

Usability Evaluation of the Electronic Medical Record of the Rapid Response Team: a Case Study

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Abstract

Aim: This study was conducted to determine the usability of the rapid response team (RRT) electronic medical records (EMRs) system at an Abu-Ali-Sina organ transplant hospital, Shiraz, Iran.

Method: This cross-sectional study was carried out in partnership with 25 direct members of RRT includes nurses and anesthesia technicians who were on the shift during the data collection for two months. To evaluate, the Questionnaire for User Interaction Satisfaction (QUIS) version 7 was used. Data were analyzed by SPSS version 19.

Results: A total of 20 out of 25 questionnaires were obtained. Seven (25.0 %) of 27 sections were higher than seven, and all areas were higher than five. The highest rankings were for 1) reading characters on the computer screen 2) highlighting on the screen simplify task 3) overall reactions: wonderful and learning to operate the system.

Conclusion: This study demonstrates the usability of the hospital RRT for the EMRs system and over the moderate. However, the flexibility and capability of the rapid response for EMRs tool require to be improved.

Keywords: Usability evaluation; Interfaces; Hospital rapid response team; Electronic medical records

Rapid response team (RRT) is a team of healthcare providers with critical care knowledge and expertise who respond to hospitalized patients showing early signs of poor health on non-intensive care units (1). Furthermore, rapid response teams have been shown to reduce the rate of respiratory and cardiac arrest outside of intensive care units (1, 2). Overall, gathering and analyzing the RRT information are fundamentals for monitoring RRTs, improving communication, and identifying the strengths and weaknesses of RRTs (3).

In recent years, the availability of information technologies in healthcare centers has enhanced the collection, analysis, processing, and dissemination of clinical information. However, electronic medical records (EMRs) lead to delays in providing medical services (3).

The use of information systems in all fields of care and treatment has gotten far-reaching. The utilization of health information technology (HIT) expands patient safety and diminishes costs (4). Notwithstanding, due to usability problems, HIT systems are still not very efficient. Several investigations have shown that HIT does not meet user requirements (5). In addition, some clinical information systems have caused new errors; the consequences of these errors lead to patients' harm and expanded expenses (6).

In the design and development of health information systems, the greatest focus is on performance, security, and database design, and less attention is paid to the usability of the health information system. Therefore, one of the problems of clinical information systems is usability, which greatly affects patient care (7, 8). Hence, it is necessary to evaluate the usability of the health information system.

Usability is defined in different ways and usually includes a set of evaluation methods to understand the user experience to create desired, useful and usable products. According to the US Department of Health and Human Services (HHS), usability testing evaluates a product or service using a user-centric evaluation (9). Typically, during the usability testing, participants try to carry out the tasks assigned to them, and the recipients are simultaneously testing, monitoring, listening, and taking notes on the participants' activities (10).

The history of evaluation studies on health information systems dates back to decades ago. However, as one of this research is related to the present study, we can refer to the research entitled *Assessing the Electronic Bedside Pediatric Early Warning System*.

The study results (Tomasi et al.) showed that decision-making based on initial electronic warning was 18%, and initial paper warning was 12.7%. The error rate of calculating the initial warning in electronic records was 15.7% lower than the initial paper warning (11). In another study, Falk et al. demonstrated that the usability of intensive care information systems was poor (12).

Ratwani et al. found that the usability challenges of health information technology have led to unwanted consequences. The weakness of the usability of electronic health records has caused harm to the patient; it causes clinical experts to spend more time using electronic health records. In addition, the poor usability of

the clinical information system will decrease patient safety (13).

This study aims to determine if the rapid response team can use the electronic medical record system. As a result, we will help identify the type of problems of clinical specialists with the electronic medical record system of the rapid response team. The collected usability problems help the developer to modify the software in the updated version.

Method

This is a cross-sectional study conducted to evaluate the EMR of the RRT in Abu-Ali-Sina Organ Transplant Hospital in 2020.

Abu Ali Sina Organ Transplant Center is the largest and most equipped organ transplant center in Iran and the Middle East, and it is recognized as one of the most critical transplant centers in the world. A significant number of rare transplants are performed annually in Shiraz, Iran (14).

This hospital is equipped with more than 600 beds. Varieties of transplant surgeries, including liver, kidney, pancreas, heart, and bowel transplants are performed in this hospital. The RRT of the hospital consists of a registered nurse anesthetist and an ICU nurse. This team is managed by a nurse supervisor and is guided by an ICU specialist daily. Nearly 80 patients receive rapid response services by the emergency response team every month. Due to the sample size limit, all the people were included in the investigation.

The Questionnaire for User Interaction Satisfaction (QUIS) version 7 was used to evaluate the usability of EMR the RRT. It is a usability-testing tool designed to evaluate user satisfaction with specific aspects of the human/computer interface. The QUIS contains six parts: demographics (6 questions), overall reactions to the software (6 questions), screen factors (4 questions), terminology and system information (6 questions), learning (6 questions), and system

capability (5 questions). RRT members received the questionnaire URL via e-mail on March 9, 2021, designed in Google Form. The subjects were asked to rate each item based on a 10-point Likert scale with opposing adjectives on each end of the scale. Besides, the Persian version QUIS has a reliability of 0.94 (Cranach's alpha) (15).

Participation in the study was voluntary, and all participants submitted written informed consent before enrollment. Also, participants were assured that their personal information in the survey would not be disclosed.

Survey responses were collected and analyzed by SPSS version 19. Data items on the 10-point Likert scale were coded from 0 to 9. The average of each item and the overall mean were calculated.

