in the case study, Choudly defined the EHR system requirements are security, availability, interoperability, and usability. He said that creating such system is never be easy or cheap; this is why EHR project divided into several processes each had to pass through system spiral development model.   These stages are mainly divided into planning, designing, implementation, testing and executing. That cycle of project management did not only provide better productivity but also distribute the tasks over longer time frame, which reduce the effort and improve investment. According to Perez, the project period started in 2010 and it is expected to finish in 2015; and break-even point (BEP) will be somewhere around 2020. Therefore, Choudly summarized the main challenges into the effort and cost.

During the open discussions with Choudly, Halabi, Revanker and BaMassood, the processes were almost addressed and classified regarding to the effort required. First of all, they agreed that effort refers to the amount of power provided to build the technical infrastructure and to control the project progress, to be done in specific time frame with enough amounts of resources, to meet the project scope and the organization objectives. As shown below, they classified effort into two categories, which are building the technical infrastructure and controlling the project progress. The two categories were sub-categorized as the following:

Effort to build the technical infrastructure:
- Processes need huge effort:
    - Bonding non-standard data definitions in the applications.
    - Implementing data mining techniques and implementing algorithm (like: Detecting medication errors, decision support…)
    - Monitoring and recording users' emotional reactions by specific functionality.
    - Developing hardware performance (ability to maintenance and upgrade, reduce time to start operate…).
    - Adopting old resources (Define and solve incorporate errors in data; Define and solve duplication in data or processes).
- Processes need medium effort:
    - Handling sophisticated data integration and linking to database servers.
    - Controlling data entry and Homan computer interaction.
    - Providing access in different locations and Link to other systems within the network.
    - Switching between patients' details, and search and link capabilities.
    - Providing network security (physically and logically).
    - Insuring System availability and legibility (shift into 24/7 operations).
    - Improving daily operational work (scheduling, billing, reporting …).

- o Detecting and correcting applications bugs (like: duplication in data or processes).
- o Controlling application functionality (relation between operations, solve processes contradiction…).
- Processes need small effort:
  - o Archiving data by provide backup.
  - o Assigning authentications and managing accessibility.
  - o Broadcasting announcements and information through the system.
  - o Providing the end users with required applications.

Effort to control the project progress:
- Processes need huge effort:
  - o Controlling users' emotional reactions.
  - o Handling emergency (System down, sensitive report required…).
  - o Managing projects (with respect to: scope, time, cost and quality).
- Processes need medium effort:
  - o Handling requests and support.
  - o Providing training for users.
  - o Controlling IT staff.
- Processes need small effort:
  - o Communication with other departments.
  - o Providing training to technical stuff.

Furthermore, they roughly agree that processes that cost and effort are directly correlated; when more effort required, more financial resources will be required as well. This is always true for the processes that have the same objective; for example: when the required applications are provided to huge number of users in the network, the effort required will increase, and so is the cost.

Unfortunately this relation is not always true with processes that have different objectives; for example: controlling IT staff is harder (need more effort) than providing

training to technical stuff, but controlling IT staff is cheaper in term of financial resources required.

Because of confidentiality, the interviewees could not provide enough information that classifies the processes in term of cost, but they all agreed that the processes that need licenses are considered to be more expensive than others.

During the Sulaiman interview, the high cost of the service providers' licenses was discussed. A suggestion was given to the candidate to replace licensed services with open source services. Sulaiman said that even though the cost of the licenses is high, but it cannot be easily replaced with the open source option. In addition, he described the open source as a bad option, since the hospitals and medical organizations have being used the licensed services for years. However, even it cost less in terms of the tools and services; it will cost more in terms of training and recruitment. There are also indirect factors that add cost to this option; the effort and cost required to develop the open source systems are relatively high; and the change in the system will affect the culture, and that will increase the turnover rate within the current users and IT specialists.

5.5   EHR and Patient Workflow

For simulation purposes, a section with structured questions was asked to Vidmar who is working in Sheikh Khalifa Medical City (SKMC), and the same section was asked to Al Adham from Emirates Hospital in Jumira, Dubai. These two specialists represent two different organizations, and each is a part of hospitals network. In other words, Emirates Hospital in Jumira is a branch of several CosmeSurge and Emirates Hospitals in UAE, while SKMC is a part of SEHA network. Furthermore, the two organization equally following the same quality standards and both were accredited by JCI.

However, the only difference between them is the phase of implementing the EHR system. Emirates Hospitals is in the initiating and planning phase of the project; EHR

were used just for registration and scheduling. On the other hand, SEHA were in implementation phase of the project; the system is even used during surgery operations.

Therefore, the structured rating-form questions were used to differentiate between the impacts of using the EHR as health record system in the workflow and communication procedures. Consequently, Vidmar and Al Adham were asked to rate the involvement of the teams by using a rating range between 0 and 5; 0 represents that team is not involved in EHR procedure of the user; and 5 represents direct involvement of the team. The answers are showed in the table (3), and they describe the involvement of hospital teams in the way the users employ the EHR system.

Table (3) shows that both organizations divide the users in the hospital into clerks, nurses, laboratories specialists, pharmacists, physicians and surgeons. And the teams characterized to:

- Technical team for providing information technology support
- Nursing team for providing clinical support
- Administrative (Non-clinical) team for controlling financial operations, insurance, transportation, and much more.
- Management team for assigning approvals for different procedures.
- Communication team for organizing the transfer procedure for the patient to other department, campus or organization.
- Government that responsible for issuing standards and procedures.

Which teams are involved directly with the **Clerks** while using the current Health Record system to do the following processes: - Register outpatient to the Organization. - Serving patient in the Organization. - Creating discharge summary of the patient. - Creating summary of the patient while transfer.		
Teams	Vidmar	Al Adham
Technical Team	3	4
Nursing Team	0	0
Administrative Team	5	5
Management Team	1	2
Communication Team	2	2

Government	1	1

Which teams are involved directly with the **Nurses** while using the current Health Record system to do the following processes:
- Recording patient data that includes physical, psychological, social, and economic factors, including a physical examination and health history.
- Adding nursing data of the patient.
- Analyze patient data.

Teams	Vidmar	Al Adham
Technical Team	4	0
Nursing Team	5	2
Administrative Team	4	2
Management Team	3	2
Communication Team	4	0
Government	2	0

Which teams are involved directly with the **Laboratories Specialists** while using the current Health Record system to do the following processes:
- Analyzing and record clinical laboratories results.
- Reviewing and commenting on laboratories results.
- Analyzing and record radiology and diagnostic Images.
- Reviewing and commenting on radiology and diagnostic Images.

Teams	Vidmar	Al Adham
Technical Team	4	0
Nursing Team	3	2
Administrative Team	4	2
Management Team	3	0
Communication Team	2	2
Government	2	0

Which teams are involved directly with the **Pharmacists** while using the current Health Record system to do the following processes:
- Read physicians notes.
- Record the medication provided for the patient.
- Record notes provided to the patient regarding the medication.
- Recording medication effects on patients.
- Recording patient's educational needs.

Teams	Vidmar	Al Adham
Technical Team	3	0
Nursing Team	2	0
Administrative Team	3	2
Management Team	3	2
Communication Team	2	0
Government	2	0

Which teams are involved directly with the **Physicians** while using the current Health Record system to do the following processes:
- Record the care provided for the patient.
- Record the procedures performed for the patient.
- Integrate between data from several departments or physicians.
- Recording medication assessment.
- Recording medication effects on patients.
- Recording patient's educational needs.

