Accuracy of nurses' performance in triage using the emergency severity index and its relationship with clinical outcome measures

Nazer Shabrandi,[1] Mohammad Iraj Bagheri-Saveh,[2,3] Bijan Nouri,[4] Sina Valiee[2,3]

[1]Students Research Committee, Kurdistan University of Medical Sciences, Sanandaj; [2]Clinical Care Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj; [3]Faculty of Nursing and Midwifery, Kurdistan University of Medical Sciences, Sanandaj; [4]Social Determinants of Health Research Center, Research Institute for Health Development, Kurdistan University of Medical Sciences, Sanandaj, Iran

Correspondence: Sina Valiee, School of Nursing and Midwifery, Kurdistan University of Medical Sciences, Pasdaran St., 66177-13446, Sanandaj, Kurdistan, Iran.
Tel.: +98.9188734619; Fax: +98.8733660092
E-mail: Valiee@muk.ac.ir

Key words: Triage; emergency; nurse; emergency severity index.

Acknowledgments: This study is results of the MSN thesis of first author which is approved in Student Research Committee, Kurdistan University of Medical Sciences. This study has been approved by the Research Council of Kurdistan University of Medical Sciences no. IR.MUK.REC.1400.033. The researchers express their greatest gratefulness to all the nurses, whose participation made this research possible.

Contributors: NSH, MIBS, SV: Conception and design, data collection, analysis and interpretation, writing the manuscript, critical revision of the manuscript; BN: Statistic advisor, Editing the manuscript, critical revision of the manuscript.

Funding: This study was supported by the research fund of the Kurdistan University of Medical Sciences no. IR.MUK.REC.1400.033.

Conflict of interest: The authors declare conflict of interest.

Ethics approval and consent to participate: The present study was approved by the Ethics Committee of Kurdistan University of Medical Sciences with code IR.MUK.REC.1400.033. In the data collection procedure, evaluating data, and examining the available resources in the files, the confidentiality of patients' information, as well as integrity and honesty, were all observed. In addition, ethical guidelines were observed when using other sources and conducting research.

Availability of data and materials: The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to their containing information that could compromise the privacy of research participants and clinical institution.

Received for publication: 24 May 2022.
Revision received: 21 November 2022.
Accepted for publication: 2 December 2022.

Licensee PAGEPress, Italy
Emergency Care Journal 2022; 18:10638
doi:10.4081/ecj.2022.10638

Abstract

Emergency Department (ED) triage in hospitals is part of their emergency structure carried out by nurses in emergency units. There have not been many studies available on nurses' performance in triage based on the Emergency Severity Index (ESI). This present study aimed to investigate the nurses' performance in triage with regard to the ESI and its relation to clinical outcome measures in the emergency department. This was a cross-sectional study. The hospitalization record of 600 patients who arrived at the emergency department of Sanandaj Social Security Hospital was randomly assessed based on the accuracy of triage performed by nurses. The data analysis procedure was done by employing STATA software version 12, as well as Fisher's exact test, independent t-test, and one-way ANOVA. Findings of the study revealed that nurses' overall performance in triage showed that 82.67% of nurses had perfect triage accuracy, 12.17% had low-level triage accuracy and 5.17% had high-level triage accuracy. There was an association between nurses' performance in triage with disposition of patients (p=0.029) and length of stay (p=0.009). Results of the study showed the acceptable performance of emergency nurses in triage using the ESI and provided a foundation for identifying effective factors for decreasing the length of stay and disposition of patients in emergency care units.

Introduction

Triage is the process of determining the priority of patients' treatments by the severity of their condition or likelihood of recovery with and without treatment according to the urgency of their need for care.[1] Triage is a priority classification system that was designed based on the severity of the problem to do the best therapeutic proceedings for patients in less time.[2] At times when demand for medical care is more than the hospital's capacity and efficiency, triage has the capability of effectiveness and trustfulness, since the population congestion is known as a major threat to patient safety and quality care worldwide.[3] Triage systems are used mostly in all emergency centers around the world and their efficiency has been proven. However, the type of triage system used in each center is under discussion.[4]

An effective triage system must work in such a way that it could have the capability to decide on each patient quickly with high precision. Simplicity in the run and reliability are considered the most important characteristics of a standard well-known triage system.[5] A qualified triage increases the quality-of-care services for patients, increasing satisfaction, reducing the waiting time, reducing mortality rate, and increasing productivity and efficiency of emergency care units parallel to reducing their relevant costs.[5,6]

