

Factors Affecting the Successful Implementation of Hospital Information System: A Preliminary Pilot Study of Iranian Nurses

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Abstract— There is little data on the Iranian nurses' level of satisfaction with Hospital Information System implementation in university hospitals. The aims of this study were: 1) To determine the reliability and validity of factors which can affect the successful implementation of Hospital Information System for nursing staff 2) and use them to propose a new implementation success model.

Keywords— Hospital Information System, Successful implementation, Nursing staff, Iran

I. INTRODUCTION

Hospital Information System (HIS) can help the hospitals to manage their administrative financial and medical information [2]. Moreover many hospital nurses, all around the world, are trying to move away from paper-based health information and have started to use electronic health records [3].

Over the last [2] decades, the Iranian nursing profession has tried to empower itself and reach to its best level of capacity for patient care. Generally speaking, nurses have been considered to be one of the most important and key providers of patient care in all health care systems [4], [5].

In fact, nurses have shown positive attitudes toward using health information technology and improve their patient care by changing the usual conventional trends [6], [7]. The use of HIS can empower the nurses to improve their quality of care, enabling patients to gain their best level of wellness. Therefore, the nurses' perception regarding HIS implementation and use is quite essential for measuring the perceived value of HIS in any health care institution.

It should, however, be recognized that hospital nurses are expected to use the institutional information technology in a mandatory fashion which completely differs from environments in which use is completely voluntary.

Since there is little comprehensive data on the nature and extent of Iranian nurses' perceptions and their satisfaction with HIS implementation, the present pilot study was planned to assess the validity and reliability of some of the factors which, they believe can affect their level of satisfaction with HIS implementation, use, their daily work and patient care.

The findings of this initial pilot study will subsequently be employed in a larger, multi-centre study which will include over 1000 nurses in order to gain a better understanding and ability to define factors affecting the Iranian nurse's satisfaction with HIS implementation.

II. RELATED WORK

A. The DeLone and McLean's IS success model

The work of DeLone and McLean [8] is highly accredited for its comprehensiveness in measuring Information System (IS) success. Their 2003 success model Figure 1 has been used 8276 time in other studies (Google Scholar, June 8, 2017) and its acceptability and reusability have been confirmed repeatedly.

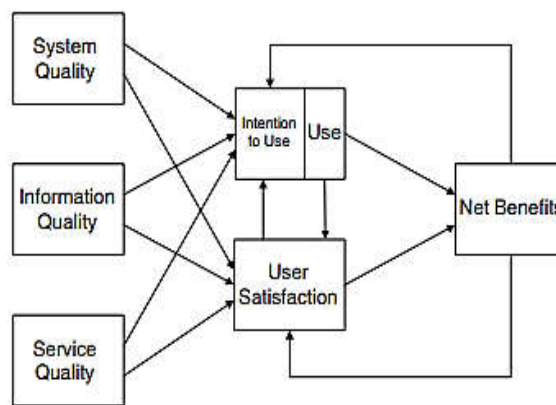


Figure 1: The DeLone and McLean Updated IS success model (adopted from DeLone and McLean, 2003)

Therefore, in view of the superiority of this model, its main constructs and their associated measures played a core role in our proposed HIS implementation success model Figure 2.

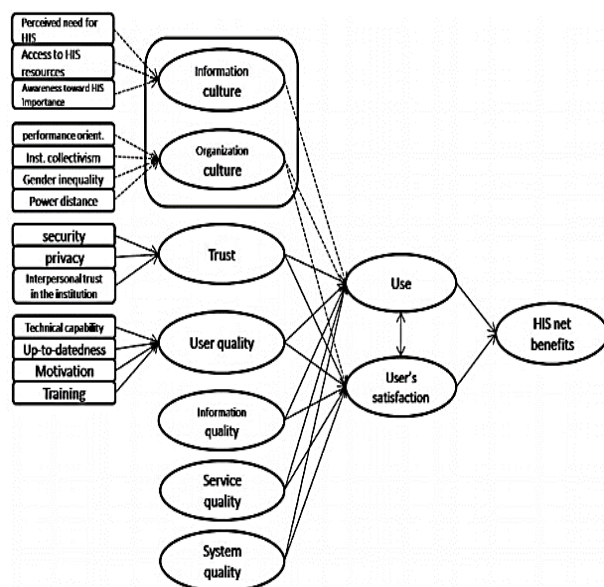


Figure 2: Showing the newly proposed HIS implementation success model

The DeLone and McLean's model has 6 main constructs which include information quality, system quality service quality, intention to use, user satisfaction and the net benefits.