Teams	Vidmar	Al Adham
Technical Team	4	0
Nursing Team	5	2
Administrative Team	4	0
Management Team	3	0
Communication Team	2	0
Government	2	0

Which teams are involved directly with the **Surgeons** while using the current Health Record system to do the following processes:
- Recording the risks, benefits, and alternatives of anesthesia care.
- Recording anesthesia used and anesthetic technique.
- Recording patient's physiological status before, during and after the anesthesia.
- Recording the risks benefits, and alternatives of surgical care.
- Recording the operations of surgery.
- Recording patient's physiological status before, during and after the surgery.

Teams	Vidmar	Al Adham
Technical Team	4	0
Nursing Team	5	2
Administrative Team	3	0
Management Team	3	0
Communication Team	2	0
Government	2	0

Table 3: The involvement of hospital teams in the way the users employ the EHR system.

5.6   IT and Organizational Work-Structure

According to Choudly, the responsibilities of the IT department are technically and strategically high. Therefore, during the initial stage of the project, IT specialists, who were working in Abu Dhabi hospitals, were asked to be certificated in at least one of the international project management certifications; such as PMP (Project Management Professional), ITIL (Information Technology Infrastructure Library), or any other equivalent certifications. Nevertheless, IT specialists were not only technically prepared to control the project, but also they had to have a good management background and know how to deal with managerial procedures.

Moreover, Choudly believes that SKMC gave a great example regarding the IT work structure to support the users. SKMC contains 15 specialists; 5 are working in IT department office to audit the workflow, develop the system, and report to the CIO. These 5 also communicate with the network section, IT support, data center and other sections related to the system. The other 10 specialists are working in a decentralized form to be close to the user to answer requests, maintain problems, and directly report the centralized section in the IT department if changes have to be done.

According to Sulaiman, The health records cannot easily be digitally centralized in a single database in UAE. It have to be well planned to start at each emirate individually and in parallel, when the Ministry of Health can study the medical standards that meet the system requirement and healthcare quality. Furthermore, the policies can be defined at each health authority in each emirate, like HAAD in Abu Dhabi and DHA in Dubai. The health authority can provide the support, set the regulations and monitor the procedures. However, controlling the project procedures were done internally by each organization to make the management criteria in form of bottom-up hierarchy.

Moreover, Sulaiman summarized that the IT has to be strategically planned within the organization because the health cannot survive without the IT involvement. Nowadays, medical organizations have to study the role of the Information Technology on every medical process; since any delay in implementing the HIT, is a delay in the healthcare for the medical organizations.

CHAPTER 6: ANALYSIS

6.1   Interviews Data Visualization and Analysis

6.1.1   EHR and JCI Accrediting
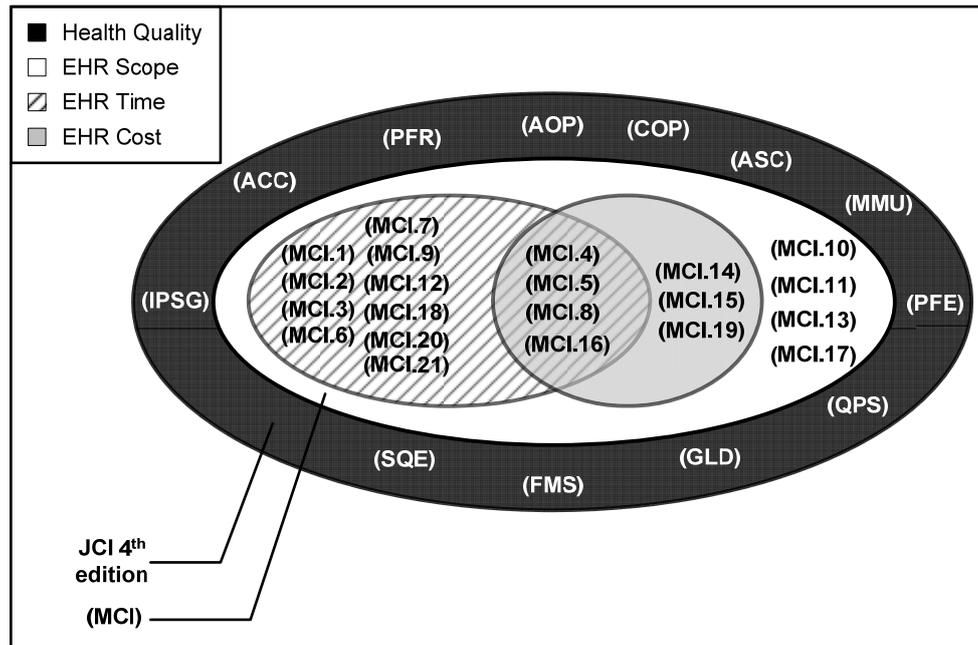
Figure 7: Analyzing the relation between the MCI standards and the core functions of the EHR project.

Figure (7) is a Venn diagram visualizing the data observed in table (1). This data was collected by a structured questionnaire that was passed to candidates to observe the effect of implementing the JCI on the dimensional constrains of the EHR. Interviewees mentioned that JCI standards obviously provide the way to get high quality from the services related to healthcare which include EHR.

Therefore, the super set, in the black color, refers to healthcare quality and includes all the JCI standards provided in the fourth edition in 2011. There is also a direct relation between the MCI (Management of Communication and Information) and the scope of the

EHR. In other words, MCI is a chapter in the JCI standards manual and it can almost refer to all the goals of creating EHR system. Therefore, the set in the light white color refers to the scope of EHR, is included in the superset and includes MCI standards.

Interviewees agreed that some of the MCI can save time of developing the EHR project, and the diagram represents them as set in blue color. Furthermore, they agreed some of the MCI can decrease the cost of developing the EHR project, and the diagram represents them as set in green color. Both sets (scheme and gray) are subsets of the scope set, so any standards that save money or save time will be part of the EHR project scope. Furthermore, some standards fall in the intersection between the time set and cost set, so some standards that save money can save project period too.

