

## Original Article



# The effect of the emergency severity index triage training on the knowledge and decision-making of the medical interns

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### Abstract

**Introduction:** We investigated the effect of education on the knowledge and decision-making of medical interns, based on emergency severity index (ESI) triage.

**Methods:** In this pre and post-interventional study, 155 medical students who were passing their internship course of the emergency ward were enrolled with convenience sampling from July 2018 to June 2019. The students were randomly classified into two groups (103 cases and 52 controls). The questionnaire was administered twice in the control group (before initiating the educational class and 1 month after completion of the educational course). In the case group, the test was conducted at three times (before the educational class, immediately after completion of classes, and one month after completion of the educational course). The data were analyzed by using t test and ANOVA.

**Results:** The total score of the students in the case group in the pre- and post-training stage (posttest 1) was  $17.13 \pm 4.26$  and  $24.93 \pm 3.20$  respectively, which had a significant difference ( $P < 0.001$ ). The total score of the students in the posttest 2 was  $23.38 \pm 5.66$ . Statistical test showed that there was a significant difference between the two groups of the students in terms of the test in the one month after completion of the educational course ( $P < 0.001$ ) except for undertriage ( $P = 0.236$ ).

**Conclusion:** The findings indicated that education based on ESI triage was effective on the knowledge and decision-making of medical interns. Based on the results of this research and given the importance of triage, theoretical and practical educational courses are proposed for medical students.

### Introduction

Emergency situations are risky conditions when the physical or psychological status of individuals are suddenly impaired, requiring immediate, essential, and proper measures.<sup>1</sup> The term "triage" is a scientific term in the emergency medicine which has been used for more than 30 years.<sup>2</sup> The goal of triage in the emergency ward is prioritizing reference of the patients to the most appropriate healthcare service.<sup>3</sup> A triage nurse, through a brief and precise assessment of the patient, allocates a level of triage to them. In this way, the duration the patient can safely wait for screening examinations or treatment, can be determined. Rapid and precise triage of patients is absolutely crucial for successful proper decision-making in the emergency department.<sup>4,5</sup> An improper triage leads to loss of resources, delay in the treatment of the patients, their dissatisfaction, and occurrence of adverse

consequences.<sup>6</sup> Achieving and applying a proper triage system is one of the essential and primary requirements for efficient and proper management of an emergency ward.<sup>7</sup> Undertriage happens when the nurse of the triage unit underestimates the clinical severity of the patient, causes delay in the patient's visit, thus increases the probability of occurrence of complications. On the other hand, over triage happens when the nurse of the unit overestimates the clinical severity of the patients.<sup>8</sup>

Among the current systems, the five-level system of emergency severity index (ESI) has been accepted more, and currently it is the common system utilized in the emergency departments of many hospitals of different countries. Level I refers to the maximum severity of damage, while level V refers to the minimum damage.<sup>2,9,10</sup> In the triage of patients, there are some internal factors including skill of the nurses (experience and knowledge),

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personal characteristics, the working environment (overwork), and the way patients are evaluated and referred; alongside the existence of supportive factors such as physicians.<sup>11</sup>

In two studies performed in Iran on the level of knowledge of medical students about hospital emergency triage, their level of knowledge was poor. Therefore, it had been suggested that triage training should be incorporated in the general practice curriculum.<sup>8,12</sup> In Iran, there is no comprehensive university course for training triage to nurses, as its portion in the curriculum of nursing students is only one session in the course of emergencies.<sup>13</sup> In medical education, training outpatient medicine, especially emergency medicine is one of the most important parts and has a strong relation with the medical profession prospect. It is expected that medical students after graduation have the ability of managing the emergency ward and emergency situations.<sup>14</sup>

Training the triage system to medical students is especially important for nursing and medical staff. Although the person in charge of emergency triage unit is a nurse who is responsible for the primary triage of patients, after the triage and entrance of the patient into the ward, the physician should evaluate the triage level of the patient. Then, in case of any problems, the physician should amend them and retriage the patient. The aim of this study was to investigate the effect of training triage on the knowledge and proper decision-making of medical students. The results of this study can help to reduce current deficiencies and problems.

