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Hospital Information Systems (HIS) Acceptance and Satisfaction: A Case Study of a Tertiary Care Hospital

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Abstract

OBJECTIVES: The main objective of this study is to evaluate hospital information systems (HIS) acceptance and satisfaction, through exploring the influential factors that might increase or decrease acceptance and satisfaction levels among different healthcare professionals**,** in order to provide solutions for successful HIS implementation. METHODS: The study used objective quantitative survey methods to collect data directly from different types of HIS users. The questionnaire included five sections; a demographic user information section, a general HIS assessment section, a section about accessibility and availability of computers, a section about HIS and patient care and a section about satisfaction with HIS. RESULTS: The availability of computers in the hospital was one of the most influential factors, with a special emphasis on the availability of laptop computers and computers on wheels to facilitate direct and immediate data entry and information retrieval processes when healthcare professionals are at the point of care. Users believed that HIS might frequently slow down the process of care delivery and increase the time spent by patients inside the hospital especially during slow performance and responsiveness phases. RECOMMENDATIONS: Three main areas showed improvement potential; system performance, organizational support and users' feedback. Improving the performance of the HIS is very crucial for its success, in addition to increasing the availability of computers at the point of care. User friendliness and new innovative methods for data entry, such as automated voice recognition, can improve the workload and enhance information quality. Organizational support is very crucial, through providing training, dedicated and protected time during working hours for users to learn and practice on HIS. Better and more reliable channels of communication and feedback are needed to consider users' complaints, suggestions and contribution.

Keywords: Hospital Information Systems, Acceptance, Satisfaction, Usability, Responsiveness.

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1. Background and Significance

Modern hospital information systems (HIS) are comprehensive, integrated and specialized information systems designed to manage the administrative, financial and clinical aspects of hospitals and healthcare facilities. They are considered one of the most important focal points on which the delivery of healthcare within hospitals and different types of medical institutions depends[1]. The importance of these systems emerges from the importance of their role in keeping all types of patient data and information including key data about the patient and other comprehensive medical data; recording all medical services that have been provided to the patient such as investigations, diagnoses, treatments, follow up reports and important medical decisions[2]. Hospital information systems have the potential to improve the health of individuals and the performance of healthcare providers, yielding improved quality, cost savings, and greater engagement by patients in their own healthcare. Despite evidence of these benefits, physicians' and hospitals' utilization of HIS and electronic health records is still low[3]. The response of healthcare professionals to the use of hospital information systems is an important research topic that can explain the success or failure of any HIS development and implementation project[4].

Many studies available in the medical literature have been trying to explain the delay or unsuccessful implementation of HIS and electronic medical records and link this problem to the acceptance or resistance of healthcare professionals' towards these systems[5]. The effect of information technology knowledge, experience and skills of healthcare professionals, current status of computerization in hospitals, and professionals' attitudes, in terms of their positive or negative beliefs about computerized systems and electronic medical records in the healthcare environment are considered among the major human type of barriers to the successful implementation and use of such systems. This is why planned training of healthcare professionals is needed to foster positive attitudes about HIS, and build confidence in the benefits of these systems[6-8]. Strategies for the successful management of HIS development and implementation should include engaging the physicians and other healthcare professionals and providing strong organizational support to them before and during the implementation activities. These two factors could eliminate major resistance and alleviate negative attitudes frequently reported and in the same time increase level of acceptance of HIS by physicians and healthcare professionals. This is why it is important to investigate and explore factors leading to HIS acceptance and satisfaction among all types of users[9].

Many studies in the literature considered even highly regarded, industry leading HIS to be challenging to use because of the multiplicity of screens, options and navigational aids. Problems with HIS usability – especially for documenting progress notes and other labor intensive components – caused physicians to spend extra work time to learn effective ways to use the HIS. These substantial initial time costs are considered an important barrier to obtaining benefits, as greater burdens on physicians' time decrease their use of HIS and increase their resistance, which lowers the potential for achieving quality improvement[10]. Although vendors are slowly improving HIS usability, most vendor analysis studies doubted that any newly innovated technology, such as voice recognition, tablet computers, computers on wheels or mobile hand-held devices will dramatically simplify HIS usage. Designing user friendly software for information and knowledge professionals is a challenge that spans the software industry beyond the healthcare domain[11]. Inadequate electronic data exchange and weak integration between different HIS modules and other electronic systems was defined as another barrier to HIS implementation and use, such as the lack of integration between the HIS and other clinical data systems such as lab, radiology or referral systems. Working with both electronic and paper based systems in parallel, usually forces healthcare professionals to switch during their work tasks between these systems, thereby slowing workflow, requiring more time to manually enter data from external systems, and increasing healthcare professionals' resistance to EMR use[12].

