ORIGINAL PAPER

Electronic Health Records: Critical Success Factors in Implementation

Reza Safdari, Marjan Ghazisaeidi, Mohamad Jebraeily

Department of Health Information Management, Paramedicine Faculty, Tehran University of Medical Sciences, Tehran, Iran.

Corresponding author: Mohamad Jebraeily, Department of Health Information Management, School of Allied Medical Sciences, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98914-349-5838, E mail: m-jabraily@razi.tums.ac.ir

ABSTRACT

Introduction: EHR implementation results in the improved quality of care, customer-orientation and timely access to complete information. Despite the potential benefits of EHR, its implementation is a difficult and complex task whose success depends on many factors. The purpose of this research is indeed to identify the key success factors of EHR. **Method and materials:** This is a cross-sectional survey conducted with participation of 340 work forces from different types of job from Hospitals of TUMS in 2014. Data were collected using a self-structured questionnaire which was estimated as both reliable and valid. The data were analyzed by SPSS software descriptive statistics and analytical statistics. **Results:** 58.2% of respondents were female and their mean age and work experience were 37.7 and 11.2 years, respectively and most respondents (52.5%) was bachelor. In terms of job, the maximum rate was related to nursing (33 %) and physician (21 %). the main category of critical success factors in Implementation EHRs, the highest rate related to Project Management (4.62) and lowest related to Organizational factors (3.98). **Conclusion:** success in implementation EHRs requirement more centralization to project management and human factors. Therefore must be Creating to EHR roadmap implementation, establishment teamwork to participation of end-users and select prepare leadership, users obtains sufficient training to use of system and also prepare support from maintain and promotion system.

Key words: Electronic Health Records, Critical Success Factors, project management, organizational Factors, human Factors, technical Factors

1. INTRODUCTION

Ever-increasing advances in medical sciences along with the customers' awareness and expectations have changed organizations providing health services to customer-oriented and competitive environments (1). Accordingly, in order to develop and sustain their activities, these organizations seek to improve the quality of services along with the cost-effectiveness of those services and this will not be possible except through timely access to quality information (2-4). In this respect, since paper documents are not able to establish proper communication between health service providers, process data, and timely access to information due to their inherent limitations, they cannot meet the critical needs of health care system in access to such information (3-5). The move toward computer information systems began from the 1970s that ultimate goal of these systems is access to Electronic Health Record (5). In fact, EHR is as a longitudinal collection of electronic health information about individual which is registered or approved by health care providers and is shared in different places (3). EHR implementation results in the improved quality of care, cost effectiveness, customer-orientation and timely access to complete and precise information (6). Despite the potential benefits of EHR, its implementation is a difficult and complex task whose success and productivity depends on many factors (7-10).

In their study, Zephir and colleagues demonstrated that the role of human factors in the implementation and application of HIS can increase the functionality of such systems (11). Rezaei and colleagues suggest that EHR has broad complexity and scope and that its successful implementation will be available only through the specification of technical requirements, information needs, readiness of the organization and human resources and the observance of the standards of health information (12). In their study, Littlejohns et al introduced insufficient training, user resistance, negative attitudes and changing top managements as the reasons for the failure of information systems (13). So, on the one hand, access to EHR requires extensive investment in infrastructure and implementing major changes in the health system. On the other hand, it requires the readiness of the users to adopt and participation in the system development (11-15). Lorenzi and Riley, who conducted much research on the use and implementation of IT systems, introduced the main causes of resistance of the health care providers to medical informatics as the following: the risk of losing their jobs, lack of computer skills, imposed work discipline, a waste of time, the increase of responsibility and lack of competition and performance (16).

Given that "a comprehensive system of health information for citizens" was developed in 2007, and that the emphasis of this project is the creation and use of EHR implementation, and the responsibility of its implementation has been granted to the Ministry of Health and Medical Education (17), it seems necessary that prior to do anything in this regard, we benefit from the experience of developed countries in this context (US, UK, Holland, Denmark, etc.) as well as the recognition of the key success factors. The purpose of this research is indeed to identify the key success factors of EHR from the perspective of health service providers.

