

**Factors influencing the adoption of health information technologies: a systematic review**Ali Garavand<sup>1</sup>, Mohammah Mohseni<sup>2</sup>, Heshmatollah Asadi<sup>3</sup>, Manal Etemadi<sup>4</sup>, Mohammad Moradi-Joo<sup>5</sup>, Ahmad Moosavi<sup>6</sup>

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**Type of article:** Systematic review

**Abstract**

**Introduction:** The successful implementation of health information technologies requires investigating the factors affecting the acceptance and use of them. The aim of this study was to determine the most important factors affecting the adoption of health information technologies by doing a systematic review on the factors affecting the acceptance of health information technology.

**Methods:** This systematic review was conducted by searching the major databases, such as Google Scholar, Emerald, Science Direct, Web of Science, Pubmed, and Scopus. We used various keywords, such as adoption, use, acceptance of IT in medicine, hospitals, and IT theories in health services, and we also searched on the basis of several important technologies, such as Electronic Health Records (HER), Electronic Patient Records (EPR), Electronic Medical Records (EMR), Computerized Physician Order Entry (CPOE), Hospital Information System (HIS), Picture Archiving and Communication System (PACS), and others in the 2004-2014 period.

**Results:** The technology acceptance model (TAM) is the most important model used to identify the factors influencing the adoption of information technologies in the health system; also, the unified theory of acceptance and use of technology (UTAUT) model has had a lot of applications in recent years in the health system. Ease of use, usefulness, social impact, facilitating conditions, attitudes and behavior of users are effective in the adoption of health information technologies.

**Conclusion:** By considering various factors, including ease of use, usefulness, and social impact, the rate of the adoption of health information technology can be increased.

**Keywords:** Technology Acceptance Model (TAM), Acceptance, Health Information Technology

**1. Introduction**

Currently, technology development has become one of the strategic elements in organizations, so that the effects of changes in the social, economic, and political systems have been more than the technologies themselves (1). The health system was not far from the outcomes, but the paper records, because of their own limitations, are not capable of proper communication between health service providers, and the data that are needed may not be available in a

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Received: January 09, 2016, Accepted: March 30, 2016, Published: August 2016

iThenticate screening: March 30, 2016, English editing: May 12, 2016, Quality control: July 02, 2016

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timely manner (2). To solve the problem, moving toward health information systems began about 30 years ago, and the ultimate goal of this movement was to improve the access to electronic health records (3). Use of information technology in various sectors of health care, particularly in hospitals, has great potential to improve the quality of services provided and the efficiency and effectiveness of staff, and they also reduce some of the organizational costs (4). Studies have shown that using electronic records in today's complex health system faces many challenges that require organizational preparation and workforce readiness. Researchers and policymakers who are running a new information system can measure the acceptance of the system among the target population. Measuring the acceptance will provide significant assistance in the successful implementation of a system. Therefore, before the implementation, technical and non-technical factors must be identified, and the barriers to implementation must be eliminated (5). Models present the process of implementing new technologies by assuming a number of systemic factors that jointly or independently predict success in the implementation phase (6). Implementation of health information systems may fail due to their being rejected by the users, so it is important to anticipate the reasons that physicians and other members of the medical team may have to accept or reject the new information system. This information will allow an organization to actively implement reforms to increase the acceptability of the new systems (7-9). Nematolahi et al. considered the users' attitudes to have a significant effect on the success of the implementation of electronic health records, and they emphasized the importance of being familiar with the applications and the concepts of electronic health records (10). In recent decades, several models have been proposed in the field of technology acceptance. Among these models are the "Task-Technology Fit (TTF) model," the "Technology Acceptance Model (TAM)," and the "Unified Theory of Acceptance and Use of Technology (UTAUT) model." IT theories to predict the response of end-users in IT are very important (11, 12). In terms of technology acceptance, there are many theories and patterns, some of which have been used in the health care field. The UTAUT model, as an integrated theory of eight other models, is necessary in technology acceptance (11). In this paper, we discuss the most important factors affecting the acceptance of the current and different information systems in health systems that have used technology acceptance theories.