HIS systems usually need a lot of difficult complementary changes and support during the process of customization and final tuning. HIS hardware and software cannot simply be used "out of the box". Instead, physicians and other healthcare professionals must carry out many complex and time consuming activities to customize, adjust and complement the HIS product before being able to generate benefits from this new technology[13]. HIS need a lot of technical support from the various software, hardware, networking, and service vendors when technical problems appear, such as poor user software interfaces, slow computer machines or

networks or difficult data entry and retrieval especially when the hardware is old. Moreover, physicians had to redesign their workflow (how they worked in the exam room) and office workflow (who did what tasks; such as data entry). As a general rule, larger hospitals could implement complementary changes and request better support from vendors more easily than smaller hospitals because they tend to have stronger organizational resources such as management expertise, experience with past process changes, financial resources, leadership, and information systems support staff[14].

Information systems adoption and use remains a major concern for both research and practice. Despite impressive advances in hardware and software capabilities, the problem of underutilized systems continues. Significant progress has been made over the last two decades in explaining and predicting user acceptance of information systems. Many studies have found that Technology Acceptance Model (TAM) consistently explains a significant proportion of the variance, typically about 40%, in usage intentions and behavior. This model theorizes that an individual's behavioral intention to use a system is determined by two beliefs: perceived usefulness, defined as the extent to which a person believes that using the system will enhance his or her job performance, and perceived ease of use, defined as the extent to which a person believes that using the system will be free of effort[15]. The TAM assumes that the effects of external variables, such as system characteristics, development process and training, on intention to use are mediated by perceived usefulness and perceived ease of use. According to TAM, perceived usefulness is also influenced by perceived ease of use because the easier the system is to use the more useful it can be[16, 17]. Figure 1 illustrates the components of the Technology Acceptance Model.
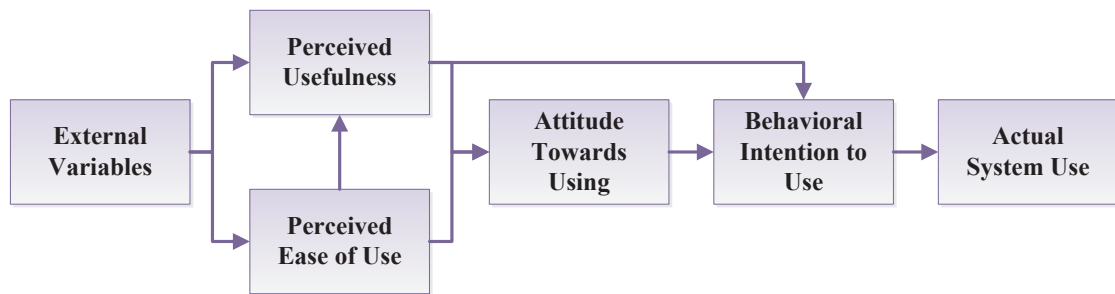

Fig 1. Technology Acceptance Model; Adapted from Davis, 1989.

2. Study Objectives

At King Faisal Specialist Hospital and Research Center, Saudi Arabia, the implementation and upgrading of the hospital information system had been facing many challenges; among these were the resistance, acceptance and satisfaction of the HIS by the end users. The Health Information Technology Affairs (HITA) department decided to conduct a survey to explore HIS acceptance and satisfaction by end users and investigate the influential factors that might increase or decrease acceptance and satisfaction levels among different healthcare professionals.

3. Methods

The Health Information Technology Affairs developed and validated a questionnaire to collect objective quantitative data from different types of the HIS users. The questionnaire contained five sections of questions; the first is a demographic user information section, including age, gender, job type, total healthcare experience and HIS module used. The second section included ten statements regarding general HIS assessment, the third section included three statements regarding accessibility and availability of computer terminals in the hospital, the fourth section included three statements regarding the HIS and the patient care and the fifth section included six statements regarding the users satisfaction with the HIS. The questionnaire sections from two to five used the classic five Likert scale format; strongly agree, agree, neutral (neither agree nor disagree), disagree and strongly

disagree. One final open ended question was added to ask users about their suggestions to improve the HIS performance, acceptance and satisfaction among users.

