



## The Impact of Hospital Information System on Nurses' Satisfaction in Iranian Public Hospitals: the Moderating Role of Computer Literacy

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### Abstract

This study aimed to investigate the impact of the hospital information system (HIS) on nurses' satisfaction in Iranian public hospitals and to examine the moderating effect of computer literacy. The study population consisted of nurses working in public hospitals in Iran. A sample of 385 Iranian public hospitals was surveyed and a total of 1912 questionnaires were collected over 9 months. The analytical method used to empirically test the proposed hypotheses was the SEM technique using SmartPLS3. Results showed that all four variables of nurses' attitude, system quality, information quality, and service quality had significant positive effects on nurses' satisfaction with HIS. The findings also indicated that the effects of nurses' attitude, system quality, and particularly service quality increased on nurses' satisfaction with HIS by rising computer literacy, and only the effect of

(computer literacy  $\times$  information quality) was not significant on satisfaction. The use of FIMIX, CTA, and permutation test analyses is the innovation of the analysis.

**Keywords:** HIS, Nurses' satisfaction, Computer literacy, Nurses' attitude.

## Introduction

A hospital information system or health information system (HIS) of a country is a comprehensive database and software for integration of statistical data, population surveys, facility surveys, personal records, service records, and official records for efficient management of health care services (Nengomasha et al., 2018). This integration of patient information aims to exchange comprehensive patient information between wards and other health centers to accelerate the process of patient care and treatment, improve quality, increase satisfaction, and reduce costs (Hoxha et al., 2020; Serrano et al., 2020). The ultimate goal of any HIS is to produce quality and timely information for evidence-based decisions and interventions (Sinha and Sinha, 2015). Therefore, HIS is an essential component of the health system in any country. However, HISs are said to be weak in developing countries due to the overall weakness of the information system and the dispersion of required information (Kamau et al., 2017). HIS should satisfy different users of health information such as patients, physicians, nurses, different communities, service providers, program managers, policymakers, fund providers, global agencies, and national organizations because they individually require information to measure the efficiency of health system, service quality, and optimal use of available resources (AbouZahr and Boerma, 2005). Developed countries have long been using this technology in healthcare. However, the implementation of this system in public hospitals in different regions of Iran requires the provision of cultural infrastructure, appropriate establishment technology, and completing health systems in accordance with global standards.

Today, the inadequacy and inefficiency of traditional and manual methods have replaced these methods with electronic techniques (Kelly et al., 2011). Actually, HIS is an essential requirement for hospitals, which causes them to effectively use the existing limited sources while taking care of patients. Furthermore, another important reason behind HIS is that it improves the quality of serving to the patient, supports education and makes the data accessible, keeps patient's reference experience and retrieves patient's experience rapidly, integrates the system of covering centers and fastens hospital related issues (Sauvan and Ozonoff, 2018). It will not be possible to utilize this technology and benefit from its effective

results unless it is accompanied by the adoption and application of the technology by nurses. The adoption of this technology has been associated with difficulties even in developed countries with highly developed health systems (Salameh et al., 2019). As such, the gap between nurses' expectations of using these information systems and what existed in practice led to decreased nurses' satisfaction over time (Laramee et al., 2012). The use of HIS has many advantages, including improving the quality of nursing records (Johnson et al., 2016), reducing medical errors (Mohammadi et al., 2016), changing the transferring method of medical records to elsewhere, helping to improve patient safety (Coffey et al., 2015), and lowering the costs of medical diagnosis and repeated similar tests (Menachemi & Collum, 2011). In spite of these benefits, further extensive research is required to improve this system, bring it closer to the expectations of nurses to achieve greater satisfaction, and enable the use of the system by nurses. This study aimed to investigate the impact of the hospital information system (HIS) on nurses' satisfaction in Iranian public hospitals and to examine the moderating effect of computer literacy.

## **Literature review and hypothesis development**

### **Nurses' satisfaction**

Among various departments involved in HIS, the nursing services department, with multiple tasks related to other departments, is one of the areas that have been highly influenced by the use of information technology (Lu et al., 2012). Related literature indicates that user behaviors and goals are associated with HIS satisfaction, the level of which can explain the future behaviors of hospital employees in the use of HIS (Salameh et al., 2019). To overcome user's resistance to the use of HIS, it is important to ensure the successful application of this new technology to obtain possible maximum advantage (Ali et al., 2016). Besides, one of the most important aspects of HIS is end-user feedback. An increasing number of users acknowledge the need for changes in the system, which favors user participation in system development and design, rendering end-users an important factor (Solatianaghizi et al., 2017). In HISs, end-users should be at the center of systems. In HIS assessments, the feelings, reactions, and behaviors of users should be taken into consideration (Sebetci, 2018).

