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Research Paper

Evaluation of Nursing Information System Implementation in two General Hospitals Affiliated to Zahedan University of Medical Sciences in Southeast Iran: Nurses' Viewpoints

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Abstract

The use of NIS capabilities depends on the needs of users. Also, the proper design of these systems disrupts the daily processes of the users and complicates the acceptance of these systems. The purpose of this study was to evaluate nurses' perceptions about the effectiveness of the NIS system and its impact on their activities. This cross-sectional survey was conducted in 2017. The research population consisted of 656 nurses working in two general hospitals affiliated to Zahedan University of Medical Sciences. According to the Cochran formula, 346 people were needed and a random stratified sampling was used to select the sample in each hospital. Data collection tool, model and questionnaire designed by Hung -Hsiou Hsu et al. ThValidity of the questionnaire was verified by five experts. To determine the reliability of the questionnaire, a re-validation test was used. The highest and lowest mean scores of nurses' perceptions related to the ease of use perceived and user satisfaction with the score of 3.55 ± 67 and 3.33 ± 1.39 respectively. According to the regression test, the quality of information and service quality have a positive effect on the perceived ease of use and perceived usefulness of the NIS. And the quality of the system does not affect the perceived usefulness of the NIS. The perceived usefulness of using NIS has a positive and significant impact on users' willingness to use this system and user satisfaction over their intention to use of NIS. The lack of complete satisfaction of NIS users in this study could be due to the lack of user-friendliness, ease of use, and the inability to receive timely information for nurses. One of the obvious weaknesses of this system is from the viewpoint of nurses that there are unnecessary items that somehow slow down the work process. It seems that the needs of users in the design or purchase of NIS are not completely covered and new requirements are not taken into account during the use of this system.

Keywords: Nursing information system, Evaluation, Nursing Informatics, Nursing.

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1. Introduction

Today, the use of information systems has expanded in many healthcare provider centers. These systems have the capability of storing, retrieving, and sharing information among professionals, medical team, and managers (1,2). Such systems are used in healthcare centers as support tools for facilitating clinical and administrative affairs (3). Many healthcare organizations have taken information technologies to provide quality care services to patients and improve their efficiency (3–5). The volume of information generated by healthcare organizations is constantly growing, so the use of information technology to support the processing and management of this massive information is a

critical issue(6). Nursing, as one of the most important careers in all healthcare centers, is also influenced by information technology(7). Nurses are the largest end-user group in the hospital information system(5). In recent years, information technology has been used in many hospitals to support nurses in their daily work(8). Information technology supports basic and advanced nursing practices in all activities(9). Healthcare and information technology should be used together to achieve the management and processing of data, nursing information, and nursing knowledge to support nursing activities and services(10). Information technology in nursing sectors of healthcare centers is employed to assist nurses in their daily tasks(8). These tasks include the planning, implementation, and documentation of nursing care based on nursing care processes, entry of orders, drug monitoring, department management, documentation, and communication with specialists(11). The nursing information system(NIS) is a part of the hospital information system (HIS) that is linked to nursing activities and is used to support nurses in their tasks(12). Accordingly, many healthcare organizations have taken into consideration the implementation of clinical information systems to improve the accuracy, completeness, and quality of the documents, since this affects the quality of care. However, the designed systems are not complete and error-free, and their problems are usually known after implementation. Hence, evaluation can be a valuable contribution to improving the design of information systems(13). Currently, the advancement of information technology offers many opportunities for the development of skills of healthcare professionals; so, nurses must also become familiar with health information systems. In fact, nurses can receive important information from using nursing information systems. However, the lack of a standardized language makes it difficult for nurses to collect information about organized clinical practices, research activities, and the development of health policies(14). Efficient and effective use of NIS largely depends on how nurses' expectations and needs are met, as well as the proper design of these systems(15,16) (21, 17). Inappropriate design of an information system disrupts nurses' daily work processes and raises problems with the adoption and use of these systems(17). If these systems do not meet the needs of users, their net benefits will not be reached. As a result, they will not cut the costs and the safety of patients will be at risk(18). A proper user interface design is effective on user interaction with NIS. In other words, the system's characteristics, such as the format of the data, the format of navigation instructions and data entry, and the data retrieval sequence, should be understood by nurses when using the system and they should easily access their profiles(15,19). In this regard, Lee described the problems nurses had with nursing information systems, including inadequate content design, lack of adequate education, and concern for data security(20). The failure of IT implementation projects, as a widespread and significant problem in healthcare environments, is estimated at around 70%. One of the most important shortcomings is the gap between the "design and reality" of information systems. From the social and technical dimension of IT projects, user's participation in the design and development of these projects is of great necessity. Hence, user participation is considered as an important tool for modeling health-related processes, a better management of information systems design, and development and reducing the risks of failures in these projects(2). Considering the importance of implementing these systems in healthcare centers, it is necessary to evaluate the effectiveness of these systems in these organizations. Therefore, the purpose of this study was to evaluate nurses' perceptions about the effectiveness of the NIS system and its impact on their activities.