The target hospital population for the study is about 4,000 staff members, including end users who directly interact with the HIS, those were five main job types; physicians, nurses, pharmacists, technicians and administrators. We calculated the required sample size using the Slovin formula, at a suggested confidence level of 95% with a margin error of 0.05 and applying the Slovin's formula, $n=N/(1+(N*e^2))$, where n = sample size; N = population; and e = confidence interval, the required sample size for the study should be 364 participants. An electronic format of the survey questionnaire was built online and published on the internal hospital website and network so that a link to the questionnaire could be sent via email to all staff members of the target population, they were also notified through an awareness campaign by the HITA to tell them more about the importance of the survey and about the study. Paper forms were also used to enhance the response of the participants who needed to be reminded with or assisted in completing the questionnaire.

4. Results

The HITA and the research center used the SPSS – the statistical package for social sciences to perform a group of statistical analyses including both descriptive and inferential statistics. The total number of valid responses was 693 participants, showing a response rate of 17.3%, with a gender distribution that is almost one to one (male to female ratio). Two thirds of the participants were nurses and administrators. Physicians and pharmacists together composed less than a quarter. Table 1 shows the distribution and percentages of HIS users sorted by their job type.

Table 1. HIS Users Distribution and Percentages – Sorted by Their Job Type.

HIS Users Job Type	Count	%
Nurses	244	35.2%
Administrators	224	32.3%
Physicians	84	12.1%
Pharmacists	80	11.5%
Technicians	61	8.8%
Total	**693**	**100.0%**

Table 2 shows the distribution and percentages of HIS users sorted by their HIS experience, where very few (14%) had over 15 years of HIS experience and the remaining 86% had less than 2 years, 2 to 5 years, 6 to 10 years or 11 to 15 years of HIS experience.

Table 2. HIS Users Distribution and Percentages – Sorted by Their Experience.

HIS Users Experience	Count	%
Less than 2 years	109	16%
2 - 5 years	135	19%
6 - 10 years	188	27%
11 – 15 years	159	23%
16 - 20 years	65	9%
Over 20 years	37	5%
Total	**693**	**100.0%**

Table 3 shows the distribution and percentages of HIS users sorted by their age group, where most of the participants (83%) were between 25 and 50 years of age.

Table 3. HIS Users Distribution and Percentages – Sorted by Their Age Group.

HIS Users Age Group	Count	%
Less than 25 years	13	2%
25 - 35 years	261	38%
36 - 50 years	313	45%
Over 50 years	106	15%
Total	**693**	**100.0%**

Table 4 shows HIS user acceptance and satisfaction factors sorted ascending by users' responses.

Table 4. HIS User Acceptance & Satisfaction Factors Sorted Ascending.

HIS User Acceptance & Satisfaction Statements	Score	Answer
HIS performance speed is acceptable	1.9	Disagree
HIS is user friendly and easy to use	3.0	Neutral
HIS provides sufficient information	3.3	Neutral
HIS provides accurate information	3.3	Neutral
HIS screens layouts are appropriate	3.3	Neutral
HIS provides updated information	3.3	Neutral
My practice needs are optimized by HIS	3.6	Agree
HIS provides clear information	3.6	Agree
HIS fonts and characters are easy to read	3.6	Agree
HIS improves access to patient information	3.6	Agree
HIS General Assessment Overall Score	**3.3**	**Neutral**
Laptop computers	1.5	Strongly Disagree
Computer on wheels	1.6	Strongly Disagree
Computers are always available when I need them for HIS use	2.5	Disagree
Desktop computers	2.9	Neutral
Availability of Computers in the Hospital Overall Score	**2.1**	**Disagree**
Using HIS decreases time spent by patients inside hospital	2.5	Disagree
HIS improves the quality of patient care process	3.4	Neutral
HIS improves the quality of patient data entry and retrieval	3.5	Agree
Patient Care & HIS Overall Score	**3.2**	**Neutral**
I am prepared for HIS downtime	2.4	Disagree
HIS downtime procedure is clear and comprehensive	2.5	Disagree
Current HIS training materials are helpful	2.8	Neutral
I am satisfied with the support provided to HIS users	2.9	Neutral
Overall, I am satisfied with HIS	3.0	Neutral
I received enough training on HIS	3.0	Neutral
Users' Satisfaction Overall Score	**2.8**	**Neutral**
Grand Total Score	**2.9**	**Neutral**