## Methods

### *General study characteristics*

In a pre-post-interventional study, 155 internship medical students of Tabriz University of Medical Sciences (TUOMS) and Tabriz Islamic Azad University who were passing their internship period at the emergency ward were enrolled. The exclusion criteria were absence in the pretest or posttest (either or both) and not giving consent for participating in the research. The sample size was determined as all-census and chosen based on the number of students at the universities. This study was conducted over a year from July 2018 to June 2019.

The student groups were randomly divided into intervention and control groups through randomized allocation software. Triage training workshop was held for the intervention group (103 individuals) while the control group (52 individuals) did not receive such a workshop. In both groups before initiating the course, first the objective of this course was explained to the students and consent form was received from them.

### *Data collection tool*

The data were collected with a researcher made questionnaire collecting demographic characteristics, knowledge, and decision-making of students. Before

executing the plan, the reliability and validity of the questionnaire were confirmed. To determine the validity, qualitative content validity method was used based on expert comments. The utilized questionnaire was provided to 10 emergency medicine specialists who are faculty members of TUOMS. After describing the proposal, the comments were taken and their suggested corrections were applied to the questionnaire. To determine the reliability, the questionnaire was provided to 10 medical students twice with one-week interval. For this purpose, Cronbach alpha method was used through SPSS software, where the Cronbach alpha value was above 0.85.

The first section of the questionnaire included the demographic information of the students while the second part consisted of 20 multiple choice questions (MCQs) about the ESI triage system measuring the students' knowledge about the ESI triage. In the third part, the decision-making of students was measured, consisting of 15 MCQs including a history of the patients' status. The students should have determined the triage level of the patient presented in the question. The score of the student was calculated based on the number of correct responses. The maximum student score in the knowledge and decision-making measurement parts was 20 and 15, respectively. Additionally, in the decision-making part, the extent of undertriage and overtriage was evaluated based on the triage level determined by the students.

### *Study design*

In the intervention group, at the beginning of the internship period in the emergency ward, the questionnaire was presented (pretest). Afterwards, the triage training workshop was held as face-to-face education through PowerPoint slides, video projector, as well as question and answer at the end of each session on practical examples. The reference used for the training was the *Emergency Severity Index* book,<sup>3</sup> translated and published by the faculty members of the emergency medicine department of TUOMS. The triage class consisted of two 60-minute sessions lectured by one emergency medicine specialist, a faculty member of the university. The first session dealt with the history of triage, the necessity of incorporating triage unit in emergency, and cursory introduction of the ESI. The second session included detailed explanation of the ESI triage as well as the way patients should be prioritized at this level. Following, the same questionnaire was distributed and then completed by the students in the intervention group at the end of the class (posttest 1). Four weeks after completion of the educational sessions and at the end of the internship course in the emergency ward, the same questionnaire was again presented to and completed by students in the intervention group in order to evaluate the extent of information retention (posttest 2).

In the control group, at the beginning of the internship course in the emergency ward, the questionnaire was given

to the students and completed by them (pretest). This group received no triage training class at the beginning of the course, where the aim in this group was to evaluate the extent of practical learning throughout the internship in the emergency ward. At the end of the internship course, again the same questionnaire was administered to the students and completed by them (posttest). In order for students not to be deprived of theoretical training of triage, triage training workshop was held with the same conditions as in the case group after completing the questionnaire.

### Statistical analyses

The data were introduced into SPSS 17 software. For statistical distribution of the obtained information, mean  $\pm$  standard deviation was used for quantitative variables and frequency and percentages were used for qualitative variables. Normal data distribution was examined by Kolmogorov Smirnov test. To compare the qualitative data, chi-square test was utilized, while independent samples *t* test and paired *t* test were employed for comparing the quantitative data. For statistical comparison between the scores of students in the case group, considering presence of three quantitative variables, repeated measurements of ANOVA was used. The significance was considered as  $P < 0.05$ .