User satisfaction has a major impact on users' behavior towards computer use and therefore on the use of the system so that user satisfaction is the most comprehensive method in the evaluation of information systems (Gürsel et al., 2014). Nurses' satisfaction as one of the main users of HIS is one of the most important evaluation criteria for the successful performance of HIS. Ignorance or underestimation of users' expectations, including nurses, will harm HIS adoption. One of the most important reasons for the failure of HIS in some hospitals is to ignore users' views and perceptions about the system (Bossen et al., 2013).

## Nurses' Attitude

As nurses constitute the majority of hospital manpower and deal with patient information and record more than other clinical groups, their viewpoints are of special importance in the adoption stage of HIS (Lu et al. al., 2012). The growth of technology has made nurses more associated with new tasks and responsibilities in addition to their existing duties in many areas related to home care and clinical and hospital settings (Kaya, 2011). A positive attitude and perception about the use of HIS leads to nursing care with good quality and prevent medication errors in nursing of patients. Therefore, nurses' attitudes and views are important about HIS; hence organizations can focus on HIS to improve nursing care (Şenol Çelik et al., 2017). It seems that the impact of HIS on the nursing care process could improve the quality of care and nursing documentation. However, nurses seem to resist slightly against technology. Some nurses are reluctant to work with HIS because these systems require nurses to change their style of working and even their performance. Nurses state that working with computers is a complicated task for them and as such justify their resistance to the use of computers in healthcare (Alquraini et al. 2007).

- **H1:** Nurses' attitude positively affects nurses' satisfaction.

## System quality

System quality addresses the issue of whether or not the system performs according to the user's need to support one's intended tasks. Ease of use is the most common criterion for measuring system quality among researchers who confirmed this criterion (Tilahun and Fritz, 2015). System reliability and credibility, response time, ease of use, and stability are other determinants of system assessment suggested by most of the researchers (Bossen et al., 2013; Garcia-Smith and Effken, 2013). To improve the quality of healthcare services and reduce their costs, health organizations have now increasingly recognized the importance of investing in information technologies. It is an undeniable fact that the health sector should use an effective and quality information system to achieve higher efficiency, greater productivity, improve service quality, and obtain patients' satisfaction (Tabibi et al., 2011; Sebetci, 2018). HIS, as a comprehensive and integrated information system, has been designed to manage administrative, financial, and medical conditions in hospitals (Praveen Kumar and Gomes, 2006). HIS consists of electronic health records that provide a comprehensive, realistic, and real-time history of its patients' health. The use of an information system enables officials to create a structured database of patient history, so that recorded data can enhance patient care, functional process care, medical personnel, diagnosis quality, and eventually increase hospital revenues (Aggelidis and Chatzoglou, 2012). HIS plays an important role in reducing medical errors, supporting health personnel, increasing patient care efficiency, and enhancing the quality of patient care (Sebetci, 2018).

- **H2:** System quality positively affects nurses' satisfaction.

## Information quality

Information quality refers to the performance criteria of an information system. The most common criteria used to measure information quality include perceived usefulness, perceived precision and accuracy, and being up-to-date (Tilahun and Fritz, 2015). The widespread use of information technology in the health sector has changed the attitude in health services, as electronic health services have facilitated and accelerated the sharing of health information (Piscotty et al. 2015). The most important benefits of a "standard nursing care plan" include the establishment of a common language in nursing activities and nursing education aiming at assessing and measuring patient care outcomes, creating information for nursing studies, and providing information flow among nurses (Monteiro 2015). With proper installation and operation of HIS in healthcare organizations, access to information, decision-making processes, reliability, employee productivity, and improved patient satisfaction will be considerably accelerated along with the reduction of costs (Sebetci, 2018). Additionally, HIS shortens the duration of decision making for diagnosis and treatment by providing reliable and accurate information about patients, which results in increased hospital revenues as a result of improved patients' satisfaction (Fadhil et al., 2012). HIS is expected to process enormous amounts of complex medical data and information.

