Hospital Information Systems Implementation: An Evaluation of Critical Success Factors in Northeast of Iran

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Abstract

Introduction: Implementation of hospital information systems (HIS) is considered as a difficult and sensitive task in terms of its scope and its mission to collect identity-related, demographic, clinical and managerial data of patients in an integrative manner as well as due to the changes it makes in users' working practices. The purpose of the present study was to investigate users' views and attitudes towards the key elements of successful implementation of HIS.

Methodology: This applied study was conducted in a descriptive cross-sectional form. To this end, 248 users of HIS at teaching hospitals in the city of Mashhad (Northeast of Iran) were selected through stratified random sampling, and then a questionnaire was distributed to collect the required data. After collecting the questionnaires, data was entered into the SPSS software and the findings were examined by using descriptive statistics (frequency) and then illustrated in tables and diagrams.

Results: Functional factors, meeting users' needs and ease of use had the highest prominence in successful implementation of a HIS. This mean that HIS considering demands of users is the first critical success factors in HIS implementation.

Conclusion: The analysis of the research findings demonstrated that three groups including system users, technical operators (professionals) and managers have important role in implementation of HIS. Furthermore, successful implementation of HIS was required to be performed through a formulated program with specified time, costs, and manpower in which the employment and participation of various users of the system had been precisely defined. In this respect, financial supports and presence of hospital management team in meetings and decisions was also of utmost importance.

Keywords: hospital information system (HIS), critical success factors, implementation

1. Introduction

Ever-increasing development of technologies and strong desire to use computers among different user have driven medical centers towards using information systems. Given the large amount of clinical data generated by medical centers and the necessity to access such data, manual hospital information systems (HIS) has

encountered numerous problems in a way that access to comprehensive information is not possible. This issue has also puzzled managers and led to failures in their performance due to their inefficiency and unresponsiveness (Takhti, Rahman, & Abedini, 2012). On the other hand, considering advancement of technologies, medical users increasingly demand for access to comprehensive and fast information (Silow, Edwards, & Rodin, 2012), Ease of use (Choi & Kim, 2012; Greiver, Barnsley, Glazier, Moineddin, & Harvey, 2011; Kimiafar, Moradi, & Sadughi, 2007; Yucel, Cebi, Hoege, & Ozok, 2012), system usability (Joukes, Cornet, Abu-Hanna, de Bruijne, & de Keizer, 2015; Joukes, Cornet, de Bruijne, & de Keizer, 2016; Khalifa, 2014), user-friendliness (Ahmadi, Rad, Nazari, Nilashi, & Ibrahim, 2014; Ismail et al., 2010), flexibility (Wright et al., 2015), respecting security and privacy (Ahmadi et al., 2014; I. Choi, R. Choi, Lee, & B. Choi, 2010; Samsuri, Ahmad, & Ismail, 2011), supports for users in legal proceedings (Van Der Meijden, Tange, Troost, & Hasman, 2003), appropriate network infrastructure (Almunawar & Anshari, 2012; Handayani, Rahman, & Hidayanto, 2013), integrated communication networks (Handayani et al., 2013), and use of new information technologies (Borycki, Joe, Armstrong, Bellwood, & Campbell, 2011; Borzekowski, 2009; Ismail et al., 2010; Safdari, Ghazisaeidi, & Jebraeily, 2015) that have been taken into account as the features of an efficient and effective information system.

It should be noted that successful implementation of a system at hospitals requires a series of issues and measures in a formulated and relatively long-term program. Provided that such programs is not implemented through full awareness of the needs of various users as well as wrong principles and methods, there is a high probability of program failure and consequently loss of time and costs (Sheikhtaheri, Kimiafar, & Sarbaz, 2014). In this regard, use of experts (Borycki et al., 2011; Hayajneh et al., 2006), allocation of adequate financial and human resources (Fritz, Tilahun, & Dugas, 2015), clarity of goals (Horowitz & Zhang, 2012), provision of training programs (Igira et al., 2007; McAlearney, Hefner, Sieck, Rizer, & Huerta, 2015; Mobasheri, Mirzaeian, Shervani, Ziaee Nejad, & Habibi, 2014), users' participation in implementation process (Ash & Bates, 2005), upgraded technical knowledge of users (Ash & Bates, 2005), senior management support (Ahmadi et al., 2014), and effective communications between managers and employees (Nguyen, Bellucci, & Nguyen, 2014) are of the main requirements for a successful implementation.

