

Available online at www.sciencedirect.com**ScienceDirect**

Procedia Computer Science 21 (2013) 335 – 342

Procedia
Computer Science

The 3rd International Conference on Current and Future Trends of Information and
Communication Technologies in Healthcare (ICTH)

Barriers to Health Information Systems and Electronic Medical Records Implementation

A Field Study of Saudi Arabian Hospitals

Mohamed Khalifa, MD

King Faisal Specialist Hospital & Research Center, Jeddah 21499, Saudi Arabia

Abstract

BACKGROUND: Despite the positive effects of Health Information Systems and Electronic Medical Records use in medical and healthcare practices, the adoption rate of such systems is still low and meets resistance from healthcare professionals. Barriers appear when they approach systems implementation. We need to understand these factors in the context of Saudi Arabian hospitals to enhance EMR adoption. This process should be treated as a change project. **OBJECTIVES:** To identify, categorize, and analyze barriers perceived by different healthcare professionals to the adoption of EMRs in order to provide suggestions on beneficial actions and options. **METHODS:** The study used a questionnaire to collect data from a random sample of healthcare professionals of two major Saudi hospitals, one private and the other is governmental, 158 valid respondents participated in the survey equally from both hospitals and then the results were analyzed to describe and evaluate various barriers. **RESULTS:** The study identified six main categories of barriers, which are consistent with those reported in recent published research. 1) Human Barriers, related to the beliefs, behaviors and attitudes, 2) Professional Barriers, related to the nature of healthcare jobs, 3) Technical Barriers, related to computers and IT, 4) Organizational Barriers, related to the hospital management, 5) Financial Barriers, related to money and funding and 6) Legal and Regulatory Barriers, related to laws, regulations and legislations. The six categories of barriers were validated with the participants of the pilot sample. **CONCLUSIONS:** Human barriers as well as financial barriers are the two major categories of barriers and challenges in the way of successful implementation of EMRs.

© 2013 The Authors. Published by Elsevier B.V. Open access under [CC BY-NC-ND license](http://creativecommons.org/licenses/by-nc-nd/4.0/).
Selection and peer-review under responsibility of Elhadi M. Shakshuki

Keywords: Barriers; Implementation; Health Information Systems; Electronic Medical Records; Saudi Arabia

Mohamed Khalifa, MD, King Faisal Specialist Hospital and Research Center - Jeddah, 21499, P.O.Box: 40047, KSA - MBC#: J-68

1. Introduction

The importance of this research comes from its aim to focus mainly on the necessity of the adoption and implementation of health information systems and electronic medical records in Saudi hospitals, and to shed more light - through data collection and analysis - on the main barriers, which represents a stumbling block on the path of the successful implementation of health information systems and electronic medical records in an effective and efficient way and on a large scale, which would enable health care professionals and providers to make better use of health information systems and electronic medical records available in many Saudi hospitals and subsequently provide better health care.

The research aimed also to analyze the perceived barriers from the perspectives of health care professionals through their knowledge and experience about factors that might - from their point of view - lead to the experienced delay or failure of adopting and implementing health information systems and electronic medical records at their hospitals where they work. This analysis should put our hands on the point that we should start from, to improve and accelerate the process of adopting and implementing health information systems and electronic medical records in Saudi Arabia hospitals. The most prevalent barriers that delayed or hindered the adoption and successful implementation of health information systems and electronic medical records - according to many local healthcare professionals - were the human barriers, including negative beliefs, behaviors and attitudes of healthcare professionals towards such systems. [1]

The great resistance of physicians and other healthcare professionals to accept and use health information systems and electronic medical records is probably one of the major barriers that delayed the adoption and successful implementation of such systems. This is why the process of HIS and EMRs implementation should be treated as a change project, and led by change managers, in medical practices. The quality of change management actually plays an important role in the success of implementation. [2].

