EMERGE AND DEPLOYING ELECTRONIC HEALTH RECORDS IN DEVELOPING COUNTRIES

Master’s (one year) thesis in Informatics (15 credits)

Nader Shams Amiri

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Author: Nader Shams Amiri

Abstract

Nowadays, the main concern for any service provider organization is to improve their services with reducing the time of service accompanying with increase in their efficiency and effectiveness. In healthcare systems, specially, these concerns are much more important where the information is the core material of providing services to patients. Electronic health record (EHR) systems are designed to address these concerns and using them is becoming more and more important for many countries. EHR systems provide many capabilities to hospitals with collecting, sharing and manipulating information in the digital format. Moreover, actual EHR systems enable hospitals to share their patient information with any other hospital no matter of the first location of storing data.

Incorporating a system with the main goal of making integrity between different organizations is not an easy task and many challenges and problems should be considered to make the system efficient for the organizations. Although many good attempts have been done in some developed countries such as Denmark and USA this issue is still a big challenge for many developing countries.

In this research study, it is tried to review the situation of EHR systems in a developing country to extract the challenges and barriers for adopting it. At first, the researcher has a deep literature review on past works on EHR from different aspects. After extracting needed information, a case study will be run to better understanding of the real situation and make a comparison between the literature and real environment. The researcher selected Iran as a developing country to review its healthcare system and the degree of using computerized system in the organizations.

Keywords: EHR, Information, IT, healthcare
**Acknowledgements**

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June 2012

Nader Shams Amiri
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1 INTRODUCTION

In this chapter an overall view of the study will be provided. The main purposes of this chapter can be summarized in two issues: first, the reasons for selecting this topic will be discussed and second a brief background of the topic is provided.

1.1 Background

This research study focus is on the Electronic Healthcare Records (EHR) in developing countries. Electronic Health Record (EHR) is one of the newest applications of Information Technology in healthcare. EHR is the soft version (digital copy) of patient’s medical history which is made available through a network (e.g. Internet) beyond the geographical borders.

The task of transforming from conventional paper-based medical records to Electronic Medical Records is now taking place in developed countries such as the U.S. and Canada. Many frameworks have been proposed in order to guarantee a smooth and efficient transformation from paper-based medical records to their electronic equivalent. Furthermore, studies have been held in order to identify the needs and expectations of the users (both the patients and clinic staff) of such systems.

In this research project, the first task is having a literature review on EHR in order increase the understanding of this issue. Next, the steps of the deployment of such system are going to be analyzed in developing countries. I have decided to choose Iran as an example of a developing country and find out the obstacles and problems in order to transform paper based medical record to Electronic Health Records.

1.2 Problem Discussion

Although many countries have implemented many different forms of EHR, this subject is still in its early stages and needs to be developed. Different difficulties in this area made this issues one of the main concerns of many countries (Farzandipour, Ahmadi et al. 2009). The benefits of EHR are many but it should be implemented correctly and many issues should be concerned before adopting and EHR system to achieve them. Moreover, there are many challenges in this way and when it comes to developing countries these challenges can be twice. Although, there are many good practices in developed countries like US and some European countries there is still a lack of good framework for deploying EHR. The question is: What are the problems of implementing EHR in a developing countries and how well hospitals can solve these problems?
1.3 Purpose of the Study and expected outcome

This research consists of both theoretical and empirical study. The author first tries to have a review on EHR literature and different frameworks provided for its implementation. Then, an empirical study would be carried out in order to gather the required information from target sample (the size and the specification of the target group would be specified further); and after processing and analyzing the obtained data, the necessary amendments would be introduced in order to deploy EHR frameworks in a developing country like Iran.

- Main objectives

  ➢ To give an overview on EHRs and its challenges
  ➢ Reviewing different implementation frameworks
  ➢ To study and assess the development of EHR frameworks in Iran as a developing country
  ➢ To find out the problems and challenges the EHR implementation
  ➢ Propose a practical model for improving EHR implementation

1.4 Research questions

The author designed research questions to fulfill the objectives of the research appropriately. In this study, the researcher tries to answer to main questions and two sub-questions which mentioned below:

- How can EHR help healthcare centers to increase their efficiency and effectiveness?
  - What is EHR? What are its advantages?
  - How healthcare centers implement EHR systems? What aspects should be considered in implementing EHR systems?

- How developing countries use the EHR systems?

1.5 Target group

Mainly two groups of people can benefit from this research.

First, from the academic point of view this study is useful for researchers who want to extend their knowledge regarding EHR concept and its role in the healthcare centers and hospitals. Because the first purpose of this study is reviewing the literature of EHR systems and the researcher tries to gather enough related information for building its structure, this study can be an appropriate source for people who want to know about EHR more. Moreover, researchers who want to find appropriate definition for EHR, its advantages and different implementation framework can benefit from this study.
Second, this study is targeted practitioners especially in developing countries like Iran who want to implement EHR systems. This people need to know a lot about the situation of healthcare centers in these countries and barriers and risks in implementing such systems. As this study reviewed the situation of EHR systems in a developing country (Iran), so it can help to increase the approach of practical people who seek to implement an appropriate system for this country.

1.6 Background of Author

The researcher obtained bachelor degree in Information Technology management from Multimedia University of technology (Malaysia) in 2009. Immediately after graduation, the author has started working as IT manager in National Iranian Petrochemical Company. The main responsibility of author was project definition and planning, project risk management estimation. During working in management team, he found his interest in developing of E-base component. Later on, he receives more tasks on design of “Assaluyeh” project which is the first Persian oil, gas and petrochemical database on the web. Currently, the researcher is taking master degree in Informatics at Högskolan in Borås. By gathering knowledge and information during master course and experiences from different projects, the author has the proficiency in performing researches in informatics area.

1.7 Delimitations

The scope of this thesis consists of both theoretical and practical works on EHR. EHR is a wide concept and the researcher has to limit his study to some specific areas in literature. The focuses of the researcher in theoretical part are: reviewing the different definitions of EHR, findings its advantages and reviewing different frameworks for implementation. In practical part, there are many obstacles for extracting needed information due to the constraints of time and resources. Therefore, the empirical part is limited to observation and some limited interviews in selected environment to extract enough information for assessment.

1.8 Structure of the thesis

<table>
<thead>
<tr>
<th>Introduction</th>
<th>In this chapter, the author discusses about the issues which build the infrastructure of the thesis. Issues like the background of the research, purpose of the study, research questions and target group are presented.</th>
</tr>
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<tbody>
<tr>
<td>Methodology</td>
<td>In this chapter the researcher describes the methods he applied in his thesis for developing the concept. Additionally, it contains some important parts like the methods for data...</td>
</tr>
<tr>
<td><strong>Theoretical frame of references</strong></td>
<td>Collection, strategies for validating the thesis and analysis method.</td>
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<td>-----------------------------------</td>
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<tr>
<td><strong>Empirical study</strong></td>
<td>In this chapter, the researcher discusses about concepts which he used in his research and tries to build its theoretical structure with reviewing previous academic works.</td>
</tr>
<tr>
<td><strong>Analysis</strong></td>
<td>In empirical study chapter, a case study will be conducted by the researcher through observation and interviews.</td>
</tr>
<tr>
<td><strong>Discussion</strong></td>
<td>In the analysis chapter, the researcher tries to connect the gathered information in the literature and empirical part to analyze them and answer the research questions.</td>
</tr>
<tr>
<td></td>
<td>In this chapter, the conclusion of the study and its implication are presented. Besides, the researcher discusses about the evaluation of the research and ideas for developing the concept.</td>
</tr>
</tbody>
</table>

*Table 1.* Structure of the thesis
2 METHODOLOGY

In this chapter, the methods used in the study to develop the research and gather needed information for analysis will be described. Furthermore, in this part the type of research approach and the validity and reliability of the research will be discussed.

