Effective Factors on Hospital Information System Acceptance: A Confirmatory Study in Iranian Hospitals

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Abstract: Introduction: Information technology acceptance by users is one of the subjects that if not being considered, it will cause organizations to lose their resources and healthcare field is not excluded in this rule. Therefore, investigating and recognizing the factors influencing information technology acceptance in organizations is a necessity. The purpose of this study was to determine the effective factors on Hospital Information Technology (HIS) by its users in non-teaching hospitals of Iran University of Medical Sciences located in Tehran. Methods: After the related models and theories were studied and compared and the literature was reviewed, the primary model included 7 variables was proposed. The questionnaire included 84 questions based on the variables was developed and its validity and reliability were tested and confirmed by expert panel and calculating Chronbach Alfa. Then the questionnaires were delivered among 278 users of HIS in the considered hospitals that were selected according to Morgan table and by using stratified random sampling method. To confirm the model and determine the relationship between variables with each other, Structural Equation Modeling (SEM) method was used by applying LISREL Software. Results: There was no significant relationship between each of the 2 variables (system Use and Mandatoriness) and other variables of the proposed model. The result of Chi square test showed that by elimination of 2 variables mentioned above, the model has fitness with the gathered data. The figures of the indices are: GFI=0.98, CFI=0.98, RMSEA=0.017, RMR=0.038. Conclusion: According to the results, the factors Perceived Ease of Use (PEU), Perceived Usefulness (PU), Subjective Norms (SN) and Satisfaction (SAT) influence user Behavioral Intention (BI) to use Hospital Information System in the considered hospitals.

Key words: Information System · Hospital · Technology Acceptance

INTRODUCTION

Nowadays healthcare organizations globally recognize the importance of investing in information technologies to improve the quality of care delivery and reduce costs [1]. In health and treatment field, it is an undeniable necessity to use the efficient information systems for meeting goals of efficiency, productivity, quality of services and also customer satisfaction [2].

Hospital Information System (HIS) is a mechanized document and information management system in hospitals. According to the wide developments in medical technology and increase in the patients' expectations, the increasing need of using HIS in hospitals has been considered more. In the era of information explosion and technology in health and treatment field, experts believe that any hospital lacking HIS in the 21st century is unable to compete with other hospitals. Hospital Information System is a strong information tool contributing managers in hospital administration process and making correct decisions and considerably increasing the positive performance of hospitals [3].

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Organizations are investing heavily in information systems (IS) as they seek to remain competitive and survive in the market place. In 1999, it was estimated that worldwide expenditure in information technology (IT) is in excess of one trillion dollars per year and continues to grow at a rate of approximately 10 percent annually. Even with such large investments, many information systems still result in failure. As organizations seek to achieve return on investments from IS, they must assess and understand what factors lead to the success of IS applications [4].

In many cases, employees of healthcare facilities do not intend to use the information system and it is ignored as supervision and pressure of authorities decrease [5]. Indeed, a system succeeds when its users intend to apply it regularly [6].

Generally, the purpose of an organized IS is to improve job performance. Unfortunately, the effects of the system performance are missed when individuals decide not to use the system. System acceptance by its user is a mainly principal and determinative factor in success or failure of an information system project [7].

Considering technological advances and the organizational behavior issues of system usage, it is critical to understand what causes users to accept or resist new information systems and the related security measures [8].

Previous findings from the "technology acceptance" literature, which has been widely popular in the IS field for the past few years, suggest that for an advantage to be attained, the technology in question must be accepted and used [9].

Practitioners and researchers require a better understanding of why people resist using computers in order to devise practical methods for evaluating systems, predicting how users will respond to them and improving user acceptance by altering the nature of systems and the processes by which they are implemented [10].

According to the study findings in Germany [11], one of the most important challenges in Hospital Information Management Systems development and optimization is human and computer interaction. The results of Hadianfar study [12] show that the main structural deficiency of Hospital Information System in Shiraz hospitals is related to the executive personnel, after which the software and hardware deficiencies are there respectively. Kimiafar [13] also showed that some users believe there are problems in different parts of Hospital Information System using in teaching hospitals of Mashhad University of Medical Sciences, requiring to be controlled by authorities.

Healthcare IT researchers must expand research strategies to include the patient-user perspectives [14].

The results of two researches in USA [15] and Italy [16] showed that the logic expectations and demands of information systems users in health system are the items which should be paid attention for obtaining success in planning, applying and developing such systems.