### Results

In this study, 155 senior students of general practice were included in two groups: 103 as case and 52 as control group. The mean age of the subjects was  $25.25 \pm 2.35$  years. The gender distribution was 54 males (34.8%) and 101 females (65.2%). Among the students, 50 (32.3%) had previous knowledge about triage while 105 (67.7%) had no previous knowledge about triage. Considering the mentioned variables, no significant difference existed between the two groups ( $P > 0.05$ ).

The results of the pretest showed that the total score of the students in the test was  $17.13 \pm 4.26$ . The mean score of students in terms of knowledge, decision-making, number of undertriaged cases, and number of over triaged cases were  $10.68 \pm 2.82$ ,  $6.39 \pm 2.65$ ,  $2.36 \pm 4.20$ , and  $1.87 \pm 4.44$ , respectively. Based on the previous knowledge, the students were categorized into two groups. Table 1 compares the results of the pretest between the two groups in terms of presence or absence of previous knowledge. Table 2 reports the results of the pretest for the two groups of the studied students (case and control).

The posttest 1 was administered only in the case group after completion of the educational class at the beginning of the course. The mean score of the students in terms of knowledge, decision-making, undertriaged cases, and over triaged cases were  $16.18 \pm 1.96$ ,  $8.73 \pm 2.36$ ,  $1.91 \pm 2.87$ , and  $1.77 \pm 3.41$ , respectively. The total score of the students in the posttest was  $24.93 \pm 3.20$ . The paired *t*-test showed that there was a significant difference in pretest and posttest 1

**Table 1.** Comparative results of the pretest in two groups of the students based on their previous information

Variable	Group		P value*	95% CI
	With previous knowledge	Without previous knowledge		
Knowledge	11.50 $\pm$ 2.98	10.28 $\pm$ 2.67	0.012	0.27-2.16
Decision	6.84 $\pm$ 1.97	6.17 $\pm$ 2.90	0.142	-0.23-1.56
Undertriage	4.36 $\pm$ 2.15	4.12 $\pm$ 2.46	0.562	-0.56-1.04
Overtriage	3.80 $\pm$ 1.78	4.74 $\pm$ 1.85	0.003	-1.56-0.32
Total	18.34 $\pm$ 3.95	16.55 $\pm$ 4.30	0.014	0.36-3.21

\*Independent samples *t* test.

**Table 2.** The results of pretest in two groups of the students (case-control)

Variable	Group		P value*	95% CI
	Case	Control		
Knowledge	10.94 $\pm$ 2.99	10.15 $\pm$ 2.41	0.101	-0.15-1.73
Decision	6.33 $\pm$ 2.64	6.50 $\pm$ 2.68	0.707	-1.06-0.72
Undertriage	4.37 $\pm$ 2.43	3.86 $\pm$ 2.20	0.211	-0.29-1.29
Overtriage	4.30 $\pm$ 1.86	4.71 $\pm$ 1.89	0.199	-1.03-0.21
Total	17.37 $\pm$ 4.50	16.65 $\pm$ 3.72	0.325	-0.71-2.14

\*Independent samples *t* test

scores in the case group ( $P < 0.001$ ), suggesting the effect of the educational class.

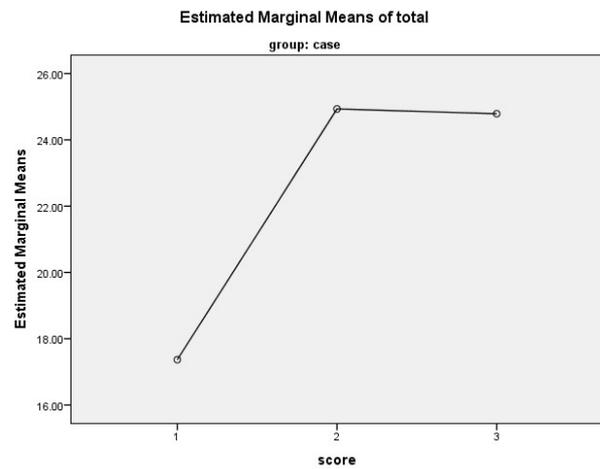
The results of the second posttest revealed that the mean score of the students in terms of knowledge, decision-making, undertriaged cases, and over triaged cases were  $14.69 \pm 3.46$ ,  $8.66 \pm 2.90$ ,  $2.06 \pm 2.80$ , and  $1.99 \pm 3.54$ , respectively. The total score of the students in the posttest 2 was  $23.38 \pm 5.66$ . The independent samples *t* test indicated that there is a significant difference in terms of the posttest 2 scores between the two groups except for the undertriage. Nevertheless, it should be noted that the extent of undertriage was less in the case group compared to the control, though not statistically significant. Table 3 provides the results of the second posttest for both groups of the students (case-control).

