

Barriers for Implementation of Electronic Medical Record (EMR)

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ABSTRACT

Electronic Medical Record system (EMRs) plays vital role in improving the quality of Healthcare. This paper discusses the factors which are recognized to be the barriers for implementations EMR in hospitals. The paper also describes the general implementation of the workflow as well as the potential benefits of EMR. The current implementation of EMRs in Jordan Hospitals and usage are also presented.

Key words: Electronic Medical Record (EMR), Information Communication Technology (ITC) Healthcare Information System (HIS).

1. Introduction

Information and Communication Technology (ICT) is very important nowadays because it has many potential which makes our life easier. The effects of ICT technology on our daily life cannot be refuted. It is impacting on every facet of human activities and the health industry is no exception. Electronic Medical Record (EMR) is one type of Healthcare Information System (HIS) like Electronic Health Record (EHR), Computerized Physician Order Entries (CPOE) and Electronic Patients Record (EPR). There are many advantages for using EMR such as; playing a major role to improve patient safety, quality of care, and medical records. EMR implementation benefits healthcare related organizations such as hospitals and clinics in reducing medical errors, facilitating access, supporting clinical decisions and others. On the other hand there are disadvantages for EMR such as high cost, security, privacy and others.

Although there many benefits of EMR, many studies are conducted to see the challenges or barriers in implementing EMR as people do tend to resist any new technology.

EMR is available in many countries nowadays, nevertheless there are still many obstacles to overcome before it can be successful implemented.

Several technological impacts and social issues have slowed the pace of implementation or the widespread plan to EMR implementation. Users of EMR include administrative staff, medical staff, and patients. The main users are the medical staffs who are physicians and nurses who have used EMR to have electronic access to patient health information. They have found EMR to be very helpful and resourceful. The next section will focus on technology that can be used in EMR.

The paper is organized as follows: Section 1 presents the introduction of the paper, while section 2 discusses the electronic medical record in detail. Section 3 describes the benefits of using EMR, while section 4 shows the analysis of the implementation barriers of EMR. Section 5 shows the EMR implementation in Jordan, while section 6 concludes the paper and presents the future work.

2. Electronic Medical Record

EMR is the software that enables medical data to be digitally processed, stored and communicated. It can also be used to access, process, manage and present medical information of the patients, to doctors, administrative staffs and other users. EMR play a major role in activating the communication between the users and patients, and between users themselves. It can also be applied for different medical issues, and business areas especially in hospitals.

EMR enable the retrieval of the medical information, storage of data for longer period and availability of data at anytime and anywhere. EMR can be defined as an electronic middleman, which allows the users to retrieve the patient data such as history for patients, diagnosis, treatments, radiology, laboratory and booking for patient in wards [1]. According to Pike [2] and Wald [3], EMR is an electronic record of patient health information such as: medical history, medical encounters, booking, immunizations, diagnosis data, treatment, laboratory data, radiology, as well as administrative issues. The next sub-section 2.1 will explain the workflow of EMR system, to show how EMR works.

2.1 Workflow of EMRs

Workflows of EMR have no fixed criterion (standards), as different organizations have different understanding of EMRs. Since, there are multiple interpretations of what exactly EMR is, and what the EMR requirements are, therefore, organizations are unable to identify their current and future needs from it [4]. Figure 1 shows the workflow of EMR and how the users can capture, store, process, communicants, and security all data for each patent. EMR helps administrative staff in order to access and retrieve information, and by activating communication with each others, users and medical researchers. EMR can be used in human resource departments, and in obtaining the patient

billing information. Therefore, the users (hospital administrative staffs) can retrieve the information that is needed at anytime and anywhere. EMR also enable the patients to access their data by themselves. The workflow of EMR shown in Figure 1 are based on the main functions of EMR [3-7].

These functions are:

-Medical history: describe as detail or longitudinal record of what happened to the patient since birth or visit to the physicians. It show chronic diseases, major and minor illnesses, as well as growth details and what happened to the patient over the years. Medical history also includes surgical history, medications, medical allergies and medications.

