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Adoption of Hospital Information System Among Nurses: a Technology Acceptance Model Approach

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ABSTRACT

Introduction: The successful implementation of Hospital Information Systems (HIS) depends on user acceptance. Nurses are the largest group of HIS users in hospitals. This study aims to evaluate some factors may affect the utilization of the Hospital Information System. **Aim.** To explore factors that contribute to using of Hospital Information System. **Methods:** In this cross-sectional study, 325 nurses from training Hospitals affiliated with Lorestan University of Medical Sciences (LUMS) were chosen. A valid and reliable structured questionnaire based on Technology Acceptance Model 1&2 and Unified Theory of Acceptance and Use of Technology was used as the data collection tool. Descriptive statistics, Correlations analysis, multiple regression analysis, path analysis technique, Structure Equation Model using AMOS software was used to examine factors that influenced the Adoption of Hospital Information System. **Results:** The findings indicate a significant direct relationship between Management Support and Perceived Usefulness of HIS. Perceived Usefulness has a significant effect on attitudes. While there was no significant effect of perceived ease of use on attitude. Attitude has a significant effect on behavioral intention. **Conclusion:** This research provides a tool to realize what factors undertake the behavioral intention of healthcare professionals to use hospital information system and how this may affect future use.

Keywords. Hospital Information System, User Acceptance, Implantation, Technology Acceptance Model.

1. INTRODUCTION

Companies are increasing investments in new technologies in order to improve their access to information and gain competitive advantages. Global competition requires organizations to reduce cost, increase productivity, and increase their dependence on information technology (1).

Health care industry plays an essential role in the economy and is highly dependent on information technology (2). Health care Organizations implement new technologies to improve the quality and efficiency of their services. Hospital Information System (HIS) is one of these technologies aiming health care professionals in the process of health care production and delivery (3).

HIS is an integrated information system that plays a key role in supporting the hospitals through the use of appropriate health care information technology. Hospitals are getting more and more dependent on the capabilities of HIS for diagnostic, administrative, and training processes to improve

the quality of their services and performances (4).

Although HIS often improves the quality of services and reduces costs, it needs to assess its users to ensure better quality, reliability, and maintenance (5). Understanding the readiness and willingness of nurses to implement new information technology is critical since they are the largest group of end users of the system (6) and their ability in clinical decisions is an important factor influencing the quality of care (7). Moody found that nurses' attitudes toward and their perception and understanding of HIS, have impacts on computerized medical records. Lee (2006) found that; knowledge, experience, and judgment of nurses can be promoted through computer technology (8).

Research history on the adoption of information technology has a history of more than 30 years. During this period, different theoretical models have been designed and implemented to evaluate an individual's adoption of new technology. Technology Acceptance Model (TAM) is one of these approaches (9).

TAM proposed by Davis in 1989, based on the Theory of Reasoned Action (TRA) by Fishbein & Ajzen, aimed to find out the reasons behind the individuals' choice to accept or reject a new technology (10–13). TAM specifically applicable in the field of information technology, because it is focused on the two particular variables of perceived usefulness and perceived ease of use affecting the implementation of new technologies (14). The original pattern of TAM is based on the factors related to perceived ease of the system use, perceived usefulness, attitude to use, intention to use and actual use of the system (13). Researchers have developed the Technology Acceptance Model (11). According to Galletta & Malhotra (1999) TAM model is not efficient for social influence in the acceptance and use of new information systems.

Davis also believes that research on the adoption of such technologies should be performed on the other variables affecting the TAM model. Therefore, TAM was revised, and Technology Acceptance Model 2 was introduced in order to include integrated theoretical structures (2, 10, 15, 16).

2. AIM

This study aims to determine factors affecting user acceptance of HIS using the Technology Acceptance Model among nurses working at training

hospitals in Khorramabad.

3. METHODS

The current cross-sectional study aimed to investigate the factors influencing the adoption of HIS. This study was conducted on nurses employed at Khorramabad training hospital. The study questionnaire was delivered to all full-time and part-time nurses. With an answer rate of 81 percent, 325 completed questionnaires returned from a total of 400. Based on the previous researches in this area factors influencing the adoption of HIS had been collected through study questionnaire asking for perceived ease of use, perceived usefulness, attitude, behavioral intention, actual use, training, user satisfaction, management support, technical support of information technology sector and computer anxiety (fear of using computers) were identified and offered our proposed model. Survey questions were chosen from a model of TAM and UTAUT and TAM2, to determine factors influencing the adoption of HIS among nurses.