6.1.2   Users' Resistance Factors
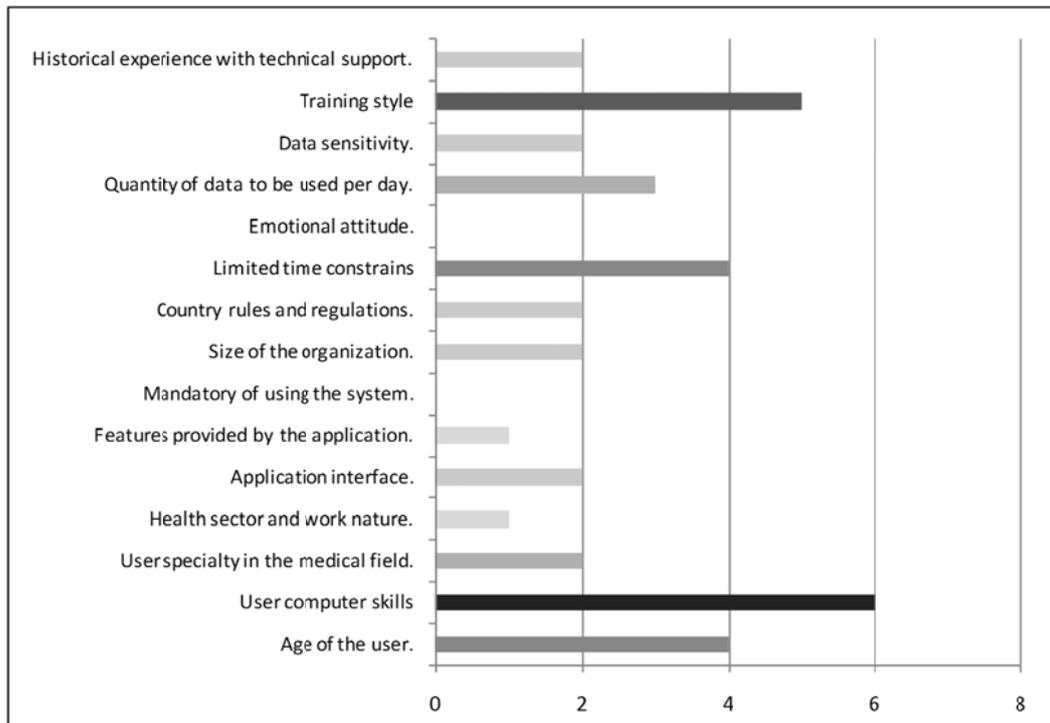
Figure 8: Analyzing users' resistance factors

Figure (8) is a 2-D Bar Histogram visualizing the data observed in table (2). That data represent the resistance factors influenced on the user's adoptability for EHR, and that information was captured during the interviews with the six experts in the medical field in UAE. When each bar represents a factor, the value of each bar represents the amount of agreement of the experts this factor considers to have a major impact on the user adoptability for EHR. The amount of darkness of each bar just refers to value; the bigger the value, the longer and the darker the bar. Figure (8) divides the factors into three sets which are:

- Four or more of the experts agreed that these factors are related to user's adoptability for EHR, to be categorized as high influence factors:
    - o User skills.
    - o Training style.
    - o Age of user.
    - o Limited time constrains
- Two or three of the experts agreed that these factors are related to user's adoptability for EHR, to be categorized as moderate influence:
    - o User specialty in the medical field.
    - o Application interface.
    - o Size of the organization.
    - o Country rules and regulations.
    - o Quantity of data to be used per day.
    - o Data sensitivity.
    - o Historical experience with technical support.
- Less than two of the experts agreed that these factors are related to user's adoptability for EHR, to be categorized as small or negligible influence:
    - o Health sector and work nature.
    - o Features provided by the application.
    - o Mandatory of using the system.
    - o Emotional attitude.

6.1.3 EHR and Patient Workflow
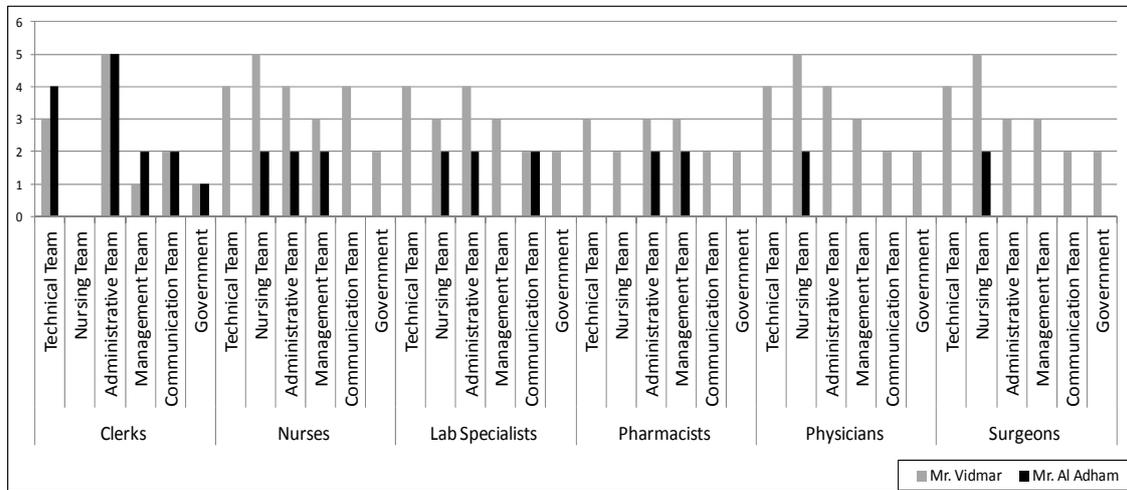
Figure 9-A
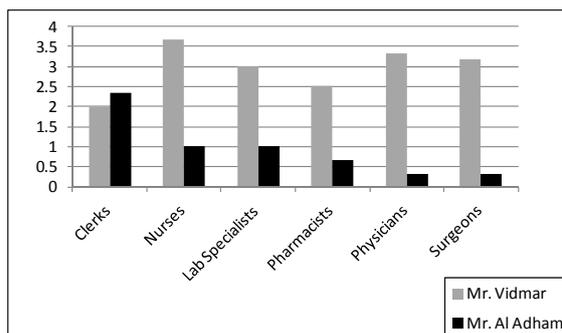
Figure 9-B
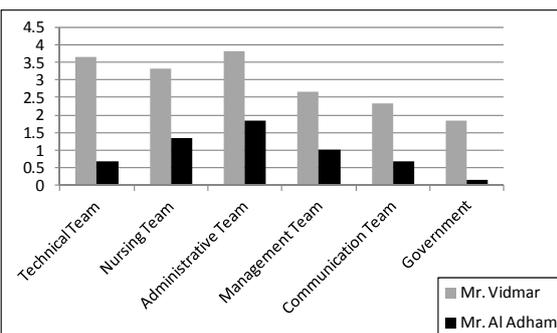
Figure 9-C

Figure 9: Analyzing the involvement of hospital teams in the way the users employ the EHR system.

Figure (9-A) is a 2-D Column Histogram visualizing the data observed in table. That data was based on information captured during semi-structure discussions with two candidates regarding the involvement of organizations, authorities or teams on the user's procedures in using the EHR. The interviewees were Vidmar, who is working in SKMC, and Al Adham, from Emirates Hospital. By using rating questions out of 5; 0 represents negligible involvement of the team; and 5 represents direct involvement.

Specialists represent two different organizations and each is a part of hospitals network. Furthermore, the two organization equally following the same quality standards and both are accredited by JCI. But the only difference is the phase of implementing the EHR system; Emirates Hospitals were in the initiating and planning phase and EHR were used just for registration and scheduling, when SKMC were in implementation phase.

Figure (9-B) has illustrates the average involvement of all teams in the each user's procedures. However, it is clear that the involvement is higher in the SKMC than it is in the Emirates hospitals, except for the clerks. The explanation is that the involvement of the teams or authorities increases with the development of EHR through the daily work. Therefore, clerks in the Emirates hospitals got more attentions than it is in the SKMC, because clerks in the Emirates hospitals started to use the EHR system at the Emirates hospitals during the initial stage.

Figure (9-C) illustrates the average involvement of each team during the patient's workflow procedures in the two hospitals. It is clear that the administrative team that controls the financial operations, insurance, transportation, and all administrative work, is the team that highly involved in the users' work in the two hospitals. Moreover, it is obvious that government that issues standards and procedures, is the slightly involve in the users' work in the two hospitals. Furthermore, the figures demonstrate the effect of the EHR in the communication between the stakeholders in the hospitals that reflect in the daily work of each user or department.

6.2 Strategic Analysis

6.2.1 PESTEL Analysis for the Centralized EHR Project

PESTEL stands for Political, Economical, Social, Technical, Environmental and Legal factors. This strategic planning technique provides analytical framework for identifying the macro-environmental pressures on the EHR project and addresses dependent pressures that may influence clinical performance in the medical organizations. The following list defines the characteristics of each environmental factor, which may give guidance about the influence of each factor to support the organization in developing the strategy.