2.1 Scientific Perspective

2.1.1 Research approach

(Kumar 2005) presents two different scientific paradigms. A paradigm shows people’s value, judgment, norms, standards, perspectives, myths, theories, frames of reference and approved procedures that govern their thinking and action. These two paradigms are:

1- Positivistic

2-Hermeneutic

Positivism is considered as a type of explanatory science. In this type of paradigm, the knowledge should be “Scientific”, objective and tangible in nature. This concept is mainly based on experiment, quantitative measurement and logical reasoning. In positivistic paradigm the research is conducted on the basis of rational, logical and reasonable approach and issues like emotions, beliefs and feelings are not incorporated as they are not considered rational and tangible issues. So we can conclude the researcher’ approach in this type is logical and analytic based on theories.

Hermeneutics is considered as an opposite concept of positivistic. In this type of paradigm, a person provides his/her own understanding from theories with the description of the issue. Hermeneutics may be considered as the review and development of theories and the interpretation and understanding of texts. The researcher tries to collect data from different theories and develop it to uncover the meaning, values and explanations. So it is a kind of comprehension science.

This research work has the hermeneutics approach by starting with the construction of theoretical frame of reference and then collecting empirical information. For making this possible, the researcher first emphasizes on constructing the theoretical framework and then tries to use this information in empirical part for better understanding.
2.1.2 Research strategy

From a point of view there are two types of research: Explorative and Evolutionary.

According to (Babbie 1995), we call a research an explorative one when the subject is relatively new and unexplored. The researcher tries to define the problem clearly and solve it with different methods. So in this type of research, it is possible to create new knowledge in the research area by the researcher. Because of the explorative research nature, some specific data collection methods like interviews and observation are more useful. Generalization to the population at large is not popular in this type of research and the results of this study are not reliable enough for decision-makings. And the results of this type of study are more useful for exploring the situation of the focus area. (www.wikipedia.org)

Evolutionary research is the other type of research which includes different steps and is developed by the researcher in these steps. In this type of research, there is chain of results and the researcher obtains new results based on previous ones.

Mainly my research can be considered as an explorative one because of its nature and the methods used by. According to the purpose of this study, I try to figure out the situation of EHR in a developing country first by reviewing the available literature in this area. Second, I tried to explore the practical environment by performing some observations and some informal and formal discussions with employees and managers through in-depth interviews.

2.2 A quantitative or a qualitative study?

Quantitative research may be defined as: a type of research deals with numerical data and in most of cases tries to relate two or more variables. So the objectives of quantitative research can be more developing mathematical models, theories and/or hypotheses pertaining to phenomena.

In Qualitative researches, the approach is more subjective. In this type of research, usually 4 methods are used: observation, analyzing text and documents, interviews, recording and transcribing.

The differences between these two methods may be summarized in: qualitative researchers are “subjective” and quantitative ones are “objective”, the value of the rich descriptions is important in Qualitative researches while in quantitative ones the researchers do not persist on such details.

This research is considered as a kind of qualitative type because of its predefined goals and the nature of data used. The goal as mentioned before is to review the situation of EHR in developing countries to find the challenges and give some suggestions for improvement. Therefore, there is no sign of numerical data and no quantitative methods will be used for analysis.
2.3 The roles of theoretical and empirical study

The roles of theories and empirical data are different based on the nature of the research and its purpose. These roles should be clarified to use them appropriately in different parts of the research. Theories can help the researcher to build the infrastructure of the study and empirical data can provide him significant insight to the given focus area.

As mentioned before, this study is both theoretical and practical research. In the theoretical part, the researcher investigates the concept of the issue in scientific sources and in the practical part information needed to conduct the study is gathered through extensive communication and interaction with people. The aim of the researcher is to provide a practical case based on information extracted from theoretical sources. Therefore, at first step the author tries to make a theoretical foundation with reviewing different scientific sources in this area. Then, based on gathered information an investigation in a practical environment will be performed. The reason for shifting to real world is to gain enough information for the analysis part of the project.

We can categorize this study as a purely deductive or inductive one. Induction is a type of research based on empirical data to explain a problem or develop a concept. In this kind of research, the validity and reliability are very important because of the connection with reality. In deduction researches, a logical reasoning is conducted based on theory. So the researcher tries to find some data from theories to support his/her predetermined concept. This study is considered both as a deductive research and inductive one because it gathers data from theories and use empirical data from practical environment to suggest some solutions in reality. However the inductive part of the study is very small.

2.4 Data Collection

According to the goal of the research, the researcher has to gather information from scientific sources and practical environment. Mainly, this data may be categorized into two categories: primary and secondary data.
2.4.1 Primary data

The basis of Primary data is coming from personal experiments such as direct observation and in-depth semi-structured interviews. In this research, these two methods are used to gather information from selected cases. In the observation part, all the stories are important for the researcher and he tries to see every activities related to EHR and gather data.

The author determined a specific purpose for the interviews. This purpose is the interviews will be run until the point where more interviews cannot add any important information for the subject. The questions and the answers will be presented in the analysis part.

It is important to mention that the main goal of this research is about understanding how hospitals perceive the concept of EHR and how they use it. Therefore, the researcher is not searching for the “correct” answers but some stories from the implemented EHRs to shape the view of practical environment.

2.4.2 Secondary data

This type of data is related to issues which are extracted from scientific sources such as documents, biographies, websites, textbooks, scientific articles and other historical and documentary records. This group of data helps to researcher to make a foundation for the research which can support his/her assumptions in further parts.

In this research, both the primary and secondary types of data have been used by the researcher. The author collected primary data from interviews and his observation from selected practical areas. The secondary data also is used in this research and plays an important role to conduct the researcher. This data collected from different scientific sources in this area like articles, textbooks and websites.

2.5 Analysis method

Data analysis is essential for a good research for reaching to the problem area thoroughly and obtaining important concepts. According to (Backman 1998) in qualitative research one the arduous task is data analysis. So the researcher in this type of study should consider it carefully. In this research, the data needed for the analysis comes from the various sources and results from empirical study.

In this research, it tries to select high reliable sources based on their relevance to the subject area. For analyzing the theoretical part, the researcher used Ricoeur's theory. Based on this theory there are three mimetic moments: Pre-figuration, configuration, and re-figuration. (Heather, Wilson et al. 2009) describes these three as below:
- Pre-figuration: in this phase the researcher tries analyze structures and norms from existing text.

- Configuration: the focus of author in this phase is the where the presentation of the real world is provided.

- Re-figuration: in this phase the researcher tries to connect the two last phases to interpret them.

Now the researcher has the aspects for analysis and gathering data from practical environment. In next part of the study which is empirical data, the researcher makes analysis on gathered data based on these aspects. In this part, the gathered data from theories and empirical study will be compared together.

### 2.6 Strategies for validating findings

We can say our research is reliable when the results of the study are not something different from the same findings and conclusions. According to (Mehrens and Lehmann 1987) the reliability is: “The degree of consistency between two measures of the same”. In this research, the reliability depends on the skills and the knowledge of the interviewer. To make this reliability possible, the researcher first studied articles and textbooks related to the concept. Also the people selected for interviews in hospitals are people with high skills and extensive knowledge about the EHR issues who can give the researcher appropriate data. Moreover, the interviews are planned carefully and conducted in a systematic way to decrease any unwanted mistakes from both the researcher and selected groups for interviews.