Decisions shall be made for reducing wastes of resources in health information systems. It is very important especially in a country like Iran where there is no strong planning and resources are difficult to achieve. In order to decrease the resource wastes, the reasons of the failure (or success) should be known [5].

According to the extensiveness of problems and barriers to apply Hospital Information Systems, it is necessary to conduct researches by using Technology Acceptance Models for deeper study of the obstacles to HIS application development in Iran [17].

Because the effectiveness of IS depends on its acceptance by users, a number of studies have examined the factors that affect the users acceptance using Davis Technology Acceptance Model (TAM) [18].

TAM, introduced by Davis *et al.* (1989) attempts to explain that a user's technology usage can be determined by their intention to use that given information technology. As mentioned in existing literature on technology development, the technology acceptance has been largely illustrated as an implication for the measurable success of IS implementation. There was a combination of both technical and sociological features that effect technology acceptance of particular applications [19].

Research findings of Hang, *et al.* [20] and Hang, Chen and Lee [21] showed that the managerial, organizational and technological factors have significant effects on decision making of technology adoption in the hospitals.

A model is offered and analyzed in order to conduct the cross-sectional survey aiming at recognition of effective factors on information technology acceptance and use in Thailand health facilities. In addition, the barriers of users for using health information technology were recognized in this research as the inadequate IT training, lack of managerial supports and unavailable internet connectivity [22].

Although some research have been conducted about the technology acceptance in the fields of banking, academic libraries and e-learning systems throughout the country [7, 23, 6], the effective factors on technology acceptance in Iran health and treatment environment has

not been yet studied. Therefore, the current research was carried out with the purpose of recognizing effective factors on Hospital Information System acceptance in non-teaching hospitals of Iran University of Medical Sciences located in Tehran and through the model test, it is finding this fact that what dimensions shall be paid attention by managers for HIS implementation to have a more complete success in application of this system and avoid waste of their investments?

MATERIAL AND METHODS

Technology Acceptance Model (TAM) has long been studied, modified and extended by IS researchers as a classical model for understanding individual's intention to use an IS [24]. The TAM proved that acceptance of computing technology was based primarily on two major characteristics of technology (Perceived Usefulness and Perceived Ease of Use) [25].

The main variables of the research model were determined based on reviewing the subject literature and many related studies and models about technology acceptance and then the proposed integrated model was drown up:

In order to measure the situation of Hospital Information System acceptance by users, a questionnaire was developed based on reviewing theoretical basis of the study and the questions applied in the related past studies. The questionnaire included a demographic characteristics section and also 7 main parts with 84 questions to assess the variables including: Perceived Ease of Use (PEU), Perceived Usefulness (PU), Subjective Norms (SN), user Satisfaction (SAT), user Behavioral Intention (BI), Mandatoriness of system use (Mand) and system Use (USE),.

Most of the questions of the research tool were ranged from strongly disagree=1 to strongly agree=5 (except satisfaction with 7 degree criteria). The validity of the questions was tested by using expert panel and according to the views of the limited number of the studied population (33 individuals).

In order to test the reliability of the questionnaire, Alpha Chronbch coefficient was used in two stages. After the study, the results of calculating reliability coefficient of each of the variables were: PEU=0.89, PU= 0.95, SN= 0.87, SAT= 0.94, BI= 0.88, Mand= 0.88, Use= 0.85. These figures were somehow similar to the calculated reliability coefficient in the pilot test. Considering total Alpha Chronbach coefficient was 0.96 and its subtests were more than 0.70, the questionnaire reliability was confirmed.

The environment of the study consisted of 5 non-teaching hospitals of Iran University of Medical Sciences located in Tehran. Statistical population of the study included all users of the Hospital Information System (HIS) in the hospitals on study. The sample users were selected according to Morgan table and by applying stratified random sampling method and 278 questionnaires were delivered, completed and gathered among the participants.

The gathered demographic data were analyzed by using descriptive statistics. To confirm the extracted model and to determine the relationships between the variables with each other, Structural Equation Modeling (SEM) was applied and the fitness of the model was studied by using LISREL Software 8.7.

Graphic schema of the mathematical model was designed by drawing direct and indirect relations between the variables and then fitting indices of the model were calculated and studied. Fitting Indices include: Chi square Index, Goodness of Fit Index (GFI), Comparative Fit Index (CFI), Adjusted Goodness of Fit Index (AGFI), Root Mean Square Error of Approximation (RMSEA) and Root Mean Residual (RMR).

