

Factors Affecting Electronic Medical Record Acceptance by Specialist Physicians

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Abstract—An Electronic Medical Record (EMR) is a longitudinal record of a patient consisting of data owned by a single provider. Generated as by-product of daily Health Information System (HIS) functions, an EMR provides caregivers with immediate access to information relevant to that patient, impacting care and safety in real time. Physicians' acceptance and willingness must be present in order to successfully implement an EMR system; understanding Physicians' attitudes and perceptions are of vital importance to physicians' acceptance and willingness. The main objective of this research is to explore physicians, attitude and perceptions of the impact on EMRs. The cross-sectional study was conducted on 133 specialist physicians of Hormozgan Medical Sciences University in 3 educational hospitals in the city of Bandar Abbas capital city of Hormozgan province. The most important barrier factors of EMRs in this study were technical barriers such as limitation of the system 96 (72.2%) and interconnectivity/standardization 96 (72.2%) and social factor of uncertainly about vendor 97 (72.9%), that mentioned by majority of physicians. This finding will help to address the barrier more appropriately, and plan for implementation EMRs. With peak interest in implementing EMR, in Iran and worldwide, knowing and acting on the beliefs associated with physicians about this technologies is as essential as ever.

Index Terms—barrier factors, electronic medical record (EMR), health information system, specialist physicians

I. INTRODUCTION

Information and Communication Technology (ICT) is very important nowadays because it has much 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 [1].

Innovative technologies such as, the Electronic Medical Record systems (EMR), allows physicians a more powerful medical quality improvement program than a paper-based procedure. Further, the health information technology system (HITs) is intended to replace existing patient records which are already familiar to physicians [2]. The most often cited keys to gaining the full benefit of technology in healthcare are: interoperability, integration among clinical systems, standardized language, decision support and physician usage [3].

EMR is currently available in many countries; nevertheless there are still many obstacles to overcome before it can be implemented successfully. Several technological impacts and social issues have slowed the pace of implementation or prevent 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. The path to quality improvement and financial gain with EMRs lies in getting the greatest number of Physicians to use the system [4]. Prior research, especially in the field of medical informatics, has identified some of the barriers to EMR system adoption among physicians [5].

Physicians may be reluctant to accept EMR technology for a number of reasons, including the perception that the use of an EMR system requires extensive training and interferes with the quality of physician-patient interaction. While the validity of these issues have been addressed in a number of previous studies, it is important to note that physician acceptance of EMR technology is dependent on the physicians' perceptions and not necessarily the actual value of EMR technology. Since physicians must use EMR systems in their day to day work, physician acceptance is crucial to widespread adoption of EMR technology [6]. Many unsuccessful attempts to implement

EMR technology have been attributed to the physicians' dissatisfaction with the EMR system [7], [8].

Current levels of electronic medical record (EMR) use in Iran have improved but are not wide-spread use. Utilization of EMR systems in Tehran hospitals still relatively low and only (21–40%) respectively [9], particularly compared with the United Kingdom (96%) and the Netherlands (99%) [10], [11]. No hospitals were found in Iran that to have an electronic connection with other hospitals. Thus, a better understanding of the factors that are associated with physicians' attitudes toward the adoption of EMR systems is a key to achieving the substantial benefits associated with EMR technology. An understanding of the factors associated with physicians, acceptance will allow organizations to better assess system readiness and facilitate successful implementation. Therefore, the present study broadly examined the specialists physicians' attitude and perceptions related in EMRs in the Bandar Abbas city of Iran, that to identify potential barriers to the acceptance of EMR technology. Such information may be useful in developing EMR training programs to enhance the prospects for successful EMR implementation.

II. METHODS

A. Sample

The cross sectional study was conducted on the same sample participants (133 specialist physicians) in the prior research conducted by the authors to obtain the more detail in the factors affecting Medical record acceptance by the specialist physicians in 3 educational hospitals in the city of Bandar Abbas, Iran in 2012 [12]. The physicians specialized in different areas including Medical specialties (Dermatologist, Cardiologist, internal medicine, neurology,) Psychiatry, Pediatrics, Surgery (Neuro Surgery, GYN/OB, Surgery, ENT, Ophthalmologist, Urologist, Orthopedics) and others (Radiologists, Anesthesiologists, Pathologists,...).