Information quality indicates the quality of the output information. It is assessed by its content accuracy, relevance, understand ability, timeliness, completeness, and others.

The system quality denotes the contribution of the information system to the end users; such as the response time of the system; the recovery speed in case of errors and stability of system.

In this study, HIS system quality was measured by its response time, availability, and reliability, ease of learning and ease of use.

The 3rd dimension of success in the DeLone & McLean's success model is the service quality, which indicates the overall support on the system itself. This promotes the usage of the HIS by the users.

The use construct indicates that to have a successful HIS implementation, system usefulness should not be disregarded. However, the perception of usefulness is very subjective and can differ from one person or institution to another and they are difficult to be replicated [9].

Net benefit is defined as "the degree to which a user believes that using a particular system enhances job performance" [10]. DeLone and McLean [8] stated that there is no consensus on the measure of an information system's success, but that the choice of a success variable is often a function of the study objective. Tangible benefits must be assessed by distinct user groups according to Weiner et al. [11]. In nursing, an effective and efficient nursing documentation system outcome has been described as one "compliant with care standard" [12]. Clinician's perceptions of how well information system enhances their ability to comply with

documentation standards can be used as a formative evaluation measure of the system's success [13]. This information provides interim feedback to clinicians to improving patient care documentation [12].

Overall, net benefits are the extent to which IS contributes to the success of individuals, institutions or organization and are a measure for the positive or negative impacts of the information system on the IS users [14].

B. Culture

The DeLone and McLean model does not specify which methods and/or measures to be used. Rather, these must be selected on case-by-case basis. Having this in mind we have added 3 additional constructs to our main ones, namely culture, trust and user quality which we thought to be essential in our culture and environment.

So, the first added construct in the proposed HIS success model is represented by nurses' perceptions of information culture. Choo et al. [15] regarded information culture as those elements of an organization's culture that influence its management and use of information. Thus, information culture is manifested in the organization's values, norms and practices that have an impact on how information is perceived, created and used. Values are the deeply held beliefs about the role and contribution of information to the organization as well as the principles that define how information ought to be created and used. Norms are rules or socially accepted standards that define what information behaviors are normal or to be expected in the organization. Riyaz [16] argued that the concept of information culture is relevant to the ways in which people value, use, approach and handle information. Information culture has also been considered as one of the six elements of an information infrastructure model by Granger [17]. In addition, Davenport and Prusak [18] distinguished between information culture pertaining to the group and organizational level and information behaviors that are demonstrated at the individual level (e.g. searching for information and using it). The measure to evaluate the information culture include perceived need for HIS, access to HIS resources and awareness toward HIS importance.

For evaluation of this newly added construct to the model and its effect on the HIS implementation success constructs and final outcome, the following research assumptions have been made:

Perceived need for HIS, access to HIS resources and awareness towards HIS importance measure the nurses' perceptions about information culture.

Information culture predicts the use/intention to use of HIS.

Another main construct in our proposed HIS success model is represented by nurses' perceptions of organizational culture (performance orientation, power distance, and gender inequality).

House et al. [19] defined performance orientation as "the extent to which a community encourages and rewards innovation, high standards, and performance improvement".

Power distance is defined as "the degree to which members of a collective, expect power to be distributed equally".

According to House et al. [19], institutional collectivism is “the degree to which institutional practices at the societal and organizational levels encourage and reward collective distribution of resources and collective action.

Gender inequality is defined as “the degree to which a collective minimizes gender inequality”.

In the study of Jaakko et al.[20], performance orientation, power distance, institutional collectivism and gender inequality, were identified to influence the use of routine health information in decision making. They also concluded that these factors seem to be related to some organizational practices influencing information use. For evaluation of the effect of organizational culture on successful HIS implementation, the following research assumptions have been made:

Performance orientation, institutional collectivism, gender inequality and power distance measure the nurses’ perceptions about organizational culture.

Organizational culture predicts the use/intention to use of HIS system.

Organization culture predicts/affects user’s satisfaction.

C. Trust

Trust is an established field of interest for IS researchers. Nah & Delgado [21] and Gefen [22] identified “trust” as an important factor for the success of large information systems such as integrated HIS.

The benefits of organizational trust are many. It is essential to coordinating collective action. Also, it enhances user’s satisfaction, work motivation and better work performance. Tutzauer [23] used a 10-item scale and showed that trust provides a direct positive effect on system usage. The motivation for security in HIS-using institutions is identical, at some level, to the motivation in all other computing systems. Simply put, to ensure that information is not modified, stolen or access to it denied. Security and privacy are [2] main determinants of trust. Security is not merely about cryptography [24], but is about assessing the risk of bad things happening in a given hospital setting and developing safeguards against these risks. In its broad case definition security covers 3 main properties of confidentiality, integrity and availability. Confidentiality is concerned with protecting the information from unauthorized access. Integrity is concerned with protecting the information from unauthorized changes; and availability is concerned with ensuring that the information remains accessible. In the light of these results, the following research statements have been made:

Security and privacy measure the nurses’ perception of trust in a HIS system.