There are various systems have been designed and introduced for triage. Among these systems, the Australian Triage system, Canada, Manchester, and ESI have gained the most advanced rate of acceptance.[7,8] In Iran, the emergency system index has been used in the healthcare system of the country, and the guidelines for the launching of the hospital triage system in emergency departments by the Ministry of Health and Medical Education in 2011 have been communicated to all hospitals.[9]

The ESI of a triage system has a 5-level which is guided by algorithms for clinical decision making, which provides the nurse with the abilities to evaluate the patient quickly, make appropriate decisions for the necessary resources, and score the health care team based on their performance. This is a user-friendly algorithm. Reduces triage assignment mentality and is more precise than other triage systems, therefore it could be defined as a well-known medium among the authorities of emergency departments.[5-8] The ESI is widely employed in emergency departments in U.S states and this application is increasingly accepted on an international level.[5-8] ESI pattern facilitates quick assignment through 3 main questions: Does this patient need immediate lifesaving intervention? Does this patient in a high-risk situation? How many facilities are needed to take care of this patient? Since the knowledge and skills of nurses are very important in the lab test, several studies have examined the role of knowledge and awareness in prioritizing patients.[5-10]

Initial triage acuity assignation had the most significant effect on the transfer time of patients and the nurse who decides on triage, directly affects hospitalization services, and inaccuracy in triage could lead to severe consequences. More than half of all incidents that lead to death have occurred as a result of a delay in treatment in the emergency department.[5,11] Also, the delay in the hospitalization of patients from the emergency department to hospitalized sector increases the length of hospitalization and as a result, increases the cost of hospitalization.[12]

Accurate and rapid triage of patients is the key to successful performance in an emergency department and if the inaccurate level of triage is selected based on misinterpretation or ignoring patient variables and triage criteria, the nurse will have a triage error.[10-13] Triage errors could occur in the form of causing patients at an under-triage level that leads to waiting and intensifying the patient's health condition, on the other hand, over-triage, may result in limited access of other patients who need immediate emergency care to the emergency department.[13,14] Ignoring high-risk situations and improper interpretation of vital sign data are the main causes of under-triage. Under triage, delay in diagnosis and treatment of patients results in adverse consequences and death rate. Under-triage in the emergency departments could lead to side effects for hospitalized patients during their stay length in the hospital on the other hand over-triage could result in misuse of the hospital facilities and staff's focus deviation from their important roles in the hospital. In the last decades, accurate triage of patients leads to a lower level of mortality rate and productivity of resource facilities. To achieve the optimal goal of safety provided for patient care, under-triage should be minimized and on the other hand, in order to reach a high productivity level, the over-triage should be lowered.[15,16]

In Iran, patients' triage in emergency departments is generally carried out by nurses who play a key role in triage,[17,18] in a study by Mirhaghi and Roudbari, showed that the nurses were not skillful in-hospital triage,[19] and in another study by Javadi *et al.*, nurses' familiarity and knowledge in triage was in a lower level.[20] In another study by Ausserhofer *et al.*, 16.3 % of the nurses had triage errors.[15]

There are few studies that have been conducted on the prevalence of patients' triage errors namely under-triage and over-triage outcomes in emergency departments in Iran. In addition to the above-mentioned points, emergency nursing managers need evidence-based data to ensure the correct implementation of the triage and identify the nurses need to train in this field and familiarity with the inadequacies failure to adopt strategies for reforming, improving, and enhancing the quality of triage and increasing the motivation for the correct triage implementation. Therefore, the present study investigated the accuracy of emergency department triage using the ESI and its relationship with clinical outcome measures in Sanandaj Social Security Hospital in 2021.

Materials and Methods

This was a cross-sectional study. The hospitalization record of 600 patients referred to the emergency department of Sanandaj Social Security Hospital in 2021 was randomly assessed based on the accuracy of triage performed by nurses and its relation with clinical outcome measures was compared. The statistical population of the study includes all hospitalization records of the patients' who were referred to the emergency department of Sanandaj Social Security Hospital in 2021, who were all hospitalized. The criteria for inclusion were all of those who were hospitalized in the emergency department, which was triaged based on the ESI, and the exclusion criteria were incomplete medical history data, and lack of triage recording in patients' hospitalization background.