## 2. Material and Methods

### 2.1. Searching articles

From the databases of Web of Science, Science Direct, Google Scholar, PubMed, and Scopus, related English language articles were searched; from the Google Scholar database, Persian Language articles were searched and located. The keywords used included adoption, use, acceptance of IT in medicine, hospitals, IT theories in health services, as well as several important technologies, including Electronic Health Records (HER), Electronic Patient Records (EPR), Electronic Medical Records (EMR), Computerized Physician Order Entry (CPOE), Hospital Information System (HIS), Picture Archiving and Communication System (PACS), also were included in the keyword search in order to conduct a comprehensive review. Also in our searches, we enlisted the help of a search specialist in order to improve the quality of our searches. The results were 156 full-text articles that were retrieved for detailed evaluation.

### 2.2. Inclusion and exclusion criteria

One of the inclusion criteria was that the studies be in the English or Persian languages. Also, studies related to the period of 2004-2014 were included in the study. Among articles, the ones before 2004, review articles, papers that did not use the theory of IT, and articles with less than 30 references were excluded. The end result was that 35 articles were chosen for use in the study. The overall search strategy is shown in Figure 1.

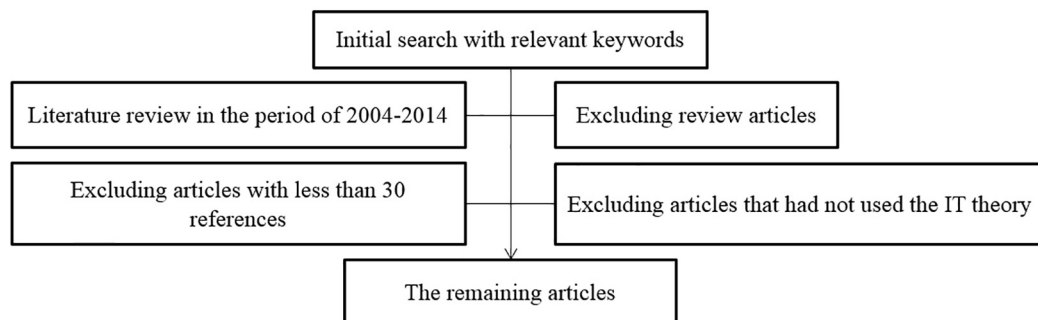


Figure 1. Strategy for searching for related articles

### 2.3. Quality assessment

Quality assessment of articles was conducted using the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) checklist. Also, qualitative evaluations of papers were conducted by two researchers who worked separately. If disagreements occurred among the two researchers, the issue was referred to a third researcher.

### 3. Results

Table 1 shows the number of articles found on the discussed technologies. According to the articles, we investigated the adoption of health information technology, electronic medical records, electronic health records, hospital information systems and clinical decision-making support system, reporting systems, mobile phones, tablets and personal computers, electronic versions and other new technologies and websites. Table 2 shows the number of cases that were found using different theories of information technology (IT Theory) in the field of health, and the Technology Acceptance Model had the most usage among researchers in the field of health, followed by the combination of different models and UTAUT. Also, the Theory of Planned Behavior and Diffusion of Innovation theories were used in a few cases. By perceived usefulness, we mean the extent to which a person believes that using the system will increase efficiency and achievement of the desired goals. The perceived ease of use factor included factors distinct from the system and also the extent to which the user assumes that the work will be easier with the technology (13). Social impact is the extent to which a person believes that using the system from the perspective of others is important. Facilitating conditions are the extent to which a person believes the technical and organizational infrastructure will support the utilization of the system (14). Attitude to use is the judgment and assessment of the people of the ultimate goal of an act or conduct in various aspects (12). User behavior is the extent to which the users' behaviors towards a particular technology will be considered (15). Table 3 shows the factors affecting technology adoption in the articles that were selected in order of importance in the reviewed studies; based on the papers, the most important factors affecting the adoption of information technology in the health system are the perceived ease of use, perceived usefulness, social influence, facilitating conditions, attitude to use, and users' behaviors.