Actually the analysis of the human barriers of adopting and successfully implementing health information systems and electronic medical records could reveal a lot of factors related directly to the beliefs, attitudes and behaviors of healthcare professionals such as the ability to learn over time, computer knowledge and typing proficiency, understanding and believing in HIS and EMR systems, motivation and personal initiative to explore and use the systems and user-developed strategies and workarounds to solve minor difficulties. [3]

2. The Research Problems

Despite the great concern and obvious interest in adopting and implementing health information systems and electronic medical records in general in both developed and developing countries, we find - especially in developing countries - that there is a large gap between planning for the introduction of health information systems and electronic medical records to hospitals and the success of implementing such systems and operating them optimally to achieve the primary purpose and benefit desired and expected. [4]. This is a typical case for Saudi Arabia, which has its national health care system as the main provider with a growing role and increasing participation from the private sector. The Ministry of Health (MOH) is the major government agency entrusted with the provision of preventive, curative and rehabilitative health care for the Kingdom's population. And just like other developing regional countries, Saudi Arabia still has this gap between planning for EMRs and their successful implementation. [5] [6] [7]

The real barriers behind this gap may not be the technology available to the medical institutions or to those developing countries, as information technology and information systems actually are becoming available almost equally to all world countries, no country or region in the world has no computers or information networks, while the real barriers may be in the problem of deficiency in providing technical support for those systems during and after their implementation, as well as the cost of changing the traditional paper medical records to the electronic system as well as the insufficient health care financing - in some cases - to cover the costs of implementing health information systems, operating them and the costs of training the end user on how to manage such systems. [8]

In many developing countries, we find that the available technology and costs of such advanced information technology systems in addition to the lack of technical expertise, technical and computer skills of hospital staff hospitals, largely the computer skills of doctors and members of the nursing staff and technicians, and the lack of facilities for data processing are the key issues to be addressed prior to implementation of hospital information systems. [9] [10]. We can add to all these factors - as mentioned above - the resistance shown by many doctors and health care professionals generally when systems change from the traditional paper medical records to the electronic medical records. This problem may be common in both developed and developing countries alike. [11] Most health care administrators and health information managers are aware that this change - from paper based systems to electronic systems - may take some time to be done and time is also needed to modify the behaviors of doctors and health care practitioners and their perception of electronic clinical systems and change their attitudes, their impressions and beliefs about the change of the work environment from the old paper to the new electronic nature with the essential need to understand the real reason and purpose behind the desire to change to the electronic system which is the most important thing in the whole subject. [12]

3. Aims and Objectives of the Research

The research aims to identify the most important barriers and constraints that hinder the successful implementation of health information systems and electronic medical records in the Middle East hospitals and especially in Saudi Arabia. It also aims to shed more light on the relative importance of these barriers and their nature and quality and their linkages and relationships to the various components and elements of the health information systems. Specifically it examined the impressions, beliefs, behaviors and attitudes of working medical staff towards those systems, or the linkage of these barriers to the policies of hospital management and their different business priorities, the linkage of these barriers to the available information technology, networks, hardware and software, the linkage of these barriers to the provision of the appropriate funding sufficient to cover the costs of implementing and operating health information systems and training and costs of developing the skills, knowledge and experiences of health care workers.

4. Research Conclusions

Participants believed that the human barriers, those related to the healthcare professionals and their beliefs, plus the financial barriers, related to money and funding are the two major barriers and challenges in the way of successful implementation of EMRs and human factors are even more important. All participants agreed and sometimes strongly agreed on the benefits expected after the implementation and use of EMRs, most importantly the potential of the EMRs to improve information access, increase productivity, improve efficiency and accuracy of coding and billing, clinical management and quality of healthcare in general, in addition to reducing costs of healthcare and medical errors.

Government hospitals had much more complains and concerns than private hospitals, especially when it comes to the technical and organizational factors, where systems are old and not satisfying the increased needs and in the same time the hospital doesn't have the experience to go with EMRs implementation.