In order to collect the data, registrations forms were used based on patients' hospitalization records. The hospitalization records were randomly selected and triage conducted by the nurse (nurse performance) was documented and then final triage by the researcher based on the ESI index checklist (final standard) was also checked, if the performed triage was parallel to the researchers' triage, accepted, and if the triage was under level, the nurse's performance scored under-triage and if the level was above, it was scored as over-triage. Clinical outcome measures include the triage assessment time, disposition of patient, the duration of the patient's presence in the emergency department, and final diagnosis, discharge, hospitalization, and death rate. Nurses' demographic information (age, gender, marital status, academic level, working resume, working resume in an emergency department, triage training resume, and working shift) and patient's demographic information (age, gender, pregnancy, arrival date, arrival time, arrival type, last 24 hours arrival, The main complaint, drug allergy, medical records), and triage characteristics (triage assessment date, working shift, triage assessment time, triage level, doctor's visiting time, triage assessment length, level of consciousness, airway hazards, respiratory distress, Cyanosis, SPO2 under 90%, shock signs, necessary equipment, vital signs), and patients form procedures (arrival time, working shift admission, entrance to an emergency department time, hospitalization length in emergency department) was documented from their file.

According to the initial reports, every year approximately 15,000 arrivals are admitted to social security hospital emergency services. Regarding the ratio of 16% (p) triage error in the Ausserhofer *et al.* study[15] and by considering the confidence level of 95 (1-α) percent and error of 3% *(d)* sample size 600 were assessed by using the following equation. This sample size was randomly extracted from files of 2021 by using the table of random numbers.

The present study was approved by the Ethics Committee of Kurdistan University of Medical Sciences with code IR.MUK.REC.1400.033. In the data collection procedure, evaluating data, and examining the available resources in the files, the confidentiality of patients' information, as well as integrity and honesty, were all observed. In addition, ethical guidelines were observed when using other sources and conducting research.

In the data analysis procedure, the STATA software, version 12, was used. In the first phase of the data analysis, the mean, and standard deviation were estimated for the qualitative variables, the distribution table, and for the quantitative variables. Then, to estimate the analytical objectives, Fisher's exact test was used to investigate the relationship between qualitative variables and if quantitative variables were normal, independent t-test and one-way ANOVA, and if not, Mann-Whitney U test and Kruskal-Wallis test nonparametric tests were used. The assumption of normality of quantitative variables was assessed by using the Shapiro-Wilk test. The significance level was equal to 5 percent.

Table 1. Demographic and Clinical Characteristics of Patients Arrived to Triage.

Variable	Freq	Percent
Gender		
Male	249	41.50
Female	351	58.50
Pregnancy		
Yes	37	6.17
No	563	93.83
Arrival date		
Saturday	187	31.17
Sunday	89	14.83
Monday	111	18.50
Tuesday	80	13.33
Wednesday	73	12.17
Thursday	53	8.83
Friday	7	1.17
Referral		
Personal	559	93.17
EMS	41	6.83
Complaint		
Chest pain	74	12.35
Poisoning	12	2.00
Trauma	103	17.20
Abdominal pain	60	10.02
GIB	12	2.00
Falling	11	1.84
Fever	33	5.51
Vomiting	32	5.34
Rectum bleeding	16	2.67
Weakness	30	5.01
Kidney pain	17	2.84
Dyspnea	18	3.01
Respiratory distress	14	2.34
Hyperglycemia	23	3.84
Incision	17	2.84
Head injury	10	1.67
HTN	28	4.67
Epigastric pain	20	3.34
Edema	9	1.50
Catheterization	12	2.00
Vaginal bleeding	11	1.84
Palpitation	8	1.34
Dysentery	10	1.67
Melena	14	2.34
Headache	5	0.83

Results

The statistical population of this study was 600 patients, 249 male (41.50%), and 351 female (58.50%). The peak of arrival rage to the hospital was Saturdays (31.17%), and the frequent complaints were related to trauma (17.20%), then chest pain (12.35%). The peak of arrival time to the hospital was at morning shift work (40.17%), the mean and standard deviation of the triage assessment time was 1.49 ± 0.6 minutes. The standard deviation and mean of the duration length of hospitalization in emergency department were 189.89 ±129.95 minutes and the standard deviation and mean of the duration of the disposition of patients were 126.82 ±88.83 minutes. The average age and standard deviation of patients referred to the emergency department were 45.28±21.83 years (Table 1).

Nurses who took part in the triage were; men 71.67%, and women %28.33, who all passed the triage training courses. The mean and standard deviation of the age of nurses were 38.39±5.24, and the criteria for the mean and standard deviation of nurses' resumes in the emergency department were 4.84±3.17 (Table 2). About half of the patients were discharged (49.67%) and the rest were transferred to the wards (50.33%). The highest rate of transfer was to the internal sector (23%; Table 3).