When the research results are correspondent to the reality we can say our research has validity. In short, validity is the extent of our reaches to measures or examines which we defined in the beginning. Mainly, the validity is divided into two groups: External and Internal validity.

The internal validity is about the connection between the theoretical framework and the empirical study. In this research, it means the interviews should be performed by relevant people who have enough qualifications. As mentioned before, the selected people for interviews are the high skill and knowledgeable ones in this area.

The external validity refers to the generalization of the research. It means whether the results of this research can be used in future or not. Form the author’s perspective, this research would be fruitful in this area as it reviews the practical environment and makes some comparison between the real world and the theories. Therefore, with considering generalization factors carefully this research study will be helpful for future works.

Moreover, for increasing the validity of the findings the researcher defined three main criteria for validation (Larsson 1994; Lind 2005):

- The criteria of validity: as mentioned before this research has hermeneutic approach. In hermeneutic research aspects such as consistency, heuristic value and empirical value are
important. For making this validity possible, the researcher tries to make an appropriate connection between the literatures to validate the results.

- The quality of outcomes: in this validity the richness of meaning, the structure and theoretical findings should be considered.

- The quality of the presentation and the text as a whole: this means the structure of the projects and the ways of reporting should be adopted appropriately. Moreover, this validity can be achieved by ethical value, perspective consciousness and internal logic.

### 2.7 Result presentation method

The written format has been selected by the author for presenting the work. Regarding the purpose of this study which is giving contribution to the research area mainly by reviewing theoretical materials this format has been selected. For better understanding and simplifying the written materials, I also used some tables and figures. Tables are the important parts of this research as it shows the researcher findings together for better understanding and comparison. For referring the sources, I used Harvard system. In this type of referring, the name of author and the publish date are presented together when a source is used. And the author uses alphabetic order when more than one source is used.
3 THEORETICAL FRAME OF REFERENCES

In this chapter, the basis of the project which is from different theories will be made. As mentioned before, to perform this task in its best way the author used different scientific sources. This part begins with an overview on EHR definition and concept discussion. Then, some information regarding the EHR implementation and its different requirements will be presented. And in final parts the author reviews the situation of EHR in developing countries from the views of previous researchers.

3.1 Defining Electronic Healthcare Record (EHR)

Emerge of the Internet have had a profound effect on our lives. Incorporating the use of computers and the Internet in our daily lives has changed the way of doing things. The combination of computers and Internet with the aim of gathering, trimming, and storing data (of any form) is termed as Information Technology (IT). A distinctive feature of the Internet is that it is time and location independent. Put differently, we can access information and services via Internet anywhere and anytime. Proper adoption of Information Technology in different areas has enabled us to produce better products, provide better services, and educate ourselves like we never did before.

The early effect of such technology on health organizations was aiming to replace paper-based documents with digital records by developing computerized systems which form information systems for hospitals. With the growth of technology and its abilities to store, manage, and transmit huge amount of information, more and more applications were introduced to health organizations (e.g. healthcare informatics, clinical informatics, health information systems, etc.).

In 1991, the Institute of Medicine (IOM) proposed the idea of elimination of paper-based document with digital documents within 10 years (Medicine 1991). Therefore, the development of electronic-based health documents started in 90’s in a complementary manner. In academics also there was a tendency at the same time to increase numbers of publications on EHR which shows the importance of this concept in the world. According to (Wena, Hob et al. 2007) between 1991 and 2005, 1803 documents were published in SCI journals from 39 countries in America, Europe, Africa, Asia, and Oceania. During these 20 years a number of different terms have been used in this area. Some of better of them are: Automated Health Records (AHR), Electronic Medical Record (EMR), Computer-basedPatient Record (CPR), and Electronic Health Record (EHR) (Organization 2006). Below a brief description of them is presented.
Automated Health Records (AHR):

This term refers to a system which has a collection of different images of traditional health records documents. In this system, the different documents are scanned into computers and the images are saved on optical discs. This system was popular in the early 1990’s. although it solved some problems of traditional paper based system like access, space and control problems, it was not able to address data input/output at patient care level.

Computerized Patient Record (CPR):

The concept of computerized patient records was similar to that of hospital information systems (i.e. only used across a single health institute). This concept first was introduced by American in 1990’s (Organization 2006). In CPR, each user would have a digital profile, where all the medical history of the users is stored. The focuses of CPR was mostly on medical alerts, medication orders, providing integrated data on a patient’s registration, admission, and financial details, and recording information from nurses, laboratory, radiology, and pharmacy. However, the core focus of computerized patient records was on the services provided in medical institutes. Among the common type of information that computerized patient records encompass we can name admission and financial details, laboratory information, medication history of the patient (Amatayakul 2004).

Electronic Medical Record (EMR):

This term is interchangeably used with EHR. But these two term are completely different (Kierkegaard 2011). Electronic medical record is the term referring to computer system which involves a comprehensive set of information about patient’s medical records (e.g. patient’s particulars, medications and prescription, lab results, etc.) especially in inpatient environments. Electronic medical record has been widely used in many developed countries private and public medical centers.

Electronic Health Records:

The definition of electronic health records varies among communities and academics depending on its coverage and the depth of details it provides. Table 2 presents some of these definitions.

<table>
<thead>
<tr>
<th>EHR Definition</th>
<th>Author</th>
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<tr>
<td>An evolving concept defined as a systematic collection of electronic health information about individual patients or populations. It is a record in digital format that is capable of being shared across</td>
<td>(Gunter and Terry 2005)</td>
</tr>
</tbody>
</table>
different healthcare settings, by being embedded in network-connected enterprise-wide information systems. Such records may include a whole range of data in comprehensive or summary form, including demographics, medical history, medication and allergies, immunization status, laboratory test results, radiology images, vital signs, personal stats like age and weight, and billing information.

…any information relating to the past, present, or future physical/mental health or condition of an individual which resides in electronic system(s) used to capture, transmit, receive, retrieve, link, and manipulate multimedia data for the primary purpose of providing healthcare and health related services

(Englebardt and Nelson 2002)

EHRs are large-scale systems that serve as a computer based patient medical record. These systems often incorporate several applications and functions for tracking, monitoring, and entering medical information, such as patient medical history, allergies, test/lab results, diagnoses, and medications.

(Edwards, Moloney et al. 2008)

Electronic Health Record is defined as a means a comprehensive medical record or similar documentation of the past and present physical and mental state of health of an individual in electronic form, and providing for ready availability of these data for medical treatment and other closely related purposes

(Kierkegaard 2011)

**Table 2. EHR Definitions**

Between these various definitions the last one is the most acceptable one among academics and practitioners. If we look carefully at them there are some common issues which all of them mentioned. These issues shape the specifications of each EHR system. An EHR system should have these features: a systematic program includes patient information, capable of recording digital data, retrieving and showing data in appropriate format, capable of network connection and having enough knowledge in any health related area such as medical information for decision making. All these features make EHR a comprehensive database which allows hospitals and physicians to exchange data information electronically in a chain of all entities within the health network (Kierkegaard 2011). Figure 1 illustrates the criteria of EHR between main features mentioned.
For better understanding of the EHR concept, reviewing its differences with EMR would be useful. As mentioned before, although these two concepts are used interchangeably they are completely different. According to (Kierkegaard 2011) “An electronic medical record contains the encounter information of patients in a care deliver organisation, while an electronic health record contains information from many or all care deliver organisations where the patient has been treated or has had an encounter.” In fact, the EMR records needed and appropriate information in hospitals and ambulatory environments to supply needed information in EHR (Habib 2010).