The authors designed a multi-section questionnaire based on previous EMR research focusing on critical success factors (barrier factors), physician acceptance/resistance to EMRs. Five physicians with expertise in medical informatics screened the questionnaire for content validity. Fifteen specialist physicians reviewed the instrument for structure, clarity, and relevance to test face validity. Ten physicians generated a test-retest reliability rate of >80% for each item over a 2-week interval.

The questionnaires designed by the authors based on eight main categories of barriers, including a total of 31 sub-categories, were identified from Boonstra and Broekhuis study [13]. These eight categories were: financial, technical, time, psychological, social, legal, organizational, and change process. Questionnaires were sent in October 2012, with a follow up visiting to non respondents 2 weeks later. The responses were entered into a spreadsheet and the data entry was verified for accuracy via manual verification; the data were imported into and analyzed using SPSS (Version 14). Differences

in demographic characteristics and barriers factors were tested for significance using chi-square tests. Statistical significance was determined by $P < 0.05$.

TABLE I. PHYSICIANS' PERCEPTION OF EMRS BARRIERS FACTORS

Barriers	Yes	No
Financial		
High start-up costs	86(64.7)	47(35.3)
High ongoing costs	80(60.2)	53(39.8)
Uncertainty over Return on Investment (ROI)	82(61.7)	51(38.3)
Lack of financial resources	71(53.4)	62(46.6)
Technical		
Lack of computer skills of the physicians and/or the staff	72(54.1)	61(45.9)
Lack of technical training and support		72(54.1)
61(45.9)		
Complexity of the system		79(59.4)
54(40.6)		
Limitation of the system		96(72.2)
37(27.8)		
Lack of Customizability		86(64.7)
47(35.3)		
Lack of Reliability		89(66.9)
44(33.1)		
Interconnectivity/Standardization		96(72.2)
37(27.8)		
Lack of computers/hardware		81(60.9)
52(39.1)		
Time		
Time to select, purchase and implement the System		80(60.2)
53(39.8)		
Time to learn the system		78(58.6)
55(41.4)		
Time to enter data		77(57.9)
56(42.1)		
More time per patient		76(57.1)
57(42.9)		
Time to convert the records		77(57.9)
56(42.1)		
Psychological		
Lack of belief in EMRs		77(57.9)
56(42.1)		
Need for control		65(48.9)
68(51.1)		
Social		
Uncertainty about the vendor	97(72.9)	36(27.1)
Lack of support from external parties		102(76.7)
31(23.3)		
Interference with doctor-patient relationship		82(61.7)
51(38.3)		
Lack of support from other colleagues		58(43.6)
75(56.4)		
Lack of support from the management level		92(69.2)
41(30.8)		
Legal		
Privacy or security concerns	60(45.1)	73(54.9)
Organization		
Organizational size		89(66.9)
44(33.1)		
Organizational type	73(54.9)	60(45.1)
Change Process		
Lack of support from organizational culture		91(68.4)
42(31.6)		
Lack of incentives		73(54.9)
60(45.1)		
Lack of participation		65(48.9)
68(51.1)		
Lack of leadership		76(57.1)
57(42.9)		

III. RESULTS AND DISCUSSION

The results of the survey were tabulated and percentile analysis was carried out. This study found that the technical barriers such as limitation of the system, interconnectivity/standardization and social factor of uncertainty about vendor could be the most barrier factors to acceptance EMRs by specialist physicians (Table I). Key factors barriers to EMR use that emerged as persistent themes from our questionnaire data included financial, technical, time, psychological, social, legal, organization and change process. These barriers were most acute for physicians in solo/small-group practice.

