

# Satisfaction and Perception of Emergency Department Personnel on Electronic Triage System

Faramarz Pourasghar, Jafar Sadegh Tabrizi, Alireza Ala, Mohammad AsghariJafarabadi, Amin Daemi

**Abstract** — *The Electronic Triage System (ETS) has recently been developed to be used in hospital emergency rooms. To assure the quality and improve the system, it is necessary to study the users' perception continuously. This study presents the results of survey on satisfaction and perception of Emergency Department (ED) staff with the ETS. In this descriptive cross-sectional study the data collection tool was a researcher-designed questionnaire that includes two sections which were multi-choice and open ended questions. The study variables were gender, occupation, computer skill, Internet skill, and the daily use of computer (in minutes). The content validity of the questionnaire was assessed by the expert panel. For reliability of the questionnaire Cronbach's Alpha and for assessing statistical significance the Independent Samples T-test and Spearman's coefficient were used and analyzed using SPSS version 16. The content validity of the tool was approved with the scores of CVR= 0.93 and CVI= 0.96. Cronbach's alpha for all the questions was 0.979. The average scores of the aspects including User interface, Learning, System capability, Data entry and retrieval, Impact on patient care, and Overall perception in a range of 0 to 100 were 50, 51, 52, 42, 46, 36, and 42, respectively. Physicians in 5 aspects out of 7 expressed significantly more satisfaction. There was no association between use of computer and internet and the satisfaction. The main strengths of the ETS from the users' viewpoint were reducing patient waiting time, speeding up the works, improving confidentiality of patient data, and accuracy of triage. The questionnaire is a useful tool for its purpose. The comments that obtained in this study can be used as a basis for increasing user satisfaction with electronic triage system<sup>1</sup>.*

**Keywords** — Satisfaction Questionnaire, User Perception, Electronic Triage system.

## I. INTRODUCTION

Triage is the first step in an Emergency Department (ED) visit that prioritizes patients according to acuity of their medical condition. In Iran the Ministry Of Health And Medical Education requires hospitals to perform triage for all ED visitors and recommends the Emergency Severity Index (ESI) which is a five-level triage system [1].

With regard to the increasing use of computers in health services [2] and following the development of electronic and computerized triage systems around the world [3-9], the Electronic Triage System (ETS) was developed in Tabriz University of Medical Sciences for the first time in Iran. The project was collaboration between departments of Health Services Management and Emergency Medicine that was implemented in late 2012. The ETS was developed upon the ESI triage system and based on patients data, determines the triage level and treatment field within ED [10].

The hospital staff is one of the main beneficiary groups of electronic clinical information systems. In fact they are the

internal customers of the system who use the system in their daily practice and can assess the quality of the system. If they become dissatisfied or mistrusted with the system, they would not use it or at least would not use it properly [11, 12]. User satisfaction is also one of the determinants of success or failure of the hospital information system [13].

Sitting and the colleagues (1999) used five aspects for evaluating clinical information system including system response time, time required by users to learn the system, ability of users to remember what they learned, error rate, and subjective user satisfaction. They stated that if a system could not attain its users' satisfaction, even if it had good performance on other four aspects, it would not have usability [14]. In another framework which was introduced by DeLone and McLean (2003), user satisfaction is one of the six aspects of evaluating clinical information system [15].

Using staff opinions would lead to improvements in information systems [16, 17] and also result in their satisfaction [17]. Kahouei et al. have mentioned that using the staff opinions in order to improve hospital information system

<sup>1</sup> F. Pourasghar is member of Road Traffic Injury Research Center and Department of Medical Informatics, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran

J. S. Tabrizi is member of Tabriz Health Services Management Research Center and Department of Health Services Management, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran

A. Ala is member of Department of Emergency Medicine, School of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

M. AsghariJafarabadi is member of Road Traffic Injury Research Center, Faculty of Health, Tabriz University of Medical Sciences, Tabriz, Iran

A. Daemi is member of Health Management and Economics Research Center, Iran University of Medical Sciences, Tehran, Iran (Corresponding author: daemi.a@tak.iums.ac.ir)

causes them to feel ownership on the system [17].

Considering importance of users' opinions in designing and improving such systems, the present study was conducted with the aim of assessing satisfaction and perception of ED personnel on the ETS.

## II. METHODS

### A. Study design and participants

This was a cross-sectional study conducted in April 2013, five months after implementation of the ETS. The study consisted of quantitative and qualitative parts. The target population was the ED physicians, nurses and supervisors.