Although sharing information is essential in comprehensive HISs, security and confidentiality are also important factors (Liu and Wang, 2015). Acharyulu (2012) emphasized the importance of complete, up-to-date, and reliable patient information and easy and timely access to this information. These systems can be applied to control a variety of parameters or intersystem activities such as hospital personnel information, finance, organizational structure and related technology, service delivery to patients, and so on (Sebetci, 2018).

- **H3:** Information quality positively affects nurses' satisfaction.

## Service quality

Service quality denotes available sustenance and support to the user, as well as internal and external infrastructure that support the correct adoption of electronic medical records. General criteria for measuring service quality include internal and external support (Tilahun and Fritz, 2015). In a study on the impact of HIS on nursing performance (Piscotio et al. 2015), it was found that nurses who often use electronic reminders embedded in the HIS had a greater understanding of the impact of this system on their performance, and were also much less inattentive of their nursing care compared to other nurses. However, some nurses find it difficult to use HIS and resist using a computer at work; they consider computer information systems to be a confusing and non-care modality (McBride et al. 2012). In recent years, in particular, it has been increasingly acknowledged that the computerization of HISs

significantly has influenced nurses' decision-making and skills, improving healthcare quality, and reducing service costs (Hoxha et al., 2020). This has led to the rapid advancement of technology at hospitals and the widespread use of computers in many of their working fields (Kaya, 2011). HIS generally supports hospital activities at the practical, tactical, and strategic levels, ultimately resulting in improved quality of provided services (Aghazadeh et al., 2012; Ismail et al., 2013).

- **H4:** Service quality positively affects nurses' satisfaction.

### **The mediating role of computer literacy and control variables**

Computer literacy refers to the knowledge and skills that enable people to use computers effectively for a particular task. Most assessments and case studies on HIS implementation report that lack of computer literacy to be a major cause of failure in HIS (Alwan et al., 2015). Nunes and Javier (2014) describe that computer literacy is an important factor in the relationship between service quality and user satisfaction. Most investigations suggest that the majority of nurses are not comfortable when using HIS and require computer and software training to use this system (Tilahun and Fritz, 2015). Most nurses admit that they do not know much about information technologies such as computer networks, hardware, or operating systems (Tilahun and Fritz, 2015). Managers play an important role in HIS training. Most HIS training for nurses is done by managers and this role continues with the provision of training sessions, training new staff, and support when promoting the clinical system (Şenol Çelik et al., 2017). Statistical studies have also demonstrated that measuring the impact of computer literacy influences the relationship between system quality and the use of computer information systems (Tilahun and Fritz, 2015). The above study also examined the controlling role of gender of nurses on the results of research hypotheses.

- **H5a:** The effect of nurses' attitude on nurses' satisfaction is moderated by computer literacy
- **H5b:** The effect of system quality on nurses' satisfaction is moderated by computer literacy
- **H5c:** The effect of information quality on nurses' satisfaction is moderated by computer literacy
- **H5d:** The effect of service quality on nurses' satisfaction is moderated by computer literacy
- **H 6:** Gender of nurses has no significant effect on satisfaction with HIS.