Another important point in HIS implementation is the power and ability of management teams in medical centers to motivate the users to perform their tasks on due time. The management is required to assure timely implementation of such changes in the working system of manpower and agree to take their consequences. Making such changes in the activities of medical teams (especially physicians) is not straightforward and needs establishment of a working culture in the form of a systematic implementation of a development plan. In other words, information systems should be implemented in centers where in medical teams have sufficient knowledge of such systems and consider them important to problem-solving and show their dedication in implementation of the system. Moreover, implementation of an information system in both medical and non-medical centers is accompanied by introducing a new culture. If a computer system is unable to meet users' expectations, users will leave it aside. Given the significance of successful HIS, this study was to examine the critical success factors of HIS implementation in an organized manner through users' views and contribute to promotion and implementation of HIS.

2. Methodology

This applied study in the form of a descriptive-analytic cross-sectional research was conducted at Imam Reza Hospital and Ghaem Hospital in the city of Mashhad in 2014. The reason behind the selection of these two centers was related to the frequency of the study population in the given centers. Both centers were also as the medical hubs in Northeast of Iran with a full coverage of all specialties. The statistical population of this study included physicians, nurses, and radiology personnel's, laboratory, pharmacy, operation room, information management, and accounting sections. Stratified random sampling method was used to select the study sample and 248 individuals personnel were selected through Cochran's sample size formula. A researcher-designed questionnaire comprised of two parts was also employed as the data collection instrument in this study. The first part of the questionnaire was associated with users' demographic information, and the second part included five categories of project management factors (including use of experts in project implementation process, adequate budget and resource allocation, transparency in implementation steps, positive thinking of project operators, clarity of project goals, assessment of project costs, development of vision document, and continuing control of project implementation); human factors (including users' involvement in implementation process, familiarity with systems, supports for users in legal cases and proceedings, clinical problem-solving, knowledge and experiences of HIS users, management problem-solving and positive thinking of users towards the system); functional factors (including ease of use, flexibility, user-friendliness, alarm system, system architecture, user

interface; standards for information input, retrieval, exchange and decision support); management factors (including knowledge of project managers, management stability, granting rewards or penalties to users, senior management supports for project, strong leadership, communications between managers and employees, and management styles); and technical factors (including integrated communication networks, information processing speed, powerful hardware terminals, use of modern hardware and software, enough terminals, suitable network infrastructure, and robust software). At first, the questionnaire purpose and the objectives of the study were introduced to the users. In the first part (demographic information), 7 items were raised about users' specialty, age, gender, working experience, education, and working hours with HIS. Then, in the second part of the questionnaire, factors affecting successful implementation of HIS were set in five points including strongly agree (scale 5), agree, neutral, disagree, strongly disagree (scale 1) and each user was scored based on responses to the items.　Afterwards, the reliability and validity of the questionnaire were approved. The validity of the questionnaire was determined through its submission to professors and experts and the required revisions were made. To determine the reliability of the questionnaire, it was distributed among 25 users and it was confirmed by a Cronbach's alpha coefficient equal to 0.857. After determining the validity and reliability of the questionnaire, it was administered to the users and they were given enough time to fill it out; then the completed questionnaires were collected by the researcher. The SPSS software and descriptive statistics were used to examine and present the findings from the questionnaire in the form of frequency distribution tables and parameters of mean and percentage.

3. Results

Reliability coefficient of the questionnaire was examined by using the SPSS software. The coefficient was reported very high in terms of reliability (Cronbach's alpha was equal to 0.915) which showed an acceptable level of confidence. It should be noted that 35% of respondents were men (87 people) and 65% were women (161 individuals).