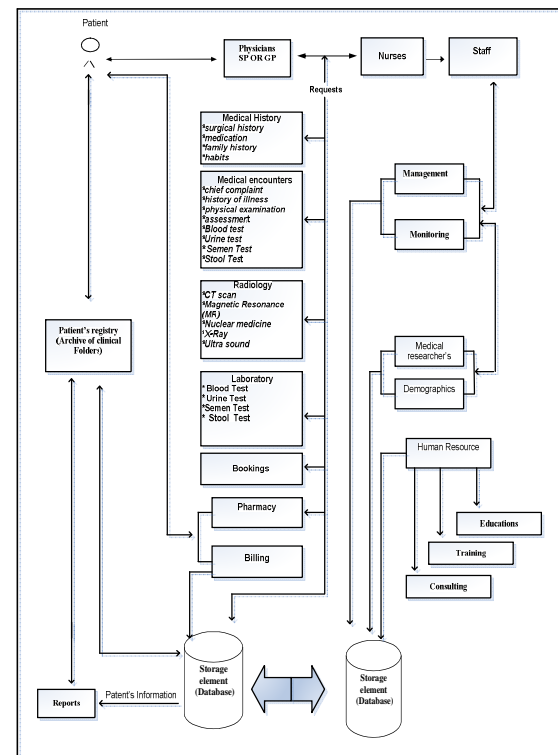


Figure 1 Workflow of an EMR System

-Medical encounter: This includes complaint, history of the present illness, assessment, plan (diagnosis, treatment), and progress notes. Within the medical record, individual medical encounters are marked by discrete summations of a patient's medical history by a physician,

nurse, practitioner, or physician assistant and can take several forms.

-Radiology: This allows physicians or other users make booking and get results of CT scan, magnetic resonance (MR), nuclear medicine, X-Ray and ultra sound easily and fast.

-Laboratories: Allows users to make booking during interviews with patients and get result which include blood test, urine test, semen test and stool test.

-Booking in the wards: Allows physicians to make booking for patients in the wards if there is an emergency case.

-Billing information: Via EMR, care users can access to the billing information of the patients, and conduct instant bill calculation for paying cases.

-Pharmacy: EMR is able to offer the electronic medical prescription which is easier than paper medical prescription. Thus, it is able to reduce the medical errors.

-Demographics: Include patient information that it is not medical information in particular. This information will include the location of patients, identifying numbers, addresses, and contact numbers. And contain information about race and religion as well as workplace and type of occupational information. It may also contain information regarding the patient's health insurance.

Through the implementation of EMR, users can access these functions that enable them to perform their job function efficiently.

3. Benefits of EMR

Figure 2 shows the most important benefits EMR, and how EMR can improve healthcare in general and patient care in particular.

According to the Institute of Medicine (IOM) 44,000 to 98,000 deaths occur each year in USA hospitals due to preventable medical errors and over 770,000 individuals are either injured or die each year in hospitals due to adverse drug

events. The cost of these errors is about \$38 billion per year [8].

There are many causes of medical errors, and one of these is different physicians treating the same patient. Not all or only a few physicians can access to all the patient's medical records. Some of them do not know anything about the history of their patients [8] and these can have damaging consequences if the wrong drugs or treatments are given to the patients.

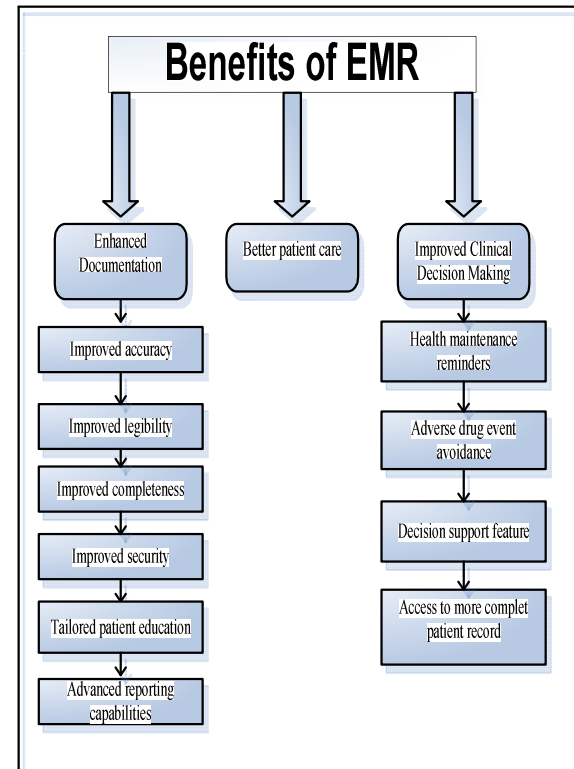


Figure 2: Potential and benefits (Deutsch, 2006)

Another important cause of medical errors is in prescriptions, as writing them on paper is not clear and is too difficult to read it. Thus, electronic prescription would greatly reduce the prescription errors. Medical errors could be reduced by the use of decision support tools that would check for drug interactions as well as dosage levels and allergies. EMR could receive alert reminders for preventative care treatments, testing, and alert about various treatment procedures, guidelines associated with the diagnosis [9].