Table 1: Evaluating and Ranking Barriers' Categories

Barriers	Mean	Participants Opinion
Human Barriers (Healthcare Professionals)	3.73	Agree
Financial Barriers (Money and Funding)	3.50	Agree
Legal and Regulatory Barriers (Laws and Policies)	3.32	Neutral
Organizational Barriers (Hospital Management)	3.16	Neutral
Technical Barriers (Computers and IT)	3.04	Neutral
Professional Barriers (Working at Hospitals)	3.00	Neutral

5. Research Recommendations

Recommendations are also categorized into six categories, just like barriers, and according to our study analysis and results, we should work on these barriers in two phases according to the following order: in the first phase, we should work on the human barriers, related to the healthcare professionals' knowledge, beliefs and attitudes and also on the financial barriers related to money and funding of EMRs projects.

In the second phase we should work on the legal and regulatory barriers, related to laws and policies, then on organizational barriers, related to the hospital management support, then on technical barriers related to information technology, computer hardware and software used, then on professional barriers related to the nature of medical staff members working in hospitals.

Table 2: Identified Barriers and Suggested Solutions

Identified Barriers	Suggested Solutions
Overcoming Human Barriers	
Lack of awareness of the importance and benefits of using EMRs	Improving the awareness of the importance and benefits of using EMRs by focusing on the topic through a multi-phase approach. Starting from the level of medical schools and colleges - the undergraduate level - and through different levels of post-graduate medical education. The importance of EMRs and their applications should be an integral part of the medical education programs
Lack of knowledge of using EMRs	Improving the knowledge of using EMRs through formal training during different levels of medical education and training.
Lack of experience using EMRs	The researcher suggests that teaching and training on EMRs should be developed and implemented as a course or a subject of the formal undergraduate as well as post graduate medical education programs.
Lack of experience of computer applications	Short courses for healthcare professionals and continuous medical education programs should be provided on the subjects of EMRs and health information management. These programs should be

	implemented by the ministry of health and its formal channels for all healthcare professionals at all types of hospitals and healthcare organizations. We need also to develop and enhance our taught computer science courses in medical schools, nursing education and post-graduate training.
Low numbers of health informatics specialists	Increasing the numbers of health informatics technicians and specialists through developing both undergraduate as well as post graduate specialized programs in “Health Informatics”, Health Information Management” and “Health Information Technology”. This way we could establish a new generation of professionals specialized in this new discipline. Undergraduate programs would deliver health information technicians and basic level professionals, while post graduate programs would deliver leaders, consultants and specialists in the field.
Negative beliefs and impressions about EMRs Negative beliefs about their ability to use EMRs	The researcher suggests developing an in-house hospital orientation and training programs on EMRs - especially for newly appointed staff - to overcome the negative beliefs and impressions about EMRs.
Overcoming Financial Barriers	
High initial cost of EMRs implementation Lack of capital resources to invest in EMRs	Allocating the proper funding and enough capitals investments, especially at the start of the EMRs implementation projects to overcome the high initial cost of EMRs implementation. This process should be done on two levels, the first is the level of the ministry of health and the second is the level of the hospitals.
High operation and maintenance costs of EMRs	Designing the annual budgets of the hospitals to capacitate the high operation and maintenance costs of EMRs, which should be a part of the regular expenses of operations and not a burden on the hospital resources, by being unscheduled or unplanned.
Lack of feasibility studies that show the benefits versus costs of implementing and using EMRs. Uncertainty about existing return on investment after implementing and using of EMRs.	Conducting feasibility studies that show the benefits versus costs of implementing and using EMRs, which should support the request for the funding of such projects from the ministry of health and other owners. Such feasibility studies could draw expectations and forecasting on the return on investment after implementing and using of EMRs.
EMRs adoption and implementation consumes a lot of hospital’s resources for less than expected benefits	Proper planning of hospital resources in the phases of EMRs implementation because if the resources are not well planned, they might get overused during implementation projects.
Overcoming Legal and Regulatory Barriers	
Lack of policies/ procedures that govern EMRs on hospital level. Lack of laws or legislation that govern EMRs on national level. Electronic health information is easily accessed/disclosed.	Ministry of health should start developing rules and regulations - on the national level - for the use of EMRs. In parallel with that, hospitals should start developing their own policies and procedures that control the use of data, information and EMRs internally, including signing privacy and confidentiality agreements and consents.
Using EMRs may threaten confidentiality of health information. May lead to information loss, corruption or hacking.	Users should be educated, trained and committed on using EMRs with caution not to disclose or abuse the information otherwise they will put themselves into liability, accountability and legal problems.