Political Factors:
- UAE is a federal state that facilitates regionalization and decentralization.
- UAE government show high intervention in the economy by providing funds and full commitment for investment in governmental project that develop the life style.
- National health decision makers and professionals improve the health sector in UAE by reforming health financing and insuring quality.
- UAE government shows great attention in developing digital health information systems to support the country cooperation strategy implementation and monitoring.
- Health organizations still consider it challenging to strengthen the organization services for planning, coordination, monitoring and evaluation, hospital management and management in general.
- The relationship between the different health care providers and the Ministry of Health needs greater clarification and streamlining.
- Almost all levels of health services are decentralized. All hospitals are either managed by medical districts or independent authorities. With rapid changes, the management of the system poses some difficulties can be addressed by the Ministry of Health.

Economical Factors:

- UAE is one of the largest oil producers in the world and one of the richest states per head of population.
- UAE gross national income per capita is $45,660.
- UAE total expenditure on health per capita is $1,756.
- UAE total expenditure on health is 2.8% of Gross domestic product (GDP).
- UAE economic policies and regulations provide investment climate and improving the banking sector and foreign exchange regulations.
- Although several sources of financing exist in UAE, the government is concerned over the cost of services. Because spending control and auditing procedures need to be updated.
- The little amount of the budget specified for health goes to preventive and primary health care services. Therefore, an increase in the cost of health transitions between organizations, medicine, and medical services is expected.

Social Factors:

- The Government allocated enough funds to ensure good education for all citizens, especially in the health and safety education.
- The Ministry of Health provides an average of one center for every 35,415 of the population.
- UAE is in need of reference center for health education.
- UAE faces a difficulty in providing public health communication, because of variety of nationalities and languages.
- UAE is in need for qualified and well trained human resources, because there is lack in career development activities for the health sector and still no centralized systematic performance appraisal.
- Because the UAE culture is considered to be conservative, most of citizens and residents request the privacy and confidentiality during taking the medical care.

Technical Factors:

- From universal point of view, the relation between the technology and medical operation are getting stronger every day. Therefore, high clinical quality needs to be engaged with the digital services.

- UAE government always copes with world's best technology and facilitates investment to attract investors.

- Ministry of Health achieved high level in the field of information technology, and e-government.

- Building and maintaining the national health information system is a strategic objective to support and enhance the country cooperation strategy and all its strategic elements.

- Health systems currently operate within an environment of rapid technological change which directly impact on the society and the economy of the country.

- Health information on the internet and the use of the internet for delivery and promotion of health care services are still very much underutilized.

- The Ministry of Health's web site (http://www.moh.gov.ae) is the official source to promote access to electronic health content. (who)

- Most of the private hospitals, primary health care centers, medical colleges and other health facilities do not have the necessary infrastructure to deploy e-health solutions due to the low penetration rate of the internet in health care institutions.

- In the last two years, the governmental heath authorities in UAE show great example in deploying digital health solutions. Furthermore, some plans were initiated to start nationwide e-Health program and one of these plans is Wareed. It is a Hospital Information System (HIS) is now the initial stage of development to design an automate system for all healthcare processes across hospital departments.

- In January 2011, UAE Ministry of Health started the Electronic Immunization Services which support the health system by improving recording, reporting and documentation. Moreover, they maintain scheduling immunization visits for clients and track events following immunization.

Environmental Factors:

- The rapid population growth in UAE is leading to environmental degradation and negative impacts on the health of the people.

- UAE is in need of community-based initiatives for the integrated development programs.

- In comparison with the paper-based Provide clean environment to save

Legal Factors:

- To improve quality of the health system management Ministry of Health in UAE obtained ISO 9000 certification.

- UAE is in need to strengthen the district health system and legislation.

- Health service in the country is provided by different authorities, with each authority having its own system and staff.

6.2.2   SWOT Analysis for the Centralized EHR Project

SWOT stands for Strengths, Weaknesses, Opportunities, and Threats of the project. This strategic technique supports project management and objectives planning to provide analytical framework for identifying the micro-environmental factors on the EHR project. These factors can be internal like those define the strengths and weaknesses, or external like those define the opportunities, and threats.

Strengths	Weaknesses
• Enhance data availability without location limitation or time constrain. • Provide almost complete information about the patient. • Utilize clinical operations and patient workflow. • Improve communication between organizations and between authorities. • Empower medical research. • Enhance organizational knowledge and public health education. • Centralized the monitoring and auditing. • Save paper charge and storage cost. • Provide better clean security and safety. • Improve the health information technology by creating shared infrastructure.	• Difficult to adopt into the organization culture. • Difficult to control user behavior. • Difficult to manage the project in term of quality, scope, cost and time. • High level of usability is required (easy to use and enough useful functions). • Huge scale type of projects that includes a lot of stakeholders. • Human resources at the government and the organization are not enough (in term of skills and quantity) to handle the project, so recruitment processes have to be done. • Work structure has to be reformed. • Patient reaction is hard to be expected.
Opportunities	Threats
• Most of the governmental health providers in UAE are at least in the implementation phase of digitalizing the health records. • HL7 standards can ensure interoperability between electronic health systems. • The experiences of other countries regarding creating centralized EHR provide great project management examples. • Health service in UAE is provided by six different authorities, each has its own system and staff • Almost all the health providers are accredited by JCI. • High motivation from government to improve the health sector in the UAE, and verity of evidences can approve its commencement. • UAE government has great experience in managing technology project. • Easy economic policies attract lots of IT venders from all over the world.	• Most of the governmental health providers in UAE are still in the planning phase of digitalizing the health records, and still using the paper-based systems. • UAE need to improve the communication between the six health authorities, to provide common regulations and policies and plan health finance and resources. • Lack in the information exchange between the organizations and the Ministry of Health. • The role of health taxes and health insurance companies will be changed. • Privacy and confidentiality are highly requested by UAE citizens and residents.

Table 4: SWAT analysis

CHAPTER 7: DISCUSSION

This work went several times through the research stage and appraisal stage to get enough amount of information formulating literature reviews, interviews and case study. In this section, the collected information will be discussed to answer the research questions. The answers were either directly obtained, or they obtained by passing through analysis for exploration.

7.1 Mission and Vision of the Project

When the availability, exchangeability, confidentiality, privacy, security and usability are the mission of any health records systems, getting them digitally centralized can be considered as a vision of any medical organization. This vision can enhance the healthcare and add business values through:

- Support clinical and administrative operations to ease the way for monitoring the performance.
- Improve the decision making procedures for the physicians.
- Improve the patient locating and information capturing.
- Provide data pool for medical knowledge inside the country that develops clinical training, medical researches, technical skills, heath technologies and organizational procedures.
- Offer medical datasets that can be integrated with health artificial intelligence systems and medical data mining technology to define new health knowledge and medical patterns.
- Provide wider accessibility over the national area for the patient details which can enhance emergencies handling, medical consulting, and time and cost saving.
- Offer better communication with civilians and residents to enhance the public health education.

7.2   Managing Project Constrains

As mentioned in many of the project management books, that the core functions that control the projects are quality, scope, time and cost. They represent the main project dependent constrains for the centralized EHR project; any process is considered to be challenging only if it has direct or indirect influence on one or more of this constrains.

