Healthcare Personnel's Acceptance of Clinical Information Systems in Teaching Hospitals of Rasht in 2014

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ABSTRACT

Objectives: Developed countries have long been aware of the importance of information technologies in achieving success. The role of information technologies in improving the quality of healthcare and aiding patient safety has always been a research interest for the healthcare industry. The present study was conducted to assess healthcare personnel's acceptance of clinical information systems in teaching hospitals of Rasht in 2014.

Methods: The present descriptive cross-sectional study was conducted in 2014 in a study population consisting of the healthcare personnel employed at teaching hospitals of Rasht. The study samples were selected through stratified random sampling and included 520 individuals. Data were collected using a standard questionnaire. The normal distribution of the data was confirmed using the Kolmogorov-Smirnov test. The Pearson correlation test and the confirmatory factor analysis were used to analyze the data.

Results: Significant positive relationships were found between the features of information and communication systems and perceived benefits (R = 0.357 and P = 0.001), between the knowledge of information and communication systems and perceived simplicity (R = 0.211 and P = 0.0001), between perceived simplicity and perceived benefits (R = 0.558 and P = 0.0001), between perceived simplicity and the attitude toward application (R = 0.472 and P = 0.0001), between perceived simplicity and the acceptance of clinical information systems (R = 0.441 and P = 0.0001), between perceived benefits and the attitude toward application (R = 0.272 and P = 0.0001), between perceived benefits and the acceptance of clinical information systems (R = 0.171 and P = 0.0001), and between the attitude toward application and the acceptance of clinical information systems (R = 0.676 and P = 0.0001).

Conclusion: The results obtained suggest that teaching hospitals' personnel should help modify the prevailing culture that impedes the acceptance of information systems and to constantly foster more appropriate values and behavioral patterns. The empowerment of the personnel to use clinical information systems is an effective measure that helps increase productivity, efficiency and the optimal use of time.

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Introduction: Many scholars, including Toffler, believe change to be the only constant in life in the third millennium. One of the most important needs of any organization is therefore the ability to adapt to change. As the mother of the new science, information technology has a fundamental role in the world today and its acceptance is absolutely essential [1]. The emergence of information and communication technologies provides many benefits; nevertheless, despite the many potential advantages they provide, the mere development and establishment of these technologies is not sufficient to fully benefiting from them, and the users' application of these technologies is key to the benefits [2]. Information technology is regarded as a powerful tool that can increase organizational efficiency and productivity. Various industries have therefore taken effective steps toward the use of these technologies as a means of surviving in today's competitive environment and to improve their products [3].

The health industry is no exception. Given the crucial role of the healthcare industry and its direct and indirect effects on the different dimensions of the society's development, various countries have incorporated information technology into their efforts for the development of health information and the improvement of the healthcare system's outcomes [4]. Over the years, hospital managers have recognized that, to provide quality patient care services, a uniform hospital information system is required [5]. A complex organization such as a hospital that has several different departments requires a fast and effective means of access to information in order to better operate [6]. As one of the main social organizations, hospitals have a major role in the improvement of the country's health status and the providing of healthcare services. Hospitals are among the most sensitive organizations, and their proper management requires the accurate collection, monitoring, classification and finalization of information, which should then be delivered to all the decision-makers involved in directing the hospital, particularly the hospital managers, at the right time and in the right format [7].

Given the factors affecting acceptance in healthcare workers, understanding the successful implementation of an information system is essential to the improvement of healthcare services and the future development of information systems. Analyzing the expectations of clinical workers and their satisfaction following the installation of an information system, the relationships that exist between the users' characteristics, the information system's compatibility, the system's perceived benefits, simplicity of use and support of the user based on the technology acceptance model is crucial. The technology acceptance model gives an account of the relationships between system design, perceived benefits, simplicity of use and the users' attitude toward the system's application. This model measures the effect of technology on users and helps the users' acceptance of information technologies [8]. Many studies have shown the role of information systems' compatibility, perceived benefits, simplicity of use and users' support in transforming the process of acceptance and spreading information technology in organizations. Other studies have shown that personal characteristics such as computer knowledge, computer use and the level of education are among the factors determining the use and acceptance of information technologies in

clinical and healthcare centers' personnel [9, 10].