2. Methods

This cross-sectional study was conducted in 2017. The research population consisted of 656 nurses working in two general hospitals affiliated to Zahedan University of Medical Sciences including Ali ibn Abi Talib (N =425) and Khatam al-Anbia (N = 231). Sampling was done regarding the broadness of the research community and the unavailability of all individuals. According to the Cochran formula, 346 people were needed as the final sample in two hospitals. In this study, stratified random sampling was employed. Data collection tool was the questionnaire designed by Hung-Hsiou Hsu et al(21). The research hypotheses are presented below.

H1: Information quality has a positive impact on the perceived usefulness of NIS.

H2: Information quality has a positive impact on the perceived ease of use of the NIS.

H3: Service quality has a positive impact on the perceived usefulness of the NIS.

H4: Service quality has a positive impact on the perceived ease of use of the NIS.

H5: The system quality has a positive impact on the perceived usefulness of the NIS.

H6: System quality has a positive impact on the perceived ease of use of the NIS.

H7: Perceived ease of use has a positive impact on the perceived usefulness of the NIS.

H8: Perceived usefulness has a positive impact on the user's intention to use NIS.

H9: User satisfaction has a positive impact on the user's intention to use NIS.

The questionnaire consisted of two parts. The first part consists of demographic information (n = 7). The second part was designed to collect nursing staff's views on the implementation of the NIS system. This part includes 34 questions in terms of the information quality (n = 3), service quality (n = 3), system quality (n = 3), perceived usefulness (n = 4), easy perceived use (n = 4), and user satisfaction (n = 3). The validity of the questionnaire was confirmed by five health information management specialists. To determine the reliability of the questionnaire, a re-validation test was used. Cronbach's alpha was 0.92 . Data analysis was performed based on descriptive statistics (mean ± SD) and analytical (linear and multiple regression) and using SPSS software. The mean scores of dimensions were used to evaluate the implementation of the nursing information system from the viewpoint of users. The average score of 3.75 (out of 5) or more was considered as complete satisfaction; 3 to 3.75 as relative satisfaction;1.5 to 3 as relative dissatisfaction; and less than 1.5 was considered as complete dissatisfaction with the NIS.

3. Results

Based on the findings in Table 1, 346 questionnaires were distributed among the study population and 288 questionnaires were answered, with the response rate being 83.2%. Most NIS users were female (65.3%). The age group of most users ranged from 20 to 29 years (70.8%). Most of the participants in the study had Bachelor's degrees (85.1%). More than half of the users did not receive NIS-related training. The average user use of the NIS was between 1-3 hours per day.

Table 1: NIS users' demographics

Category	*Subcategory*	*Total number*	*%*
Sex	Female	188	65.3
	Male	100	34.7
Age	20-29	204	70.8
	30-39	69	24.0
	40-49	15	5.2
Education	Associate's Degree	23	8.0
	Bachelor's	245	85.1
	Master's	20	6.9
Tutorial on the NIS system before implementation	Yes	142	49.3
	No	146	50.7
	Less than 1 hour	97	33.7
Use of the NIS system During the day	Between 1 and 3 hours	163	56.6
	More than 3 hours	28	9.7

Table 2 shows the user's perspective on NIS. As can be seen, the highest and lowest mean scores for PEOU and RU dimensions are 3.55 ± 67 and 3.33 ± 1.39, respectively. In all dimensions, the average score was between 3 and 3.75. To analyze the mentioned hypotheses, linear regression and multiple regression tests were used. It was found that system quality (P=010.0), information quality (P=001.0), and service quality (P=001.0) have a positive effect on the perceived ease of use of NIS. Although information quality and services quality have a positive effect on the perceived usefulness of using NIS, the system quality does not affect it (P=062.0). Also, the perceived ease NIS implementation has a positive effect (P=001.0) on perceived usefulness. The perceived usefulness of using NIS on the users' intention to implement this system has a positive effect (P=001.0). Finally, user satisfaction has a positive and significant effect on their intention to use NIS (P=001.0) (Table 3). According to the results (Table 4) the entire research hypotheses are confirmed, except H5