The study site, Tabriz Imam Reza hospital, is one of the Iran's largest hospitals that serve as a referral center for other hospitals of the city and also other cities of the Eastern Azerbaijan Province. The hospital's ED is one of the most crowded EDs in the country with over 80000 visits annually. Inclusion criteria for participants to enroll in the study were working in the ED and with the ETS. 49 people had the eligibility to be included in the study and all of them participated.

### B. Study tool

The data collection tool was a questionnaire which was prepared based on questionnaires on satisfaction with web sites, soft wares and electronic medical record systems [18-20]. Additionally some items which were specific for triage or the ETS were included in the questionnaire.

Validity of the questionnaire assessed using the Content Validity method by expert panel. All 12 members of the expert panel evaluated the questionnaire items in four dimensions including relevance, clarity, simplicity and necessity. Then the Content Validity Ratio (CVR) and the Content Validity Index (CVI) was calculated for each item. Items that had low scores in each of the dimensions were revised. One item with CVI and CVR scores less than 0.75 was removed from the questionnaire.

Cronbach's Alpha calculated for each of the aspect and for the entire questionnaire to assess the reliability.

### C. Study variables and data collection

The questionnaire comprised of following sections: participant information (5 questions), multi-choice items (42 questions) and open ended items (3questions). The options in the multi-choice section (quantitative part of the study) were in a five-choice Likert scale. For each of the options very low, low, moderate, high, and very high, the scores of 1, 2, 3, 4 and 5 were assigned respectively. The items categorized in 7 aspects including, terminology, learning, system capability, data entry and retrieval, impact on patient care, and overall perception. In the quantitative part the independent variables were gender, occupation, computer use, internet use, and the

average daily use of computer (in minutes). The dependent variable was satisfaction with the ETS.

The items of the qualitative part of the study were unstructured questions and the participants wrote their opinions in a descriptive manner.

### D. Data analysis

For quantitative part of the study the descriptive statistics was used. Score of each item normalized on range of 0 to 100 and instead of 1, 2, 3, 4 and 5 the scores of 0, 25, 50, 75 and 100 was used respectively. Then the score of each aspect calculated as average score of its consisting items [21]. In order to evaluate the association between the independent variables of gender, occupation, use of computer, use of internet and the average score of the aspects, the Independent Samples T-test was used. And for the association between the average daily use of computer and the scores of items the Spearman's coefficient was used [22]. All tests performed using SPSS 16 and with the 0.05 significance level. In analyzing the data the nursing supervisors were considered within the same group as nurses.

For the analysis of the qualitative data obtained from the open ended questions, the Content Analysis was used. After reading the data several times, the primary codes extracted, the similar codes classified into the potential themes, and then the themes formulated/named.

## III. RESULTS

### A. Results of quantitative part

From 49 people who participated in the study, 21 were physicians and the others were nurses and nursing supervisors. 28 of participants were female which 8 of them were physicians. 17 out of 21 physicians and 25 out of 28 nurses stated that they use computer in work or at home. The similar rate of using the internet among physicians and nurses were 16 out of 21 and 26 out of 28, respectively. The average daily use of computer by the people who gave a positive answer to the question, in physicians and nurses groups and the overall was 152, 140 and 144 minutes respectively.

Content Validity of the questionnaire confirmed with the CVR= 0.93 and CVI= 0.96. Cronbach's Alpha for all items of the questionnaire was 0.979 indicating the high reliability of the questionnaire. The Alpha values for each of the seven aspects of the questionnaire are presented in Table I.

TABLE I  
RELIABILITY OF THE QUESTIONNAIRE

Aspect	Items	Cronbach's Alpha
User interface	4	0.896
Terminology	6	0.912
Learning	7	0.908
System capability	4	0.853
Data entry and retrieval	8	0.934
Impact on patient care	8	0.935
Overall perception	5	0.950

The average score of the ETS on the seven aspects are shown in fig. 1. The Learning aspect had the highest and the Impact on patient care had the lowest scores. The standard deviation of the scores of user interface, terminology, learning, system capability, data entry and retrieval, impact on patient care, and overall perception were 6, 6, 8, 8, 3, 5 and 4 respectively.

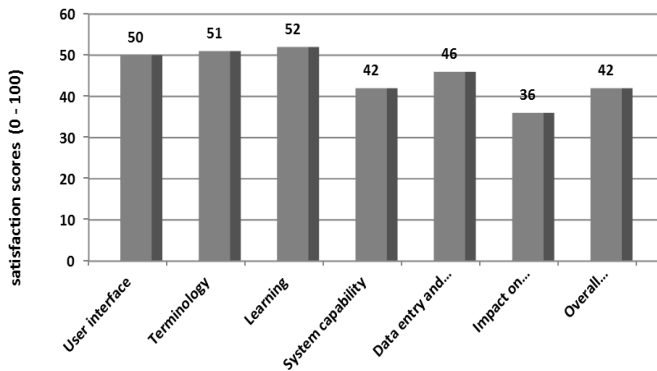


Fig. 1. Average scores of the ETS in each dimension of the questionnaire.