Almost all experts deem Chi-square/df ratio smaller than 3 the suitable fitting of a model [26]. The fitting indices GFI and CFI more than 0.90 and RMSEA and RMR smaller than 0.50 show the appropriate and desired fitting [27].

RESULTS

Most of the study participants almost include women (78%), less than 30 years old, holding Bachelor's Degree, employed on contractual basis, with less than 10 years working experience.

Correlation and internal consistency coefficient of the variables were evaluated suitable. After drawing graphic schema of the mathematical model, fitting indices of the model were calculated and studied. Two variables "system Use (Use)" and "Mandatoriness of use (Mand)" had no significant relationship with other variables of the model. So, two above mentioned variables were ignored. Chi-square test showed that the model is fitting to the data if these two variables are omitted χ^2 (N=278, df =1) =1.07, P>0.05.

Table 1: Percentage Frequency of the Demographic Characteristics of the Participants

Demographic Characteristics	Groups	Percentage Frequency
Sex	Female	78
	Male	22
Age Group	Less than 30	51
	31-40	33
	More than 41	16
Education	Diploma and Less	22
	Associate's Degree	15
	Bachelor's Degree	60
	Master's Degree and Higher	3
Working Experience	Less than 10 Years	68
	11-20 Years	26
	21-30 Years	6

Table 2: Fitting Indices of the Model of Hospital Information System Acceptance in the Hospitals on Study

P	2χ	GFI	AGFI	CFI	RMSEA	RMR
P>0.05	1.07	0.98	0.92	0.98	0.017	0.038

Table 3: Path Coefficients of the Model of Hospital Information System Acceptance in the Hospitals on Study

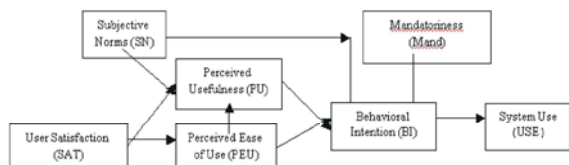| Latent Variables	Coefficient	P	t	Standard Error	R^2
SN - PEU	0.17	0.05	3.21	36.19	0.29
SAT - PEU	0.17	0.023	7.36		
SN - PU	0.38	0.05	6.15	68.55	0.51
SAT - PU	0.29	0.033	11.10		
SN - BI	0.14	0.041	5.72	22.36	0.42
SAT - BI	0.08	0.021	8.72		
PU - BI	0.21	0.047			
PEU - PU	0.35	0.049			

Fig. 1: The Proposed Model of Hospital Information System Acceptance in the Hospitals on Study
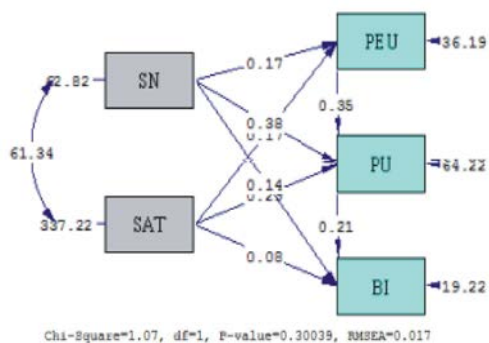

Fig. 2: Path Diagram of the Model of Hospital Information System Acceptance in the Hospitals on Study

χ^2 / df for the model of the study was equal to 1.07 that shows acceptable fitness of the model with the data (Table 2).

Reviewing fitting indices such as CFI, GFI, AGFI more than 0.9 and RMSEA equal to 0.017, according to the obtained rates, it may be told that the following model has a suitable fitting to the data.

Most of the relations between variables on study were confirmed. Also, user Satisfaction (SAT), as well as the drawing relations in the suggested model, was effective on user Behavioral Intention to use the system (BI). In addition, Subjective Norms (SN) influences on Perceived Ease of Use (PEU) according to this model. Though no direct relationship was approved between Perceived Ease of Use (PEU) and Behavioral Intention (BI), PEU indirectly influenced on variable BI through variable Perceived Usefulness (PU).

Covariance between error of user Satisfaction (SAT) and Subjective Norms (SN) was =61.34, being significant with probability less than 0.01. The study of factor loadings and the multiple correlation square rates showed all the supposed paths were significant.