2. METHODOLOGY

This is a descriptive- analysis study conducted cross-sectional in 2014. The studied population consisted of all workforce from different types of job (include: top management, physician, nursing, paramedical staffs, health information technology staffs) employees from teaching hospitals affiliated to Tehran University of Medical Sciences that among from them, by the method of multi-stage cluster sampling, 340 individuals were selected. Data were collected through a self-structured questionnaire and through visiting centers. The first part of the questionnaire is dedicated to the respondents' demographic information including sex, age, educational level, job, work experience and level of computer skills. Its second part also includes the critical success factors in implementation EHRs that using available literature and conducted researches, it is in four main category: Project management, Organizational factors, Human factors, Technical factors .The impact rate of the critical success factors was considered through Likert scale and in 5 choice types (very low = 1, low = 2, medium = 3, high = 4 and very much = 5) that given the response to the samples, by calculating the mean obtained total scare (1 to 5), the impact rate of the critical success factors is determined. The validity of the instrument was determined based on concepts in the valid scientific texts and comments of experts (including health information management, medical informatics and health services management professionals).The reliability of the questionnaire was also assessed through calculating the internal consistency. In so doing, the designed questionnaire was given to 22 individuals of the research population and after collecting data, the value of Cronbach's alpha was estimated as 0.82. It was analyzed using SPSS software.

3. RESULTS

Out of 340 distributed questionnaires, 260 ones (76.5%) were collected. 58.2% of respondents were female and their mean age and work experience were 37.7 and 11.2 years, respectively and most respondents' educational degree (52.5%) was bachelor.

Based on the Figure 1, in terms of job, the maximum rate was related to nursing (33 %) and physician (21 %) and the minimum rate was related to top management (11%).

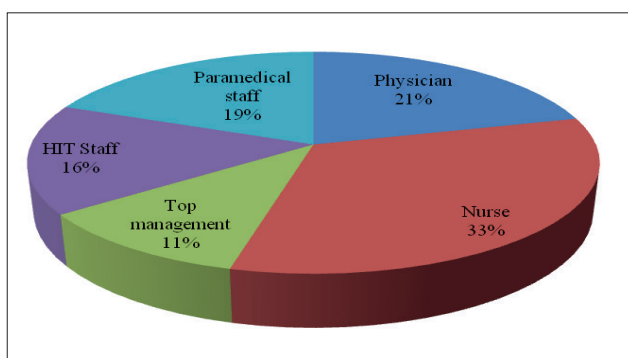According to the table 1, at the category of project man-

Figure 1. *Distribution of respondents according to job*

Four-fold Category	Related cases	Mean	SD
	Creating detailed roadmap	4.84	0.67
	Establishing working group and user engagement	4.72	0.73
Project Management	Appropriate team leadership	4.58	0.76
	Training Knowledge and skills necessary	4.22	0.73
	full support and upgrade	4.66	0.82
	Supporting top managers	3.80	0.64
	Stability Management	4.32	0.76
	Hardware and network infrastructure	3.54	0.73
Organizational factors	Sufficient funds for investment	4.12	0.81
	According to the organization's strategy	4.14	0.68
	Security and Confidentiality of information	4.24	0.78
	Understanding of the features and benefits	4.18	0.62
	Participate in the implementation of the system	4.44	0.74
Human factors	Positive Attitude	4.22	0.58
	Employment of medical informatics professionals	3.93	0.76
	Ease of use of the system	4.46	0.67
	High speed information processing	4.22	0.77
Technical factors	Principles of security and privacy	4.33	0.72
	Exchange of information between sectors	4.54	0.67
	User-friendly	4.18	0.72

Table 1. *Mean of subcategory related to critical success factors in Implementation EHRs (range 1–5)*

agement, the highest and lowest levels of scale are related to creating detailed roadmap (4.84) and training Knowledge and skills necessary (4.22), respectively; whereas at the organizational factors, the highest rate related to stability management (4.32) and lowest rate related hardware and network infrastructure (3.54), respectively. At the human factors, the highest rate related to participate in the implementation of the system (4.44) and lowest rate related to employment of medical informatics professionals (3.93); while at the technical factors, the highest and lowest rate are related to ease of use of the system (4.46) and user-friendly (4.18), respectively.