EHR has evolved during past years and currently the features mentioned before are just the primary expectations from it. Many countries tried to develop this concept and between these countries Scandinavian countries in Europe are the pioneers in this area and countries like Denmark promoted this concept to its high level (Kierkegaard 2011). For instance, in Denmark the term “one-letter solution” feature is famous between hospitals and care systems which is a specific electronic form that is common in 5000 health institutions (http://www.commonwealthfund.org).

The other promoted feature in Denmark is the accessibility of the medical information for patients such as medical records and test results in a specific website called Borger.dk.(Kierkegaard 2011). This website actually connects the patient to the doctor for any task relating to him/her health. Moreover, in most of Danish hospitals carrying wireless handheld computers is common by doctors and nurses. This task allows them to have enough information about their patient in any place in the hospital through online networking (Harrel 2009). The result of this successful implementation in Denmark can be summarized in ((http://www.medcom.dk/) mentioned in (Nohra, Andersena et al. 2005)):
- 95% of GPs have EHR of which 85% can make communication electronically with hospitals, pharmacies and health authorities.

- 100% of pharmacies can use IT and communicates electronically with GPs and hospitals.

- 100% of hospitals earn Patient Administration System (PAS), Laboratory Information System (LIS) and other proprietary systems.

- More than 30 million clinical messages are communicated annually.

However, these features are not evolved in many countries and are special for specific countries. The adoption of e-health in many countries is not as fast and mature as Denmark and has been slow and problematic (Crippsa and Standing 2011). So not all healthcare centers in different countries expect to take these advantages from EHR. The degree of using advantages of an implemented EHR depends on many factors which will be discussed further in implementation part. But according to the primary specifications and features of every EHR system there are some fixed advantages which all healthcare centers and practitioners expect to earn after implementation. Table 3 summarizes some expected advantages of EHR which researchers mentioned before.

<table>
<thead>
<tr>
<th>Table 3. Expected Advantages of an Electronic Health Record</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Eliminate illegibility</td>
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<tr>
<td>- Reduce error</td>
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<tr>
<td>- Facilitate data collection and analysis for quality improvement</td>
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<tr>
<td>- Allow for real-time decision support</td>
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<tr>
<td>- Improve continuity by increasing availability of information across the continuum of care</td>
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<tr>
<td>- Reduce redundancy by allowing for the cross-population of information into different areas of the record simultaneously (eg, weights, vital signs, etc)</td>
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<tr>
<td>- Automate and improve coding and billing</td>
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<tr>
<td>- Automate completion of various forms</td>
</tr>
<tr>
<td>- Provide prompts and screening or monitoring tools for clinicians</td>
</tr>
<tr>
<td>- Increased job satisfaction by having access to better patient data in a</td>
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</table>
convenient form

- Generation of statistical reports that are created through the system for reporting purposes for funding agencies

(F. Michael Gloth, Eric A. Coleman et al. 2005) and (Crippsa and Standing 2011)

In summary, the EHR provides appropriate environment for flowing information which brings all of these advantages. Through all mentioned benefits, for the clients advantages like saving time and cost efficiency are the most important ones and for staff the ability to access patient data is the most important advantage mentioned by researchers (Crippsa and Standing 2011). All of these advantages make EHR as a stand-alone system operated by physicians’ offices or hospitals. But if healthcare centers want to take all these advantages they need to understand how to increase the efficiency and effectiveness of this technology (David F. Lobach and Don E. Detmer 2007). This means appropriate procedures should be defined to implement the system completely and evaluate its performance based on defined factors which will be discussed in next section.

3.2 EHR implementation

Until now, we discussed about the concept of EHR and its potential to bring various advantages for the healthcare centers. Undoubtedly, without an appropriate implementation achieving to mentioned benefits is not possible. Although the benefits of using any EHR system are more than to convince managers, EHR adoption has been slow in healthcare systems (David F. Lobach and Don E. Detmer 2007). Before starting any implementation action, the hospital or healthcare center must show its readiness to adopt a new system. They should determine their goals and expectations from the EHR. To achieve this readiness, (David F. Lobach and Don E. Detmer 2007) defined some specific questions for managers to ask themselves when they implement their EHR to assess the success of implementation. But I suggest it is better for hospital to consider these questions before implementation. Table 4 shows these questions.
### Table 4. Questions for assessing the impact of an EHR implementation

- What will change if the system is successful?
- What parameter can be measured to demonstrate this success?
- What data are needed to calculate this parameter?
- Through what sources can these data be located?
- How can the data be obtained from these sources?
- How should these data be analyzed to demonstrate if the change reflecting success has occurred?

(David F. Lobach and Don E. Detmer 2007)

### 3.2.1 Implementation barriers and risks

There are many obstacles in this way which make the implementation the main concern of hospitals and not all hospitals and healthcare centers can overcome these obstacles. These obstacles at the first step can change the decision of hospitals for implementation of the EHR. According to (Maguire 2002), currently the percentage of physicians who use EHR in their practices is less than 10%. Because of these problems hospitals usually prefer to purchase a package of EHR system from providers. But this is not an easy task and many issues should be considered before implementation any EHR system. According to (F. Michael Gloth, Eric A. Coleman et al. 2005), before deciding to purchase and EHR package below issues should be considered by hospitals:

- **Upfront Purchase Cost.** Initial costs to implement EHR are different and it is hard task to convince physicians to accept them without a clear understanding of return.

- **Equipment Cost.** Most of EHR packages need to purchase or upgrade of hardware and/or network software.

- **Lack of Technical Personnel.** Adequate human resource always has been a concern, specially, when it comes to technical issues.

- **Office Staff Training.** Usually, EHR packages are too complex to understand and incorporating them into daily activities needs sufficient and appropriate training. Training various levels of office staff is not practical. And most of the times Large EHR companies with complex packages cannot provide enough oversight to the personnel.
• Technology Changes. Due to the speed of technology development, the fear of wasting investment is always a concern for hospitals.

• Privacy/Security Issues. One of the important issues in any given EHR system is the patient record protection. Although, the security of most EHR packages is better than old-fashioned paper charts, the concern of security should be considered within EHR system.

Between these primary obstacles, the cost issues and the last one privacy/security are the most important obstacles which most of healthcare centers and hospitals deal with (Amatayakul 2004). These two issues will be discussed in detail in next parts. However, these are only the primary obstacles for EHR implementation and there are many other obstacles mentioned by experts in this area. In table 5 some of the most important barriers and risks of EHR adoption are showed which mentioned by previous researchers.

<table>
<thead>
<tr>
<th>Table 5. barriers and risks of EHR adoption</th>
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<tbody>
<tr>
<td>Technical barriers</td>
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<tr>
<td>- Lack of ICT infrastructure including some of the remote communities relying on satellite links rather than broadband</td>
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<tr>
<td>- Cost of system implementation and maintenance due to the remoteness of the communities</td>
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<tr>
<td>- Frequent power outages and a lack of backup power mean the clinicians cannot rely on the system 24/7</td>
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<tr>
<td>- Availability of suitable web based software and robust hardware at the time of implementation</td>
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<tr>
<td>Administrative barriers and issues</td>
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<tr>
<td>- Lack of protocols for access to other electronic health records outside of the NG Health Service</td>
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<tr>
<td>- Access to immunization records across the three states to reduce over inoculation of patients</td>
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<tr>
<td>- A way of being able to share data with services outside NG Health without allowing total access to all the files in the database</td>
</tr>
<tr>
<td>- Some way to insert a date stamp when working with critical patients so that the Royal Flying Doctors Service can see the development of the patient’s condition over time</td>
</tr>
</tbody>
</table>
Human resource barriers and issues

- Lack of previous experience with IT and health IT programs
- Lack of ICT knowledge among staff. Transient nature of staff due to isolated region

(Crippsa and Standing 2011)

As it appears in table 5, there are mainly three categories in EHR barriers and risks which are technical, administrative and human resource. These three issues should be addressed independently by healthcare centers if they want to get benefits from their EHR system. As mentioned before, Cost and privacy issues are the ones which most of hospitals fear to deal with them. In next section these two barriers will be discussed.