Table 2: The user's perspective on NIS

Variables	*Mean ± S.D.*
System Quality (SQ)	3.51±.66
Information Quality (IQ)	3.43±.67
Service Quality (SEQ)	3.38±.68
Perceived Usefulness (PU)	3.53±.75
Perceived Ease of Use (PEOU)	3.55±.67
User satisfaction (US)	3.33±1.39
Use intention (UI)	3.42±.71

Table 3: Regression analysis results to investigate the effect of NIS

dependent variables	*independent variables*	*Beta*	*SE*	*B*	*T*	*P-value*
Perceived Ease of Use	System Quality	0.704	0.050	0.747	8.784	<0.05
	Information Quality	.154	0.058	0.151	4.010	<0.05
	Service Quality	0.190	0.057	0.188	1.504	<0.05
Perceived Usefulness	System Quality	0.171	0.000	0.195	5.954	> 0.05
	Information Quality	0.115	0.009	0.110	1.841	<0.05
	Service Quality	0.101	0.007	0.114	5.441	<0.05
Perceived Usefulness	Perceived Ease of Use	0.050	0.000	0.095	17.4	<0.05
Use intention	Perceived Usefulness	0.007	0.509	0.475	15	<0.05
Use intention	User satisfaction	0.145	0.000	0.194	0.81	<0.05

Table 4: The evaluation of the hypotheses used in this study

H.No	*Hypothesis*	*Verification Results*
H1	The information quality has a positive impact on the .perceived usefulness of NIS	Supported
H2	The information quality has a positive impact on the .perceived ease of use of the NIS	Supported
H3	The Service quality has a positive impact on the perceived .usefulness of the NIS	Supported
H4	The Service quality has a positive impact on the perceived .ease of use of NIS	Supported
H5	The system quality has a positive impact on the perceived .usefulness of NIS	Not Supported
H6	The system quality has a positive impact on the perceived .ease of use of the NIS	Supported
H7	The perceived ease of use has a positive impact on the .perceived usefulness of the NIS	Supported
H8	Perceived usefulness has a positive effect on the user's .intention to use NIS	Supported
H9	User satisfaction has a positive impact on users' intentions to use the NIS	Supported

4. Discussion

The system quality deals with measuring an electronic system such as usability, accessibility, reliability, compatibility, and response time. The mean score of QS from nurses' point of view was 3.51 ± 0.66. This level reflects the relative