**Table 1.** Prevalence of articles published in the field of health information technology adoption using information technology theories and based on the type of technology

Topic	Articles
Electronic Health Records (EHR)	4
Electronic Medical Records (EMR)	7
Hospital Information System (HIS)	3
Health Information Technologies (HIT)	11
Electronic Patient Records (EPR)	1
Other	9

**Table 2.** Use of information technology acceptance theories in articles

Theories	Frequency of use	Use with other models
TAM	13	6
UTAUT	8	4
TPB	1	1
Combination of models	12	0
DOI	1	1

**Table 3.** Factors affecting technology acceptance in papers

Factors affecting technology acceptance	The importance rate in found articles
Perceived usefulness	4
Perceived ease of use	2
Social Impact	6
Facilitating conditions	7
Attitude to use	7
User behavior	4

#### 4. Discussion

Among the selected articles, more than all technologies, the adoption of health information technology was studied. In the articles, after health information technology, electronic medical records were examined since they are required for Health Records, and having a complete EHR requires the successful implementation of electronic medical records (16), hence, it was allocated more attention than some other areas. Developing countries must implement electronic medical records to manage patients (17), but they are in the prior levels of the process of implementing electronic health records (16). In a study by the American Medical Association (Institute Of Medicine) in 2001, only 31% of physicians stated that the use of EHR will ease the management of medical procedures (18) so, more research is required on the technology that is required for the implementation of her. Also, the systems that were studied in papers were quite varied and encompassed a wide range of health information technologies. In the papers that were selected, the model was used the most was the TAM model, which is one of the extensive behavioral models in the IT field (19) and is the most common model (12). In 2005, Chau and Hu studied 40 models of technology adoption and came to the conclusion that technology acceptance model shows validity, reliability, power, and simplicity of IT (20), and additional studies that were conducted showed the high ability of the TAM to demonstrate the technology adoption among physicians (21, 22). For these reasons, to investigate the different technologies in the health system, TAM also has the most use. The results of studies in the field of health information technology suggest that more researchers are using a combination of models and are interested in developing and offering their models. In 2012, Putzer et al. used a combination of technology adoption and diffusion of innovation for mobile acceptance among physicians (23). In 2014, in Mekić's study, the technology acceptance model was developed (24), and Aggelidis et al. (4) proposed a model based on the technology acceptance model that showed 87% intention to use the technology. The template provided by Chau and Hu (20) based on a unified theory of acceptance and use of technologies developed by Venkatesh et al., as unified theory of acceptance and use of technology (25), and the model proposed by Haselina for the adoption of electronic medical records (15) are only a small sample of researchers' interest in the development of models to adopt technology in the field of healthcare. Domestic studies also were no exception; AbdeKhoda et al. (26) used the factors of technology acceptance and several other factors, such as administrative support, occupations, authority of physicians, and doctor-patient relationships as the factors affecting the use of electronic medical records. Tavakoli et al. (27) in their study in 2013 used the Technology Acceptance Model and other factors, such as the user interface and data quality, in order to assess the use of electronic medical records. Hamidfar et al. (28) used the unified theory of acceptance and use of technology and several other factors that can show up to 76% the intention for use. A literature review showed that the use of a unified theory of acceptance and use of technology by researchers has increased in recent years. The resulting unified theory of acceptance and use of technology was a long line to offer the different models of technology adoption that was presented in 2003 (11), and up to 70% can indicate the intention to use the system (14). The revised version also was presented in 2012 (25). Also, in two cases of studies, a combination of planned behavior models was used with other models, and, in one case, Innovation Diffusion Theory was used that according the universality of the adoption and use of technology the need is not so much for the use of such models (12). Papers in the study showed that the perceived ease of use, perceived usefulness, social impacts, facilitating conditions, attitude to use, and users' behaviors were the most important factors affecting the adoption of information technology in the field of health. The remarkable thing is that, in the literature, the most important factor in technology adoption was the simplicity of perceived usage. Howard & Warner (29) came to the conclusion that the key to willing acceptance of electronic medical documents by physicians was perceived ease of use. Ground et al. (30) assessed the perceived ease of use and perceived usefulness in acceptance of storage system and process of images important. Also, according to Davis, perceived ease of use of the system was relatively more important than ease of use itself, because users often want to be faced with a system that is difficult to use provided that the system can meet the needs of their practical applications (31). The results showed that the technology acceptance model, perceived usefulness, and perceived ease of use are the most important factors in technology adoption and in an integrated model of adoption and use of technology, social impacts have a greater role in the adoption and use of technology in the field of healthcare. In a study by Holtz and Krein (32) in 2011, the most important factor in the adoption of electronic patient records was considered to be social impacts. In 2008, Wills et al. (11) concluded that social impacts have an important role in the decision to use electronic medical records. Kijisanayotin et al. (6) found the social impacts to be one of the most important factors affecting the adoption of health information technology. However, a study by Jason (33) showed that social impacts had less influence on the adoption of electronic prescribing in South Africa. In the studies, a number of factors in addition to the technological theories were found. For example, Monem et al. (34) considered the user's role and her or his personal understanding of the system as important factors in technology adoption. In a study in 2012 by Putzer et al. (23) to determine the new factors influencing the use of smartphones by physicians in clinical decision making, they concluded that factors such as

adjustment, interaction in the workplace, internal environment, visibility, personal experience, and external environment are the main factors affecting the attitudes of physicians in the use of smartphones.