Results of the study showed that nurses' triage acuity was 82.67%, 12.17 % under-triage, and 5.17 % over-triage. The highest level of triage was related to the triage level 3; 38.67%, level2; 33.5 %, level 4; 27.83% (Table 4). There was an association between nurses' gender and triage performance (p=0.026) (Table 5). Also, there was an association between nurses' performance in triage and disposition of patients (p=0.029), and length of stay (p=0.009), but there was no association between shift work of patients' visit and triage assessment length with nurses' performance. There was an association between patients' chief complaints and nurses' performance (p=0.001). But there was no association

Table 2. Demographic characteristics of nurses in the emergency department.

Variable	Freq	Percent
Gender		
Male	430	71.67
Female	170	28.33
Marital status		
Single	8	1.33
Married	592	98.67
Academic level		
BSN	598	99.67
MSN	2	0.33
Work shift		
Fixed	3	0.50
Rotating	597	99.50
Training		
Yes	600	100.00
No	0	0.00
Age M±SD	38.39	5.24
Work Experience M±SD	14.45	4.70
Emergency work experience M±SD	4.84	3.17

was observed between sex, arrival time, and last 24 hours' emergency referral with nurses' performance. There was an association between medical records, medication records, triage level, and facility-level with nurses' performance (p=0.0001). All of the vital signs, except pulse rate, had an association with nurses' performance (p<0.05) (Table 6). There was an association between nurses' performance in triage with disposition of patients (p=0.029) and length of stay (p=0.009; Table 7).

Discussion

Results of the study showed that nurses' triage acuity was 82.67%, 12.17% under-triage, and 5.17% over-triage. In another study by Mirhaghi and Roudbari, under-triage of 8.57% and over-triage of 48% were reported.[19] In another study by Cherry *et al.*, 22% was categorized in the under-triage group.[21] In a related study by Hinson *et al.*, for triaged patients in high ESI levels, 8.7% was considered the over-triage category. Patients who on arrival were triaged in mid-level %13.6 assessed as over-triage, and 5.8% assessed as under-triage, 18.4 % of those who assessed as under-triage in ESI level, were considered as under-triage category.[22] Rehn *et al.*, reported the under-triage at 10% and over-triage at 55%.[23] Lehmann *et al.,* reported under-triage at 0.4% and over-triage at 79%.[24] Chen *et al.*, reported that nearly 24.3% of nurses fall into the under-triage category and %19.7 in the over-triage category, and factors like working resume in an emergency department, triage training resume, hospital level, and triage methods are considered as effective factors on triage performance among nurses.[25] Investigating nurses' skills and performance in different educational centers necessities the primary triage training and conducting periodic retraining in covered centers for the relevant authorities. More serious education in the field of promoting nurses' ability to identify and classify patients and more accuracy in identifying the high-risk situation of patients referred to the emergency department seems necessary.

There was an association between nurses' performance with

Table 3. Clinical measure outcomes of the patients arriving to the triage.

Variable	Freq	Percent
Work shift arrival		
Morning	241	40.17
Noon	197	32.83
Night	162	27.00
Disposition		
Transfer	302	50.33
Discharge	298	49.67
Ward (Transferred)		
Internal	138	23.00
Surgical	32	5.33
Pediatric	12	2.00
CCU	56	9.33
ICU	32	5.33
NICU	17	2.83
Elective	16	2.67

Table 4. Nurses' Performance in Triage Based on the Emergency Severity Index.

Variable	Freq	Percent
ESI triage level		
2	201	33.50
3	232	38.67
4	167	27.83
Nurse's triage level		
2	165	27.50
3	266	44.33
4	169	28.17
ESI performance		
Accurate	496	82.67
Under	73	12.17
Over	31	5.17

Table 5. Association between demographic characteristics of nurses and the performance of the emergency department triage.

Variable	ESI Performance			P-Value
	Accurate	Under n(%)	Over n(%)	
Gender n (%)				
Male	357 (83.02)	57 (13.26)	16 (8.82)	0.026
Female	139 (81.76)	16 (9.41)	15 (8.82)	
Marital status n (%)				
Single	8 (100.00)	0 (0.00)	0 (0.00)	0.742
Married	488 (82.43)	73 (12.33)	31 (5.24)	
Academic level n (%)				
BSN	494 (82.61)	73 (12.21)	31 (5.18)	1.000
MSN	2(100.00)	0 (0.00)	0 (0.00)	
Work shift n (%)				
Fixed	3(100.00)	0 (0.00)	0 (0.00)	1.000
Rotating	493 (82.58)	73 (12.23)	31 (5.19)	
Training n (%)				
Yes	496 (82.67)	73 (12.17)	31 (5.17)	1.00
No	0 (0.00)	0 (0.00)	0 (0.00)	
Age mean (SD)		38.37(5.25)	38.52(5.19)	38.29 (5.37) 0.885
Work experience mean (SD)	14.41(4.71)	14.76(4.59)	14.22 (4.77)	0.631
Emergency work experience mean (SD)	4.89 (3.20)	4.75 (3.11)	4.16 (2.73)	0.375