To achieve project target, the quality of the project's processes must be managed by controlling how they are planned, designed and executed. Therefore, the quality management of the project can be summarized into the following "how" questions:

- How to meet the expectations of the stakeholders? And how to involve them in the project?
- How to maximize the project values with minimum amount of challenges?
- How the project risk factors are controlled?
- How the project required resources and budget have to be selected and evaluated?
- How to provide the required amount of human skills?
- How change can be managed and controlled?
- How the critical stages of the project (milestones) can be identified and tracked?
- How the detailed task list (work breakdown structures) is developed?

The project core functions are dependent; so the quality of EHR project is strongly related to project scope, time and cost. The scope of the centralized EHR project can be defined as the objectives that meet the health mission of the UAE and support achieving the vision, and that from the management perception and technical point of view. The scope shows the way to obtain the business value, enhance the quality of healthcare, and develop the current health record system to be used in a meaningfully manner.

Time, as a project constrain, can be described as everything related to the project's processes periods and dates to meet the scope of the project with maximum quality. It usually refers to processes' milestones, deliverables' due dates, tasks' schedules, tasks' dependencies, meetings' regularity, and project's phases. The cost also is strongly linked with the wideness of the scope and the desired quality. It regularly refers to the finical

issues related to the project such as the budget, the amount of investment required, the breakeven point for the investment, the sponsors involved, and the amount of value returned.

The research information can specifically identify the entities that impact on the core functions of managing the centralized EHR. As shown in Appendix [C], JCI contains several standards that divided into sections and define how the health provider can obtain high quality out of the daily operations and processes. The targeted level of quality can be defined by reviewing the JCI standards and define how they can be enhanced if the centralized EHR is implemented, not only to obtain accreditation but also to make sure that the healthcare improved by using the EHR. However, by integrating the mission and vision of the centralized EHR with the quality management techniques which defined above as "how" questions, the key factors that controlled the quality of the whole project can be identified.

MCI stands for Managing Communication and Information, and it is a section of the JCI standards. Appendix [C] shows the 21 standards categorized under the MCI section. The 4th edition of JCI describes when the medical organizations that use the MCI standards will become more effective in

- Identifying information needs.
- Designing an information management system.
- Defining and capturing data and information.
- Analyzing data and transforming it into information.
- Transmitting and reporting data and information.
- Integrating and using information.

Luckily, these exactly match with the project scope in UAE which can be described as the need of UAE to enhance medical records by improving data availability, enriching patients' information, and summarizing clinical experience. Moreover, EHR scope objectives improve the national health communication, empower the medical research,

and enhance the governmental auditing. Furthermore, EHR is not also build shared technical health infrastructure, but also it develop the public health education.

Therefore, as showed in figure (7), the MCI standards can be used as key performance indicators for the project scope. Because the scope and the quality of the project have to be shared between the health providers; the government must go through studying the development of the health providers in the area, then creating the requirements of the project that match with most of the providers, and finally defining requirements as rules and regulations. The task of the health provider is to manage the project internally with the way that matches with organizational objectives, without violating the mission and the vision of the organization of the project.

Figure (7) also shows that some of the MCI standards can be used to manage time and cost, and define a simple model the assist organizations. Regardless to the organizational level of EHR adoption, the model finds alternative ways to manage these two constrains in a manner match with the organization preferences and objectives.

When the scope and quality can be described as terms, regulations and even certifications that identified by the government to be followed by health provider, time and cost management can be described as management styles and techniques that defined by the health providers to meet the national project objective with respect to organizational limitation. Managing quality and scope are from top down in assessments, but managing cost and time are from bottom up in implementations.

7.3   Organization Culture and Change Management

The adoption of the centralized EHR system needs huge change in the health organization, and the following can recap most of the change actions:
- The employees' roles and responsibilities in the organization.
- The government's roles, responsibilities and powers.

- The structure of the departments and the way they communicate.
- The workflow that constructs the patients' operations.
- The organizational culture that describes the behavior of the employees in the organization.

When figure (9) gives a better image for the change in the communication actions that could happen in the organization; figure (8), on other hand, illustrates the factors that affect the user behavior. User behavior impact can be categorized into three different levels which are high influence, moderate and small. The following list can define the counter resistance factors which can be used to eliminate the resistance in user behavior regarding adoption of the system:

1- Proper use of **training** by:
   a. Hire trainers with high soft skills (presentation, personality and reactions) and hard skills (technical background and familiarity with the content).
   b. Define training methodology by dividing it into several stages.
   c. Well define for the participants and providing different training styles according to their background, specialty, job role, age, and load of responsibilities.
   d. Identify and clarify the training content for the non-technical trainees, and develop it to include how to adopt clinical skills, and how to deal and report technical issues.
   e. Identify and clarify the training content for the technical trainees, and develop it to include how to work with clinical operations and how to communicate with non-technical users.
   f. Enhance communication in the classroom to share experience between different parties.
   g. Define the appropriate number of participants per room.
   h. Provide feedback to higher management and reflect their direction in a flexible manner.

    i. Declare the benefit of using the system to the trainees and show the bright side of change.

2- Proper use of **leadership** by:

    a. Improve the relations horizontally and vertically in organization structure.

    b. Control the communication between different organizations and share experience.

    c. Secure the required resources in the scale of organization and government.

    d. Recognize the employee who provides good examples in the organization level or even government.

    e. Provide job security for the employee and respect their efforts.

    f. Control turnover and establish employee satisfaction by controlling the change and well planning the risk.

    g. Take executive decisions in a participative and democratic manner.

    h. Monitor the transformation of the health records to ensure the healthcare quality in the country. And ensure that IT and clinical development are done in parallel.

3- Proper use of **project management** by:

    a. Plan the project objectives to be SMART (Specific, Measurable, Achievable, Realistic, and Timely structured).

    b. Define the project scope and quality desired in the government level by a participative manner, and manage the cost and time in organization level by a using delegative leadership.

    c. Characterize the tasks and responsibilities for each team, manager, and employee within the organizational work structure.

    d. Considerate in major functions of the system in designing and developing the implementation, then extra features can be planned. This ensures smoothness in implementation and wisdom in using resources.

    e. Define the health records transformation phases and audit the implementation.

     f.   Document the project technical and clinical processes and tasks during all the project phases.

4- Proper use of **standardization** by:

     a.   Try to develop "pay for performance" method to reward the physicians for their performance. This can act as motivator and replacer for "fee for service" method.

     b.   Divide standardization into several levels to develop in parallel with the implementation of the project. This to act in the beginning as controlled motivation and to end as certified innovation.

     c.   Obtain international health approvals and accreditations.

     d.   Improve the certification and experience level required from the information technology team to obtain acceptable amount of technical and managerial skills.