Fig. 2 shows results of satisfaction among physicians and nurses. As it is seen, in all aspect the physicians expressed higher satisfaction. Those aspects that the difference between nurses and physicians was significant are highlighted by \*.

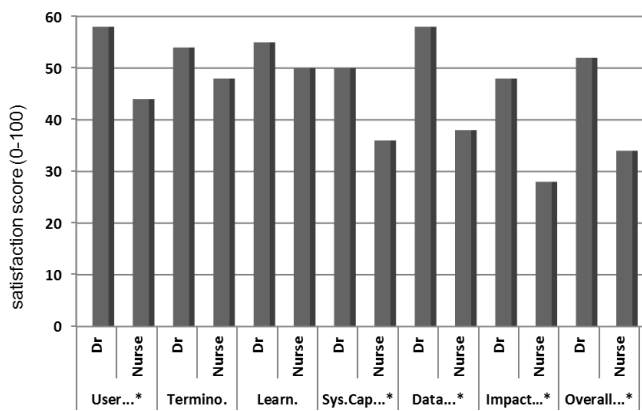


Fig. 2. Average scores of the ETS in each dimension divided by respondents. Physicians expressed more satisfaction than nurses.

There was no association between the use of computer and internet with the satisfaction scores. Spearman’s test revealed a statistically significant association between daily average use of computer and the scores of the user interface, data entry and retrieval, and impact on patient care aspects. The average scores of the questionnaire items are shown in Table II.

**B. Results of open-ended items**

The most important advantages of the system from the perspective of its users are speeding up patient progress, novelty and applicability, improving confidentiality of patient data, more accuracy in triage, ease of reporting and patient follow-up, elimination of paperwork, readability and

completeness of triage forms.

The most important disadvantages and challenges of the ETS from the users' perception were: personnel are slow in using computer; the personnel are accustomed to the traditional method; the ED resident physicians do not cooperate with the system in the expected way; working with computer strains the eyes; using the system increases workload for nurses and physicians; duplication in entering patient data, due to non-integration of the ETS and the hospital information system.

**TABLE II**  
SATISFACTION AND PERCEPTION SCORES OF THE ITEMS OF THE QUESTIONNAIRE (N=49)

Aspect	Item	Mean ± SD (0-100)
User interface	Easy to read text on the screen	59 ± 28
	Organization of the information	44 ± 29
	Sequence of the screens	47 ± 27
	Color of the pages	51 ± 28
Terminology	Consistency of the used terms	60 ± 27
	Helpfulness of the error messages	47 ± 26
	Proper use of specific terms	52 ± 29
	Messages are clear	51 ± 28
	Consistency of position of messages on the screen	51 ± 31
Learning	The system informs about its progress	43 ± 32
	Learning to operate the system is easy	58 ± 26
	Exploring new features by trial and error	55 ± 24
	Remembering commands' names and uses	59 ± 28
	The system processes are clear	60 ± 26
	Help messages exist and appear when needed	43 ± 30
System capability	Help messages are helpful	50 ± 28
	Supplementary materials are available	40 ± 30
	System speed	38 ± 31
	The system is trustworthy	42 ± 31
Data entry and retrieval	Correcting mistakes is easy	35 ± 30
	Designed for all levels of users; beginner and professional	53 ± 23
	Easy to enter data into the ETS	47 ± 29
	Easy to retrieve data from the ETS	51 ± 27
	Satisfaction with elimination of paperwork	45 ± 33
	The system reduces risk of making errors	48 ± 31
	Easy to monitor patient progress	46 ± 33
	Satisfaction with the possibility to see the patient's condition before s/he enter the treatment room	43 ± 31
The system is compatible with requirements of patient record documentation	48 ± 31	
Impact on patient care	Satisfaction with automatic calculation of two indicators of the Ministry of Health on triage	42 ± 33
	Improves the quality of patient care	41 ± 31
	Reduces the expenditure	40 ± 28
	Decreases patient waiting time	39 ± 31
	Decreases the number of laboratory tests and graphs	31 ± 30
	Decrease ED workload	27 ± 31
	Improves confidentiality of patient data	40 ± 29
Improves accuracy of triages	41 ± 27	
Reduces the time it takes to triage	32 ± 29	
Overall perception	Makes works easy	41 ± 32
	Satisfaction with system capability	38 ± 31
	Flexibility of the system and user spaces	44 ± 29
	It is easy to work with	47 ± 30
	Overall satisfaction with the system	39 ± 32

Proposals and recommendations provided by the users for improving the ETS are: holding more workshops for training and discussing with personnel; simultaneous presence of two triage nurses for speeding up the process; integration of the

ETS with the hospital information system; consulting with nursing staff in designing the system; using high-speed computers and equipment; ability of triage nurse to override acuity level and treatment area assigned by the ETS.