Users of EMRs are monitored and may be subjected to liability and accountability.	
Overcoming Organizational Barriers	
Workflow needs redesign to match with EMRs	Sometimes it is important for hospitals to redesign their medical and administrative workflow to match with EMRs specifications. This adaptation is important for the successful implementation.
EMRs implementation took more than expected time	Implementation of EMRs should be controlled by a time frame and project management schedules not to let the EMRs implementation take more than expected time.
Hospital management doesn't have the necessary experience to choose & implement the best EMRs. Hospital management doesn't have the necessary experience to evaluate the performance of EMRs.	Hospital management should develop their experience choose, implement and evaluate EMRs and their performance over time. If hospital management cannot get that experience, they should be advised to recruit an expert to the hospital team or simply outsource the process of EMRs selection and evaluations.
No live model for the EMRs was demonstrated to the hospital management before implementation.	Hospitals should check for an installed live model of the system in another hospital so as to evaluate the system while in the production phase.
Hospital management doesn't provide effective monitoring or protection on EMRs.	System protection and monitoring should be one of the priorities of the hospitals.
Hospital management has no strategic planning for the adoption and implementation of EMRs.	Hospital management should develop a strategic plan for the adoption, implementation and future development of EMRs.
Hospital management doesn't provide the necessary training for the staff on using EMRs.	Hospital management should provide necessary initial and continuous training for hospital staff on how to best use EMRs and HIS.
Overcoming Technical Barriers	
There are no manuals or guidelines for using EMRs	To ensure that HIS and EMRs vendors and commercial providers are supplying hospitals with the proper system documentations, user manuals and guidelines for using and troubleshooting EMRs.
Computers and networks have a lot of maintenance problems. There is no maintenance/technical support for hardware/software	We have to make sure that computers and networks are working fine - in terms of hardware - and that they have less maintenance problems, so that we can guarantee that the software will consequently work better. Hardware maintenance and technical support is essential.
The computer terminals are old and slow. Communication networks are old and slow	We might need to upgrade computer machines and communication networks for new ones, update their operating systems to enhance their performance.
EMRs are not satisfying different users' needs	Technically, EMRs should be satisfying different users' needs, this can be achieved - as we mentioned above - by performing requirements analysis thoroughly before the design phase is started and much before the implementation phase starts.
The main difficulty with EMRs is data entry The main difficulty with EMRs is data retrieval	Overcoming data entry difficulties through implementing new innovations in both software and hardware. For the software innovations, the system should be designed to support structured data entry rather than unstructured, drop down list fields more than text

	fields, dictation and voice recognition techniques. For the hardware innovations, we can implement touch screens, hand-held devices and tablet PCs so as to minimize the gap between the acquisition of data and the process of recording them and provide every user with a computer device so as to make information accessibility easier. Outsourcing some electronic processing tasks, such as medical transcription of the dictated voice files, could also eliminate the overload on the health information technology and management staff.
The system's interface design is not user friendly/understandable. The user interface language is difficult or not clear. EMRs are difficult to use because they are very complicated.	It is essential, for the healthcare professionals as users, to make the system's interface design more friendly and understandable, it is essential to make such systems less complicated and convenient for the daily use of the regular or standard user not for the super or knowledgeable users.
There are no standards for data entry and/or retrieval	Using data standards is an essential step in validating data on the systems and consequently important for the quality, accuracy and reliability of such source.
There are not enough computer terminals	Increase the number of computer terminals at the point of care.
Overcoming Professional Barriers	
Lack of healthcare professionals' support to EMRs	Improving healthcare professionals' support to EMRs through increasing their participation and involvement in the stages of systems development, systems implementation and deployment. Healthcare professionals support would be much better if developers and implementers of EMRs took into account their different needs during the stages of requirements analysis and before implementation.
Lack of motivation to learn and train on using EMRs	Improving motivation of healthcare professionals to learn and train on using EMRs by providing them with direct and indirect incentives, including overtime payments, bonuses and rewards for the hospital sections and departments successfully implementing EMRs. Departments that achieved well should also be recognized.
Lack of time allowed learning and training on using EMRs. EMRs add more work/needs more time/effort.	We should also provide the enough time suitable and convenient for healthcare professionals to learn and train on using EMRs.
EMRs adds more professional responsibilities	Conducting training programs for healthcare professionals to educate them on how to take new EMRs responsibilities and accountabilities, so they would better understand their part of the process.
EMRs slows down work/decreases productivity	When healthcare professionals are overloaded with EMRs tasks and functions, we should look for workflow redesign of processes so that they could minimize or completely eliminate some unnecessary processes, provide help in some complicated tasks and assign more help to super busy users.