Trust (privacy/security) affects the intention to use.

Trust predicts/affects user’s satisfaction.

D. User quality

In their IS success model, Monem et al. [25] introduced user quality as an independent variable influencing the success of IS. They showed that user quality has positive impact on both usage quality and satisfaction quality. Some measures of

the user quality include technical capability [26], up-to-datedness [27], timeliness, and training [28].

III. MATERIAL AND METHOD

One hundred sixty nurses from a major university hospital (with 422 beds with an average occupancy rate of about 85%) in Shiraz-Iran, participated in this study and voluntarily completed a questionnaire containing 10 items related to demographic, work and work place and 51 items pertaining to various constructs of DeLone and McLean’s implementation success model as well as three additional constructs namely culture, trust and user quality (appendix 1). The reliability of all constructs were checked by Cronbach alpha coefficient. Confirmatory factor analysis and factor loading were done for all 51 items to confirm the dimensionality of the derived instrument. The questionnaire items were based on literature review and experts’ opinions to ensure its content and construct validity[1].

A 6-point Likert scale was used to measure each construct’s indicators. Nurses were asked to score each item from 1 to 6 based on their perception regarding the significance of any particular element. The 6 items included strongly agree, agree, undecided, disagree, strongly disagree and do not know.

Permission from the university officials and hospital managers were obtained and their ethics committees approved the study. The gathered data were electronically computed and analysed using SPSS-16 (Chicago, USA) for windows.

IV. CONCLUSIONS

The aim of this pilot study was to evaluate the reliability and validity of parameters which may affect the nurse’s perception regarding successful HIS implementation. The study results clearly indicated the reliability of all the constructs. Factor loading, turned to be more than 0.4 in 48 (94%) out of 51 studied items. Three (5.88%) of dimension items had values less than 0.4, and turned to be candidates for omission from the proposed HIS success model and future study.

The evaluation of information technology in nursing is relevant due to the rapid implementation of HIS in healthcare, especially in developing countries of the region and Iran is no exception. Indeed there are many unanswered questions regarding an effective design and implementation of HIS for healthcare personnel including the nurses [32][34].

In fact, the need to reduce the healthcare costs, improving the quality of patient care, providing better and more efficient health care services mandates the implementation and use of more effective HIS systems, especially for hospitals which deliver a large range of clinical services [35][36].

To develop a standard nursing information system, one has to have adequate knowledge about their needs, concepts and nursing data standards. This, of course, requires the involvement of nurses in the development and implementation of HISs, after they have had adequate, and appropriate IT training. Having educational IT classes, access to knowledge resources and adequate and efficient, technical support form

IT technicians could help nurses to achieve maximum benefit from HISs.

TABLE 1: SHOWING THE DEMOGRAPHIC CHARACTERISTICS OF 160 PARTICIPANTS.

Demographic Parameters		Frequency	percentage
Gender	Female	136	85
	Male	24	15
Age (years)	20-30	66	41.25
	30-40	61	38.12
	40-50	28	17.5
	50-60	5	3
Educational status	Bachelor	151	94.37
	Master	9	5.63
Marital status	Single	69	43.13
	Married	90	56.25
	Widowed	1	0.63

TABLE 2: SHOWING THE CRONBACH ALPHA COEFFICIENT VALUES OF CONSTRUCTS USED IN OUR PROPOSED HIS IMPLEMENTATION SUCCESS MODEL.

Item	Cronbach alpha
Information Culture	0.918
Organization Culture	0.786
Trust	0.706
User Quality	0.781
Information Quality	0.942
Service Quality	0.899
Systems Quality	0.907
Use/ Intention to Use	0.944
User Satisfaction	0.890
Net Benefit	0.943
Total	0.960

TABLE 3: THE DISTRIBUTION OF FACTOR LOADING VALUES OF THE 51 ITEMS USED IN THE PROPOSED HIS SUCCESS MODEL.

Value	Number & Percentage
< 0.4	3 (5.88%)
0.4- <0.5	2 (3.92%)
0.5- <0.6	4 (7.87%)
0.6- <0.7	3 (5.88%)
>0.7	39 (76.47%)
Total	51 (100%)

< = less than, > = more than

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