Moreover, electronic records improve record keeping, recording and documentation of medical examination.

EMR usage in hospitals generally reduces cost, improves clarity of documentation, clinical decision support, and enables better communication of information about patient referred for consultation, potential availability of the record anywhere, anytime as well as increased storage capabilities for longer periods of time.

The EMR also enhance the patient provider communication. EMRs can remove the communication barrier between users and patients. EMR can help public health officials easily detect an outbreak of illness and determine what measures are needed to protect the community [10]. Another advantage of using EMR is the patient privacy and security. Electronic files play a significant role in maintaining patient information and confidentiality, as unauthorized access can reveal history of drug abuse, venereal disease, or life-threatening illness, psychiatric notes reveal inner fantasies, sexual activities, crimes, or the crimes and abuses of family members.

Therefore, if anyone could have easy access to these private information without any security, will caused a lot of problems for patients that can affect their daily lives. EMR also make it easier for medical researchers to ask questions or query about diseases that were previously been impossible to ask of it, and it may well lead to the discovery of tens or even hundreds of new diseases and allow reclassifications of existing ones [11].

The EMR have some functions associated with patients different than the medical functions such as financial, legal information, research and quality improvement purposes. Due to some reasons, this information must not be shared among many professionals who are not related to the healthcare team.

On the financial side, EMR allows the accounting staff to provide more accurate billing information and allow users to submit their claims electronically. Therefore, receiving payment will be quicker, and the information for any patient will available. Thus, there is no need for the patient to provide the same

information over and over again. They may even forget about it. Therefore, there is a general consensus that the widespread use of electronic medical records improves the coordination and quality of healthcare for patients. However, there are still many barriers in implementing EMR in hospital around the world. The next section will section there barriers.

4. Implementation Barriers of EMR

Table 1 in the last page shows the results of analyzing the EMR implementation barriers conducted in this research. This was done by analyzing previous studies by researchers in the area of EMR implementation over the years. This paper will discuss these barriers in order of importance.

1. High Cost of Implementations for EMR:

Costs significantly affect the implementation of EMRs. For example, the cost of installation, and maintenance of EMRs, will increase during the use of EMRs [12, 13]. When discussing about cost it is not only covering the software cost because the implementation of EMR includes the costs of hardware, networking (including Internet service providers), infrastructure, installation operating system and training. Therefore, this will increased the costs that may be unaffordable for sector hospitals [12-14].

2. Training Issues: Training is the sessions these organizations teach the skills to improve their practice during work. Thus, training is one factor which increases the costs of implementation for EMRs. This is because training on electronic medical records software will add additional expense as if involves paying people to take training and paying the trainers to teach practitioners.

Training helps to enhance the works of users to enter the data faster and get some background of using computer; also training is important for users [15, 16].

After proper training, there is no guarantee that all users will feel comfortable using

the computer [17]. Therefore, training will cost organizations time and money.

3. Resistance to New Technologies:

Technology is changing rapidly every day in our life and this is reflected adversely on the technology systems that we use. Physician resistance is one of the barriers in EMR implementation [18-20]. Every time new EMR technology appears, users will resist these new technologies. This is because it will make them take more time to learn on how to use the new software, and they become reluctant to adopt the new ways of working. Thus it will interfere their workflow and will slow their work [21].

New technologies force the physicians to work on the same way together, although almost of them had practiced medicine in different ways. This causes frustration and impatience amongst them because EMR take time from them. Therefore, they are unable to see the same number of patients as when they were under a paper chart system [12, 22].

EMR is closely tied to the computer industry, whose obsolescence is another concern. EMR technology is changing rapidly, and just as the PC that someone bought three or four years ago is made obsolete by today's PCs, today's EMRs will also be obsolete in a short period of time. This means that the EMR that took a lot of time and money on implementing may be obsolete by the time that the practice is fully implemented and used [22].