Tables 1 and 2 presented the analysis of factors affecting successful implementation of information systems from the views of users. Since the users at the hospitals reviewed were among the first centers in Iran using HIS, the duration to use the system was high and users in these two centers had greater experience compared with users in other regions of the country. The results of this analysis would be employed in implementing HIS in other regions and it could help developers and those involved in this respect. The factors affecting successful implementation of HIS also require special attention. Table 1 showed the mean of the factors affecting implementation of HIS in order of priority. Functional (4.65), project management (4.44), human (4.41), technical (4.35), and management (4.11) factors had the highest importance considering HIS implementation. The most important success factor for HIS in terms of functional factors was meeting the needs of users (4.85) and use of experts was considered as a success factor among project management factors (4.77). Moreover; provision of continuing training for users (4.77), suitable network infrastructure (4.55), and strong leadership (4.76) were among the important success factors among human factors, technical factors, and management factors; respectively. The sub-categories of each group of factors were illustrated in Table 2 in terms of priority.

Table 1. The mean critical success factors of a HIS implementation from the views of users (range 1-5)

Critical Factors	Management	Technical	Human	Project Management	Functional
Mean	4.11	4.35	4.41	4.44	4.65

Table 2. The mean of subcategory critical success factors of a HIS implementation from the views of users (range 1-5)

Factors	Sub factors	Mean	SD
Functional	meet user needs	4.85	0.74
	ease of use	4.82	0.68
	usability	4.78	0.62
	user interface	4.75	0.82
	security and confidentiality	4.59	0.76
	user friendly	4.57	0.56
	flexibility	4.55	0.72
	standardization of information processes	4.22	0.75
Project Management	use of experts in project implementation	4.77	0.59
	allocation of sufficient funds and resources	4.65	0.71
	clearly, the goals of the project	4.51	0.68
	continuous monitoring of project implementation	4.27	0.72
	project implementers positive thinking	3.98	0.82
Human	continuous users training	4.77	0.65
	familiarization with system	4.74	0.74
	members participation	4.69	0.83
	adequate human resources	4.62	0.72
	organizational Culture	4.52	0.53
	users experience and Knowledge	4.02	0.73
	system users Positive thinking	3.89	0.84
	user support in legal claims	3.79	0.75
Technical	appropriate network infrastructure	4.55	0.69
	integrated communication network	4.53	0.68
	high speed Information processing	4.47	0.76
	adoption of new technologies	3.82	0.7
	strong hardware terminals	3.71	0.83
Managerial	strong leadership	4.76	0.57
	top managers support	4.73	0.73
	employees and employer Communication	4.12	0.75
	paying rewards/penalties to users	4.03	0.62
	knowledge of managers	3.75	0.55

4. Discussion

Frequency distribution of participants' age showed that 7% of individuals were under 25 years old, 49% were 26 to 35, 38% were 36 to 50, and 5% of individuals were included in the over-50-years-oldage group. The results also indicated that people aged over 50 years (5%) were less likely to respond to the questionnaire which could be due to their reluctance to use information systems (Khalifa, 2014). Furthermore, frequency distribution of work group of participants revealed that most participants were nurses due to the higher population of users in this work group.

The level of participation among physicians were relatively low which originated from lack of time (Ludwick & Doucette, 2009), unwillingness to use information systems due to technical issues (Fritz et al., 2015), lack of

experience (Yucel et al., 2012) and excessive workload (Ismail et al., 2010).

Also the results of this study suggest that critical factors for HIS success rely on the functionality of the implemented system and the availability of technical infrastructure and managerial leadership. Amazingly, in this study financial issues has not been found to be the first major criteria, although this may seem to be an essential factor in HIS implementation. Misplace of these issues might be due to the fact that many of these programs were funded by the vendors or executive management, and users of HIS have no responsibility relating to initial and on-going costs of implementation. Lewis, Synowiec, Lagomarsino, & Schweitzer (2012) in their studies confirmed that about half of the health IT programs in developing countries are based on donor funding. Regardless, financial issues need to be taken into account. Also studies show that there is a return on investment in low-resource settings after 3 to 5 years. The initial funding is therefore crucial to bridge the gap until the HIS generates a value to the health care institution. Otherwise, the argument could be made to use the budget for direct medical care (Fritz et al., 2015). Therefore the success factors include: functionality, project management, human application andtechnical and managerial leadershipthatare discussed below.