3.2.1.1 Cost barrier

Cost issue has been a major concern in implementing and developing EHR systems. There is a lack of enough funds in supporting such systems from governments and healthcare administrators as they believe the system should be self-supporting in a specific time (Organization 2006). Currently, most of healthcare centers deal with reduced revenue and increased cost (Amatayakul 2004). And they believe the time need to completely implement and see the result of EHR is the major problem which reduces the value of their investment. Regarding time concern, generally learning how to make documentation in EHR does not need very much time if the system is properly designed. In fact, the time needed for the adoption of the system processes and managing work flow changes is very much.

The question here is: can the EHR system really be capable of paying for itself? At first, we should separate the cost of EHR with other activities. As we discusses before, because the EHR success is achieved by integrating all other clinical and administrative systems, sometimes some of these costs are interchangeably attributed to the EHR instead of the processes that needed attention anyway (Organization 2006). The other issue which should be considered is this fact: Not all of the benefits of such system can be quantified or it is very hard task to do. So in most of the times, the benefits are not tangible to be seen by organization to make a satisfaction for the cost of the system.

3.2.1.2 Privacy barrier

There is always a concern in health service users that that information technology (IT) and EHRs makes this possibility for a greater number of individuals to see their personal information
(Woodward 1995; Lyons, Payne et al. 1998). According to (HIMSS 2004) in United States (2004), the greatest obstacles for computerized record systems and EHR are security and confidentiality issues. Patients’ rights are in danger because of the absence of clear directions for the patients’ information confidentiality (Farzandipour, Ahmadi et al. 2009). So this is an initial concern, many academics and practitioners have tried to address it in many ways.

(Haas, Wohlgemuth et al. 2011) defined some requirements for an EHR system to make sure about the security of personal data. These privacy-preserving EHR requirements are:

**Requirement 1:** “Every patient must be able to express binding privacy policies concerning the flow of information related to him/her.”

This requirement has an important value for information systems. However, to use this requirement and its benefits there should be a procedure to control whether the system enforces this policy. To make this possible requirement 2 is defined:

**Requirement 2:** “Patients must be able to check whether the agreed-upon privacy policy has been enforced. In the case of unwanted information flow they should be able to identify the data source or leak.”

Incorporating this requirement is not an easy task as we can only control the enforcement when there are some procedures for checking that the design and implementation of the system are under properties and they work correctly. So if there is not procedures like this, the patients can only trust to the provider of the EHR system. The problem here is most of the time enough information is not given to the patients about the provider. So these problems push us to define the third requirement:

**Requirement 3:** “The patient should not be forced to trust anybody but those parties directly involved with the treatment and common certification authorities.”

This requirement means the patient should not easily trust to the EHR system provider. In fact, in combination with requirement 1, it shouldn’t be the possibility for the provider to access to any patient-related data (unnecessary for the service itself) or to change medical data stored in the system. But even when we are sure about meeting these requirements there is always a possibility to produce new knowledge about a patient with information processing on several data sources. Requirement 4 helps to solve this problem:

**Requirement 4:** “The information gained from linking different flows of medical data should be insufficient to establish profiles of or gain new knowledge about patients.”

The examples for requirement 4 are Google Health (http://www.google.com/health) and Microsoft Health Vault (http://www.healthvault.com). They keep medical information as well as personal information on central servers. But “the data is encrypted – if at all – at the servers and the provider itself only stores the encryption keys.” (Haas, Wohlgemuth et al. 2011)
3.2.2 Implementation frameworks

As we reviewed, there are many obstacles in the way of EHR implementation. Many academics and practitioners have attempted to address these obstacles and suggested different frameworks for simplifying implementation stage. In previous part we reviewed some of these works. Additionally, there are some specific frameworks for better using of EHRs suggested by different communities. In this part, two of these frameworks will be discussed which would be useful for the analysis part.

3.2.2.1 European eHealth strategy

European countries are the pioneers in EHR implementation and Scandinavian ones like Denmark and Sweden were more successful. But how these countries are successful in this way? According to (Kierkegaard 2011), the reason of success in these countries is a coherent national policy and financial incentives to adopt health IT and technical support for providers.

There is a specific strategy in Europe for adopting EHRs. This very new legal strategy for using and implementing EHR helps organization to have a better understanding from the concept and consider all issues in implementing any EHR system. According to (Kierkegaard 2011), this strategy contains below issues:

(a) Any EHR framework should be capable of analyzing different personal data protection impacts of organisational alternatives for storing personal data.

(b) The EHR framework should guarantee the patient’s self-determination. This is possible by allowing for the patient’s autonomous and freely taken decision.

(c) The EHR framework should guarantee the system is designed and selected in accordance with the defined aims.

(d) The information security is an important factor and the EHR framework should provide appropriate ways for its assessment. Personal data protection also should be considered prior to the implementation of an electronic health record system.

(e) The EHR framework should determine the type of personal data based on their availability in electronic form or online. For instance, personal data as genetic or psychiatric data is the one which may have to be excluded from online processing altogether.

(f) Determining which people can use personal data is another important factor which should be addressed by EHR framework. Using this personal data should be in accordance with national law or rules established by national competent bodies.

(g) The requirements for accessing and using personal data should be defined. These policies should be applied and implemented in the organizations.
(h) Informing patients regarding the nature of the data and the structure of the EHR is vital and the framework should define some procedures to guarantee it. This data should be understandable for patients and included appropriate language and manner for special persons (e.g. children or elderly persons).

(i) Some special procedure should be provided to prevent patients from being illegally induced to disclose their personal data contained in electronic health record systems.

(j) The EHR framework must be sure that different processes, especially the storage-of personal data in electronic health record systems, are in accordance with jurisdictions applying Directive 95/46/EC or those with an adequate level of protection of personal data.

(k) Any system needs to be audited regularly to assess its performance. In EHR system the framework should audit the system for the purpose of ensuring compliance with data protection obligations, such as reliability of the electronic identification system and authentication, data access logging, documentation of all processing steps, duration of maintaining the auditing information, effective back-up and recovery systems, and enforce the adoption of these requirements or solutions according to best practices for information handling;

(l) The last requirement focuses on the confidentiality of EHR systems. In this procedure, appropriate technical and organisational measures should be determined, including rules on incident detection and management processes, in case of a breach of security or identity mechanisms leading to the accidental or unlawful destruction, loss, alteration, unauthorized disclosure of or access to personal data transmitted, stored or otherwise processed in EHR systems.

3.2.2.2 Amatayakul framework

Amatayakul (2004) suggested another framework for incorporating EHR systems in practical environment. This is more practical than the European one which can be considered as a set of rules for better implementation. Amatayakul defined some specific stages which help to simplify the hard task of implementation. These stages are:

1. **Determine readiness for an EHR.** As mentioned earlier, readiness for an EHR is an important factor and should be cultivated if there is a tendency in the hospital to resist to computer use. User participation is an important factor in this stage which can influence the performance of the system.