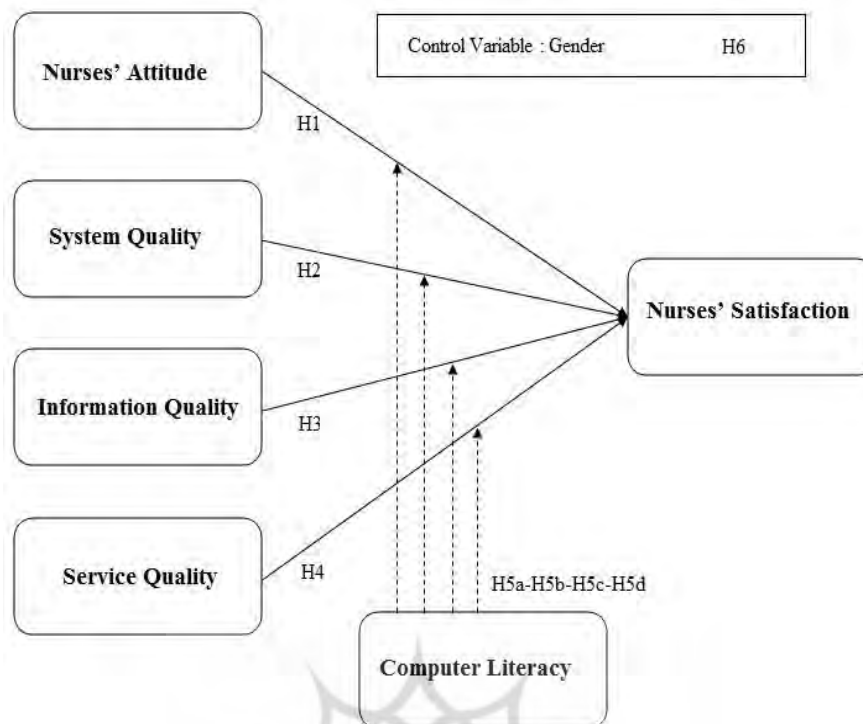


Figure 1. The conceptual model

## Methodology

### Sample size

The study population consisted of nurses working in public hospitals in Iran. According to information available at the Statistical Center of Iran ([www.amar.org.ir/english](http://www.amar.org.ir/english)), there are 954 active hospitals throughout Iran, of which 80 percent is state-owned and 20 percent is non-governmental hospitals. Regarding the number of public sector nurses, a total of 125,369 nursing staff including nursing experts and nurses with higher degrees, operating room, and anesthesia technicians, and practical nurses, nursing assistants, and assistant nurses are currently active in the Ministry of Health. Of these, 90,061 nurses hold bachelor and higher degrees. Female and male nursing staff comprise 78% and 22%, respectively. Nursing staff with permanent or contractual employment, nurses passing a compulsory training course, and those with service purchase contracts comprise 53%, 23%, and 24%, respectively. SPSS Sample Power (version 3) was used to determine the optimal sample size.

The largest number of variables in the multivariate regression model is 5, where a minimum value of sample size (382) was obtained considering a confidence level of 95%, a power of 0.95, and an increment to R-squared of 0.05.

Since this analysis was implemented at the organizational level, the mean of questionnaires per hospital was considered as the average of that hospital. A total of 385

hospitals was surveyed for more accuracy, and a total of 1,912 questionnaires was collected over 9 months with the help of medical universities throughout the country. Tehran with 30 hospitals had the highest contribution to the study sample, and Bushehr and Zahedan each with one hospital had the lowest contribution to the sample. Due to the in-person referring of researchers or representatives at hospitals, data were collected during a long period. Besides, it was not possible to send questionnaires online in most of the cities, or the researchers did not receive replies from questionnaires sent online to hospitals. In the research sample, female and male respondents were 81% and 19%, respectively. Most of the respondents were in the age group of 30-40 years (55.8%). Besides, 70.4% of the respondents held a bachelor's degree in nursing and had the necessary background and sufficiency to answer questions of the questionnaire.

### **Measures, reliability, and validity**

The questionnaire consisted of 22 closed-ended questions. A 5-point Likert scale divided the responses from 5 ("strongly agree") to 1 ("strongly disagree"). Nurses' attitude variable was measured with four items adapted from previous research (Salameh et al. 2019). Other research variables were measured using a questionnaire by Tilahun and Fritz (2015), with an emphasis on HIS. System quality variable was measured with three items including "Q6: HIS system is easy to use". The information quality variable was measured by four items including "Q12: With HIS system, I am able to access the information I need in time". To measure service quality variables, three items were measured including "Q13: My supervisor has been helpful in using the HIS". Finally, the dependent variable of nurses' satisfaction was evaluated with four items.

Measurement models were assessed by SmartPLS 3 software (Ringle et al., 2015). Reflective measurement models were confirmed through accuracy in the concept of questions and according to CTA (Confirmatory Tetrad Analysis) ( $p$ -value < 0.05) (Hair et al., 2018, p.88; Ebrahimi et al., 2019a).

The convergent validity of measurement models was assessed according to the values of outer loadings and the AVE index. Due to the reflective measurement models, the convergent validity was assessed using AVE values, with those above 0.5 (Henseler et al., 2015; Ebrahimi et al., 2016) indicating convergent validity of measurement models (Table 1). Also, values of outer loadings above 0.4 (Hair et al., 2006; Ebrahimi et al., 2017; Ebrahimi and Mirbargkar, 2017; Ebrahimi et al., 2018b; Janavi et al., 2020) indicate convergent validity of measurement models (Table 1).