DISCUSSION AND CONCLUSION

The present study showed that three variables (PEU, PU, SN) had direct or indirect effects on BI and it was supported by Salavati's study [7] that the mentioned variables had influence on BI for using electronic banking system among personnel of National Bank in Tehran. However, the effect of Mandatoriness on BI was not confirmed in the current research and just in this case, the findings of the two researches are not similar.

The influence of PEU and PU on BI is also in compliance with the results of Sheikh Shoaei study [23]. According to the current study, BI is not effective on Use of HIS. However, it contrasts with Sheikh Shoaei study [23] who found a direct effect of BI on Use of IT in the libraries of engineering faculties of state universities of Tehran.

Proving the relationship between SAT and BI in this study confirms the findings of Ghahremani's research [6] who determined that there is a very strong relationship between SAT and BI for applying electronic learning system among students of e-learning course of Amirkabir, Shiraz and Science and Industry University.

Duyck, *et al.* [28] applied in a research, Unified Theory of Acceptance and Use of Technology (UTAUT) model in radiology ward of an academic hospital in Belgium and according to the obtained findings, recognized the model suitable for evaluation of technology acceptance in this environment. The results showed that radiologists and technologists were positive and intended to use the Picture Archiving and Communication System (PACS).

The current research represented that PEU influences on BI and PU suggested this relationship indirectly. In his study, Davis [29] offered an evidence showing confirmation of benefits of personal Electronic Health Record acceptance by persons older than 65. In that study, the research model was used as a measure of studying quality factors effecting on use and efficiency of personal Electronic Health Record in viewpoint of persons on study and the collected data analysis showed that a high number of old people in three states of USA had accepted the system. The confirmed model of technology acceptance showed again that there are two specifications significant for technology acceptance: PEU and PU.

In order to perform a cross-sectional survey in Thai society health centers, Kijsanayotin [22] analyzed his research model with the purpose of recognizing effective factors on using IT. Data of his research showed the high level of acceptance and positive view of people on study for using health information technology.

One of the recognized relationships in this research is the relationship between SN and BI for using HIS and it is in compliance with the findings of Kowalczyk [30] who conducted the survey of the views of radiologists working in healthcare facilities in USA about Digital Imaging Technology.

Findings of this research are in line with the results of Wu, *et al.* [31] study so that PU and PEU and SN affect healthcare professional intention (BI) to use an Adverse Event Reporting System.

According to the desirability of fitting indices calculated in the model and also concordance between the results of this study and many related researches in the field of technology acceptance, it can be concluded that the relevant authorities of hospitals on study may be contributed in the further comprehensiveness and successful application of HIS through recognition of effective factors on user Intention to use the system.

REFERENCES

1. Ozogul, C.O., E.E. Karsak and E.A. Tolga, 2009. Real Options approach for evaluation and justification of a Hospital Information System. The J. Systems and Software, 82: 2011-2102.

2. Siamiyan, H., K. AliGolbandi, E. Nasiri and A. Shahrabi, 2005. The role of Health Information Management in Hospital Management. Journal of Iranian center of Scientific Records and Information, 4(3): 19-28.

3. Mooseli, L., 2008. Hospital Information System (HIS). The Abstract Articles of the Sixth Conference of Health Care Management Students, Tehran. Iran.

4. Thomas, P., 2008. Information Systems success and Technology Acceptance within a government organization. PhD Dissertation, University of North Texas, U.S.A.

5. Setayesh, H., 2005. A study of some current Health Information Systems in Iran. M.S. Thesis. Tehran University of Medical Sciences and Health Services, Iran.

6. Ghahremani, S., 2007. A model of effective factors on Electronic Learning System acceptance. M.S. Thesis. Tarbiat Modares University, Iran.

7. Salavati, M., 2004. A study of effective factors on Technology Acceptance on Electronic Banking in Iranian National Bank. M.S. Thesis. Mazandaran University, Iran.

8. Jones, C.M., 2009. Utilizing the Technology Acceptance Model to assess employee adoption Information Systems security measures. DBA Dissertation, Nova Southeastern University, Florida, U.S.A.

9. Ciganek, A.P., E. Mao and M. Srite, 2008. Organizational culture for Knowledge Management Systems: A study of corporate users. International Journal of Knowledge Manage., 4(1): 1-16.

10. Davis, F.D., R.P. Bagozzi and P.R. Warshaw, 1989. User acceptance of computer technology: A comparison of two theoretical models. Management Sci., 35(8): 982-1003.