4. Limited Ability to Access External Data:

Exchange of data between EMRs and the users and other clinical data systems is important to reduce the medical errors. One of the medical errors is that different physicians treating the same patient, do not have access to all the patient's medical records or they do not have all data about the history of their patients, such as lab test results and others. The EMR does not cover all application areas, and all information types that constitute the

medical record because it needs high costs [9, 23].

The lack of limited access to health information from external sources and the lack of data sharing with users is already causing major barrier in the widespread implementation of the electronic medical record systems. Thus, the lack of sharing data between the users to access information for patients will make their work limited.

5. Ease of Use: User friendly programs:

systems should make users comfortable using it. EMR helps to improve the quality of healthcare and help users to accomplish their work short period time and efficiently. Thus, to provide a good EMR software, it should not be complex to its users to understand and use [24, 25]. User friendly programs will help users to enter data easily, and the results of training will be positive. Therefore, this will encourage the user to accept EMR [18, 26]. Furthermore, continued vendor support will encourage the users to accept EMR through the as they can give provide technical assistance this is important as it make it easy for users to use [27].

6. Resident Background: The resident background is the knowledge (experience) of using computers, which is acquired during study or during work.

The users who do not have any computer background will not accept to use IT in their work. Therefore, they will not accept to use EMR or even to take the training, especially older individuals who have never used computers in their lives [28, 29].

The users who have a computer background will accept training, and use EMR. The reason is because they already know how to use computers and they will not face problems like those who have no computer background.

Moreover, there are very strong relation between health care professionals and computer skills, when the medical users have experience or computer skills the users will accept working using the EMRs and will not affect the implementation of EMRs [12, 30].

EMR has been implemented in many countries and we will discuss the current implementation in Jordan in the next section.

5. EMR Implementation in Jordan

Jordan has one of the highest population growths in the world. The Jordanian government plans to implement EMR for its hospitals via the Medsphere Systems Corporation of USA. Jordan is at the centre of the middle-east healthcare, where a fairly high level of medical care standards is found. However, this good reputation started to face some threats due to the lack of medical technology [31]. The number the hospitals which have implementation of EMRs is very little compared to the total number of hospitals in Jordan.

All hospitals in Jordan are under the administration of one of the following entities: government hospitals, ministry of defense, universities and private sector. Most hospitals are using manual paper work or on very basic software tools. Most of the hospitals that have implemented EMRs are in the private sector. Many researches have already been conducted in the field of Electronic Medical Records in many countries. However, they are no research conducted in Jordan to identify and investigate the main barriers in implementing EMR systems.

Few Jordan hospitals have implemented EMR system, which is often different than other highly developed countries such as Sweden, United Kingdom, Netherlands, and Australia whose more than half of their primary care physicians are using the EMR [21, 32]. This indicates that Jordan is still far away from using EMR extensively. Furthermore, users in most Jordan Hospitals which have full implementation of EMRs, do not fully make use of them. Therefore, the users are unable to fully utilize the functions of EMR, and use the main functions of EMRs. Thus EMR is unable to play its role effectively, despite its importance and reliability. Although, these functions are available for the users to use for tasks such as patients data entry,

nevertheless these are seldom or never utilized.

Furthermore, some medical organizations want to implement EMRs but they are unable to make the bold step in implementing Electronic Medical Record System (EMRs) at their hospitals.

There are other reasons that contributes to the limited EMR implementation in Jordan such as effective training program for health care users, high implementation cost, lack of computer background amongst users, delay in data entry, software immaturity, lack of standards, security, privacy, limited access, patient confidentiality and others. We strongly believe that understanding these barriers and having the right strategy to deal with these will ensure the success of EMR implementation in Jordan.

6. Conclusion and Future work

This paper shows how implementation of EMRs can be affected by organizational, technological and social issues and the barriers that affect the implementation of EMRs. Future research in these areas such as investigating the effects of EMR implementations on the total quality of care as perceived by the medical users such as physicians, pharmacists, nurses, lab technicians, administration staff and medical records staff at medical organizations in Jordan will be undertaken. A comprehensive research on finding the successful factors that contributes to EMR implementation can also be beneficial.