2. **Plan the migration path** with determining the goal and a migration strategy to reach that goal. Without doubt, it is possible that you will not be able to find a quick solution. We all know changing the structure of a paper-based environment to the automated one is difficult. So, it is better to call EHR achievement “Evolution” rather than a revolution, although recently there are good achievements in revolutionary approach.
3. **Select the EHR system that is right for the organization.** There are many providers in EHR system and it is vital to select the appropriate one for your hospital. Functionality (especially the customizability) should be considered in this stage and vendors play an important role to achieve it better. According to (Amatayakul 2004), “It may be necessary to compromise and extend the migration path until the vendor catches up, compromise the functionality to achieve the best integration with the incumbent vendor, or “bite the bullet” and switch vendors.” The organization can follow a thorough cost–benefit analysis.

4. **Install, design, and test the system.** In this stage, try to have anticipation on the impact on users, work flow, productivity, and patients. Many issues should be addressed in this stage, like whether and how implementation will be organized and how past data will be integrated and old data retained.

5. **Train, train, and train.** User involvement is one of the most important factors from the beginning. Therefore, training is vital and it is not far from the mind to see more trainers than the staff on-site during the implementation.

6. **Determine benefits, correct course if needed, and enhance the system.** Benefits should be determined and understood through the organization. If you think your results from EHR is far from your expectations it is time for some corrections. And when you feel you can see and feel the benefits, further enhancements can be considered.

![Figure 2. EHR implementation stages](image-url)
3.3 EHR practices in Developing countries

As mentioned before, there are good examples of EHR implementation in some developed countries. But this issue is not restricted to these countries and some developing countries also have good practices of EHR implementation despite many obstacles. Below some of these practices will be discussed.

In Malaysia, currently there are two hospitals which have implemented a kind of EHR system and become paperless. One of them is a 960-bed hospital and the other one is a 270-bed hospital. In addition, there is also a primary healthcare facility which has implemented an EHR system and does not use paper record. But if we want to mention the first one, we should go back to 1985. In that year, a Teaching Hospital in Kuala Lumpur implemented a Health Information Management Administration System (HIMAS) which used an IBM mainframe computer to do tasks like patient admission, transfer, and separation (ATS), appointment scheduling and a medical records tracking system. The current system in Malaysia hospitals named INFOMED system has been developed from HIMAS. INFOMED is capable of performing tasks such as: ATS, patient scheduling, medical records tracking applications, pharmacy ordering, laboratory ordering/reporting, radiological ordering and reporting, patient accounting and a small system on case-mix. In Malaysia, EHR systems are not integrated and they use a kind of Health Information System (HIS). However, since 2004 they begun a plan to upgrade the INFOMED to integrate systems in seven years (Organization 2006).

In Indonesia, they designed and developed a local EHR system. The main concern of this system refers to the hospital-based environment. They designed a java system to integrate hospitals. In this Java system, there is a link between reporting and recording of several primary healthcare centers into their computer system (using a Local Area Network, approaching to WAN). In this area, it is possible to count the TB patients treated as well as a number of other diseases treated. However, there are still hospitals which use traditional ways and do not interested in EHR progress which is developed in the country because of various problems mentioned before.

In Taiwan, there is an integrated system which is developed more than previous cases. Taiwanese experts developed a PHR (Personal Health Records) system which has been developed as part of a larger 5 year project to develop portable health records that includes EHR data exchange between hospitals and a creation of data banks (Jian, Wen et al. 2011). The design, development and implementation of the PHR have been done in this 5 year period to provide 1844 patients with electronic versions of their health data. Regarding EHR, an interoperable EHR adoption project, as part of NHIP, implemented among eleven medical centers in 2007 (Chang 2010). In this project, the goal is to digitize the patient health records in participating hospitals in the end of 2011. Therefore, the majority of patients can retrieve their electronic personal health record online during their hospital visits, and there is possibility for them to keep the data themselves or storing it at a data bank in the future.
4 Empirical Foundation

After reviewing the literature of EHR from different perspectives, in this part a case study will be run to gather enough information for assessing the situation of EHR in a developing country (Iran). As mentioned before in methodology part, the needed information has been extracted based on two methods: Observation and in-depth semi-structured interviews. In this empirical attempt, an investigation has been done through some of Iranian hospitals.

Although, currently it seems there is no an integrated EHR system such as Danish one in Iran there are some good attempts to implement some non-sharable type of health information systems in some hospitals (Riazi, Fathi Roodsari et al. 2007). Sina hospital is one of pioneers in this way and the researcher decided to follow his investigations in this private hospital. The researcher chose Sina hospital mainly because of two reasons: First, the experts in Iran and Ministry of Health, Treatment and Medical Education suggested this hospital to the researcher because of its high placement in servicing to patients between private hospitals in Iran. Second, extracting information from this hospital is easier because of its clear strategies and the approach of the hospital manager to cooperate with the researcher. Below, the information gathered is provided.

4.1 Introduction to Sina hospital

Sina hospital has been founded nearly 130 years ago in Tehran, Iran. This hospital is considered as one of the most important education-treatment centers of Tehran University of Medical Sciences. Because of its equipments and professional staffs, it is one of the chief referral centers for trauma patients from all over the country. Moreover, Sina hospital is famous for its restorative surgery and organ transplantation.

Currently, this hospital provides educational and medical treatment services with 338 active beds, 70 academic members as well as about 700 personnel (including physicians, nurses, employees, …) and resident. Dr. Gholamreza Pourmand is the present chancellor of the hospital (http://en.sinaih.com/).

This hospital offers different hospitalization and out-patient preclinical services which are presented below:

1. Hospitalization services

General surgery, Sub-specialized vascular surgery, Sub-specialized hand restorative surgery, Orthopedic & spine surgery, Neurosurgery, Renal & renal transplant surgery, Internal diseases
(gastroenterology, endocrinology, nephrology, neurology, infectious diseases, rheumatology), CCU, ICU, Extracorporeal shock wave lithotripsy (ESWL), Hemodialysis.

2. *Outpatient Para-clinical services*

Surgery clinic, Orthopedic clinics, Neurosurgery clinic, Renal surgery clinic, Cardiology clinic, Neurology clinic, Nephrology clinic, Endocrinology clinic, Rheumatology clinic, Gastroenterology clinic, Exercise test, Holter monitoring, Holter blood pressure, echocardiography, electrocardiography (ECG), EMG, EEG, Laboratory (clinical and nuclear tests), Pathology, Radiology (CT scan, sonography, Doppler sonography, vascular angiography), Bone densitometry, Spirometry, Methacholine, Bronchoscopy.

4.2 Interviews

The researcher had the opportunity to make some interviews with the IT manager of Sina hospital and the manager of hospital to extract his information. This interview consists of some structured questions to lead the discussion in appropriate way and take needed information. Below this information is provided.

As mentioned before, Sina hospital is one of pioneers in using new technologies in Iran. Nearly 7 years ago, the managers decided to implement a HIS (Healthcare Information System) in the hospital to improve its services to patients. This system implemented by an IT services provider company named Tirajeh. They made an internal network in the hospital to integrate all departments and share digital data. This internal network consists many modules to support all the activities in different parts of the hospital.

This system works easily like other HIS in the world. When a patient enters to the hospital a specific code is allocated to him/her. With this special code, all the hospital parts can access to the patient documents related to theirs. This task is easily possible as all parts have been integrated based on a SQL program.

The advantage of Sina hospital is: you cannot find a place in the hospital without a computer. This degree of using technology in the hospital allows them to use various benefits of the installed program such as increasing the speed of sharing data and decrease the human errors.