The reliability of the questionnaire was assessed by Cronbach's alpha and composite reliability (CR) (Table 1). Some researchers suggest a value of 0.7 and above to be favorable points for Cronbach's alpha and CR (Sanchez, 2013; Hair et al., 2014; Khajeheian and



Ebrahimi, 2019; Arbatani et al., 2019). The values of these coefficients are higher than 0.7, which confirms the reliability of research means.

The VIF index was also calculated to examine multicollinearity for all items. Values less than 3.5 are considered to be favorable for the VIF index (Hair et al., 2014; Ebrahimi et al., 2019a; Ebrahimi et al., 2019b); in other words, there is no multicollinearity between independent variables (Table 1).

**Table 1. Measurement models, convergent validity, and reliability**

Constructs and items	Outer loadings	AVE	C. alpha	CR	VIF	Model type
<b>Nurses' attitude</b> (SD=0.680, M=4.272)		0.639	0.856	0.898		Reflective
Q1	0.862				2.864	
Q2	0.838				2.739	
Q3	0.812				2.149	
Q4	0.825				2.318	
Q5	0.641					
<b>System quality</b> (SD=0.620, M=4.322)		0.645	0.726	0.845		Reflective
Q6	0.772				1.416	
Q7	0.812				1.411	
Q8	0.824				1.456	
<b>Information quality</b> (SD=0.625, M=4.310)		0.657	0.824	0.884		Reflective
Q9	0.850				1.995	
Q10	0.710				1.406	
Q11	0.837				1.949	
Q12	0.837				1.911	
<b>Service quality</b> (SD=0.689, M=4.246)		0.698	0.784	0.873		Reflective
Q13	0.751				1.452	
Q14	0.880				1.930	
Q15	0.869				1.768	
<b>Nurses' satisfaction</b> (SD=0.603, M=4.311)		0.656	0.825	0.884		Reflective
Q16	0.777				1.621	
Q17	0.863				2.088	
Q18	0.805				1.789	
Q19	0.791				1.825	
<b>Computer literacy</b> (SD=0.677, M=4.516)		0.813	0.884	0.928		Reflective
Q20	0.845				1.960	
Q21	0.916				2.011	
Q22	0.940				1.868	

Notes: AVE, Average of Variance Extracted; C. alpha, Cronbach's alpha; CR, Composite Reliability; VIF, Variance Inflation Factor; SD, Standard Deviation; M, Mean.

Discriminant validity was assessed at the construct level by HTMT (Table 3). Values below 0.9 are considered to be favorable for this index (Henseler et al., 2015).

**Table 2. Discriminant validity with HTMT**

Variable	Computer literacy	Information quality	Nurses' attitude	Nurses' satisfaction	Service quality	System quality
Computer literacy						
Information quality	0.876					
Nurses' attitude	0.878	0.842				
Nurses' satisfaction	0.855	0.782	0.757			
Service quality	0.833	0.836	0.833	0.814		
System quality	0.837	0.777	0.780	0.757	0.838	

## Data analysis and findings

After confirming the reflective measurement models, the PLS-SEM approach was used with SmartPLS 3 software to assess the structural model and test the hypotheses in the second step (Ringle et al., 2015). Outlier data were examined for hypotheses before testing the hypotheses for better and more accurate results. The unobserved heterogeneity of the statistical population was studied with the FIMIX approach. The homogeneity of the population is confirmed given an entropy statistic normed of  $EN = 0.755$ , which is a positive and acceptable value (Ramaswami et al., 1993; Ebrahimi et al., 2018a; Hair et al., 2018; Ebrahimi et al., 2019b) that further confirms the results of testing hypotheses with greater confidence.

Software output was calculated after testing the conceptual research model (Figure 2). The model prediction ability was assessed using the Q<sup>2</sup> index, including construct cross-validated redundancy (CC-Red) and cross-validated communality (CC-Com), which is more desirable when values are closer to 1 (Stone, 1974; Geisser, 1974).  $R^2$  also indicates that independent variables explain 80.4% of the independent variable of Nurses' satisfaction. SRMR was also used as the main index to assess the whole model, including the structural model and measurement models. Values of less than 0.08 are considered optimal for the SRMR index (Hair et al., 2014). RMS-theta is another indicator of the model fit. RMS\_theta values below 0.12 indicate a well-fitting model, while higher values indicate a lack of fit (Henseler et al., 2014).