Table 6. Association between demographical and clinical characteristics of patients with nurses' performance in triage based on the emergency severity index.

Variable	ESI Performance			P-Value
	Over n(%)	Under n(%)	Correct n(%)	
Sex				
Male	15 (6.02)	29 (11.65)	205 (82.33)	0.703
Female	16 (4.56)	44 (12.54)	291 (82.91)	
Pregnancy				
Yes	2 (5.41)	7 (18.92)	28 (75.68)	0.424
No	29 (5.15)	66 (11.72)	468 (83.13)	
Arrival time				
Saturday	10 (5.35)	22 (11.76)	155 (82.89)	
Sunday	5 (5.62)	8 (8.99)	76 (85.39)	
Monday	7 (6.31)	16(14.41)	88 (79.28)	
Tuesday	3 (3.75)	6 (7.50)	71 (88.75)	0.471
Wednesday	6 (8.22)	12(16.44)	55 (75.34)	
Thursday	0 (0.00)	7 (13.21)	46 (86.79)	
Friday	0 (0.00)	2 (28.57)	5 (71.43)	
Referral				
Personal	28 (5.01)	66 (11.81)	465 (83.18)	
EMS	3 (7.32)	7 (17.07)	31 (75.61)	0.465
Last 24 hours referral to emergency				
Yes	4 (12.12)	5 (15.15)	24 (72.73)	
No	27 (4.76)	68 (11.99)	472 (83.25)	0.139
Chief complaint				
Chest pain	0 (0.00)	14 (18.92)	60 (81.08)	
Poisoning	0 (0.00)	2 (16.67)	10 (83.33)	
Trauma	1 (0.97)	2 (1.94)	100 (97.09)	
Abdominal pain	5 (8.33)	7 (11.67)	48 (80.00)	
GIB	0 (0.00)	1 (8.33)	11 (91.67)	
Falling	1 (9.09)	0 (0.00)	10 (90.91)	
Fever	5 (15.15)	3 (9.09)	25 (75.76)	
Vomiting	6 (18.75)|	4 (12.50)	22 (68.75)	
Rectum bleeding	1 (6.25)	3 (18.75)	22 (68.75)	
Weakness	2 (6.67)	1 (3.33)	27 (90.00)	
Kidney pain	0 (0.00)	3 (17.65)	14 (82.35)	
Dyspnea	0 (0.00)	5 (27.78)	13 (72.22)	
Respiratory distress	0 (0.00)	2 (14.29)	12 (85.71)	
Hyperglycemia	1 (4.35)	5 (21.74)	17 (73.91)	
Incision	1 (5.88)	0 (0.00)	16 (94.12)	
Head injury	2 (20.00)	3 (30.00)	5 (50.00)	
HTN	1 (3.57)	4 (14.29)	23 (82.14)	
Epigastric pain	2 (10.00)	2 (10.00)	16 (80.00)	0.001
Edema	0 (0.00)	2 (22.22)	7 (77.78)	
Catheterization	1 (8.33)	4 (33.33)	7 (58.33)	
Vaginal bleeding	1 (9.09)	2 (18.18)	8 (72.73)	
Palpitation	0 (0.00)	2 (25.00)	6 (75.00)	
Dysentery	0 (0.00)	1 (10.00)	9 (90.00)	
Melena	0 (0.00)	1 (7.14)	13 (92.86)	
Headache	1 (20.00)	0 (0.00)	4 (80.00)	
Drug allergy				
Yes	1 (2.56)	4 (10.26)	34 (87.18)	0.835
No	30 (5.35)	69 (12.30)	462 (82.35)	
Medical record				
Yes	8 (3.39)	51 (21.61)	177 (75.00)	0.000
No	23 (6.32)	22 (6.04)	319 (87.64)	
Medication record				
Yes	7 (3.13)	50 (22.32)	167 (74.55)	0.000
No	24 (6.38)	23 (6.12)	329 (87.50)	
Triage level				
1	0 (0.00)	1 (25.00)	3 (75.00)	0.000
2	16 (8.74)	9 (4.92)	158 (86.34)	
3	11 (4.37)	49 (19.44)	192 (76.19)	
4	4 (2.48)	14 (8.70)	143 (88.82)	

Table 6. Association between demographical and clinical characteristics of patients with nurses' performance in triage based on the emergency severity index.