Tirajeh Company supports its network in the hospital with different ways. They use a team viewer program to control the situation of the installed program. In addition, they regularly go to the hospital every week to answer questions and check the performance of the system. They trained one person in each parts of the hospital professionally. This trained person can solve the problem of the system in most of the times.
Regarding confidentially issues, every part of the hospital only can access to information which relates to the department. This means, for instance the surgery part cannot see the finance information of the patient. Limiting information in this way can decrease the possibility of using information for inappropriate purposes. However, as the system needs to be integrated in all departments one person in each part can access to all information and this person is the supervisor of the department. After discharging the patient, the IT department makes a backup of all the patient information and then they removed it from the network. The backup file will save in the security department of the hospital and in case of need the information will be called from this system.

Although it is possible for the current HIS for sharing information externally this task is not allowed currently. For instance, the patient cannot get the electronic version of its health information and the system does not connect to any other hospital system for transferring information. So the system is completely internal and the information only is used in the hospital.

4.3 Observation

In observation part, the researcher attempts to gather as much as information related to its research. In this case, the researcher visited the hospital 3 times in 3 weeks to gather enough information and see the hospital in different situations. At first blush, it seems the users of the implemented HIS are satisfied with it and the benefits are visible for them. The HIS has integrated different departments of the organization and the results are tangible in time and cost efficiency for the hospital.

The IT manager of the Sina hospital gave this opportunity to the researcher to use the HIS and see its different parts. At first blush, when I entered to the program homepage I felt I am using a database program which stores patient’s information such as: Personal information, the reason of hospitalization, doctor reports, patient pictures and finance information. But when I searched more in other parts of the program I see some capabilities of the EHR systems mentioned in the literature. The system has the ability to make a special report for the patient which contains readable format of information for using anywhere outside of the hospital. However, currently this task is not allowed due to privacy issues. In fact, as I understood there is no clear policy for giving any information to the patient. There is a same situation for transferring information between hospitals. The HIS provider considered the module of transferring information in the program but the hospital does not use it. The reasons will be discussed in analysis part.

Regarding medical issues, the system is capable for storing medical information and connects to online databases to get medical suggestions. This means it is possible to give the sickness information to the system and take decision-making supports for curing the patients. As mentioned before in the literature, this task is one of EHR features and it is possible by sharing information between doctors and hospitals. In this case because there is no external connection
the supports are called from database and in some special cases from valid sources in the internet.

To sum up my experiment from the Sina hospital HIS, I would like to say the current system with all its features and modules is capable of performing all the EHR system mentioned in the literature. But due to the policy of the hospital and the situation of the Iran healthcare system some of the important parts of the system cannot be used. In analysis part the reasons and suggestions for improvement will be discussed more.
5 Analysis

In previous section, I gathered some information from a hospital in a developing country (Iran) to analyze the situation of adopting EHR in this country. Although gathering information only from one hospital would not be useful to analyze the overall situation in this country I try to extract the barriers and problems from gathered information and scientific papers in this area.

If we look carefully to the situation of Sina hospital in adopting HIS which is considered as limited type of EHR we can find the reason of the main problem of this system for not being a integrated system with other healthcare centers. The reason of this problem refers to the information sharing and its acceptance degree in a developing country such as Iran. As mentioned before, an investigation in 2005 shows that there is no certain law for the disclosure of the health information in Iran (Farzandiypour, Ahmadi et al. 2009). This means even when organizations decide to share information they cannot perform it correctly because there is no specific law to follow. So integration task would be harder for them and they prefer to work only inside of their organizations. As mentioned in the literature, some pioneer countries in developing EHR such as Denmark has specific strategy for adopting an integrated system like EHR and sharing information between organizations. This lack of specified policy in Iran for sharing information leads hospitals to use non-sharable format of EHRs.

But the confidentially issue is not the only problem in Iran for adopting EHR. Although many attempts and works has been done in many hospitals such as Sina hospital and it appears these hospitals were successful to implement a computerized healthcare system there are many other hospitals which were not successful in adopting any kind of EHR systems (Jahanbakhsh, Tavakoli et al. 2011). The results from my observations and interview revealed some important problems and barriers in the Iranian healthcare system. Although there are some common issues with the mentioned problem in the literature some of these barriers are more visible in this system. In table 6 these barriers and problems are provided. In this table I tried to provide the challenges of adopting EHR in Iran from 3 different perspectives: The interviews, Observations and literature. With reviewing these challenges it will be possible to suggest issues to address these problems.

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<th>Interview</th>
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<tr>
<td></td>
<td>- The cost of implementing EHR systems</td>
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<td></td>
<td>- Lack of standard format for sharing information</td>
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<td>- Lack of financial resources for developing EHR</td>
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<td>- Legal restrictions for sharing information in EHR</td>
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<td>- Confidentially problems for sharing information</td>
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<td>- Rejection of using EHR by some users</td>
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<td>- Low speed of sharing information between users</td>
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<td>Observation</td>
<td>- Lack of structured procedures for introducing the capabilities of EHR</td>
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patients for better collaboration
- Not using of all implemented EHR capabilities
- Lack of users’ training
- Lack of appropriate relationship between doctors and patients

Literature
- Lack of common language between designers and users
- Lack of enough supporting and maintenance of the System
- Limitation of digital signature

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<thead>
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<th>Table 6 EHR challenges in Iran</th>
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It seems there are many obstacles for adopting EHR in Iran. However, as mentioned before many good attempts have been done to overcome these obstacles. To better addressing these challenges we can categorize them into two main categories: Infrastructure challenges and Structure ones.

For infrastructure challenges below suggestions are provided:

- Working more on specific procedures regarding data warehousing or data mining to reduce the cost of system maintenance

- Regarding lack of common language between different parts it is suggested to use some specific standards for sharing data such as ISO/EN 13606

- Using V&V (Verification and Validity) procedures for insuring the safety of transferring information

- Regarding the staffs problems for using EHR below issues are suggested:
  - Discuss as much as you can about the benefits of EHR in the organization
  - Evaluate the degree of motivation between staffs and increase it by special trainings

- For determining the readiness of the organization to adopt the system it is suggested to have meetings between the organization managers and execute exploratory studies for identifying the information needs of different parties

Regarding structure challenges below suggestions are provided:

- Without any doubt the role of governments in supporting EHR system are very important and their helps can remove many obstacles from financial ones to promotion of responsibility and transparency in EHR

- Regarding confidentially issues many works has been done in promoting systems and below issues can help more:
- Creating identity cards with password for users

- Defining access level for users (like the Sina hospital HIS) to increase the safety of using information

- For making integration between organizations it is needed to have special policies which are designed by governments to cover all the requirements and needs of the hospitals like the Danish one mentioned in the literature

These are only some of the suggestions which researcher can mention for the improvement of the current situation of EHR systems in Iran and many other issues should be addressed. From my point of view, between all these suggestions still the role of governments and their decisions for supporting the EHR systems is the main issue for improvement of the current situation and should be considered from early stages.
6 Discussion

6.1 Conclusion

In this research study, I tried to review the concept of EHR from its different definitions to its benefits and the challenges for adopting it. The main purpose of this study is to review the situation of EHR systems in a developing country (Iran). This work has been done by reviewing the literature of the concept and running a case study.

The profitability of using EHR systems for hospitals and patients is inevitable and healthcare organizations perceived it long time ago. But as we reviewed, implementing an integrated EHR system in the healthcare of a country comprehensively is not an easy task and organizations face many barriers and problems in this way. The advantages of using EHR system are achievable only with addressing all these challenges and problems. In this research, these problems have been reviewed with considering the various limitation of the target country (Iran).