The validity of the questionnaire was confirmed by reviewing the literature and using expert (faculty members) opinion (content validity) and confirmatory factor analysis, and its Reliability calculated by using ICC and Cronbach α coefficient of the 24 samples that were selected randomly. Due to high levels of 0.7 for Cronbach α is optimal, and in this study, all Cronbach α values for all variables was over 0.7; therefore the reliability of the data was confirmed.

The questionnaire consisted of a short introduction stating the purpose of the study. The first part of the questionnaire included demographic information such as gender, age, years of service, education, the organizational position, and marital status and the second part includes 59 questions expressed using a 5–item Likert scale (strongly agree to disagree strongly).

Two final questions measured the frequency of respondents experience with HIS using a Likert scale. Descriptive statistics, correlation coefficient tests, multiple linear regression analysis (stepwise), path analysis and statistical equation model (SEM) were performed for data analysis.

Since most of the independent variables in the proposed model were somehow related to each other and as a result, conventional multiple linear regression analysis was suffered from Multicollinearity. Path analysis model was used as a sup-

plement for multiple linear regression for defeating this problem. AMOS software package was used for data analysis. In term of Ethical issues several considerations have been included: before data collection, the research proposal was approved in research deputy of the university and written permission was issued for conducting the study. Informed consent of the respondents and the issue of anonymity and confidentiality was obtained through researchers descriptions about the aim of the research in face to face encounters by respondents and in the introductory paragraph at the survey questionnaire.

4. RESULTS

Of 400 questionnaires distributed among nurses, 325 questionnaires were returned. Table 1. Show Descriptive statistics for gender, age, years of service (employment), and the level of education. Most respondents were female (80.9), and the level of education of the most participants was the bachelor.

Variable	Group	Samples size
gender	Male	62 (19.1%)
	Female	263 (80.9%)
Age Group	< 25	86 (26.5%)
	25 to 34	168 (51.7%)
	35 to 44	53 (16.3%)
	45 to 54	18 (5.5%)
Years of service	<5	175 (53.8%)
	5 to 9	68 (20.9%)
	10 to 14	47 (14.5%)
	15 to 19	20 (6.2%)
	>20	15 (4.6%)
Education	AS	24 (7.4%)
	BS	291 (89.5%)
	MS	10 (3.1%)

Table 1. Characteristics of the respondents

Model framework and testing hypotheses based on regression coefficients are shown in Figure 1.

The results of the correlation between all variables are shown in Table 2.

Chi-square over degrees of freedom ($x2 / df$) was estimated for testing the fitness of the model. Most experts consider the fitness value less than three as the indicator of reasonable fitness. Fitness indices of PNFI and PCFI were estimated. The more the values of these indices close to one, the more fitted the proposed model.

The more close the value of Root Mean Square Error of Approximation to zero, the more accurate fitness of the model. Fitness indices are shown in Table 3.

Factor loading was used to verify the reliability of the items and is presented in Table 4.

5. DISCUSSION

Previous studies suggest that adoption of hospital information systems by nurses has a dramatic effect on the improvement of hospital services. By proposing a conceptual model, this study aims to evaluate the factors influencing the adoption of HIS among nurses. Findings of the current study can help managers to consider critical factors influencing the process of development and utilization of HIS as an infrastructure for the development and improvement of the hospital system.

The study analysis suggests that the training

RMSEA	PNFI	PCFI	(x^2/df)
0.069(0.066 - 0.071)	.793	.886	2.617

Table 3. Summary of overall fit indices for the measurement model

Factor	1	2	3	4	5	6	7	8	9	10
1. Attitude	1.000									
2. Perceived ease of use	0.423**	1.000								
3. perceive of usefulness	0.551**	0.404**	1.000							
4. Training	0.473**	0.364**	0.397**	1.000						
5. Actual Use	0.246**	0.243**	0.264**	0.344**	1.000					
6. User Satisfaction	0.391**	0.146**	0.345**	0.393**	0.374**	1.000				
7. Management Support	0.468**	0.297**	0.391**	0.438**	0.286**	0.550**	1.000			
8. IT Support	0.398**	0.284**	0.388**	0.402**	0.261**	0.486**	0.595**	1.000		
9. Behavioral Intention	0.466**	0.327**	0.315**	0.314**	0.284**	0.133*	0.239**	0.216**	1.000	
10. Computer Anxiety	- 0.064	- 0.100	0.043	0.044	0.079	0.191**	0.178**	0.124*	-0.242**	1.000