Variable	ESI Performance			P-Value
	Over n(%)	Under n(%)	Correct n(%)	
Level of consciousness				
A	30 (5.22)	68 (11.83)	477 (82.96)	0.592
V	1 (4.76)	5 (23.81)	15 (71.43)	
P	0 (0.00)	0 (0.00)	2 (100.00)	
U	0 (0.00)	0 (0.00)	2 (100.00)	
Airway				
Yes	0 (0.00)	0 (0.00)	4 (100.00)	1.000
No	31 (5.20)	73 (12.25)	492 (82.55)	
Respiratory distress				
Yes	0 (0.00)	0 (0.00)	2 (100.00)	1.000
No	31 (5.18)	73 (12.21)	494 (82.61)	
Cyanosis				
Yes	0 (0.00)	0 (0.00)	1 (100.00)	1.000
No	31 (5.18)	73 (12.19)	495 (82.64)	
Shock				
Yes	0 (0.00)	0 (0.00)	1 (100.00)	1
No	31 (5.18)	73 (12.19)	495 (82.64)	
Spo2				
<90	0 (0.00)	3 (20.00)	12 (80.00)	0.520
90	31 (5.30)	70 (11.97)	484 (82.74)	
Facilities				
More than two	23 (5.50)	63 (15.07)	332 (79.43)	0.005
One	8 (4.42)	10 (5.52)	163 (90.06)	
Non	0 (0.00)	0 (0.00)	1 (100.00)	
Age Mean(SD)	43.70 (21.35)	54.67 (17.82)	43.99 (22.15)	0.000
PR Mean(SD)	81.90 (19.18)	84.95 (16.89)	83.98 (13.07)	0.541
RR Mean(SD)	27.22 (35.61)	19.38 (1.67)	18.82 (1.82)	0.012
T Mean(SD)	36.79 (0.69)	36.76 (0.50)	36.62 (0.87)	0.038
SPo2 Mean(SD)	95.80 (1.35)	94.82 (2.05)	95.26 (2.51)	0.014
BPS Mean(SD)	124.48 (28.22)	132.32 (23.35)	126.09 (22.97)	0.046
BPD Mean(SD)	76.35 (11.81)	82.08 (16.85)	76.03 (13.20)	0.014

disposition of patients and hospitalization length of stay. In their study, Dadashzade *et al.*, showed that the most significant factors in triage assessment that affected hospital personnel are experience and adroitness, and in out of personnel dimension was related to patient's vital signs.[26] Khatiban *et al.*, study, showed that problem-based triage training could reduce the triage assessment in emergency departments and nurses' performance improvement.[27] Therefore, the more efforts to improve nurses' performance in triage the more improvements in patients' clinical outcome measures in emergency departments.

In this study, the highest level of triage was related to triage level 3; 38.67%, level2; 33/50%, level 4; 27/83%. In the study by Hinson et al., patients were triaged in 3 levels; half of them were 49.1% in level 3 (ESI3), one-third 32.5% in (ESI 4 or 5), and just 18.3 %were triaged in (ESI 1 or 2).[22] In this study, the frequent complaints were related to trauma patients and then chest pain, and abdominal pain patients. In a study by Rahmati *et al.*, the most frequent complaints in emergency departments were related to the nursery and surgical groups, and the most frequent dissatisfactions were related to the care services quality, staff misbehavior, and impoliteness.[28] In another study showed that, the most frequent complaints in female emergency departments related to joint problems and in male emergency departments were respiratory diseases.[29] Regarding the high arrival statistics of trauma patients and chest pain in this research context, providing a standardized workflow, teamwork enforcement, training courses for nurses about the acuity of triage for trauma patients and chest pain cases can be helpful.

In our study, the average time length from admission in the emergency department to hospitalization was 189.89 minutes. In a study, the average time length from admission to the emergency department to hospitalization was 236 minutes (4 hours).[30] Tabibi *et al.*, showed that the average length of hospitalization in case study hospitals was 244 minutes (4 hours).[31] Therefore, although the length of hospitalization in the emergency department can be affected by various factors, promoting nurses' performance in triage can somehow reduce the length of hospitalization among patients.