Critical success factors	Mean	SD
Project Management	4.62	0.74
Organizational factors	3.98	0.72
Human factors	4.22	0.69
Technology factors	4.35	0.71

Table2. Mean *of main category of critical success factors in Implementation EHRs (range 1–5)*

According to the table 2, in the main category of critical success factors in Implementation EHRs, the highest rate related to Project Management (4.62) and lowest related to Organizational factors (3.98).

4. DISCUSSION

According to the study conducted, Leonard (2004), the key success factors in the implementation of IT projects is classified in five categories, including: Enterprise environment, individual characteristics, technical requirements, vendor commitment and organizational culture (18).

In this research, all these things were considered except that organizational environment and organizational culture are discussed as one class called organizational characteristics. In addition, project management is addressed rather than vendor commitment.

Medical Records Institute (2005) conducted a comprehensive study on the orientation and the use of computerized information systems in which 280 respondents of health information management, medical information systems specialists, network managers and related specialties participated. The results indicated that the main factors influencing the successful implementation of computerized information systems for 75% of the responses included the preparation of human resources and organizations (19), whereas the most important factor in this research is project management.

The results of the dissertation by Chen revealed that the main barriers to the use of information systems for doctors were: low transfer rate (4.35), the time-consuming nature of the system (4.22), the problems of security and confidentiality of the data (4.10) and the lack of standards to transmit messages (3.77), respectively. Doctors also believe that the lack of computer training (2.57) and the high volume of daily work (2.46) do not have much impact on their use of information systems. In this study, the high speed and ease of use of EHR (3.81) and ensure the security and confidentiality of information in the EHR (3.88) are of paramount importance (20). The only remarkable thing in our study was that contrary to this research, training of knowledge and skills necessary to working with EHR (3.83) is very essential for the users of the system.

In his study, Columbus found the average participant's knowledge of and attitudes toward EHR prior to the training equal to 58% and 64%, respectively, while they were improved to 72% and 78% at the end of the period. The results also showed that training the providers of health care to know EHR better is an important factor in the success of the system (21).

According to the research done by Robinson, appropriate leadership, good communication, detailed roadmap of implementation, setting measurable goals and specific attention to the preparation of human resources in terms of motivation and training were considered as the most important factors affecting the success of the implementation of this system (22). This was also consistent with the results of the current study.

In the study conducted by HFMA, about the main constraints of EHR implementation, the following results were obtained: The lack of national standards and coding systems (62%), lack of funds available (59%), concern about the use of physicians (51%), lack of ability to mutual relationship (50%), lack of skilled human resources (43%), lack of local data network (37%), concern about the acceptance of insurance companies (32%), lack of quick profitability (28%), concern about maintaining the confidentiality of information (16%) which are consistent with the results of the conducted research (23).

5. CONCLUSION

Success in implementation EHRs requirement more centralization to project management and human factors. Therefore must be Creating to EHR roadmap implementation, establishment teamwork to participation of end-users and select prepare leadership, users obtains sufficient training to use of system and also prepare support from maintain and promotion system. Given that the most important factor in the successful implementation of EHR is project management, it seems necessary that in order to ensure the success of the system, Creating to EHR roadmap implementation, establishment teamwork to participation of end-users (clinical, administrative and information technology) and select prepare leadership. Also training of knowledge and skills necessary to work with EHR are provided for the users and standards of confidentiality and security of data and messaging capabilities be observed.

CONFLICT OF INTEREST: NONE DECLARED.