## 5. Conclusions

The results showed that, using models 1, 2, and 3, factors affecting the adoption of health information technology can be assessed. Also, when managers and policy makers want to implement health information technology, perceived usefulness and perceived ease of use are factors that should be considered. Due to the role of information technology adoption theories in successful implementation of information technologies, it is suggested that managers and policy makers study the affecting factors before implementing health information technologies.

## Acknowledgments:

We especially thank Dr. Hasoumi for his sincere and critical comments on this study.

## Conflict of Interest:

There is no conflict of interest to be declared.

## Authors' contributions:

All authors contributed to this project and article equally. All authors read and approved the final manuscript.

## References:

- 1) Esmaeili M, Toloei Eshlaghi A, Pour Ebrahimi AR, Esmeili R. Study on feasibility and acceptance of implementation of Technology Acceptance Model of Davis in staff of Shahid Beheshti University of Medical Sciences . Pajoohandeh. 2013; 18(1): 40-5.
- 2) Robert M. The Evaluation and Effectiveness of an Interdisciplinary Course in Electronic Health Record (EHR) Technology for Health and Rehabilitation Professionals. University, ML [M. Sc thesis]. 2006.
- 3) Gartee R. Electronic health record: understanding and using computerized medical record, 2nd Edition. New York: Julie Levin Alexander. 2007.
- 4) Aggelidis VP, Chatzoglou PD. Using a modified technology acceptance model in Hospitals. *Int J Med Inform.* 2009; 78(2): 115-26. doi: 10.1016/j.ijmedinf.2008.06.006. PMID: 18675583.
- 5) Block BM. How we improved our practice and bottom line with a new EMR system. *Fam Pract Manag.* 2008; 15(7): 25-30. PMID: 18763681.
- 6) Kijsanayotin B, Pannarunothai S, Speedie SM. Factors influencing health information technology adoption in Thailand's community health centers: applying the UTAUT model. *Int J Med Inform.* 2009; 78(6): 404-16. doi: 10.1016/j.ijmedinf.2008.12.005. PMID: 19196548.
- 7) Tsiknakis MKA. Organizational factors affecting successful adoption of innovative eHealth services: A case study employing the FITT framework. *Int J Med Inform.* 2009; 78(1): 93-52. doi: 10.1016/j.ijmedinf.2008.07.001. PMID: 18723389.
- 8) Holden RJ, Karsh BT. The technology acceptance model: its past and its future in health care. *J Biomed Inform.* 2010; 43(1): 159-72. doi: 10.1016/j.jbi.2009.07.002. PMID: 19615467, PMCID: PMC2814963.
- 9) Yaghobi NM, Shakeri R. Analytical comparison of technology acceptance models with emphasis on internet banking adoption. *Journal of Management Sciences.* 2008; 3(11): 21-44.
- 10) Nematollahi M, Abhari Sh, Garavand A. Attitudes and behaviors related to introduction of Electronic Health Record (EHR) among Shiraz University students in 2014. *J Health Man & Info.* 2015; 2(3): 97-100.
- 11) Wills MJ, El-Gayar O, Bennett D. Examining healthcare professionals' acceptance of electronic medical records using UTAUT. *Issues in Information Systems.* 2008; 9(2): 396-401.
- 12) Venkatesh V, Morris MG, Davis GB, Davis FD. User acceptance of information technology: Toward a unified view. *MIS quarterly.* 2003, 27(3): 425-78.
- 13) Davis FD. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly.* 1989; 13(3): 319-40. doi: 10.2307/249008.
- 14) Gupta B, Dasgupta S, Gupta A. Adoption of ICT in a government organization in a developing country: An empirical study. *The Journal of Strategic Information Systems.* 2008; 17(2): 140-54. doi: 10.1016/j.jsis.2007.12.004.
- 15) Haslina M, Sharifah M. Acceptance Model of Electronic Medical Record. *J Adv Inform Manage Stud.* 2005; 2(1): 75-92.
- 16) Torabi M, Safdari R. Electronic health record. tehran: jafari publication. 2009.