Table 2. Discriminant validity

Factor	Item	Factor Loading	Cronbach α	Factor	Item	Factor Loading	Cronbach α
Attitude	A1	0.660		**User Satisfaction**	US1	0.677	
	A2	0.685			US2	0.606	
	A3	0.500			US3	0.758	0.817
	A4	0.679	0.885		US4	0.596	
	A5	0.724			US5	0.665	
	A6	0.767			US6	0.544	
	A7	0.582					
	A8	0.606					
	A9	0.731					
Perceived ease of use	PEOU1	0.831		**Management Support**	MS1	0.548	
	PEOU2	0.849			MS2	0.661	
	PEOU3	0.765	0.816		MS3	0.790	0.866
	PEOU4	0.702			MS4	0.818	
	PEOU5	0.279			MS5	0.816	
					MS6	0.648	
					MS7	0.562	
Perceived usefulness	PU1	0.627		**IT Support**	ITS1	0.645	
	PU2	0.614			ITS2	0.754	
	PU3	0.591	0.818		ITS3	0.764	0.876
	PU4	0.658			ITS4	0.816	
	PU5	0.746			ITS5	0.755	
					ITS6	0.685	
Training	T1	0.624		**Behavioral Intention**	BI1	0.186	
	T2	0.739			BI2	-0.721	0.801
	T3	0.518	0.655		BI3	-0.810	
	T4	0.429					
Actual Use	AC1	0.598		**Computer Anxiety**	CA1	0.193	
	AC2	0.668			CA2	0.183	
	AC3	0.755			CA3	0.792	0.855
	AC4	0.716	0.801		CA4	0.933	
	AC5	0.776			CA5	0.894	
	AC6	0.645			CA6	0.942	
	AC7	0.216					
	AC8	0.231					

Table 4. Construct reliability

factor has a positive and significant effect on nurses' perception of the ease and usefulness of the HIS implementation. Due to these direct relation between related training and readiness of individual for working with HIS, it seems that HIS related training through workshops, brochures can be an important factor in the adoption of technology by nurses. By more and correctly targeted training, the system can be perceived more and more user-friendly and users perform quickly, and ultimately the effectiveness of their activities and level of satisfaction would be increased.