References

- [1] M. Haslina and S. Sharifah-Mastura, "Electronic Medical Record Evaluation Using Task Analysis Technique," presented at Proceedings of the 11 th International Symposium on Health Information Management Research, iSHIMR 2006, USM, Kelantan, Malaysia, 2006.

- [2] T. Pike, "Physician Practical Management Systems and Electronic Medical Systems," Ambercom, 2007.
- [3] J. Wald, B. Middleton, A. Bloom, D. Walmsley, M. Gleason, E. Nelson, Q. Li, M. Epstein, L. Volk, and D. Bates, "A patient-controlled journal for an electronic medical record: issues and challenges," *Medinfo*, vol. 11, pp. 1166-70, 2004.
- [4] J. Muller-Albrecht, "Challenges in Introducing an Integrated Hospital Information System," *Electromedica-Erlangen*, vol. 68, pp. 12-15, 2000.
- [5] M. Rajesh, D. Rana Sarosh, and K. Kolay Saroj, "Hospital Information System In Medicare-An Experience At Tata Main Hospital, Jamshedpur," <http://medind.nic.in/haa/t01/i1/haat01i1p70o.pdf>, Accessed November 2008.
- [6] B. Fisher, R. Fitton, C. Poirier, and D. Stables, "Patient access to electronic medical record and automatic," *The British Journal of General Practice*, vol. 57, pp. 507, 2007.
- [7] M. Müller, T. Frankewitsch, T. Ganslandt, T. Bürkle, and H. Prokosch, "The Clinical Document Architecture (CDA) Enables Electronic Medical Records to Wireless Mobile Computing," *MEDINFO*, pp. 1448-1452, 2004.
- [8] F. Gimenes, A. Miaso, D. De Lyra Junior, and C. Grou, "Electronic prescription as contributing factor for hospitalized patients' safety.," *Pharmacy Practice*, vol. 4, pp. 13-17, 2006.
- [9] H. T. a. R. Leitman, "U.S. Trails Other English Speaking Countries in Use of Electronic Medical Records and Electronic Prescribing," *HarrisInteractive ,Health Care Research*, vol. 1, 2001.
- [10] C. McDonald, "The barriers to electronic medical record systems and how to overcome them," *Journal of the American Medical Informatics Association*, vol. 4, pp. 213-221, 1997.
- [11] H. Fraser, P. Biondich, D. Moodley, S. Choi, B. Mamlin, and P. Szolovits, "Implementing electronic medical record systems in developing countries," *Informatics in Primary Care*, vol. 13, pp. 83-96, 2005.
- [12] M. Sultan Alanazy, "Factors Associated With Implementation of Electronic Health Records," in *Department Of Health Informatics: University Of Medicine And Dentistry Of New Jersey*, 2006.
- [13] V. Podichetty and D. Penn, "The Progressive Roles of Electronic Medicine: Benefits, Concerns, and Costs.," *The American Journal of the Medical Sciences*, vol. 328, pp. 94, 2004.
- [14] L. Goodwin, "Potential Problems and Solutions with Web-based Electronic Health Records," http://web.duke.edu/~cjpg8/indiv_papers/Trust%20Issues%20paper.pdf, Accessed August 2008.
- [15] S. Pearsaul, "Connections to care: how technology makes information accessible.," *Journal of AHIMA/American Health Information Management Association*, vol. 73, pp. 28, 2002.
- [16] N. Lorenzi and R. Riley, "Managing Change An Overview," *Journal of the American Medical Informatics Association*, vol. 7, pp. 116-124, 2000.
- [17] A. Berger, R. Neame, and E. Kluge, "Why do people worry about computers?," *British Medical Journal*, vol. 319, pp. 1295-1295, 1999.
- [18] J. F. Wilson, "Doctors are the main barrier to computerizing records.," *American College of Physicians*, 1997.