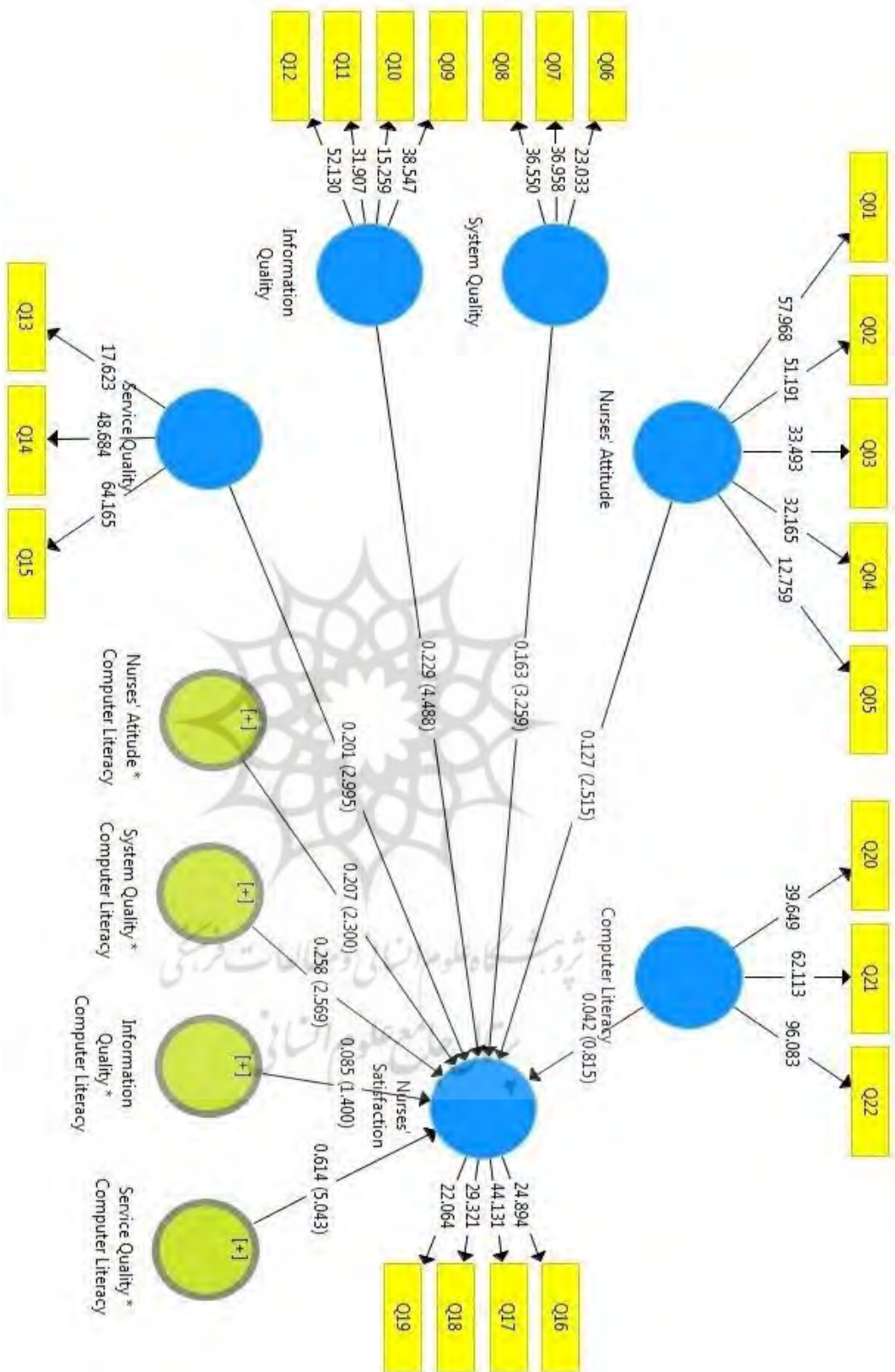


Figure 2. Path coefficients and T-statistics model

The direct effect was assessed to test the four hypotheses of H1, H2, H3, H4, all of which are supported due to  $t > 1.96$  and  $p < 0.05$  (Table 3). The H5a, H5b, H5c, and H5d hypotheses and the moderating role of computer literacy were examined by the product indicator measurement approach in SmartPLS 3 software. The moderating effect is significant for H5a in H5a hypothesis ( $\beta = 0.207$ ,  $t = 2.300$ ,  $p = 0.022$ ), so computer literacy is a moderator of nurses' attitude effect intensity on nurses' satisfaction. Given the positive value of coefficient, it can be claimed that the effect of nurses' attitude on nurses' satisfaction increases with rising nurses' computer literacy. Similarly, H5b ( $\beta = 0.258$ ,  $t = 2.569$ ,  $p = 0.011$ ) and H5d ( $\beta = 0.614$ ,  $t = 5.043$ ,  $p = 0.000$ ) are supported by the results. The impacts of system quality and service quality on nurses' satisfaction increase with rising computer literacy among nurses. In the case of H5c, no significant interaction effect was supported at a 95% confidence level.

The H6 and gender controlling effects were investigated through the permutation test (Sanchez, 2013; Hair, et al, 2018) to compare the two groups of male and female nurses. According to  $p$ -value  $> 0.05$  in permutation test results of all hypotheses, it can be stated that there were no statistically significant differences between the male and female nurses.

**Table 3. Results of research hypotheses and model fit**

Hypotheses	Direct effect	S. D	t-statistics	p-value	Decision	Moderation
H1	0.127	0.051	2.515*	0.012	Supported	
H2	0.163	0.050	3.259**	0.001	Supported	
H3	0.229	0.051	4.488***	0.000	Supported	
H4	0.201	0.067	2.995**	0.003	Supported	
H5a	0.207	0.090	2.300*	0.022	Supported	Yes
H5b	0.258	0.100	2.569*	0.011	Supported	Yes
H5c	0.085	0.061	1.400	0.162	Not Supported	No
H5d	0.614	0.122	5.043***	0.000	Supported	Yes
H6	No statistically significant differences were observed between the two groups of women and men based on a permutation test					

*Model fit criterions:*

R <sup>2</sup>	80.4%					
R <sup>2</sup> adjusted	79.9%					