Based on the knowledge obtained from the research and from the information analyzed, the following table can be considered as a sample model. This Model doesn't only show how to counter the employees' resistance, but also specify how to turn each of the resistance factors into acceptance factors based on the list just has been specified:

Resistance Factors	Counter Resistance factors			
	Training	leadership	Proj. Man.	standardization
High Influence				
User skills.	1.a, c, d, e, f, g, h	2.a, d, e, h	3.a, b, c	4.a, b
Training style.	1.a, b, c, d, f, h, i	2.d, e, g, h	3.a, b, c, f	4.c
Age of user.	1.a, c, d, f	2.d, e	3.a	4.a
Limited time constrains.	1.c, d, e	2.a, c, f, g, h	3.a, b, c, d, e, f	4.b, d
Moderate Influence				
User specialty in the medical field.	1.a, c, d, e, f, h, i	2.a, b, g, h	3.a, b, c, d, e, f	4.b, d
Application interface.	1.a, d, e, f	2.c, f, g, h	3.a, b, d, e, f	4.d
Size of the organization.	1.a, b, c, g	2.a, g	3.a, b, c	4.b, d
Country rules and regulations.	1.d, h, i	2.a, b, h	3.a, b, c, e, f	4.a, b, c

Quantity of data to be used per day.	1.c, d, e, f	2.a, b, h	3.a, b, c, d, e, f	4.a, d
Data sensitivity.	1. d, e, f, g, i	2.a, b, g, h	3.a, b, c, d, e, f	4.a, d
Historical experience with technical support.	1. d, e, h	2.c, g, h	3.a, c, f	4.d
Small Influence				
Health sector and work nature.	1.a, c, d, e, f, h	2.a, b, c, d, e, f, g, h	3.a, b, c, d, e, f	4.b, d
Features provided by the application.	1.a, b, c, d, e, f, g, h	2.a, c, f, g, h	3.a, b, d, e, f	4.d
Mandatory of using the system.	1.c, e, g, i	2.a, c, d, e, f, g, h	3.a, b, e	4.a, b, c
Emotional attitude.	1.a, c, e, f, g, h, i	2.a, c, d, e, f, g	3.a	4.a, b, c

Table 5: The counter resistance factors for each resistance factors characterized by the influence on the change to centralized EHR

7.4 Information Technology Infrastructure

According to research resources and analysis, the information technology tasks are focused on creating shared infrastructure for the health records in the UAE to centralize the patient data in the country. The module that describes the technical related issues of the project are divided into three main entitles. These entities are the system structure, the development procedure and the change management.

System structure is the entity that describes the core functions and requirements of the system to operate probably in a way which is suitable with the government mission and vision for improving the healthcare by developing the centralized EHR. These functions are as the following:

- Functions to control application interface to be able to communicate with the user. They mostly preferable to be systematic procedures, rather than free text entry. In general, these functions have to concentrate on the easiness of using the system.

- Functions to manage database to employ the data of the system by enhance reporting procedures, and improve the features. These functions can support the users and the organization by offering: data entry validation, error correction, scheduling and alert handling and even statistics handling which can be connected to artificial intelligent systems.

- Functions to link variety of processes to differentiate between users to cope with the medical nature in health providing in a way that avoid duplication in the work, to save time and minimize errors.

- Functions to support interoperability of the data between servers in the organization and between servers in different organizations. Following the international standard (HL7) can help the organization to create a frame work for exchanging, integrating and sharing EHR information; such as medical notes, patient files, clinical summaries, test results and even radiology images.

- Functions to provide backups for the data and processes of the EHR system in different physical location (different server), to use them in the case of system failure for the original data or processes to achieve availability and reliability.

- Functions to secure data and processes of the EHR system from the intentional and unintentional intrusions to the patients' details or misuse of the applications. From wider view, these functions must provide security by ensuring confidentiality for the processes, and privacy for patients' data and users' authorizations. The same functions can afford alarms when unexpected behavior is captured in the system to alert the IT specialist or the automated system.

The previous list shows the required set of functions to build the system structure. However, not all the organizations in the UAE have to construct the same amount of functions, because of the variety in the IT infrastructure between the organizations. The following list defines the **development procedures** for technical team at each organization to achieve the EHR governmental project:

- Each organization has to follow a development model to organize the procedures by dividing them into phases; such as planning, designing, developing applications, building functionalities, testing, training, maintaining and executing.

- The preferred developing process for the project is the spiral life cycle model. It is mostly used with large projects like EHR or e-government systems because it combines between prototyping and sequencing of events. This will ensure that the project is growing on a strong base.

- The stages that define the developing procedures can be organized internally, but they have to meet the governmental project scope. Furthermore, the development of the basic functions must be given higher priority than the complementary functions.

- The medical organizations that already using EHR system, like in the case of SKMC, already passed several stages of implementation procedures. Therefore, they can support other organizations that did not implement the system yet. This support can be afforded by organizing governmental communication, national integration, and organizational documentations, case studies or recommendations.

- The medical organization that did not implement the EHR yet, or late in the implementation, have to use the support provided by the advanced organizations. These supports can be used as prototypes to build the system on them in a way that minimize the development time for adopting the system.

- Sharing experience in the national region reduces the cost and time of the project by decreasing the risk factors, improving the estimation for the resources required, improving the approximation for the training required, and supporting the assessment for recruiting technical specialists.

- The organization must contain auditing team to support the communication between the users and the departments related to their work. Hiring is not necessary; this team can be constructed from several specialists from different departments.

Besides planning the development procedures, the technical team must define the plan of the technological change. Although the definition of change is related to the development concept, the following list concentrates about **handling the change** in the technology from the technical and managerial perspective:

- Technical teams must transparently report to their managements about the resources required, so the organizations can define the quality of the service and the limitations of the project development from the respective of time and cost.

- If the organization secures the resources, the EHR performance can be guaranteed. If the government provides approval about the quality of the resources, the project can promise the improvement in the healthcare in the country.

- The technical team must focus on involving the users in the testing procedure in a way that demonstrates the use of the EHR, such as creating workshops.

- The technical team must consider the rapid improvement of the technology. Enough planning is needed for the upgrading procedure for the hardware devices, such as servers, routers or firewalls. Moreover, upgrading plan is required for planning for the software applications for maintainability, development and licensing. Therefore, although open source systems can cost less from the licensing perspective, it can cost more if it is measured with respect to ability to change or fix.

- Technical team must choose a product to be supportive for the international standards, and provide a solution which has compatibility to operate on any operating system.

- With a project of this size, technical manager have to mix between centralization and decentralization in the work structure of the technical team. The centralized part can handle the developing of the functionality and the decentralized part can handle the supporting operations.

- Technical documentation has to be conducted in the whole life cycle of the project, to record the processes that describe the way to adopt the system, and the way to handle mistakes or challenges.

- An intensive training must be provided to the IT department not only to learn about technical operations of the project, but also to study how the EHR deal with the medical operations and how to use the system in the meaningful manner.

- Technical team must be encouraged to enhance their technical skills to know how to deal with the system in emergency cases in a suitable way. However, their personal skills must be shaped as well to know how to deliver the information for the user and to know how to react about requests.

7.5   Governance

After discussing the mission and the vision of the project, managing the project constrains, organization culture and change management, and Information technology infrastructure; it is important to discuss what is the work structure required to handle the project. This part basically concentrates on the information collected from the case study developed earlier. Moreover, figure (9) analyzes the relationship between the EHR users and the teams related to their daily work. Figure (10) illustrates the governance of the centralized EHR in the organization, and it has the following characteristics:

- The figure shows the structure of the work for the medical organization while implementing the EHR project.
- The backbone communication is between the Chief Information Officer (CIO), Chief Medical Officer (CMO), Chief Operation Manager (COO), and Chief Quality Manager (CQO). The controller of the backbone, who is considered to be the highest management in the organization, is the Chief Execution Officer (CEO).

- The second level of the management hierarchy is HIS steering committee, Medical Directors Board, Quality Directors Board, and Head of Departments. They are interacting in their work and responsibilities; the directors working in this level may work in two sections to meet the requirements although they are dedicated with specific positions. This level working in a semi-centralized form.

- The last level of the hierarchy represents the teams and departments, and they directly reporting to the second level of the hierarchy.