- 17) Fraser HS, Biondich P, Moodley D, Choi S, Mamlin BW, Szolovits P. Implementing electronic medical record systems in developing countries. *Inform Prim Care*. 2005; 13(2): 83-95. PMID: 15992493.
- 18) Morton ME. Use and acceptance of an electronic health record: factors affecting physician attitudes. 2008.
- 19) Price AP. A study of factors influencing physician adoption of electronic medical records technology [dissertation], Texas: Grenoble Ecole de Management. 2010.
- 20) Chau P, Hu PJ. Information technology acceptance by individual professionals: a model comparison approach. *Decision Sciences*. 2001; 32(4): 699-719. doi: 10.1111/j.1540-5915.2001.tb00978.x.
- 21) Rogers EM. diffusion of innovation. New York: the free press. 1995.
- 22) Kahouei M, Babamohamadi H. Factors affecting information technology acceptance in clinical settings from Nurses' perspective. *Payavard Salamat*. 2013; 7(4): 262-77.
- 23) Putzer GJ, Park Y. Are physicians likely to adopt emerging mobile technologies? Attitudes and innovation factors affecting smartphone use in the Southeastern United States. *Perspect Health Inf Manag*. 2012; 9: 1. PMID: 22737094, PMCID: PMC3329206.
- 24) Mekic E, Kürşad Ozlen M. Acceptance of smart phones by users in BiH through extended technology acceptance model. *European Researcher*. 2014; 67(1-2): 136-49. doi: 10.13187/issn.2219-8229.
- 25) Venkatesh V, Thong JY, XU X. Consumer acceptance and use of information technology: extending the unified theory of acceptance and use of technology. *MIS Quarterly*. 2012; 36(1): 157-78.
- 26) Abdekhoda M, Ahmadi M, Gohari M, Noruzi A. The effects of organizational contextual factors on physicians' attitude toward adoption of Electronic Medical Records. *Journal of Biomedical Informatics*. 2015; 53: 174-9. doi: 10.1016/j.jbi.2014.10.008.
- 27) Tavakoli N, Jahanbakhsh M, Shahin A, Mokhtari H, Rafiei M. Electronic Medical record in central Polyclinic of isfahan oil industry: a case study based on technology acceptance model. *Acta Inform Med*. 2013; 21(1): 23-5. doi: 10.5455/AIM.2012.21.23-25. PMID: 23572857, PMCID: PMC3610586.
- 28) Hamidfar M, Limayem M, Zegordi H. Using the UTAUT Model to Explore Iranian Physicians and Nurses' Intention to Adopt Electronic Patient Records. the 2008 International Conference on E-Learning, E-Business, Enterprise Information System. 2008.
- 29) Howard LB, Warner VS. Reflections on electronic medical records: When doctors will use them and when they will not. *International journal of medical informatics*. 2010; 79(1): 1-4. doi: 10.1016/j.ijmedinf.2009.10.002.
- 30) Garavand A, Ghanbari Sh, Ebrahimi S, Kafashi M, Ahmadzadeh F. The Effective Factors in adopting Picture Archiving and Communication System in Shiraz Educational Hospitals Based on Technology Acceptance Model. *Journal of Health and Biomedical Informatics*. 2015; 1(2): 76-82.
- 31) de Veer AJ, Francke AL. Attitude of nursing staff towards electronic patient records: A questionnaire survey. *Int J Nurs Stud*. 2010; 47(7): 846-54. doi: 10.1016/j.ijnurstu.2009.11.016. PMID: 20022007.
- 32) Holtz B, Krein S. understanding Nurse Perceptions of a Newly Implemented Electronic Medical Record System. *Journal of Technology in Human Services*. 2011; 29(4): 247-62. doi: 10.1080/15228835.2011.639931.
- 33) Cohen J, Bancilhon JM, Jones M. south african physicians acceptance of e-prescribing technology: an empirical test of a modified UTAUT model. *SACJ*. 2013; 50: 43-54. doi: 10.18489/sacj.v50i1.175.
- 34) Monem H, Hussin AC, Sharifian R, Afrasiabi M. Neglected Role of User in Prominent IS Models and Framework. *International Journal of Computer Applications*. 2013; 72(1): 975-8887.