In a study conducted to assess the factors affecting the acceptance of technology by doctors working in private clinics in Penang, Malaysia, San (2013) investigated seven parameters, including the doctors' attitude, the technology vendors' support, perceived benefits, perceived simplicity, costs, technological knowledge and social influence. The results obtained showed that all these parameters contributed significantly to the doctors' intention to use information technologies [11]. The results of a study conducted by Phalet (2004) on the healthcare sector in Thailand in a population consisting of the provincial representatives of the healthcare system showed that the factors affecting acceptance had a significant effect on the simplicity of performance as well as on behavioral intentions [12].

In a study conducted to investigate the effect of factors affecting the acceptance of information systems in hospital personnel, Melas (2011) concluded that the use of technological systems is influenced by perceived benefits, simplicity of use and the attitude toward the application of the system [6]. In another study, Kahouei & Babamohammadi (2013) investigated the acceptance of clinical information systems in nursing personnel based on the information technology acceptance model, and found that nurses who were aware of their obligation toward the computer program or those informed about its objectives showed a greater acceptance [13]. In a study conducted in a statistical population consisting of students at Isfahan University, Rezaee-Dowlatabadi et al. (2013) found that security, simplicity of use, compatibility and benefits were significant predictors of the attitude toward e-shopping and that normative beliefs have a positive effect on the online shopping tendencies [14]. In a study conducted to determine the level of acceptance and the possibility of implementing the technology acceptance model proposed by Davis among Shahid Beheshti University of Medical Sciences' employees, Esmaeili et al. (2013) found that the highest correlation between the dimensions of the technology acceptance model pertained to the easier performance of tasks through the use of information technologies and the attitude toward working with these technologies, and also found the lowest correlation to pertain to being pre-occupied and the outcome of information technology output features [15].

Despite the importance of the subject, reviews showed a lack of comprehensive studies conducted on the acceptance of clinical information systems in healthcare personnel at hospitals of Guilan province. The present study thus intends to assess the level of acceptance of clinical information systems in hospital personnel in Rasht so that the research findings can be of help to healthcare policy-makers and planners.

Material and Methods: The present descriptive cross-sectional study was conducted in 2014 in 15 teaching, non-teaching and private hospitals of Rasht in a statistical population consisting of 3198 clinical information system experts. Data were collected using the standard questionnaire designed by Melas in two parts. The first part of the questionnaire assessed participants' personal and demographic information with eight items. The second part contained a total of 49 items, including 19 items about the attitude component and which were scored based on a 5-point Likert scale (totally agree, agree, no comments,

disagree and totally disagree), and with variables including perceived simplicity, perceived benefits, the attitude toward application and the acceptance of information systems, 15 items about the information system users' knowledge and scored based on a 3-point Likert scale (no knowledge, little knowledge and full knowledge), and 15 items about the features of the information system and scored based on a 4-point Likert scale (totally essential, essential, not essential and absolutely not essential) [6]. The study used stratified random sampling to select its participants from the population of individuals familiar with clinical information systems and working at either of the 15 centers under scrutiny. The maximum error rate assumed for this study was 0.05 given the total of 3198 healthcare employees working with clinical information systems in hospitals of Rasht. Sample size was determined given a confidence interval of 95% and a critical value of 1.96. Sample size was thus calculated as 561 using the equation. A total of 520 (93%) of the subjects completed and returned the questionnaires. The normal distribution of the data was verified using the Kolmogorov-Smirnov test. Data were analyzed in SPSS and Lisrel.

Results: The employees' age (R = 0.680 and P = 0.546), level of education (R = 4.090 and P = 0.007), work history (R = 1.194 and P = 0.311) and type of hospital (R = 4.086 and P = 0.017) were found to be related to their acceptance of clinical information system. As shown by these results, the acceptance of clinical information systems is affected by the individual's level of education and the type of hospital in which he works. Given the normal distribution of the data pertaining to all the study variables, the Pearson correlation coefficient test was used to assess the relationship between the variables.

The features of information and communication systems variable was found to be related to perceived benefits (R = 0.357 and P = 0.0001), knowledge of information and communication systems to perceived simplicity (R = 0.211 and P = 0.0001), perceived simplicity to perceived benefits (R = 0.558 and P = 0.0001), perceived simplicity to the attitude toward application (R = 0.472 and P = 0.0001), perceived simplicity to the acceptability of clinical information systems (R = 0.441 and P = 0.0001), perceived benefits to the attitude toward application (R = 0.272 and P = 0.0001), perceived benefits to the acceptance of clinical information systems (R = 0.171 and P = 0.0001), and the attitude toward application to the acceptance of clinical information systems (R = 0.676 and P = 0.0001). As shown, there was a significant relationship between all the hypotheses and the acceptance of clinical information systems.