Generally, regarding the results of the present study, it is highly recommended that nurses should be provided with theoretical and practical triage training courses and highlighting effective factors to reduce the duration of patient`s disposition and length of stay in the emergency departments and also consider the fact that, there is an association between the nurses' performance with patients complaints, it is recommended that nurses pass the triage training courses and related training courses, therefore they could be famil-

Table 7. Association between nurses' performance and clinical measure outcome of the patients.

Variable	ESI Performance			P-Value
	Correct n(%)	Under n(%)	Over n(%)	
Referral shift				
Morning	194 (80.50)	30 (12.45)	17 (7.05)	0.527
Evening	167 (84.77)	23 (11.68)	7 (3.55)	
Night	135 (83.33)	20 (12.35)	7 (4.32)	
Disposition				
Transfer	242 (80.13)	47 (15.56)	13 (4.30)	0.029
Discharge	254 (85.23)	26 (8.72)	18 (6.04)	
Ward (Transferred)				
Internal	107 (77.54)	23 (16.67)	8 (8.80)	0.408
Surgical	26 (81.25)	4 (12.50)	2 (6.25)	
Pediatric	11 (91.67)	0 (0.00)	1 (8.33)	
CCU	46 (82.14)	10 (17.86)	0 (0.00)	
ICU	26 (81.25)	5 (15.63)	1 (3.13)	
NICU	14 (82\.35)	3 (17.65)	0 (0.00)	
ELECTIVE	13 (81.25)	2 (12.50)	1 (6.25)	
Discharge	253 (85.19)	26 (8.75)	18 (6.06)	
Triage length mean (SD)	1.47 (0.58)	1.56 (0.68)	1.54 (0.56)	0.402
Emergency hospitalization length mean (SD)	187.50 (132.57)	222.12 (127.22)	152.32 (65.59)	0.009
Disposition length mean (SD)	127.08 (90.84)	136.21 (87.68)	100.48 (44.99)	0.313

iar with recording a full medical background of patients and become familiar with the most frequent complaints of the patients arrived to triage. Also, implicating the findings of this study in the courses of nursing students as future nurses the adverse consequences of inaccurate triage could be decreased.

Limitations

Considering the research method, inaccurate recording of information by triage nurses was considered as one of the limitations of the present study, which could not be handled by the researcher, and also considering the retrospective nature of the study, the information in the patient's file was not fully recorded, so the researcher had to replace another patient's file. It is recommended to investigate the nurses' performance in triage by other methods like prospective and observational. Also it recommended to compare the nurses` performance with other gold standards and triage methods.

Conclusions

The results of the study showed that the performance of the majority of nurses was acceptable and their performance was associated with the patient's disposition and length of stay. Therefore, improving nurses' performance by identifying effective factors in clinical outcome measures can help provide faster and more accurate services in emergency departments.

References

1. Esmailian M, Zamani M, Azadi F, Ghasemi F. Inter-rater agreement of emergency nurses and physicians in Emergency Severity Index (ESI) Triage. Emergency 2014;2:158.
2. Ghafarypour-Jahrom M, Taghizadeh M, Heidari K, Derakhshanfar H. Validity and reliability of the emergency severity index and Australasian triage system in pediatric emergency care of Mofid Children's Hospital in Iran. Bull Emerg Trauma 2018;6:329.
3. Daemi A. The role of electronic triage system in management of hospital emergency department. Bull Emerg Trauma 2016;4:62.
4. Trinder MW, Wellman SW, Nasim S, Weber DG. Evaluation of the trauma triage accuracy in a Level 1 Australian trauma centre. Emerg Med Australasia 2018;30:699-704.
5. Hinson JS, Martinez DA, Cabral S, et al. Triage performance in emergency medicine: a systematic review. Ann Emerg Med 2019;74:140-52.
6. Barzanji A, Abdi K, Yaghobi M, et al. Triage room principles and recommendations for 2019 novel coronavirus. Adv Biomed Res 2021;10:24.
7. Bazyar J, Farrokhi M, Khankeh H. Triage systems in mass casualty incidents and disasters: a review study with a worldwide approach. Open Access Macedonian J Med Sci 2019;7:482.
8. Zachariasse JM, van der Hagen V, Seiger N, et al. Performance of triage systems in emergency care: a systematic review and meta-analysis. BMJ Open 2019;9:e026471.
9. Safari S, Rahmati F, Baratloo A, et al. Hospital and pre-hospital triage systems in disaster and normal conditions; a review article. Iranian J Emerg Med 2015;2:2-10.
10. Zakeri H, Saleh LA, Niroumand S, Ziadi-Lotfabadi M. Comparison the emergency severity index and manchester triage system in trauma patients. Bull Emerg Trauma 2022;10:65.
11. Soni KD, Kaushik G, Gupta A, et al. From emergency department to intensive care unit, does the delay matter to trauma patients? J Emerg Trauma Shock 2018;11:189.
12. Stohl S, Sprung CL, Lippert A, et al. Impact of triage-to-admission time on patient outcome in European intensive care units: a prospective, multi-national study. J Critical Care 2019;53:11-7.
13. Moon S-H, Shim JL, Park K-S, Park C-S. Triage accuracy and causes of mistriage using the Korean Triage and Acuity Scale. PLoS One 2019;14:e0216972.