4.1 Functionality

According to results of this study functionality is the most important critical success factor for HIS implementation. The results of other studies showed that the system will not accomplished if there are lack of clarity in functionality and poor user-interface design (Heeks, 2006; Lucas, 2008).

Another important success factors in this set of factors is data security. Ensuring the data security and confidentiality of HIS is very crucial. Many of data stored in the system are valuable. Unsecured data can be abused and violated and can leading to unpleasant events for both patient and caregiver (Clifford, Blaya, Hall-Clifford, & Fraser, 2008). Audit trails and log-in identification are two main and simple methods to obtaining data security. In audit trails management can supervise the data usage and access. Also username and password protect system from anonymous access. Also to achievement of these goals establishing security and privacy policies in the organizations is necessary (Ismail et al., 2010**)**.

4.2 Project Management

Project management is the principle determining success factor of an HIS. Also high quality project management and detailed planning will ensure good implementation, institutionalization and user acceptance (Ismail et al., 2010**)**. Organization's readiness is another success factor for implementation. Although an organization's readiness must create by top managers and technical developers, its angles such as the clear goals of the project, positive thinking of developers and allocation of sufficient resources must be explored fully before starting an implementation process (Peute, Aarts, Bakker, & Jaspers, 2010).

4.3 Human

Our results showed that human training is one of the most important factors to avoid failure of the HIS. In this regard continuous training is critical for success of implementation. However, the available time to train is usually limited because of limitations in patient care, staff, and other facility problems. Also users underestimate the essential time of training and expect to have less training than is needed to become expert in working with the new HIS (Joukes et al., 2015).

In various studies, raising users understanding of the system requisites and benefits are mandatory for all users, diminish technical problems, and ensure HIS success. Also the important role of baseline computer knowledge was evident in other some studies (Ball, 2003; Joukes et al., 2015).

Nevertheless, considering similar and same amount of training to everyone is not likely proper. Unfortunately age and computer experiences are negatively correlated and younger employees feel more comfortable than older users in working with HIS (Terry et al., 2008). Expectation is that the older users need more training. It would be advisable for developer to adjust the times of training for personnel based on the users characteristics.

Participation of user in implementation process is another factor that can effect on HIS implementation. Involvement of users in decision making, and having knowledge about the effects of HIS is necessary for successful implementation. People tend to judge an activity more enthusiastically if the results was successful than when those are less successful, especially when they were involved in implementation progress (Hirt, Zillmann, Erickson, & Kennedy, 1992). Moreover in order to prosperity of HIS implementation, physicians must have significant involvement in the IT initiatives and developers must take personnel feedback into account before, between and during system builds and designs. Surely without physicians participation, failure of implementation process was not unexpected (McAlearney et al., 2015).

4.4 Technical

Users of HIS must be satisfied with the available technical features. Providing appropriate technical, and communicational infrastructure is very critical for success implementation of HIS (Mohammadzadeh & Safdari, 2014). Note to availability of software and hardware equipment, proper networking, adoption of new technologies, strong hardware terminals, high speed Information processing, combination of hardware interfaces that available through modern technologies like smart phones are necessary. Generation of false alarms can effect on patient safety and effectiveness of care. So in design and provide technical factors must be considered (Choi & Kim, 2012; Fritz et al., 2015; Ismail et al., 2010).

4.5 Managerial Leadership

Successful implementations needs to provide personalized and full-time managerial support. One managerial support must have sufficient knowledge for organizations leadership. Managerial leadership like physician leaders, chief information officer and clinical manager had to work together to move the HIT initiatives forward (Robinson, 2007)**.** As well as the importance of IT champions has been noted in most studies and in our study, this concept was more stressed (Terry et al., 2008).

Also in-house development of HIS can have many benefits. Reducing of cost, development in accordance with user's needs, upgrading of hardware and software on needed, flexible development accommodate with technology changes and advancements. At the end of discussion it is necessary to remind that the HIS implementation's success depends on the satisfaction of the initially set goals and the elimination of any negative side effects.