The numerical value showing the significance of the relationship between the variables was 2.51 (t = 2.51) for the features of information and communication systems and perceived benefits, 3.1 (t = 3.1) for the knowledge of information and communication systems and perceived simplicity, 7.46 (t = 7.46) for perceived simplicity and perceived benefits, 2.37 (t = 2.37) for perceived simplicity and the attitude toward application, 3.61 (t = 3.61) for perceived simplicity and the acceptance of clinical information systems, 2.85 (t = 2.85) for perceived benefits and the attitude toward application, 3.61 (t = 3.61) for perceived benefits and the acceptance of clinical information systems and 15.63 (t = 15.63) for the attitude toward application and the

acceptance of clinical information systems. The results obtained show that all the study variables had significant positive relationships with the acceptance of information technologies. Table 1 presents a summary of these findings.

Table 1. Results showing the significance of the variables in relation to the acceptance of information technologies

Hypothesis	Route	Non-Standard Coefficient	Standard Coefficient	Significance Values
1	Features of information and communication systems and perceived benefits	0.15	0.15	2.51
2	Knowledge of information and communication systems and perceived simplicity	0.13	0.13	3.10
3	Perceived simplicity and perceived benefits	0.67	0.67	7.46
4	Perceived simplicity and the attitude toward application	0.16	0.16	2.37
5	Perceived simplicity and the acceptance of clinical information system	0.20	0.20	3.61
6	Perceived benefits and the attitude toward application	0.21	0.21	2.85
7	Perceived benefits and the acceptance of clinical information systems	0.18	0.18	3.61
8	The attitude toward application and the acceptance of clinical information systems	0.82	0.82	15.63

Table 2. Fit indices of the model

Fit Indices of the Model	Research Indices' Values	Optimum Values
x^2 / df	2.1013	≤ 3
RMSEA	0.077	≤ 0.08
RMR	0.29	≤ 0.5
PNFI	0.83	≥ 0.8
AGFI	0.87	≥ 0.8
NFI	0.88	≥ 0.9
NNFI	0.88	≥ 0.9
CFI	0.91	≥ 0.9
IFI	0.92	≥ 0.9
GFI	0.92	≥ 0.9
Degree of Freedom	1115	≥ 0

Fit indices of the model: Table 2 presents fit indices of the model and their optimum values. Comparison of the research model's values and the optimum values confirms that all the indices of the research model are in an optimum state.

Discussion and Conclusion: The model proposed by Melas et al. was used in this study to explain the model of the acceptance of clinical information systems by hospital employees in Rasht [6]. The data obtained from the questionnaires were analyzed and the structural equation modeling (SEM) was then used to identify the relationships between the examined variables.

The features of information and communication systems were found in this study to have a significant positive effect on the benefits perceived by hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.357 and a significance level of 0.000. According to the results of the SEM, the features of information and communication systems have a direct significant impact on perceived benefits with a standard impact coefficient of 0.15, indicating that perceived benefits will increase by 0.15 for each unit of increase in the features of information and communication systems. The results of testing this hypothesis were consistent with the results obtained by Melas [6] and Kahouei & Babamohammadi [13].

Knowledge of information and communication systems was also found to have a significant positive impact on perceived simplicity of use in hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.211 and a significance level of 0.000. According to the results of the SEM, knowledge of information and communication systems has a direct significant effect on perceived simplicity with a standard impact coefficient of 0.13, indicating that perceived simplicity will increase by 0.13 for each unit of increase in the knowledge of information and communication systems. The results of testing this hypothesis were consistent with the results obtained by Melas [6] and Kahouei & Babamohammadi [13].

Perceived simplicity was found to have a significant positive effect on perceived benefits in hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.558 and a significance level of 0.000. According to the results of the SEM, perceived simplicity has a direct significant impact on perceived benefits with a standard impact coefficient of 0.67, indicating that perceived benefits will increase by 0.67 for each unit of increase in perceived simplicity. The results of testing this hypothesis were consistent with the results obtained by Melas [6].

Perceived simplicity was found to have a significant positive effect on the attitude toward application in hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.472 and a significance level of 0.000. According to the results of the SEM, perceived simplicity has a direct significant impact on the attitude toward application with a standard impact coefficient of 0.16, indicating that the attitude toward application will improve by 0.16 for each unit of increase in perceived simplicity. The results of testing this hypothesis were consistent with the results obtained by Melas [6].