- [19] M. Langberg, "Challenges to implementing CPOE: a case study of a work in progress at Cedars-Sinai," *Modern Physician*, pp. 21–22, 2003.
- [20] "Growing Concerns As Physicians Move Forward with Electronic Medical Records," <http://www.acfas.org/practicemang/bus-tech/emr-concerns.htm>, Accessed December 2008.
- [21] J. Ash and D. Bates, "Factors and forces affecting EHR system adoption: Report of a 2004 ACMI discussion," *Journal of the American Medical Informatics Association*, vol. 12, pp. 8-12, 2005.
- [22] M. Kishore Tipirneni, "The Problem with Electronic Medical Records," *U S M U S C U L O S K E L E T A L*, 2006.
- [23] E. Poon, D. Blumenthal, T. Jaggi, M. Honour, D. Bates, and R. Kaushal, "Overcoming Barriers To Adopting And Implementing Computerized Physician Order Entry Systems In US Hospitals," *Health Affairs*, vol. 23, pp. 184-190, 2004.
- [24] C. Moseley, R. Gettings, and R. Cooper, *Having it Your Way: Understanding State Individual Budgeting Strategies: National Association of State Directors of Development Disabilities Services Inc.*, 2003.
- [25] B. Middleton, W. Hammond, P. Brennan, and G. Cooper, "Accelerating US EHR Adoption: How to Get There From Here. Recommendations Based on the 2004 ACMI Retreat," *Journal of the American Medical Informatics Association*, vol. 12, pp. 13-19, 2005.
- [26] J. Ash, P. Gorman, M. Lavelle, T. Payne, T. Massaro, G. Frantz, and J. Lyman, "A Cross-site Qualitative Study of Physician Order Entry," *Journal of the American Medical Informatics Association*, vol. 10, pp. 188-200, 2003.
- [27] J. Ash, J. Anderson, P. Gorman, R. Zielstorff, N. Norcross, J. Pettit, and P. Yao, "Managing Change Analysis of a Hypothetical Case," *Journal of the American Medical Informatics Association*, vol. 7, pp. 125-134, 2000.
- [28] P. Clayton, G. Pulver, and C. Hill, "Physician use of computers: is age or value the predominant factor?," presented at *Proc Annu Symp Comput Appl Med Care*, 1993.
- [29] J. Aaronson, C. Murphy-Cullen, W. Chop, and R. Frey, "Electronic Medical Records: The Family Practice Resident Perspective," *Family Medicine-Kansas City*, vol. 33, pp. 128-132, 2001.
- [30] M. Morton, "Use and acceptance of an electronic health record: factors affecting physician attitudes," *Drexel University*, 2008.
- [31] H. Al Khasawneh, "Health Professionals and the Right to Health in Jordan: A Critical Analysis," *University of Essex*, 2006.
- [32] M. Amatayakul, *Electronic health records: A practical guide for professionals and organizations: American Health Information Management Association*, 2004.

Author	computer background	Training	cost	limited ability to access	Progress technology (New technology)	case of use
SULTAN ALANAZY, MS(2006)	X		X			X
Alan S., Anne LeMaistre and David Tucker.2006		X				
Alan Brookstone, MD(2002)		X	X	X	X	
Robert H. Miller and Ida Sim(2004)		X		X	X	
William M. Chop, MD; Robert D. Frey, MD(2001)		X	X	X		
GLENN A. LOOMIS, MD; J. SCOTT RIES, MD; ROBERT M.(2002)	X		X			
Kishore Tipirneni, MD(2006)		X			X	
Lori Gurley(2004)			X			X
William R. Hersh(1995)				X		X
Micky Tripathi (2004)			X			
Khalil MM and Jones R(2007)		X	X			
Werner Ceusters(2006)			X			
Robert Charette (2006)			X			
Alan Falkoff, MD (2005)			X			
LAURA LANDROU(2004)			X			
Copyright 2006 Medical Records Institute		X	X		X	
David B. Meinert(2006)	X					
Robert A. Jenders(2004)			X			
Justo Mendez(2006)		X	X		X	
James S. Kennedy(2008)		X				
Harris Interactive(2001)				X		
Mary Elizabeth Morton(2008)	X	X		X		X
Andover, MA-(2000)					X	X
Conrad Bock (2005)		X	X		X	X
Moh Hshina and Mohamad Sharifah(2006)	X		X			
Jerome H(1998)		X	X		X	
LUKE EDWARD LYONS(2007)	X	X				
Jodi Lynn Simon(2006)			X	X		
Patrick D. Pauken,(2006)			X			
Joan S. Ash and David W-(2004)		X				
Total Repetition for each variable	6	14	18	8	8	6
Overall of Variable by Repetition	4	2	1	3	3	4

Table 1: Analysis of EMR Implementation Barriers