5. Conclusion

The success or failure of HIS implementation in hospital's organization are very elaborated. For this complexity HIS implementationis not similar to other sophisticated technology. Also successful implementation of HIS is affected by numerous factors. Among the most important ones were functional factors, project management factors; and human, technical, and management factors. Moreover, three groups should be considered in the successful implementation of a HIS. The first group was system users who needed training, financial and spiritual incentives, appeal to participate in implementation process, meeting operational needs, process and feedback control to be considered in the implementation process. The effectiveness and efficiency of the system should be also approved for users to encourage them that the system is not an obstacle for their activities and it reduced their workloads and improved their activities. The second group was technical operators who had expertise and adequate resources to conduct implementation process effectively and with high accuracy. The third group included managers who supported implementation process from the beginning to the end and even after its completion through financial and spiritual supports and effective communications. In addition to the factors listed; some factors such as cultural, ethical and behavioral factors could be effective in some regions and special centers**.**

Competing Interests Statement

The authors declare that there is no conflict of interests regarding the publication of this paper.

References

Ahmadi, H., Salahshour-Rad M., Nazari M., Nilashi M., & Ibrahim, O. (2014). Factors affecting the implementation of hospital information system (HIS) using AHP. *Life Science Journal;11(3)*, 202-207.

Almunawar, M. N., & Anshari, M. (2011). *Health information systems (HIS): Concept and technology.* Paper presented at the International Conference Informatics Development, Cornell. Retrieved from https://arxiv.org/abs/1203.3923

Altuwaijri, M. (2011). Health information technology strategic planning alignment in Saudi hospitals: A historical perspective. *Journal of Health Informatics in Developing Countries, 5(2).* Retrieved from http://www.jhidc.org/index.php/jhidc/article/view/75/112

Ash, J. S., & Bates, D. W. (2005). Factors and forces affecting EHR system adoption: Report of a 2004 ACMI

discussion. *Journal of the American Medical Informatics Association, 12(1),* 8-12 . http://dx.doi.org/10.1197/jamia.M1684

Ball, M. J. (2003). Hospital information systems: perspectives on problems and prospects, 1979 and 2002. *International Journal of Medical Informatics, 69(2),* 83-89. http://dx.doi.org/10.1016/S1386-5056(02)00098-9

Borycki, E., Joe, R. S., Armstrong, B., Bellwood, P., & Campbell, R. (2011). Educating health professionals about the electronic health record (EHR): Removing the barriers to adoption. *Knowledge Management & E-Learning, 3(1),* 51-62.

Borzekowski, R. (2009). Measuring the cost impact of hospital information systems: 1987–1994. *Journal of health economics, 28(5),* 938-949 . http://dx.doi.org/10.1016/j.jhealeco.2009.06.004

Choi, I., Choi, R., Lee, J., & Choi, B. G. (2010). Implementation of single source based hospital information system for the Catholic Medical Center affiliated hospitals. *Healthcare Informatics Research, 16(2),* 133-139. http://dx.doi.org/10.4258/hir.2010.16.2.133

Choi, J., & Kim, H. (2012). A workflow-oriented framework–driven implementation and local adaptation of clinical information systems: A case study of nursing documentation system implementation at a tertiary rehabilitation hospital. *Computers Informatics Nursing, 30(8),* 409-414. http://dx.doi.org/10.1097/NXN.0b013e3182512ffd

Clifford, G. D., Blaya, J. A., Hall-Clifford, R., & Fraser, H. S. (2008). Medical information systems: A foundation for healthcare technologies in developing countries. *Bio Medical Engineering, 7(1),* 1-8. http://dx.doi.org/10.1186/1475-925X-7-18

Fritz, F., Tilahun, B., & Dugas, M. (2015). Success criteria for electronic medical record implementations in low-resource settings: A systematic review. *Journal of the American Medical Informatics Association, 22(2),* 479-488 . http://dx.doi.org/10.1093/jamia/ocu038

Greiver, M., Barnsley, J., Glazier, R. H., Moineddin, R., & Harvey, B. J. (2011). Implementation of electronic medical records: Theory-informed qualitative study. *Canadian Family Physician, 57(10),* 390-397.