In the case group, the test was administered three times; the first time before beginning of the educational class (pretest), the second time immediately after completion of the educational class (posttest 1), and the third time one month after completion of the internship course of the emergency ward (posttest 2). The results of repeated measurements of ANOVA, in comparing the impact of education and internship of emergency ward regarding knowledge and performance of the students, showed a statistically significant difference between the scores of the three tests over time ( $P < 0.001$ ). Presence in the ward caused better decision-making for students, but the level of knowledge of the students at the end of the internship course was lower than the post-class score. Table 4 compares the results of the tests performed on the case group. Figure 1 demonstrates a schematic model of the total score of students in the case group in the three tests.

In the control group, the test was administered twice: first before beginning the internship course of the emergency ward (pretest) and the second one month after the internship course of the emergency ward before holding the educational tests (posttest). Table 5 presents the results of the tests (2 tests) in the control group. The results of paired t-test showed that there was a significant difference between the scores of the two tests except for the overtriage score over time. Nevertheless, presence in the ward caused better knowledge and decision-making for the students.

**Discussion**

The aim of triage in the emergency ward is prioritizing the referring patients for better management and provision of healthcare services.<sup>3</sup> Knowledge about the prioritization of patients and the way different levels should be allocated to patients is absolutely essential for both the nurses



**Figure 1.** The mean score of students in the case group based on the total score in the test.

**Table 3.** The results of the second posttest in the case and control groups of students

Variable	Group		P value*	95% CI
	Case	Control		
Knowledge	15.56±3.07	12.96±3.58	<0.001	1.51-3.69
Decision	9.17±2.97	7.63±2.48	0.002	0.59-2.48
Undertriage	2.66±2.06	3.08±2.06	0.236	-1.11-0.28
Overtriage	3.17±1.99	4.29±1.81	0.001	-1.84-0.15
Total	24.79±5.38	20.60±5.23	<0.001	2.40-5.98

\*Independent samples t test

**Table 4.** Comparison of the results of the tests performed in the case group

Variable	Group			P value*
	Pre-test	Post-test 1	Post-test 2	
Knowledge	10.94±2.99	16.18±1.96	15.56±3.07	<0.001
Decision	6.33±2.64	8.73±2.36	9.17±2.97	<0.001
Undertriage	4.37±2.43	2.87±1.91	2.66±2.06	<0.001
Overtriage	4.30±1.86	3.41±1.77	3.17±1.99	<0.001
Total	17.37±4.50	24.93±3.20	24.79±5.38	<0.001

\* Repeated measurements of ANOVA.

**Table 5.** Comparison of the results of the tests administered in the control group

Variable	Group		P value*
	Pre-test	Post-test	
Knowledge	10.15±2.41	12.96±3.58	<0.001
Decision	6.50±2.68	7.63±2.48	0.026
Undertriage	3.86±2.20	3.08±2.06	0.038
Overtriage	4.71±1.89	4.29±1.81	0.199
Total	16.65±3.72	20.60±5.23	<0.001

\*Paired samples t test

and physicians employed in the emergency department. An improper triage leads to loss of resources, delay in the treatment of the patients, their dissatisfaction, and incidence of adverse consequences. In contrast, proper triage can be useful in determining the treatment line as well as facilitating the processes for stabilizing the status of the patients and their admission.<sup>4,15</sup>

In this research which was a semi-experimental study of pre-/post interventional type, the impact of the education based on ESI triage was tested on the knowledge and decision-making of medical internship students. The sample size examined in this study was 155 internship students of Tabriz University of medical sciences and Tabriz Islamic Azad University passing the internship course of the emergency ward. There was no significant difference between the case and control groups in terms of age, gender, and initial knowledge. Accordingly, it can be stated that the impact of the factors of gender, age, and initial knowledge had been removed from the study. The findings of our research showed that although presence in the ward has caused better level of knowledge and decision-making for the students, the influence of the preliminary training of the ESI triage was greater than that of presence in the ward.