11. Kuhn, K.A. and D.A. Giuse, 2001. From Hospital Information Systems to Health Information Systems: Problems, challenges, perspectives. Institute of Medical Informatics. Philips University, Marburg, Germany.

12. Hadiyanfar, A.M., 2002. A study of the structural situation of Hospital Information System in Shiraz Hospitals. M.S. Thesis. Shahid Beheshti University of Medical Sciences, Iran.

13. Kimiyafar, K.H., 2006. A study of users views about Hospital Information System quality in Teaching Hospitals of Mashhad University of Medical Sciences. M.S. Thesis, Iran University of Medical Sciences and Health Services, Iran.

14. Liu, J.J., 2009. Pervasive Tele-monitoring for patients living with chronic heart failure: A quantitative study of Telemedicine Acceptance, PhD Dissertation, Capella University, U.S.A.

15. W.H.O. 1992. The hospital in rural and urban districts: Report of a WHO study group on the functions of hospitals on the first referral level, Geneva, Switzerland.

16. Ferrara, F.M., 2000. Architecture of Health Information Systems state of the art and new perspectives. Amministratore Delegato della GESI Gestione Sistemi per informatica S. R. I. Roma, Italy.

17. Zamani, O., 2005. Designing a framework to evaluate Hospital Information Systems and using it for created systems in Iran, MPH Thesis, Tehran University of Medical Sciences and Health Services, Iran.

18. Lee, S. and B.G. Kim, 2009. Factors affecting the usage of Intranet: A confirmatory study. Computers in Human Behavior, 25: 191-201.

19. Vanthanophas, V., N. Krittayaphongphun and C. Klomsiri, 2008. Technology Acceptance toward E-Government initiative in Royal Thai. Navy. Emerald, 2(4): 256-282.

20. Hung, S.Y., W.H. Hung, C.A. Tsai and S.C. Jiang, 2010. Critical factors of hospital adoption on CRM System: Organizational and Information System perspectives. Decision Support Systems, 48: 592- 603.

21. Hung, S.Y., C.C. Chen and W.J. Lee, 2009. Moving hospitals toward E-Learning adoption: An empirical investigation. Journal of Organizational Change Management (JOCM), 22(3): 239-256.

22. Kijsanayotin, B., 2008. Penetration, Acceptance and use of Health Information Technology in Thailand's Community Health Center. PhD Dissertation, University of Minnesota, U.S.A.

23. Sheikh-Shoaie, F., 2006. A study of effective factors on Information Technology Acceptance by librarian of technical college libraries of Tehran public universities: Applicability of Technology Acceptance Model. M.S. Thesis. Tehran University, Iran.

24. Reid, M., 2008. Integrating trust and computer self-efficacy into the Technology Acceptance Model: Their impact on customers' use of Banking Information Systems in Jamaica. PhD Dissertation, Nova Southeastern University, U.S.A.

25. Merchant, S., 2007. Exploring the influence of cultural values on the Acceptance of Information Technology: An application of the Technology Acceptance Model, USA, Issues in Informing Science and Information Technol., 4: 431-443.

26. Giles, D.C., 2002. Advanced research methods in psychology. Routledge, New York, U.S.A.

27. Alexopoulos, D.S. and I. Kalaitzidis, 2004. Psychometric properties of Eysench Personality Questionnaire-Revised (EPQ-R) short scale in Greece. Personality and Individual Differences, 3(7): 1205-20.

28. Duyck, P., B. Pynoo, P. Devolder, T. Voet, L. Adang and J. Vercruysse, 2008. User Acceptance of a Picture Archiving and Communication System applying the Unified Theory of Acceptance and Use of Technology in a radiological setting. Methods Info Med., pp: 2.

29. Davis, D.L., 2008. Acceptance of Personal Health Record Technology: A survey analysis of the elderly. PhD Dissertation, Capella University, U.S.A.

30. Kowalczyk, N.K., 2008. The impact of voluntariness, gender and age on subjective norm and intention to use Digital Imaging Technology in a healthcare environment: Testing a theoretical model. PhD Dissertation. The Ohio State University, U.S.A.

31. Wu, J.H., W.S. Shen, L.M. Lin, R.A. Greens and D.W. Bates, 2008. Testing the Technology Acceptance Model for evaluating healthcare professionals' intention to use an Adverse Event Reporting System. International J. Quality in health Care, 20(2): 123-129