Perceived simplicity was found to have a significant positive effect on the acceptance of clinical information systems in hospital employees in Rasht working with clinical

information systems. This relationship was confirmed with a correlation coefficient of 0.441 and a significance level of 0.000. According to the results of the SEM, perceived simplicity has a direct significant impact on the acceptance of clinical information systems with a standard impact coefficient of 0.20, indicating that the acceptance of clinical information systems will improve by 0.20 for each unit of increase in perceived simplicity. The results of testing this hypothesis were consistent with the results obtained by San [11] Melas [6], Rezaee-Dowlatabadi et al. [14], Esmaeili et al. [15], Hiva-Abdkhoda et al. [17], Fahami & Zare' [18] and Tabibi et al. [19].

Perceived benefits were also found to have a significant positive effect on the attitude toward application in hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.272 and a significance level of 0.000. According to the results of the SEM, perceived benefits have a direct significant impact on the attitude toward application with a standard impact coefficient of 0.21, indicating that the attitude toward application will improve by 0.21 for each unit of increase in perceived benefits. The results of testing this hypothesis were consistent with the results obtained by San [11] Melas [6] and Hiva-Abdkhoda et al. [17].

Perceived benefits and the attitude toward application were found to have a Pearson correlation coefficient of 0.272 and a significance level of 0.000, which is lower than the significance level of 0.05, thereby confirming hypothesis one. It can therefore be asserted that perceived benefits have a significant positive effect on the attitude toward application in hospital employees in

Rasht working with clinical information systems. According to the results of the SEM, perceived benefits have a direct significant impact on the acceptance of clinical information systems with a standard impact coefficient of 0.18, indicating that the acceptance of clinical information systems will improve by 0.18 for each unit of increase in perceived benefits. The results obtained from testing this hypothesis were consistent with the results obtained by San [11] Melas [6], Lee [20], Lee et al. [21], and Haux [16], Rezaee-Dowlatabadi et al. [14], Esmaeili et al. [15], Hiva-Abdkhoda et al. [17], Fahami & Zare' [18] and Tabibi et al. [19].

The attitude toward application was found to have a significant positive effect on the acceptance of clinical information systems in hospital employees in Rasht working with clinical information systems. This relationship was confirmed with a correlation coefficient of 0.676 and a significance level of 0.000. According to the results of the SEM, the attitude toward application has a direct significant impact on the acceptance of clinical information systems with a standard impact coefficient of 0.82, indicating that the acceptance of clinical information systems will improve by 0.15 for each unit of improvement in the attitude toward application. The results obtained from testing this hypothesis were consistent with the results obtained by San [11] Melas [6], Lee [20], Esmaeili et al. [15], Hiva-Abdkhoda et al. [17] and Fahami & Zare' [18].

Given the significant positive effect of the features of clinical admission systems on perceived benefits, training workshops are recommended to be held for increasing the knowledge of hospital employees about hospital information systems. As hospital employees learn more about the features of

information and communication systems, they are expected to gain a more positive perception of the benefits of these systems. In addition to increasing the knowledge and skills of employees, the designers of these systems and the software engineers working on them should also focus on the needs assessment of the users and the identification of the relevant processes, so that new systems are designed with a greater compatibility with the users' needs and are thus more easily acceptable by them.

Given the significant positive effect of the knowledge of clinical admission systems on perceived simplicity, and taking into account the effect of computer illiteracy on the use of hospital information systems and ultimately the users' satisfaction, holding computer training workshops is a recommended step.

Given the significant positive effect of perceived simplicity on perceived benefits, booklets and visual guides on the use of clinical admission systems should be designed that enable hospital personnel to use these systems and enter their data into them with a greater ease.

Given the significant positive effect of perceived simplicity and perceived benefits

on the acceptance of clinical information systems, hospital personnel are advised to learn of the duration of time taking to finish a particular task before these systems were implemented and after they are in use so as to assess the difference in efficiency and productivity. All the statistical data associated with the productivity and improvements ensuing from the implementation of these systems should also be displayed in public within the organization.

Given the significant positive effect of the attitude toward application on the acceptance of clinical information systems, it is recommended for managers to carefully assess the particular cultural conditions impeding the acceptance of these systems, and to then change the existing approach and to gradually modify the cultural components affecting the acceptance of the systems and to constantly foster favorable values and behavioral patterns. The useful and effective components of the existing culture should be maintained and strengthened through the proper management of the organizational culture and the undesirable and ineffective components should thus be gradually modified.

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