- Some of the teams and departments which are reporting to the same section in the second level; have to work vertically in parallel to achieve several tasks for the EHR project. One of these relations is the connection between the Application Team, Technology Team and Support Team to synchronize the technical operations. Moreover, the relation between the Physicians and Surgeons, Laboratories and Pharmacies with the Nursing Team; shows the nurses' supporting role in the medical operations.

- Sometimes, the team has to report horizontally to an external section in the second level; this section is not the direct controller of the team, but they have this link to achieve several tasks for the EHR project. This represents the relation between the Quality Team, Training Team and Clinical Transformation and Communication Team by reporting to HIS Steering Committee and Medical Director Board to provide communication and training requirements to achieve high quality of the software development.

- Some of the teams and departments which are reporting to different sections in the second level; have to coordinate vertically with each other to achieve several tasks for the EHR project. This represents the relation between Decentralized Support Team with all the other teams and departments to provide technical support related to the project.

- Government role can be more effective if it gets deeper in hierarchy, but this requires higher budget. Therefore, government involvement decision can be based on the maturity of the organization to handle the process, and the budget afforded by the organization and the government.
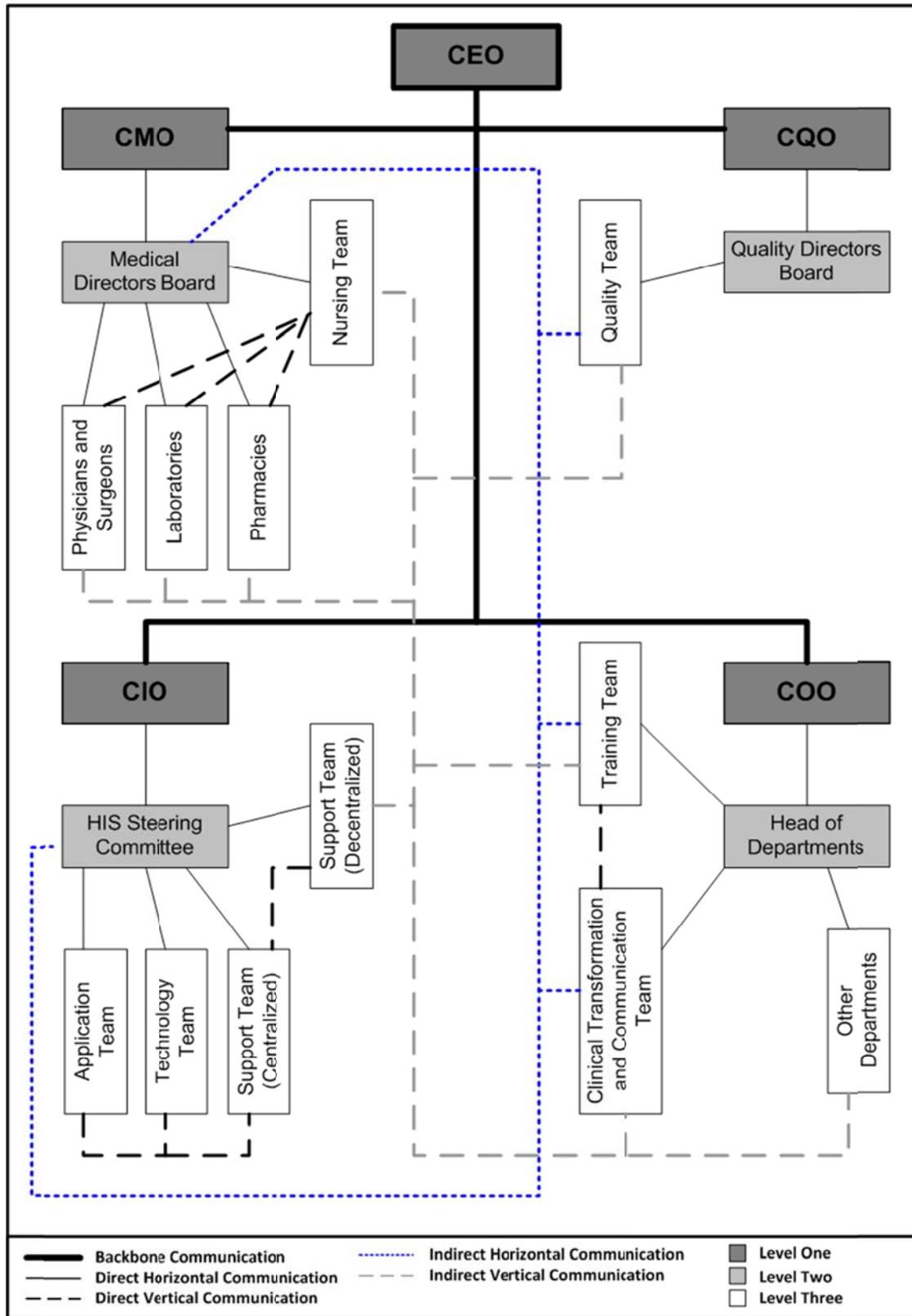
Figure 10: Governance model for the centralized EHR project

CHAPTER 8: CONCLUSION

To conclude this research, the health providers have to be aware about the importance of improving the health records to be digitally centralized. The electronic health service can achieve great technical solutions to manage the patient record within shared bases to be available to any medical organization. Moreover, the country can develop the health care not only by increasing patients' data availability and accuracy, but also by raising the patients' trustfulness in the healthcare, enriching the medical research field, and leading to a better national life care.

Several interviews were conducted with experts in the UAE. Observations show that Abu Dhabi formed a prominent place for itself in terms of development in the medical field in the last few years by achieving commendable progress toward a centralized EHR. Furthermore, the macro and micro strategic analysis showed that there are great opportunities to establish the system and make it active all over the country. However, the other emirates still faced hindering difficulties such as organizational challenges and technical complexities.

Organizational challenges can be described as the difficulties threaten project progress during the change from the current workflow to the desired status in the medical organization. The major difficulty is the resistance of the users to accept the change that may introduced by the EHR system. Therefore, the main resistance factors can be summarized into user technical skills, training style, age of user, and implementation time constrains.

On the other hand, technical complexities can be described as the amount of changes in the information infrastructure to adopt the centralized EHR system. The conducted interviews show that the technical teams in Abu Dhabi hospitals became the backbone of the medical organization after implementing the centralized EHR. These teams became the controllers of many of tasks for the system. As being realized, the most challenging tasks are bonding non-standard data definitions, adopting data mining techniques and

algorithms, monitoring users' reactions, developing hardware performance, and interacting with the existing resources. Therefore, organizations' groups and departments have to be restructured during the implementation of the project; to match with the revolution in the health informatics by developing the governance for the organization.

To control the development of the centralized EHR, the initial stage of project must have specific objectives with a realistic scope for the system implementation. Therefore, achievable management plans have to be created to control the progress of the project through a structured time schedule and measureable quality standards.

In addition, health organizations have to follow common strategies that may differ in the way of the implementation but meet the same goals. Consequently, the JCI accreditation standards can be used to modulate the management of the core functions for the EHR project; which are quality, scope, time and cost. Managing organization culture and healthcare workflow can be achieved by establishing a strategic model based on controlling leadership, training, project management and standardization.

However, this dissertation has some limitations that can be related to time and resources. The research time was suitable to do only few interviews, therefore, only people with high experience were selected. With time constrains, conducting surveys with wider range of users' feedbacks for the current record systems was hard to achieve. Although the interviewees were generous, information resources were very limited because of the security and confidentiality roles in the medical organizations.