satisfaction of users from system quality. Pai and Huang reported a mean score of 0.75±3.35, which is consistent with the results of the present study(22) and the findings of Fathema et al(23). Jabraili et al. Obtained a mean system quality score of 3.28, which is consistent with the present study(24). Lack of complete satisfaction of NIS users in this study could be due to the lack of user-friendliness, ease of use, and the inability to receive timely information for nurses. One of the obvious weaknesses of this system is the presence of unnecessary items from the viewpoint of nurses that slows down the work process. It seems that the needs of users in the design or purchase of NIS are not completely covered and the new user requirements are not taken into account during the use of the system. Therefore, we suggest that to improve the quality of the NIS system, the design of the implemented system should be based on the needs of nurses. Based on the obtained results, QS has a positive effect on the perceived ease of use of the NIS. This result is consistent with the results of Pai and Huang (22) and Hsu and Wu(25). Therefore, when the nurse's attitude towards NIS information quality is more positive, the ease of use of the NIS will be greater. In this context, to increase the ease of use of NIS, hospitals should be committed to upgrading the system in terms of user interface, user-friendliness, ease of use, and timely and accurate receipt of information. However, the system quality does not affect the perceived usefulness of using NIS. This means that the quality of the implemented NIS system does not affect the usefulness of its use. This result may be due to the non-fulfillment of the needs of users in the NIS system. Another reason for this outcome could be the lack of proper training for users on the benefits of the NIS system. Therefore, it is suggested that the hospital should increase the perceived usefulness of users to train them before using the system and support it during its use. Delon and McLean consider the system quality as one of the most desirable features of an information system and define it as ease of use, system flexibility, system reliability, and ease of learning, as well as system features, transparency, complexity, flexibility, and response time(26). Pai and Huang also recognize the system quality including design quality, response time, and access.)44(. The mean QI score from nurses' point of view was 3.43 ± 0.67. This level reflects the relative satisfaction of users with NIS information quality. Huang also obtained a mean score of this dimension 3.53 ± 0.74, which is consistent with the results of the present study(27). Gebraeli et al. obtained the mean score of information quality 2.89 ± 0.68, which did not match the results of the present study(24). The complete lack of users' satisfaction with NIS information quality can be due to the inability of the system to provide accurate, updated, and sufficient information. The problems encountered in this area included a lack of efficient database and limited storage space. Therefore, hospitals are recommended using new technologies and tools such as computerized physician order entry (CPOE) to have up-to-date, accurate, and sufficient information. Also, they are recommended the use of database and virtual and cloud storage space. The results showed that QI has a positive effect on the perceived usefulness of NIS usage and the perceived ease of use of NIS. Pai and Huang and Hsu and Wu showed that the information quality on the perceived usefulness of using NIS and the perceived ease of use of NIS had a positive effect. This finding is in line with the results of Choi et al (28). Delon and McLean defined the information quality by measuring the system quality and information quality, including accuracy of information, integrity, reliability, and relevance(26). When nurses' views about NIS information quality are more positive, the perceived usefulness and perceived ease of use of NIS will be greater. As a result, when purchasing or designing a NIS, the accuracy, adequacy and up-to-date information provided by this system should be considered in order to increase the efficiency and ease of use. Mean QSV score from nurses' point of view was 1.18 ± 0.08, which reflects the relative satisfaction of users with the quality of NIS services used. Pai and Huang obtained the average service quality score of 1.71 ± 0.44, which is in line with the current study(44). Jabraeli et al. scored this quality as 4.90 ± 0.41, which is not consistent with the present study(47). The lack of full users' satisfaction with the quality of NIS services can be due to a lack of security in service completeness, non-compliance with privacy standards when entering information, and the inaccessibility of this system at the time of patient care. The present study recommends NIS hospitals using the PDA to enter data for easy and quick access. The results showed that QSV had a positive effect on the perceived usefulness of using NIS and the perceived ease of use of NIS; which is in line with the study of Choi et al(48). Pai and Huang and Hsu and Wu also reported this result(44,45). So, when the quality of the NIS system service increases, its usefulness and ease of use will also increase. The mean PEOU score from nurses' point of view was 3.55 ± 0.6, which suggest that users have not completely understood the ease of use of NIS. Therefore, it can be stated that the use of this system is not convenient for users and the implemented system is not easy to use, simplify activities, facilitate user interaction with the system, and establish a connection with the system users' expectations are not optimal. This finding is in line with the results of Pai and Huang, who state

that the use of a management information system can improve the performance and productivity of users(22). The results showed that PEOU had a positive effect on the perceived usefulness of using NIS. This result is in line with the results of the Hsu and Wu, who argue that by increasing the information quality and the system quality, the utility and ease of use of the perceived use of NIS increases.)45(. The mean PU score from nurses' point of view was 3.53 ± 0.75. Pai and Huang reported the average score of this dimension as 3.55 ± .76, which is consistent with the results of this study(22). This finding represents that users have not understood the usefulness of using NIS and the system has not been fully successful in terms of improving its efficiency, effectiveness, efficiency, and performance. In addition, they believe that when introducing a health information system to the hospital, users need to learn practical and easy-to-use user interfaces(25). Therefore, the study recommends hospitals to implement user-friendly interfaces in order to increase the user-friendliness of the NIS system such that to enhance system utilization and user efficiency and effectiveness. The mean TR and RU scores from nurses' point of view were 3.42 ± 71.7 and 3.33 ± 1.39, respectively. This level reflects the tendency to use and relative satisfaction of users from NIS, which is in line with the results of Pai and Huang(22). Thus, it can be said that the system implemented in hospitals does not fully meet the expectations of users and the desire of users to use this system is not high. According to the findings of this study, the reasons for users' dissatisfaction may include lack of adequate knowledge of the benefits of the system, lack of knowledge about how the system is used, the lack of re-engineering processes during system execution, the lack of nurses' participation in designing the system and lack of adequate training. In this regard, it has been well evidenced that nurses see the system as a nuisance to their work. They pointed out the cases of increasing workload of nurses when using this system, poor system quality, time-consuming system use, poor user interface, and a low level of information security of the system studied as the reasons for the failure of this system. Therefore, it is recommended introducing the benefits of this system, increasing the level of information security, increasing the awareness of users about how to use, performing reengineering at system runtime and fixing it, using the comments and suggestions of nurses in the system design, providing complete and accurate training, and shortening the processes involved in using the system. Eventually, using the right tools to run the system can recover system failures and increase system performance.

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Conflicts of Interest: None declared.

5. Reference

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