Some challenges like confidentially problems and the cost of implementation are more highlight in developing countries like Iran. From the researcher point of view, defining specific polices from the government for using patient information and sharing it between different organizations can be a primary stage for solving the problem of confidentially issues. In Iran, specially, some issues like the condition of information maintenance, principles for accessing to information data using and information disclosure should be considered more and further researches should be done in this area. Regarding cost problems, the most important and efficient way to overcome it is to get supports directly from the government to integrate all organizations to use EHR system. If this cost supporting carries on continuously most of the financial problems of this area will be solved shortly.

6.2 Implications for the subject area

This research would have great benefits in the area of informatics and e-Health. Mainly two groups of people can benefit from this research:

1. The academics society who their focus is on the EHR concept and its different aspects from definition to implementation issues.

In this study, the researcher tried to increase the understanding of the EHR concept with describing the concept of EHR and issues in its implementation by reviewing different sources in this area. People who want to know more about the concept of EHR from its definition to different aspects of its implementation can benefit from this study. E-Health has been developed through past years and concepts like EHR are in their mutual phases in literature. One of the
important parts of this study which can be beneficial for academics is reviewing the path of EHR development and making comparison between its different definitions.

2. Managers and practitioners who their main consideration is EHR implementation specially in developing countries

This research can be beneficial for managers and practitioners in two aspects. First, the researcher tried to extract the benefits of the EHR for healthcare systems and present it in a structured manner. So managers who seek to find the answer of questions such as “Why healthcare centers and hospitals should use EHR system?” can benefit from this study. Second, the other main goal of this research is reviewing the situation of EHR system in a developing country (Iran) to extract the information needed for EHR implementation and propose improvements. One of the important issues which this study reviewed and is very useful for practitioners is the barriers and risks of EHR implementation with considering of the limits of the healthcare system. Therefore, practitioners who search for an implementation framework with considering different factors can benefit from this study.

6.3 Method Evaluation

In theoretical part of my study, my goal was to review the literature of EHR concept for making the infrastructure of the research. The problem was there are lots of sources in this area. So before starting the reviewing work, I felt it is necessary to set a structure for selecting these materials and review the most important of them based on their relevance to the subject area. So I broke down my research into three main parts in theoretical part. The first part, defining EHR, I tried to focus only on sources which their main purpose is clarifying the concept of EHR and defining EHR is their main purpose. In the next part, my focus was on implementation of EHR and I tried to consider different aspects and issues in this area such as implementation barriers and risks. So based on my specified goal, I selected sources which only concentrate on EHR implementation phase. In final part, I decided to gather some information from developing countries which have implemented EHR system. This was a hard task because there is lack of academic works which their focus is on reviewing the situation of e-health in developing countries. But I tried to solve this problem by using other sources like web pages.

To make a connection between the theoretical part and practical environment, I performed a case study in a developing country (Iran). As mentioned before, I used interview and observation method for gathering information. In interviews, it is tried to have meetings with experts and managers to decrease the possibility of receiving wrong answers. The problem in this part was there was a fear that I do not have enough knowledge when the discussion goes deeper in details. To solve this problem, I tried to set questions step by step and avoid questions which lead the discussion in details that are not necessary for the research. Moreover, I set some open questions in my interviews to increase my understanding whenever I feel it is necessary. The advantage of interviews performed in this research is, all of them done by the researcher in face-to-face
manner. This type of interviews decreases the possibility of gathering wrong and unrelated answers and increases the reliability and validity of the answers.

The second method used by the researcher to gather information is observation. The researcher chose this method to validate the findings in interviews more and used his knowledge for observing the real practical environment. The well-known problem in observation method is making coordination between the research and the organizations for having visits is a hard task and in some situations is impossible. But I tried to convince the manager with describing the necessity of visits and the needs of observation information for the study. Moreover, I wrote a schedule for my visits and proposed them.

6.4 Result Evaluation

In section 2.6, I talked about 3 validity criteria for evaluation of the research. In result evaluation part, I mentioned to some word: the richness of meaning, the structure and theory contribution.

In richness of meaning issues like making integration between different parts and the degree of details achievement come to account. To achieve richness of meaning, the researcher tried to consider different perspectives in the thesis such as EHR definition, EHR advantages and EHR implementation issues. This degree of using different perspectives helped the researcher to address the research questions and sub-questions appropriately. On the contrary of richness of meaning, a good structure is the one that has low complexity and is clear as much as it is possible. For achieving to a good level of structure, the researcher broke down the study into different parts and answered research questions step by step. This work however can have negative influence on richness of meaning. Regarding theory contribution, the researcher tried to add some new issues to existing theories. According to the main goal of the research, this study tried to make a theoretical base in area of EHR implementation. To make this possible, the materials from literature and practical environment have been used in analysis part to create something new and different from former theories in EHR system area. There are few studies which reviewed the situation of EHR systems in a developing country with the same view of this study.

6.5 Possibilities to generalize

The main goal of this study, reviewing the situation of EHR systems in a developing country and suggesting implementation framework, has been achieved by reviewing the literature of EHR and running a case study. The author believes that the findings of this research are applicable to other e-Health areas. It means results in analysis part such as suggestion for improvement of EHR situation can be used in other developing countries if all the factors are considered appropriately. To achieve a general framework for implementing EHR system which includes
different issues like implementation risks and barriers and executive issues, factors like the economy and government limitations also should be addressed comprehensively.

6.6 Ideas for continued research

This topic with its specific view on the EHR concept is relatively new and it is needed to be developed. Although we see a lot of academic and practical works in EHR area in developed countries this concept is still in infancy in developing countries and needs to be considered comprehensively specially by academics.

It would be interesting if a study work on more aspects of EHR implementation issues such as economic factors and privacy concerns. Although this research mentioned to these issues they have to be considered more and their different aspects should be discussed in detail.

My empirical part limited to only one developing country with its specific condition. Is the situation in other countries the same of this country? Can we use this framework in other developing countries? If it is not applicable, what factors should be added to this framework? Is it possible to build a general framework for EHR implementation in all developing countries? These are the questions that have to be answered and future studies can work on them.
7 References


Maguire, P. (2002). "For doctors, the pressure is on to computerize." ACP-ASIM Observer 22.
University of Borås is a modern university in the city center. We give courses in business administration and informatics, library and information science, fashion and textiles, behavioral sciences and teacher education, engineering and health sciences.

In the School of Business and IT (HIT), we have focused on the students' future needs. Therefore we have created programs in which employability is a key word. Subject integration and contextualization are other important concepts. The department has closeness, both between students and teachers as well as between industry and education.

Our courses in business administration give students the opportunity to learn more about different businesses and governments and how governance and organization of these activities take place. They may also learn about society development and organizations' adaptation to the outside world. They have the opportunity to improve their ability to analyze, develop and control activities, whether they want to engage in auditing, management or marketing.

Among our IT courses, there's always something for those who want to design the future of IT-based communications, analyze the needs and demands on organizations' information to design their content structures, integrating IT and business development, developing their ability to analyze and design business processes or focus on programming and development of good use of IT in enterprises and organizations.

The research in the school is well recognized and oriented towards professionalism as well as design and development. The overall research profile is Business-IT-Services which combine knowledge and skills in informatics as well as in business administration. The research is profession-oriented, which is reflected in the research, in many cases conducted on action research-based grounds, with businesses and government organizations at local, national and international arenas. The research design and professional orientation is manifested also in Innovation Lab, which is the department's and university's unit for research-supporting system development.