Research's findings confirm that the presence of technical support and guidelines for information technology system has a direct and significant impact on the perceived usefulness and ease of HIS and finally on nurses satisfaction of HIS. When nurses make sure that the IT department staff always are available for answering their questions and solving their technical problems encountered in the process of using HIS, they will feel more comfortable in working with the new HIS and more satisfied with the introduction of new HIS. Since strong administrative support is a critical factor to create a suitable environment for HIS (13), it is more beneficial to establish strong administrative support for HIS and nurses will feel more determined to implement HIS if it is followed by sound management and administrative support. Lee et al. believe that if top-level management promote nurses participation in decision-making process and provide proper and efficient support through available organizational resources in the process of implementation of HIS and information technology programs, Nurses will be encouraged to participate, and this would lead to an increase in the perceived level of easiness and usefulness of HIS and its acceptance (4). According to the results, if hospital managers and information sector be able to resolve professionals needs for patient safety in the process of HIS design and implementation of HIS, the advantages of HIS utilization will be increased.
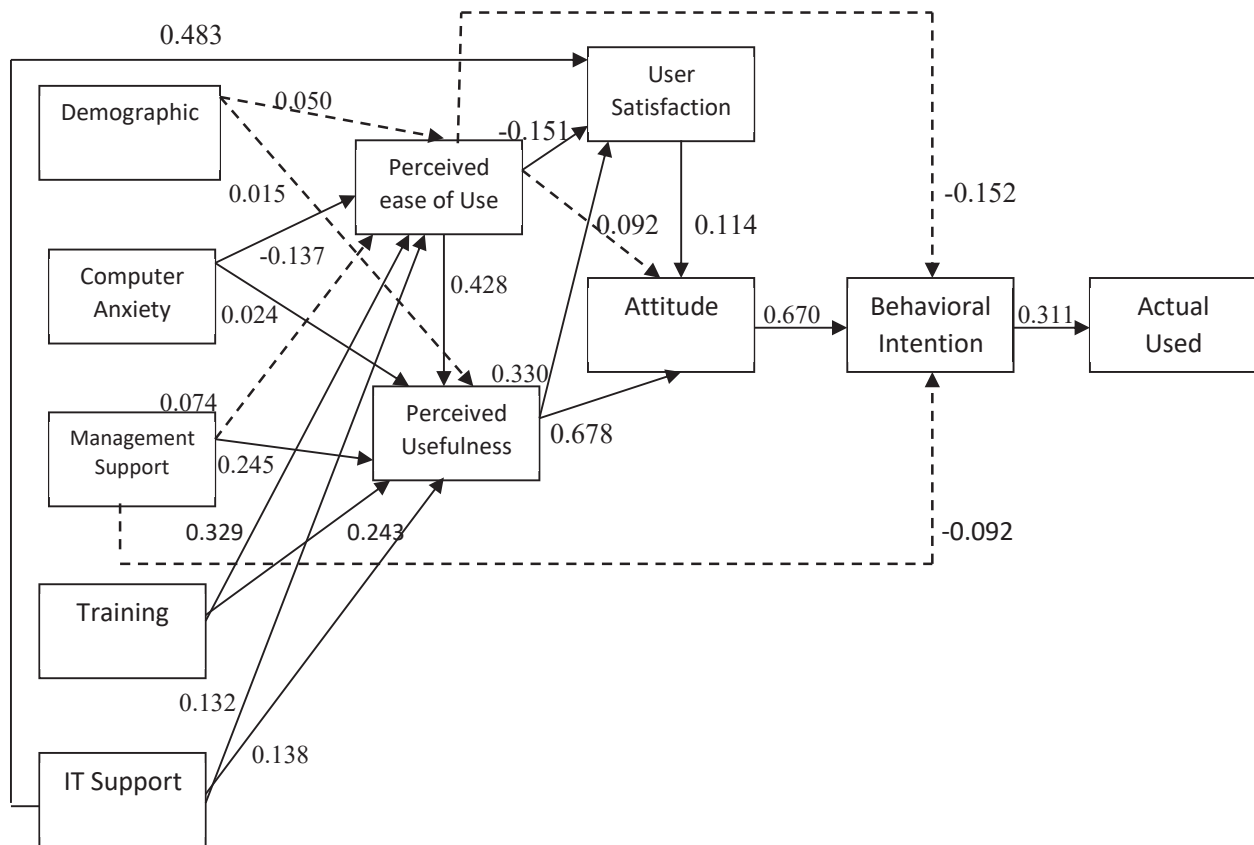
Figure 1. Model framework and testing hypotheses based on regression coefficients

The Significant relationship between perceived usefulness, attitude, and satisfaction in the proposed model suggests that a more positive attitude of nurses toward HIS usefulness is related to more satisfaction. Moreover, due to the indirect effect of perceived usefulness on behavioral intention, they will be more determined to utilize HIS. The lack of a significant relationship between perceived ease of use and attitude was following the findings of Kowitlawakul et al. (6).

As can be seen in the model, computer anxiety has a significant effect on the usefulness and ease of HIS using. Computer anxiety is an unpleasant aspect which may include negative emotional states during interaction with the computer.

If nurses experience negative consequences of computer anxiety during work with HIS, may cause a reduction in their motivation to accept the work and work with this technology. Consequently, the quality of their work and the number of errors will be increased. In this context, Chen et al. (17) concluded that computer anxiety has no effect on perceived usefulness but has an adverse effect on perceived ease of use.

6. CONCLUSION

In studied hospitals, lack of adequate education and inadequate allocation of budget to orientating nurses, nurses' fear of using technology has been observed. One of the main reasons for nurses' resistance is the lack of awareness of new technology. Holding Adequate and related training workshops for nurses before and after the arrival of the new technology will decrease their anxiety and concerns.

In general, it can be said that the findings of our study can help nursing management and system developers to identify the complexity of launching information technology as well the needs and concerns of nurses to develop a user-friendly system. Since a user-friendly system can help to decreased cost and time of documentation, it will lead to more cooperative and congruent activities among different sections of hospitals.

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