N.B. This is a research project submitted in partial fulfillment of the requirement of the award of the degree of master of science in health informatics from the Royal College of Surgeons of Edinburgh and the University of Edinburgh, 2012.

References

- [1] Altuwaijri M., Bahanshal A., Almehaid M. Implementation of computerized physician order entry in National Guard hospitals: Assessment of critical success factors. *J Fam Community Med* 2011;18:143-51
- [2] Boonstra, A., & Broekhuis, M. (2010). Barriers to the acceptance of electronic medical records by physicians from systematic review to taxonomy and interventions. *BMC Health Services Research*, 10(1), 231. BioMed Central.
- [3] Holden, R. (2011). What Stands in the Way of Technology-Mediated Patient Safety Improvements? A Study of Facilitators and Barriers to Physicians' Use of Electronic Health Records. *Journal of Patient Safety*. 2011 Dec;7 (4):193-203.
- [4] Sapirie, S. (2000). *Assessing Health Information Systems. Design and Implementation of Health Information Systems*. World Health Organization.
- [5] Siddiqi, A., Ahmed, Y. M., Alginahi, M., Alharby, A. (2009). Use of information and mobile computing technologies in healthcare facilities of Saudi Arabia. *International Conference on Information and Communication Technologies*. IEEE.
- [6] Almalki, M., Fitzgerald, G., & Clark, M. (2011). Health care system in Saudi Arabia: an overview. *Eastern Mediterranean Health Journal*, 17(10).
- [7] Bah, S., Alharthi, H., El-Mahalli, A., Jabali, A., Al-Qahtani, M., and Al-Qahtani, N., "Annual Survey on the Level and Extent of Usage of Electronic Health Records in Government-related Hospitals in Eastern Province, Saudi Arabia." *Perspectives in Health Information Management (Fall 2011)*: 1-18.
- [8] Amatayakul, M. (2010). Keys to successful EHR implementation. *Healthcare financial management journal of the Healthcare Financial Management Association*, 64 (12), 104, 106.
- [9] Al-Shorbaji, N. (2008). E-health in the Eastern Mediterranean Region: a decade of challenges and achievements. *Eastern Mediterranean health journal La revue de sante de la Mediterranee orientale alMajallah alsihhiyah lisharq almutawassit*, 14 Suppl, S157-S173. World Health Organization, Regional Office for the Eastern Mediterranean.
- [10] Haughom, J., Kriz, S., McMillan, D. R. (2011). Overcoming barriers to EHR adoption. *Healthcare financial management journal of the Healthcare Financial Management Association*, 65(7), 96-100.
- [11] Borycki, E., Joe, R. S., & Armstrong, B. (2011). Educating Health Professionals about the Electronic Health Record (EHR): Removing the Barriers to Adoption. *Knowledge Management*, 3(1), 51-62.
- [12] Pagliari, C., Donnan, P., Morrison, J., Ricketts, I., Gregor, P., Sullivan, F. (2005) Adoption and perception of electronic clinical communications in Scotland. *Informatics in Primary Care*. 13 (2), 97-104.