5. Discussion

The availability of computers in the hospital was one of the least acceptable and satisfying group of factors, with a special emphasis on the unavailability of laptop computers and mobile computers (computers on wheels) to facilitate the direct and immediate data entry and information retrieval processes when healthcare professionals are at the point of care. Many studies discuss and highlight the influence of computers availability on the success or failure of hospital information systems adoption and implementation[18]. Users were not satisfied with the downtime procedure and they highlighted that they are not prepared for it; to switch to an alternative manual system in case the electronic system failed. They said that HIS downtime procedure is no clear and not comprehensive, this is consistent with many studies which highlighted that minimal and clearly understood downtime can spare a lot of the unintended consequences or HIS related medical errors, especially in the areas of medications and ICU[19].

Users highlighted that using the HIS might frequently slow down the process of care delivery and increase the time spent by patients inside hospital. This is typically reported, through many studies, in the form of decreased efficiency and increased patient waiting time at the many hospital services, mainly in the outpatient settings and during the procuress of registration and admission especially at the beginning of the HIS implementation or at the transitional phases of updating or upgrading HIS[20]. Users agreed that the performance of the HIS is slow overall and that this unexpected slowness is not acceptable and might lead to more slowness in the process of care delivery and might increase the time spent by patients inside hospital even more. The implementation of HIS has proved to be a path ridden with many challenges. It is obvious that inadequate design of HIS, such as bad or inadequate user interface or poor HIS performance, such as slow response times, will reduce its chances of being accepted by users and implemented successfully[18].

Using ANOVA tests to look into the inferential statistics, the Gender of the HIS users did not have any significant influence on the level of satisfaction of users with any of the factor groups or individual factors. While the participants' Job Type, Years of Experience and Age were all significantly influential. Pharmacists were the least satisfied users with all parameters of HIS performance, especially performance speed and the status of information provided by the HIS; being up-to-date. Physicians were the next least satisfied especially with the design of the HIS in terms ease of use; being user-friendly, which is highlighted as an influential factor of technology acceptance in many studies[16, 17]. Nurses, technical staff and administrators did not report much different satisfaction levels that the overall response.

Years of experience and age both had similarly significant influence on the level of satisfaction of users where younger and less experienced users had lower satisfaction levels. Younger and less experienced users thought that the system is very slow, the system is not user friendly or easy to use, and the system provides insufficient information, inaccurate information and sometimes out-of-date information. Younger and less experienced users thought that there is a severe shortage in number and availability of computers, especially laptop computers and computers on wheels. They believed that computers are not always available when they needed them. They also thought that using the HIS increases the time spent by patients inside hospital and does not improve the quality of patient care much. They also reported that they are not prepared for the HIS downtime, the downtime procedure is not clear or comprehensive and that the HIS training materials are not helpful.

6. Conclusions and Recommendations

From the results, discussion as well as users' feedback to the open ended question; about the suggestions to improve the HIS performance, acceptance and satisfaction among users, we could summarize the conclusion and recommendations into three main areas; system performance, organizational support and feedback mechanisms.

On the first area; improving the performance and availability of the system is very crucial for its acceptance, satisfaction and overall success. The HIS needs enhancements in the form of improving the software speed, responsiveness and increasing availability of computers, laptops and computers on wheels. Screen designs need to

be enhanced with more focus on the sequence and logic of functions, tasks and buttons, some software features need to be more user friendly or user adjusted when possible, such as font size. The conventional methods of data entry, using keyboards, are labor intensive and time consuming, which can be alleviated by using new innovative technologies such as automated voice recognition and dictation systems. The second area includes improving the organizational support of users, through providing more training to new and old users, more dedicated and protected time during working hours for users to learn and practice on the system after implementation or upgrade and providing better user manuals and materials for training and also as reference for users when they have problems. More technical support is needed from the vendor. The third area is providing better and more reliable channels of communication and feedback, since many users reported that they have been suggesting ideas and sometimes finding solutions for problems but the low communication level and unavailability of reliable feedback mechanisms decreased their chance of successful contribution to HIS improvement. Most users were very enthusiastic about conducting this study and survey and they all recommended that it should be done on a regular basis to monitor and improve the level of HIS acceptance and satisfaction among users and focus on critical issues and high priority challenges. Since this study was conducted on one hospital, external validity would be limited in terms of generalizing the results and conclusions on other hospitals, especially if these were on a different healthcare level.

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