In this study a majority 84(64.7 %) of the respondents expressed that high start-up costs were a primary and major barrier to EMR adoption. This finding is supported by many studies that stated these costs are significant and therefore should be regarded as a high barrier to physicians adopting EMRs, especially for those without large IT budgets [4], [5], [14], [15]. Positive Return on Investment (ROI) can be experienced in the second year but ROI is greater over time and, saving may not be realized for 1-3 years [16]. Nearly one-half 71(53.4%) of the respondents expressed that lack of financial resources is a barrier to EMR adoption in this study. This was echoed by Meade *et al.* (2009) study [17]. However, the high start-up and ongoing costs of implementing an EMR system can result in problems finding sufficient financial resources in a medical practice especially in small and medium practices with low IT budgets [13].

Limitation of the system expressed by nearly two-thirds 96 (72.2%) of physicians in this study as a barrier to them adopting EMRs, while some physicians worry that EMRs are machine-based systems, made and programmed by IT companies. They are concerned that under certain circumstances, or as time passes, the systems will reach their limitations, become obsolete and will no longer be useful [5].

Interconnectivity and standardization expressed by nearly two-thirds 96(72.2%) of respondents in this study as an important obstacle to the wide adoption of EMRs. Lack of standards adoption and enforced interoperability standards is a key issue facing implementation of EMR systems and compliance with EMR security standards [5], [14], [18]. In order for electronic health records to be successfully implemented, universally adapted standards must exist to efficiently capture data, generate reports, and provide a technically-sound interoperable system on a national scale. A new EMR may be incompatible with legacy electronic systems in the practice, and physicians may be reluctant to give up existing functional systems for EMR integration. Critical to successful implementation is the fit of staff and physician work flow to that of the EMR functional and usability design constrictions or flexibility. The format of data varies among the different software packages and systems, in large part due to the lack of consistent data standards within the industry, and this makes data exchange difficult if not impossible between systems [4], [5], [19]. Spend time to select, purchase and implement the system expressed by 80(60.2%) of physicians in this study as a barrier to physicians adoption an EMRs. Time to be a

precious resource for physicians in several facets of their day-to-day functions. Physicians do not take the time to properly become familiar with the available products, select an EMR, implement it, and then train to use it [5]. Investigating systems during office hours reduces revenue generating opportunity and increases patient wait times [20].

Physicians' psychological concerns are regarding the use of EMRs that are based on their personal issues, knowledge, and perceptions. Implementing EMRs does mean a change in working styles for physicians and, initially, people are generally afraid of change and doubt its necessity. Further, the physicians' skepticism and negative perceptions of EMRs are affected by the social influences around them.

Lack of belief in EMRs expressed by seventy seven (57.9%) of respondents in this study that expressed as an important factor to physicians resistance to use and implementation EMRs. This finding was echoed by Kemper *et al.* (2006) that demonstrated more than half (58.1%) of the physicians without an EMR doubt EMRs can improve patient care or clinical outcomes [19]. Other researchers have stated that those who are unwilling to use such a system are skeptical about claims that EMRs can successfully improve the quality of medical practices [5], [21].

Lack of support from external parties stated by some researchers that the reason why physicians have not yet adopted EMRs is a lack of involvement and support from external parties [5], [21], [22]. Similarly in this study more than two-thirds of physicians 102(76.7%) stated that the lack of support from external parties as a factor that influences decisions by physicians on EMR adoption. Simon *et al.* (2007) noted that although the national agenda in the USA encouraged EMR adoption, one-third to one-half of physicians commented that their decision-making was affected by local and regional organizations that were not active in the EMR debate [5]. Furthermore, insurance companies, which work closely with medical practices, lack specific actions and policies to support the use of EMRs [21].

The change to electronic medical records brings up some issues with compliance, privacy, and security. Privacy and confidentiality issues were expressed by the majority 60(45.1%) of physicians in this study and they have concern about an increased risk to patient confidentiality; hence, there was found to be a statistically significant relationship between the privacy and confidentiality and sex of physicians [$\chi^2=4.971$, d.f.=1, $p<0.05$]. Many studies showed that concerns about the privacy and security of patient data are experienced as a barrier to EMR usage [19], [21], [23], [24]. Physician and patient concerns regarding security must be addressed, especially for Web-based records. Patients have a more relaxed attitude toward security of their data, but there are still 24-40% of them who have data confidentiality concerns, particularly with Web-based applications [25]. Physicians are more concerned about this issue than the patients themselves [5].