14. Najafi Z, Abbaszadeh A, Zakeri H, Mirhaghi A. Determination of mis-triage in trauma patients: a systematic review. Eur J Trauma Emergency Surg 2019;45:821-39.
15. Ausserhofer D, Zaboli A, Pfeifer N, et al. Errors in nurse-led triage: An observational study. Int J Nursing Stud 2021;113:103788.
16. Lentz BA, Jenson A, Hinson JS, et al. Validity of ED: addressing heterogeneous definitions of over-triage and under-triage. Am Of Emerg Med 2017;35:1023-5.
17. Ebrahimi M, Mirhaghi A, Mazlom R, et al. The role descriptions of triage nurse in emergency department: a Delphi study. Scientifica. 2016;2016:5269815.
18. Javadi N, Rostamnia L, Raznahan R, Ghanbari V. Triage training in iran from 2010 to 2020: A systematic review on educational intervention studies. Iranian J Nursing Midwifery Res 2021;26:189.
19. Mirhaghi A, Roudbari M. A survey of emergency department nurses on hospital triage. Iran J Crit Care Nurs 2010;3:165-70.
20. Javadi S, Salimi T, Sareban MT, Dehghani MA. Knowledge and Practice of Nurses Regarding Patients' Triage in Emergency Department. Iranian J Emerg Med 2016;3:15-22.
21. Cherry RA, Bradburn E, Nichols PA, et al. Outcome assessment of blunt trauma patients who are undertriaged. Surgery 2010;148:239-45.
22. Hinson JS, Martinez DA, Schmitz PS, et al. Accuracy of emergency department triage using the Emergency Severity Index and independent predictors of under-triage and over-triage in Brazil: a retrospective cohort analysis. Int J Emerg Med 2018;11:1-10.
23. Rehn M, Eken T, Krüger AJ, et al. Precision of field triage in patients brought to a trauma centre after introducing trauma team activation guidelines. Scandinavian J Trauma Resuscit Emerg Med 2009;17:1-10.
24. Lehmann R, Brounts L, Lesperance K, et al. A simplified set of trauma triage criteria to safely reduce overtriage: a prospective study. Arch Surg 2009;144:853-8.
25. Chen S-S, Chen J-C, Ng C-J, et al. Factors that influence the accuracy of triage nurses' judgement in emergency departments. Emerg Med J 2010;27:451-5.
26. Dadashzade A, Abdolahzade F, Lotfi M, Ghujazade M. The necessory experiences and educational activies for the role of triage in Tabriz emergency departments. J Caring Sci 2008;10:31-7.
27. Khatiban M, Khazaei A, Karampourian A, et al. The effects of the emergency severity index triage education via problem-based learning on the triage nurses 'performance and the patients 'length of stay in the emergency department. J Clin Res Paramed Sci 2014;3:63-74.
28. Rahmati F, Gholamalipoor H, Hashemi B, et al. The reasons of emergency department patients' dissatisfaction. Iran J Emerg Med 2015;2:59-63.
29. Afshinjoo M, Moghadam M, Tourabi Ahmadi M. The relationship between causes and demographics of patients admitted to emergency departments of Zanjan University of Medical Sciences in the Zanjan city. Iranian J Emerg Care 2017;1:52-60.
30. Kamrani F, Ghaemipour F, Nikravan M, Alavi Majd H. Prevalence of miss triage and outcomes under triage of patients in emergency department. J Health Promot Manag 2013;2:17-23.
31. Tabibi SJ, Najafi B, Shoaie S. Waiting time in the emergency department in selected hospitals of Iran University of Medical Sciences in 2007. Pejouhesh dar Pezeshki (Research in Medicine) 2009;33:117-22.