SRMR(Saturated model) = 0.074 , SRMR(Estimated model) = 0.082

RMS\_theta = 0.112

CC-Red for dependent variable = 0.494

CC-Com = Computer literacy(0.561), Information quality(0.419), Nurses' attitude(0.453), Nurses' satisfaction(0.416), Service quality(0.388), system quality(0.298)

**Note:**  $t > 1.96$  at \*  $p < 0.05$ ;  $t > 2.58$  at \*\*  $p < 0.01$ ;  $t > 3.29$  at \*\*\*  $p < 0.001$ ; two-tailed test; SD, Standard Deviation;

## Discussion

The results of the research hypotheses demonstrate the significant effect of HIS on nurses' satisfaction in Iranian public hospitals. This finding has been confirmed in previous studies (Tilahun and Fritz, 2015; Senol Celik et al., 2017; Sebetci, 2018). Computer literacy also plays an important determining role in the level of satisfaction. Increasing computer literacy leads to a marked rise in service quality impact on nurses' satisfaction. This result is consistent with previous study of Tilahun and Fritz (2015). Computer literacy as an important factor has influenced nurses' attitudes towards using HIS. Accordingly, it is necessary to focus on computer literacy as a critical element in the adoption and use of HIS. It seems that computer literacy has been a missing link in HIS adoption. Our findings emphasize that special attention should be paid to educating nurses to enhance their computer literacy to obtain satisfaction with the use of HIS.

It is also clear from our results that service quality and system quality have remarkable impacts on nurses' satisfaction with HIS, which necessitates the use of up-to-date technology and ease of use. This result is consistent with previous studies (Tabibi et al., 2011; Piscotio et al. 2015; Tilahun and Fritz, 2015, Sebetci, 2018). Besides proper training, the effectiveness of HIS such that it can meet the expectations of nurses is important in addition to proper training. Therefore, the results emphasize that the ease of use, user-friendliness, and proper accountability of HIS have significant effects on the satisfaction of nurses who are the major users of HIS (Tilahun and Fritz, 2015). Moreover, the system format and its functionality can lead to higher satisfaction among nurses (Aghazadeh et al., 2012).