There is a trade-off between achieving rapid implementation of EMR technology and strong health care privacy laws. Healthcare policy-makers will need to choose how much EMR implementation they want and at what cost to privacy of the patient [26].

The consequent inappropriate disclosure of patient information might lead to legal problems. Furthermore, there is, in some countries, a lack of clear security regulations that could help ensure patient privacy and confidentiality. Particularly with improving standards, we should expect secure electronic transfer of information [27]. EMR privacy and confidentiality should be at least equal to that of paper record systems [28].

Physicians in different sizes and types of practices may well have different attitudes toward EMRs. In the organizational context, general health care hospitals face a higher degree of competitiveness. Hospital ownership may also guide organizational strategy, based on hospital mission and values. Organizational size is one of the most studied ICT adoption factors, since size is associated with more financial capability but also adequate human resources [29]. Several studies show positive relationship between ICT adoption and organization size [30], [31]. It is expected that larger hospitals tend to adopt EMRs [4], [5], [15]. One reason is that the physicians in larger organizations have more extensive support and training systems in the use of EMRs. Conversely, large organizations require more time to select, purchase and learn a system, convert and enter data, and for individual patient consultations. Seventy three (54.9%) of respondents in this study expressed Organizational type as a barrier factor to adopting EMRs by physicians that is also mentioned in prior studies [5], [32]. Also a slightly more than 89(66.9%) of physicians mentioned organization size is a barrier to adopting EMRs. Japsen (2009) found that small practices that do not get funds and support to equip their offices with the latest technology [33]. The amount of inter-departmental information should be much lower in specialized hospital comparing to a general hospital were the different services act as isolated islands. For these reasons, is expected that a general hospital would be more likely to take actions, such as EMRs adoption to attract patients. And also physicians who are employed by or contracted to a medical practice are more likely to use EMRs than those who own their own practices [34].

In this study 91(68.4%) of physicians believed the lack of support from the organizational culture is an important barrier factor to adopting EMRs by physicians. This finding support by prior research [15]. Academic health centres' culture of change and innovation as attributes, which could foster EMR system adoption, diffusion and infusion. To work successfully in new ways needs a change in certain organizational aspects.

IV. CONCLUSION

This study identified many different beliefs that physicians have about EMR. It should be noted that although this study was interested in factors related to EMRs acceptance, this does not imply that acceptance

should be the role or even primary goals for the informatics community. An additional goal must be to ensure that EMRs, in interaction with the greater work system, supports the cognition and work performance of clinicians. It is quite likely that the same design issues that influence acceptance and use also influence EMRs work performance and, consequently, outcomes such as quality and safety. The study indicates that policymakers should be more aware of the reality that removing technical and social barriers of EMRs. Finally, and very importantly, there is no doubt that design-and policy-mediated solutions developed on the basis of elicited beliefs can have profound beneficial effects on safety, quality, and other outcomes. With peak interest in implementing EMR, in IRAN and worldwide, knowing and acting on the beliefs associated with physicians about this technologies is as essential as ever.

Widespread adoption of EMRs and related technologies, applied correctly, could greatly improve health-care in the IRAN, while yielding significant savings. A range of policy options could be used to speed the development of EMRs. Healthcare administrators need to begin preparing their staff for the inevitable technology upgrades that will take place in their practices. EMRs need to be implemented with common sense. Although this may sound simplistic and even blunt, this is a major conclusion of this investigation of the phenomenon of the implementation of the Electronic Medical Record System while jumping through the hoops to earn government stimulus funding. Going digital does not mean that we neglect basic common sense. Taking time to put in place a method and making sure that it is accurate and ethical is beneficial to all who are involved. Using common sense to implement an EMR system will conclude in success for the stakeholders of electronic medical records. Lack of standards to select and use a useful system is a universal problem that all hospitals have challenge with vendors and they could not be sure about all the things which seems in advertisements or marketing meetings.

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