Handayani, P. W., Rahman, M. Z., & Hidayanto, A. N. (2013). Information technology assessment on hospital information system implementation: Case study a teaching hospital. *International Journal of Engineering and Technology, 5(2),* 631-634.

Hayajneh, Y. A., Hayajneh, W. A., Matalka, I. I., Jaradat, H. Z., Bashabsheh, Z. Q., & Alyahya, M. S. (2006). Extent of use, perceptions, and knowledge of a hospital information system by staff physicians. Retrieved from www.hayajneh.org/research/Extent_of_Use_.pdf

Heeks, R. (2006). Health information systems: Failure, success and improvisation. *International Journal of Medical Informatics, 75(2),* 125-137. http://dx.doi.org/10.1016/j.ijmedinf.2005.07.024

Hirt, E. R., Zillmann, D., Erickson, G. A., & Kennedy, C. (1992). Costs and benefits of allegiance: Changes in fans' self-ascribed competencies after team victory versus defeat. *Journal of personality and social psychology, 63(5),* 724.

Horowitz, D. R., & Zhang, C. (2012). Streamlining electronic health records and health care information system implementation for general practices: One clinic's experience. *Proceedings of the Southern Association for Information Systems (SAIS) Conference (pp. 18). Atlanta, GA, USA.*

http://cjni.net/journal/?p=1796

Igira, F. T., Titlestad, O. H., Lungo, J. H., Makungu, A., Khamis, M. M., Sheikh, Y., . . . Braa, J. (2007). Designing and implementing hospital management information systems in developing countries: Case studies from Tanzania-Zanzibar. *Health Informatics in Africa (HELINA).* Retrieved from http://www.academia.edu/17298145/Designing_and_implementing_hospital_management_information_sys tems_in_developing_countries_case_studies_from_Tanzania-Zanzibar

Ismail, A., Jamil, A. T., Rahman, A. F. A., Bakar, J. M. A., Saad, N. M., & Saadi, H. (2010). The implementation of hospital information system (HIS) in tertiary hospitals in malaysia: A qualitative study. *Malaysian Journal of Public Health Medicine, 10(2),* 16-24.

Joukes, E., Cornet, R., Abu-Hanna, A., de Bruijne, M., & de Keizer, N. (2015). End-user expectations during an electronic health record implementation: A case study in two academic hospitals. *Studies in Health Technology and Informatics, 210,* 501-505 . http://dx.doi.org/10.3233/978-1-61499-512-8-501

Joukes, E., Cornet, R., de Bruijne, M. C., & de Keizer, N. F. (2016). Eliciting end-user expectations to guide the implementation process of a new electronic health record: A case study using concept mapping. *International Journal of Medical Informatics, 87,* 111-117. http://dx.doi.org/10.1016/j.ijmedinf.2015.12.014

Khalifa, M. (2014). Technical and human challenges of implementing hospital information systems in Saudi Arabia. *Journal of Health Informatics in Developing Countries, 8(1),* 12-25.

Kimiafar, K., Moradi, G., & Sadughi, F. (2007). Quality information and perspectives on hospital information systems training. *Health Information Management, 4(1),* 43-50.

Lewis, T., Synowiec, C., Lagomarsino, G., & Schweitzer, J. (2012). E-health in low-and middle-income countries: findings from the Center for Health Market Innovations. *Bull World Health Organ, 90(5),* 332-340. http://dx.doi.org/10.2471/BLT.11.099820

Lucas, H. (2008). Information and communications technology for future health systems in developing countries. *Social Science & Medicine, 66(10),* 2122-2132. http://dx.doi.org/10.1016/j.socscimed.2008.01.033

Ludwick, D. A., & Doucette, J. (2009). Adopting electronic medical records in primary care: Lessons learned from health information systems implementation experience in seven countries. *International Journal of Medical Informatics, 78(1),* 22-31. http://dx.doi.org/10.1016/j.ijmedinf.2008.06.005

McAlearney, A. S., Hefner, J. L., Sieck, C., Rizer, M., & Huerta, T. R. (2015). Fundamental issues in implementing an ambulatory care electronic health record. *The Journal of the American Board of Family Medicine, 28(1),* 55-64. http://dx.doi.org/10.3122/jabfm.2015.01.140078

Mobasheri, M., Mirzaeian, R., a, M., a, Y., & Habibi, M. (2014). Clinical and official users' readiness for hospital information system implementation in Valiyasr Hospital of Boroujen. *Journal of Shahrekord University of Medical Sciences, 15(6),* 53-59.