Performing precise triage has potential impacts for the patient consequences. Between the knowledge of triage and working background, pure knowledge about triage is more important than working background for decision-making of nurses in triage. Better understanding of the relationship between clinical decision-making, knowledge, and experience is a key factor in evaluating the triage educational programs.<sup>16</sup> Meanwhile, this point should be noted that in Iran there is no comprehensive university course for training triage to nurses, such that the share of triage in the curriculum of nursing is limited

to one session in the unit of emergencies.<sup>13</sup>

Haghdoust et al indicated that training triage was effective for enhancing the knowledge, attitude, and performance of nurses employed in the emergency ward.<sup>17</sup> In the study by Sarikaya et al, it was observed that in the pre-education stage, less agreement was observed between the two groups regarding triage performance. However, after the education, this performance improved, though the extent of agreement remained at an average level.<sup>18</sup> Kalantarimebidi et al indicated that education can have a positive impact on enhancing the level of awareness and performance of the nurses about triage of the patients through ESI method. Thus, development of theoretical and practical educational courses of triage for the nurses employed in the emergency ward seems to be essential to promote the knowledge and in turn the quality of services provided.<sup>19</sup> In the studies conducted by Hedayati et al and Mirhaghi & Roudbari, it was concluded that the low knowledge of medical students about hospital triage can emanate from lack of specialized educational courses for triage and insufficient university credits in the curriculum of the students.<sup>13,20</sup> Furthermore, past researches indicated that the adverse consequences of incidence of error in triage can be reduced through the curricula of nursing students and emphasizing accuracy among these individuals who are the future nurses.<sup>21</sup>

Based on the above points, in our study it was well observed that the knowledge of the medical group can significantly support provision of the services and awareness of the prioritization of patients in the emergency ward. Besides, comparing the two groups in terms of the knowledge and decision-making, the situation of the case group for whom educational session had been held at the beginning of the emergency ward internship was better. This suggests the fact that educational classes alongside the practice in the ward can better enhance the ability of the individuals in the subject matter. Thus, training triage can be recommended to the education authorities of the universities. They can employ triage training to develop competence and knowledge about triage among medical students who are the future physicians of the emergency wards and hospitals and will step into the healthcare system of the country as a young and creative force. Accordingly, triage training should be incorporated in the academic curriculum of these students. In this way, their knowledge about emergency processes as well as provision of health services will improve.

One of the limitations of this study was the fact that considering the one-month gap between posttest 1 and posttest 2. As limited number of students go through emergency internship course every month, data collection was time-consuming. Further, around 30% of the students who had participated in the educational session and posttest 1 were absent in the session in which posttest 2 was administered.

## Conclusion

It is suggested that considering the limitations of our study including the low number of participants, future researches capture a larger sample size. Additionally, educational classes can be held actively, where the students before each class are encouraged to pre-study, for whom the goal of each class should be explained before the beginning of the educational class. The findings indicated that education based on the ESI triage was effective on the knowledge and decision-making of internship students. Based on the results of this research and considering the importance of triage, theoretical and practical educational courses in this regard are proposed for medical students. This could be more effective if education is continuous and the students are encouraged to study more.

## Conflict of Interest

The authors declare that there is no conflict of interest.

## Ethical approval

This study was approved by Educational Development Research Center of Tabriz University of Medical Sciences, also this study approved by the ethics committee of Tabriz University of medical sciences with the code of IR.TBZMED.REC.1396.289 on 2017.06.17. It was also registered in the Iranian clinical trial study system (IRCT) under the code of IRCT2017080412592N4.

## Authors' contributions

MZ and FA offered the study. FR designed the present research. MZ, HEB and ZP searched articles. HEB and FR extracted the data and summarized it. ZP translated and FR supervised; FR reviewed the quality of the articles and revised it.

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