Theoretically, this study presented a research model to investigate the impact of research variables. The results showed that the impact of information quality on nurses' satisfaction was the strongest direct hypothesis confirmed by the research. The impact of information quality on end user satisfaction has been confirmed in previous studies (Fadhil et al., 2012; Tilahun and Fritz, 2015). The items of information quality point out that factors such as providing sufficient information through HIS, accuracy of provided information, complete reports, and access to the information within the shortest possible time have resulted in nurses' satisfaction with HIS in Iranian public hospitals. Given a high volume of clients in public hospitals, rapid access to and transfer of information, and provision of separate reports for patients are very time-consuming for nurses, hence the availability of HIS can drastically accelerate the process of nurses' tasks. The results confirm the hypothesis that information plays an important role in the performance of nurses and can eventually affect overall hospital performance and patient satisfaction (Sebetci, 2018). H5d is also the strongest supported hypothesis of the research. The results of this hypothesis showed that rising computer literacy was associated with a significantly increased impact of service quality on nurses' satisfaction. Service quality directly affected nurses' satisfaction, which greatly increased by adding the

moderating role of computer literacy. Computer literacy, which includes the literacy and knowledge needed to implement HIS, is a variable that should receive more attention in Iranian public hospitals because it strongly affects both service quality and the quality of using the HIS.

## Conclusion

This study emphasizes that computer literacy is an important variable which influences the use of HIS in Iranian public hospitals. Although nurses at different ages and education levels acknowledged the applicability of HIS, they also considered the need to reinforce computer literacy and believed that the quality and satisfaction with using HIS would improve with further training and increased skills. Moreover, this study examined the effectiveness of HIS among male and female nurses using a permutation test. No significant differences were observed between men and women and both groups emphasized the important role of HIS in hospital performance. In terms of management, this study emphasizes the need to pay attention to computer literacy and to update systems to influence the satisfaction of both nurses and patients, and ultimately hospital overall performance.

The considerable point in the results of the current study was that having increased computer literacy among nurses, the effect of service quality on nurses' satisfaction increased, as well. This issue is of utmost importance in the results of the current research since it was the most powerfully confirmed hypothesis of the study. Hospital managers should focus on educating nurses and improving computer literacy. As increasing computer literacy has had a positive and significant effect on increasing service quality and finally nurses' satisfaction, it could be stated that it would have a strategic role in hospital performance. Finally, having improved service quality and nurses' satisfaction, patients would also have more satisfaction and hospital would benefit from this issue, which would eventually lead to system unification. On the other hand, the only rejected hypothesis of the study showed that increasing computer literacy doesn't have a significant influence on increasing the effect of information quality on nurses' satisfaction. The reason behind this issue is that information quality variable, itself, had a positive and significant effect on nurses' satisfaction and this effect was to the extent that no changes was made in its effect with the intervention of computer literacy variable. Actually, information quality is the heart of HIS, whose presentation requires utmost accuracy and experience. Presenting wrong data and information regarding patients is not acceptable. Therefore, nurses are obliged to have enough accuracy regarding factors related to information quality and computer literacy intervention has no significant effects in this case.

## Research limitations and future researches

Despite the results of this study, some limitations should be taken into consideration. First, as this study focuses on public hospitals in Iran, the results may be different from those of other

countries because of different policies in various societies regarding the health system depending on whether a country is developed or underdeveloped. In some countries, health systems are of higher quality than developing countries. Our research focused only on public hospitals in Iran that have greater limitations (in terms of resources and facilities) than private hospitals and admit higher numbers of clients due to the high costs of the latter. The unfavorable conditions of some health insurance companies and rejection of insurances by private hospitals have greatly increased the clients of public hospitals, confronting nurses with a large workload. Future researchers are recommended to compare the situation of public and private hospitals in Iran with each other and also Iranian hospitals with other neighboring countries.

It is suggested that country hospitals appreciate IT educational courses regarding the improvement of computer literacy level among employees and nurses. Increasing the literacy level of employees would fasten the performance of the hospital and would present more appropriate services. Moreover, it is suggested to the hospitals all over the country to use update information systems such as HL7. In addition, it is suggested to the hospital managers to support the information system unification to make the data accessible among hospitals all over the country. This issue can fasten the process of document transferring and investigation of patients' experiences in various hospitals.

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