Mohammadzadeh, N., & Safdari, R. (2014). Patient monitoring in mobile health: Opportunities and challenges. [Review]. *Medical Archives, 68(1),* 57-60. http://dx.doi.org/10.5455/medarh.2014.68.57-60

Nguyen, L., Bellucci, E., & Nguyen, L. T. (2014). Electronic health records implementation: An evaluation of information system impact and contingency factors. *International Journal of Medical Informatics, 83(11),* 779-796. http://dx.doi.org/10.1016/j.ijmedinf.2014.06.011

Peute, L. W., Aarts, J., Bakker, P. J., & Jaspers, M. W. (2010). Anatomy of a failure: a sociotechnical evaluation of a laboratory physician order entry system implementation. *International Journal of Medical Informatics*, *79(4),* 58-70. http://dx.doi.org/10.1016/j.ijmedinf.2009.06.008

Robinson, C. (2007). Clinician adoption of healthcare information technology. *Canadian Nursing Informatics Journal, 2(1),* 4-21.

Safdari, R., Ghazisaeidi, M., & Jebraeily, M. (2015). Electronic health records: Critical success factors in implementation. *Acta Informatica Medica, 23(2),* 102-104. http://dx.doi.org/10.5455/aim.2015.23.102-104

Samsuri, S., Ahmad, R., & Ismail, Z. (2011). Towards implementing a privacy policy: An observation on existing practices in Hospital Information System. *Journal of E-health Management, 2011*, 1-9. http://dx.doi.org/10.5171/2011.345834

Schuster, D. M., Hall, S. E., Couse, C. B., Swayngim, D. S., & Kohatsu, K. Y. (2003). Involving users in the implementation of an imaging order entry system. *Journal of the American Medical Informatics Association, 10(4),* 315-321. http://dx.doi.org/10.1197/jamia.M1208

Sheikhtaheri, A., Kimiafar, K., & a, M. (2014). Evaluation of system quality of hospital information system: A case study on nurses' experiences. *Studies in Health Technology and Informatics. 205,* 960-964. http://dx.doi.org/10.3233/978-1-61499-432-9-960

Silow-Carroll, S., Edwards, J. N., & Rodin, D. (2012). Using electronic health records to improve quality and efficiency: the experiences of leading hospitals. *The Commonwealth Fund,* 17, 1-40.

Takhti, H. K., Rahman, A. A., Abedini, S., & Abedini, S. (2012). Impact of hospital information systems on patient care: Nurses' perceptions. *Canadian Journal of Nursing Informatics, 6(4)*.

Terry, A. L., Thorpe, C. F., Giles, G., Brown, J. B., Harris, S. B., Reid, G. J., . . . Stewart, M. (2008). Implementing electronic health records Key factors in primary care. *Canadian Family Physician, 54(5),* 730-736.

Van Der Meijden, M., Tange, H. J., Troost, J., & Hasman, A. (2003). Determinants of success of inpatient

clinical information systems: A literature review. *Journal of the American Medical Informatics Association, 10(3),* 235-243. http://dx.doi.org/10.1197/jamia.M1094

Wright, A., Sittig, D. F., Ash, J. S., Erickson, J. L., Hickman, T. T., Paterno, M., Dixon, B. E. (2015). Lessons learned from implementing service-oriented clinical decision support at four sites: A qualitative study. *International Journal of Medical Informatics, 84(11),* 901-911. http://dx.doi.org/10.1016/j.ijmedinf.2015.08.008

Yucel, G., Cebi, S., Hoege, B., & Ozok, A. F. (2012). A fuzzy risk assessment model for hospital information system implementation. *Expert Systems with Applications, 39(1),* 1211-1218. http://dx.doi.org/10.1016/j.eswa.2011.07.129

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