#### IV. DISCUSSION

Findings from this study showed that the questionnaire has high validity and reliability and is a good tool to survey satisfaction and perception of users against the ETS. The ED physicians in most aspects expressed more satisfaction than the triage nurses.

The result that the satisfaction with the ETS was about moderate may be due to this reason that the survey had been performed only five months after implementing the ETS. The users may express more positive view if they would have used ETS more and thus get familiar with the system [18].

The score of user interface aspect was one of the highest scores among the others. However using the users' opinions in designing the system may improve the acceptance of it [17]. Providing the users with the ability to change the background color and font size in future versions of the system may improve user satisfaction in this aspect.

The score of Terminology aspect was among highest scores too. It seems that appropriate use of professional terms and words that are familiar to the users, have effect on acceptance of the system and accelerating its learning. Also the messages that appear in case of error or after entering the data should be understandable in order to be effective.

The highest score belongs to the Learning aspect that indicates learning to work with the system and remembering the used terminology is easy for the users. Ease of learning is turned out to be as one of the most important factor that influences the user satisfaction [23].

Among the items of the Learning aspect the lowest score belongs to availability of supplementary materials. Despite the training workshops and distributing handbook of the system among the users, this finding indicates the importance of training from the users' perspective. The finding is repeated in qualitative part of the study in which the users proposed holding more workshops and meetings.

The item related to ease of use of the system by all levels of users -beginner and professional- had the highest score among the items of Capability aspect. This indicates that simplicity and avoiding unnecessary complexity are well-respected in designing phase of the system. This finding is in alignment with the high score of item number 14 that relates to understandability of the system processes.

The impact on patient care aspect acquired the lowest score among all the seven aspects. This indicates that most of the ED personnel believe that using the ETS will not make a remarkable change in the quality of services provided to ED patients. This finding is in line with the findings of a study performed on an electronic medical record system in an ED and showed that computerizing the ED information system will

not improve the quality of services [18].

Yet the ETS has an important difference with the electronic medical record systems. In contrast with electronic medical record system and other hospital information systems, the ETS has the ability of decision making and in fact determines the triage level (treatment priority) and treatment field for ED visitors. Additional investigations are needed to be taken to assess the extent in which this belief of the ED staff is true about the impact of ETS on quality of services.

More satisfaction of the ED physicians than the nurses may be due to the fact that the physicians are less involved in the triage process and their task is only to confirm the triage result. Actually it is the triage nurse that is responsible for the triage process and punching patient data on the ETS. The amount of data that must be entered into computer and the nature of the work are reported as possible factors influencing the satisfaction with the information system [17]. May be this increment in the workload of the nurses is the reason of their dissatisfaction.

Dansky et al. showed that the more use of computer, the more positive view that the staff have towards computerized information system [24]. On the other hand, regarding this fact that the ETS is designed as a web-based system that is used through the internet browsers [10], it was expected that an association will be found between the use of computer and internet and the satisfaction scores. But the results of the study were against this expectation. This finding complies with the findings of a study on perspective of family physicians on an electronic medical record system [25]. However considering the fact that in the present study the number of people who did not use computer and/or internet at home or work was limited (7 out of 49), the conclusion requires more investigation by studies with bigger sample size.

In case of slowness of personnel in using the computer, educational and training courses can be provided on computer skills and high-speed typing. Previous studies on perceptions of hospital staff about computerized information systems found that if entering data into the system is time-consuming, the staff will not use it [12, 17].

#### V. CONCLUSION

Validity and reliability of the questionnaire proved with high scores indicating that it is an appropriate tool for its purpose. Scores of all aspects were moderate or less. If users' opinion that obtained in this study became implemented, it can result in increased user satisfaction with the ETS. The qualitative part of the study revealed the advantages, disadvantages and challenges of implementing the ETS. As it was the first time that an electronic triage system is implemented in Iran, this study can be used as a basis of comparison for future research on satisfaction with such systems.

## ACKNOWLEDGMENT

The authors would like to thank Mr. Afshin Safapour head nurse, Mrs. Vida Saberian, Mrs. Zahra Abdolalipour for their contribution in data collection and all other emergency department personnel of Tabriz Imam Reza Hospital who kindly participated in this study.

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