REFERENCES

1. Poon EG, et al. Relationship between use of electronic health record features and health care quality: results of a statewide survey. Medical Care. 2010; 48(3): 203-209.
2. Leonard KJ. Critical success factors relating to healthcare's adoption of new technology: a guide to increasing the likelihood of successful implementation. Electronic Healthcare. 2004; 2(4): 72-81.
3. Gartee RW. Electronic health records: understanding and using computerized medical records: Prentice-Hall, Inc., 2006.
4. Franczak MJ, et al. In emergency departments, radiologists' access to EHRs may influence interpretations and medical management. Health Affairs. 2014; 33(5): 800-806.
5. Shortliffe EH, Barnett GO. Biomedical data: their acquisition, storage and use. In: Biomedical informatics. London, England: Springer; 2014: 39-66.
6. Gagnon MP, et al. Electronic health record acceptance by physicians: testing an integrated theoretical model. Journal of Biomedical Informatics. 2014; 48: 17-27.
7. Yusof MM, Kuljis J, Papazafeiropoulou A, Stergioulas LK. An evaluation framework for Health Information Systems: human, organization and technology-fit factors (HOT-fit). International journal of medical informatics. 2008; 77(6): 386-698.
8. Miller RH, Sim I. Physicians' use of electronic medical records: barriers and solutions. Health affairs. 2004; 23(2): 116-126.
9. Valdes I, Kibbe DC, Tolleson G, Kunik ME, Petersen LA. Barriers to proliferation of electronic medical records. Informatics in Primary Care. 2004; 12(1): 3-9.
10. Terry AL, Thorpe CF, Giles G, Brown JB, Harris SB, Reid GJ, et al. Implementing electronic health records Key factors in primary care. Canadian Family Physician. 2008; 54(5): 730-736.
11. Beuscart-Zéphir MC, Elkin P, Pelayo S, Beuscart R. The human factors engineering approach to biomedical informatics projects: state of the art, results, benefits and challenges. IMIA. 2007; 2: 109-127.
12. Rezaei Hachesoo P, Ahmadi M, Sadughi F. Electronic Health Record: Structure, Content, and Evaluation. A Comparative Study. Journal of Health Administration. 2007; 10(29): 55-64.
13. Littlejohns P, Wyatt JC, Garvican L. Evaluating computerised health information systems: hard lessons still to be learnt. BMJ. 2003; 326(7394): 860-863.
14. Jebraeily M, Ahmadi M, Hajavi A, Gohari M, Sedghi Jahromi M, Zareh Z. Electronic Health Records: Personnel Readiness Assessment. Journal of Health Administration. 2010; 13(39): 17-24.
15. Haughom J, Kriz S, McMillan DR. Overcoming barriers to EHR adoption. Healthcare financial management: Journal of the Healthcare Financial Management Association. 2011; 65(7): 96-100.
16. Lorenzi NM, Riley RT. Organizational aspects of implementing informatics change. Behavorial Healthcare Informatics: Springer; 2002: 156-170.
17. Ministry of Health and Medical Education. "The comprehensive plan of citizen's health information system", 2008.
18. Leonard KJ. Critical success factors relating to healthcare's adoption of new technology: a guide to increasing the likelihood of successful implementation. Electronic Healthcare. 2004; 2(4): 72-81.
19. Medical Records Institute. "Medical Records Institute's Seventh Annual Survey of Electronic Health Record Trends and Usage for 2005," 2005 Available at: http://www.medrecinst.com
20. Chen Chi-Hsiu. Factors affecting physician' use of medical informatics system. Ph.D. thesis in Health Services Policy and Management, University of South Carolina, 2006.
21. Columbus ML. The evaluation and effectiveness of an Interdisciplinary course in Electronic Health Record technology for health and rehabilitation professionals. Master of Science University of Pittsburgh, 2006.
22. Robinson C. Clinician adoption of healthcare information technology, Canadian Nursing Informatics J. 2007; 2(1): 4-21.
23. Healthcare Financial Management Association (HFMA). Overcoming Barriers to Electronic Health Record Adoption: 2006. Accessible to site: www.hfma.org.