Results

In this study, 20 responses were obtained out of 25 responses. The mean (SD) age of the participants was 27.9 (1.93) years (with the age range of 25-31). Also, the mean (SD) of work experience in hospital and work experience with

hospital information systems (HIS) was 4.05 (1.73) and 2.9(1.51) years, respectively. The demographic characteristics of the participants are shown in Table 1.

Table 1: Demographic characteristics of participants

Variable		Frequency (%*)
Sex	Male	15 (75)
	Female	5 (25)
Career Field	Nurse	13 (65)
	Anesthesia technician	7 (35)
Education level	Bachelor	18 (90)
	Master	2 (10)

A higher score indicates higher user satisfaction. The average QUIS rating for the EMR was 6.45, and a mean less than five shows an unacceptable level of satisfaction.

Seven (25.0%) of 27 sections were higher than seven. The score of all areas was higher than five. The highest rankings were for 1) reading characters on the computer screen 2) highlighting on the screen simplify task 3) overall reactions: terrible-wonderful and learning to operate the system (Table 2).

Table 2: User satisfaction ratings for the EMR

	Section	Range	Mean
1. Overall reactions to the software	Overall reactions: Terrible-wonderful	5-9	7.11
	Overall reactions: Difficult-easy	2-9	6.74
	Overall reactions: Frustrating-satisfying	5-9	7.05
	Overall Reactions: Inadequate power-adequate power	3-9	6.21
	Overall reactions: Dull-stimulating	1-9	5.68
	Overall reactions: Rigid-flexible	0-9	5.00
2. Screen factors	Reading characters on the computer screen	4-9	7.42
	Highlighting on the screen simplifies the task	4-9	7.16
	Organization of information on the screen	4-9	7.00
	Sequence of screens	4-9	7.05
3. Terminology and system information	Use of terms throughout the system	5-9	6.95
	Computer terminology is related to the task	4-9	6.74
	Position of messages on screen	4-9	6.58
	Messages on the screen that prompt the user to input	0-9	6.42
	The computer keeps you informed about what it is doing	0-9	5.79
	Error messages	3-9	6.68
4. Learning	Learning to operate the system	4-9	7.11
	Exploring new features by trial and error	3-9	6.00
	Remembering names and using commands	2-9	6.42
	Tasks can be performed in a straight-forward manner	4-9	6.37
	Help messages on the screen	4-9	6.53
	Supplemental reference materials	1-9	6.26

	Section	Range	Mean
5. System Capabilit.y	System speed	0-9	5.84
	System reliability	2-9	6.47
	System sounds tend to be	3-9	6.00
	Correcting mistakes	0-9	5.74
	Designed for all levels of users	1-9	5.74
Total			6.45

Discussion

The overall opinion of the users towards the EMR of the RRT was easy to use, satisfying, stimulating, flexible, and powerful enough. It obtained a range between 4-9 and means of 5 and above in screen factors. Ghalayini et al. demonstrate that organization of display has a positive effect on the system's usability (16), consistent with the results of our study in the field of organization of information on-screen with a Mean of 7. In addition, 'reading characters on the computer screen' with a mean of 7.42 and 'highlighting on the screen simplifies tasks' with a mean of 7.16 indicates the good organization of the rapid response team software screen.

In the 'Terminology and System Information' section, the rapid response team software achieved a Mean higher than 5 in its options range of 0-9. Romaric et al. indicate that incomplete content and display method is one of the most important usability problems (17), consistent with our study results. The lowest rapid response team software means in the part of 'terminology and system information' was related to 'computer keeps you informed about what is doing' and 'messages on-screen that prompt user to input' with means of 5.79 and 6.42 in the range of 0-9, respectively. It means a defect and disability of rapid response team software in this regard. However, the 'use of terms throughout system option' with a mean of 6.95 in the range of 5-9, evaluated relatively well.

Hardenbol et al. showed that it is necessary to consider remembering, shortcuts, and adaptability to apply decision support systems in the outpatient ward (18). According to our

findings, 'learning to operate' the rapid response team software system with a mean of 7.11 in the range of 4-9 has been evaluated at a good level. Also, 'help messages on the screen with a range of 4-9 and a mean of 6.53 were evaluated relatively well.

Many studies have investigated the importance of errors prevention and correcting system errors. Most of these studies have paid special attention to this issue, and the deficiency or weakness of error prevention in the system can make the designed system or software very weak and incapacitated (19-21). In our evaluation of the rapid response team software, the 'correcting mistakes' feature with a mean of 5.74 in range 0-9 was not evaluated well, indicating the software weakness. In addition, designed for all levels of users with a mean of 5.74 and the system speed with a mean of 5.84 were evaluated at low levels.

This study had some limitations, including methods and tools. Due to COVID-19 conditions and overcrowding in hospitals, we could not use qualitative methods such as focus group interviews. Certainly, qualitative methods in sparsely populated research samples can provide more detail. This issue can be considered as future work.

Conclusion

This study indicates that the usability of EMR interfaces, specifically screen factors like using the screen to highlight letters, simplifies the task and can increase by organizing information on the EMR system. Paying attention to the screen dimension of usability in an EMR system can help to reduce medical errors. To increase consistency in EMR interfaces, terminology and

system information must be considered. For this intention, attention must be paid to how the terms are used throughout the system and how the messages are displayed.

In conclusion, this study demonstrates that the usability of the in-hospital rapid response team electronic medical record system was over moderate. However, the flexibility and capability of the rapid response EMRs system need to be improved. A further qualitative study on the usability of rapid response team EMRs is needed to identify the usability problem of this software. To increase the satisfaction of the user, the design, and development of systems based on the principles of user-centered design and participation of system stakeholders at all stages of system design and development, are necessary.

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