For the future work, I believe several workshops can be conducted to put the users in different scenarios to monitor the users' reactions and record unusual behaviors. Although this required a long time of preparation, workshops can be a good way to simulate the medical workflow. In addition, automated questionnaire can be performed in a broad area to include several medical organizations. This survey can test the models proposed during this dissertation, and can capture further information regarding EHR adoption factors. However, the best practice can be conducted by creating a team of

technical specialists and medical experts, who are working in different medical organization. This team can share information about system adoption processes over long time interval to develop the information bank of the research area.

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APPENDICES

Appendix [A]

Summary of interpretative Field Research Principles (Klein and Myers 1999):

1. The Fundamental Principle of the Hermeneutic Circle
This principle suggests that all human understanding is achieved by iterating between considering the interdependent meaning of parts and the whole that they form. This principle of human understanding is fundamental to all the other principles.
2. The Principle of Contextualization
Requires critical reflection of the social and historical background of the research setting, so that the intended audience can see how the current situation under investigation emerged.
3. The Principle of Interaction Between the Researchers and the
Subjects Requires critical reflection on how the research materials were socially constructed through the interaction between the researchers and participants.
4. The Principle of Abstraction and Generalization
Requires relating the idiographic details revealed by the data interpretation through the application of principles one and two to theoretical, general concepts that describe the nature of human understanding and social action.
5. The Principle of Dialogical Reasoning
Requires sensitivity to possible contradictions between the theoretical preconceptions guiding the research design and actual findings (―the story which the data tell‖) with subsequent cycles of revision.
6. The Principle of Multiple Interpretations
Requires sensitivity to possible differences in interpretations among the participants as are typically expressed in multiple narratives or stories of the same sequence of events under study. Similar to multiple witness accounts even if all tell it as they saw it.
7. The Principle of Suspicion
Requires sensitivity to possible ―biases and systematic ―distortions in the narratives collected from the participants.

Appendix [B]

Interviews' candidates:

	Name	Job Title	Organization	Date	Further Details
1	Dr. Abu Hajaj	Ophthalmic	Ministry of Health	7/Aug/2011	
2	Mr. Aladham	Medical Records Manager	Emirates Hospital	7/Aug/2011	
3	Mr. BaMassood	CEO	ONYX, IT integrated solution	3/Aug/2011	More than 2 years experience as HRIS Specialist in DHA
4	Mr. Choudhary	Clinical System Analyst	Sheikh Khalifa Medical City	7/Aug/2011	
5	Mr. Halabi	CEO	NoLimit IT Solutions	4/Aug/2011	More than 5 years experience in HIS solutions in KSA
6	Dr. Kaii	Dentist	Ministry of Health	3/Aug/2011	
7	Mrs. Madi	Clinical Coordinator & Educator Service	---	13/Aug/2011	
8	Mrs. Perez	Operations Project Manager	Sheikh Khalifa Medical City	28/Jul/2011	
9	Dr. Revanker	Functional Consultant	---	16 /Aug/2011	
10	Mr. Sulaiman	CIO	Sheikh Khalifa Medical City	7/Aug/2011	
11	Mrs. Shediac	Institute Director, Cardiac Sciences and Clinical Care	Sheikh Khalifa Medical City	28/Jul/2011	
12	Mr. Vidmar	Institute Director, COO office	Sheikh Khalifa Medical City	28/Jul/2011	

Appendix [C]

Management of Communication and Information (MCI)

Overview

Providing patient care is a complex endeavor that is highly dependent on the communication of information. This communication is to and with the community, patients and their families, and other health professionals. Failures in communication are one of the most common root causes of patient safety incidents.

To provide, coordinate, and integrate services, health care organizations rely on information about the science of care, individual patients, care provided, results of care, and their own performance. Like human, material, and financial resources, information is a resource that must be managed effectively by the organization's leaders. Every organization seeks to obtain, to manage, and to use information to improve patient outcomes as well as individual and overall organization performance.

Over time, organizations become more effective in
- identifying information needs;
- designing an information management system;
- defining and capturing data and information;
- analyzing data and transforming it into information;
- transmitting and reporting data and information; and
- integrating and using information.

Although computerization and other technologies improve efficiency, the principles of good information management apply to all methods, whether paper based or electronic. These standards are designed to be equally compatible with noncomputerized systems and future technologies.

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(Joint Commission International. 2011, p. 229)

Standards

The following is a list of all standards for this function. They are presented here for your convenience without their intent statements or measurable elements. For more information about these standards, please see the next section in this chapter, Standards, Intents, and Measurable Elements.

Communication with the Community

MCI.1 The organization communicates with its community to facilitate access to care and access to information about its patient care services.

Communication with Patients and Families

MCI.2 The organization informs patients and families about its care and services and how to access those services.

MCI.3 Patient and family communication and education are provided in an understandable format and language.

Communication Between Practitioners Within and Outside of the Organization

MCI.4 Communication is effective throughout the organization.

MCI.5 The leaders ensure that there is effective communication and coordination among those individuals and departments responsible for providing clinical services.

MCI.6 Information about the patient's care and response to care is communicated among medical, nursing, and other health care practitioners during each staffing shift and between shifts.

MCI.7 The patient's record(s) is available to the health care practitioners to facilitate the communication of essential information.

MCI.8 Information related to the patient's care is transferred with the patient.

Leadership and Planning

MCI.9 The organization plans and designs information management processes to meet internal and external information needs.

MCI.10 Information privacy and confidentiality are maintained.

MCI.11 Information security, including data integrity, is maintained.

MCI.12 The organization has a policy on the retention time of records, data, and information.

MCI.13 The organization uses standardized diagnosis codes, procedure codes, symbols, abbreviations, and definitions.

MCI.14 The data and information needs of those in and outside the organization are met on a timely basis in a format that meets user expectations and with the desired frequency.

MCI.15 Appropriate clinical and managerial staff participate in selecting, integrating, and using information management technology.

MCI.16 Records and information are protected from loss, destruction, tampering, and unauthorized access or use.

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(Joint Commission International. 2011, p. 230)

MCI.17 Decision makers and other appropriate staff members are educated and trained in the principles of information management.

MCI.18 A written policy or protocol defines the requirements for development and maintenance of internal policies and procedures and a process for managing external policies and procedures.

Patient Clinical Record

MCI.19 The organization initiates and maintains a clinical record for every patient assessed or treated.

> **MCI.19.1** The clinical record contains sufficient information to identify the patient, to support the diagnosis, to justify the treatment, to document the course and results of treatment, and to promote continuity of care among health care practitioners.

>> **MCI.19.1.1** The clinical record of every patient receiving emergency care includes the time of arrival, the conclusions at termination of treatment, the patient's condition at discharge, and follow-up care instructions.

> **MCI.19.2** Organization policy identifies those authorized to make entries in the patient clinical record and determines the record's content and format.

> **MCI.19.3** Every patient clinical record entry identifies its author and when the entry was made in the record.

> **MCI.19.4** As part of its performance improvement activities, the organization regularly assesses patient clinical record content and the completeness of patient clinical records.

Aggregate Data and Information

MCI.20 Aggregate data and information support patient care, organization management, and the quality management program.

> **MCI.20.1** The organization has a process to aggregate data and has determined what data and information are to be regularly aggregated to meet the needs of clinical and managerial staff in the organization and agencies outside the organization.

> **MCI.20.2** The organization has a process for using or participating in external databases.

MCI.21 The organization supports patient care, education, research, and management with timely information from current sources.

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(Joint Commission International. 2011, p. 231)

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