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# Factors affecting the accuracy of nurse triage in tertiary care emergency departments

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## Abstract:

**OBJECTIVES:** The accuracy and duration of triage is vital in emergency departments. However, patient density, diversity of cases, and time pressure make triage difficult. Triage performed properly and at the right time prevents patients from experiencing any untoward incidents that may occur because of waiting. Therefore, the study aimed to share the data obtained from the Hospital Information Management System (HIMS) regarding the accuracy and duration of nurse triage in an adult emergency department.

**METHODS:** This descriptive and cross-sectional study evaluated the accuracy and duration of triage decisions made by nurses for patients admitted to an adult emergency department between June 15 and July 15, 2019. Statistical analysis was performed using Statistical analysis was performed using SPSS software version 23.00.

**RESULTS:** The study included the data of 7705 adult patients. The accuracy rate of nurse triage was 59.3% ( $n = 4566$ ), and the average duration of triage was  $1.52 \pm 2.10$  min. It was observed that the average duration of accurate triage decisions was longer in patients with triage category 3. A statistically significant relationship was determined between the accuracy of nurse triage and the duration of triage, years of seniority of the nurse, and shifts ( $P < 0.05$ ).

**CONCLUSIONS:** The accuracy and duration of nurse triage in the hospital where the study was conducted can be evaluated via the HIMS. In order to increase the accuracy of nurse triage in the emergency department, it is necessary to employ experienced and trained nurses, develop computer-based support systems, and increase the number of nurses working in shifts providing care to a large number of patients.

## Keywords:

Duration, emergency nurse, triage decision, triage

## Introduction

In emergency departments, every second is important for patients. The duration of time spent in an emergency department can determine the patient's death, disability, or return to life.<sup>[1]</sup> Another factor affecting this process is the accuracy of triage decisions

made.<sup>[2]</sup> It is the most important role of triage nurses in the initial assessment to ensure that the patient is in the right place at the right time in the emergency department and that no one is ignored.<sup>[3]</sup> Approximately half of the triage assessments are estimated to be erroneous in emergency departments.<sup>[4,5]</sup> Inaccurate or inconsistent triage in emergency departments can lead to poor clinical results, such as prolonged diagnosis and treatment time for patients, improper use of hospital resources,

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### Box-ED

Accurate triage is one of the most important solutions in providing safe care and treatment in emergency departments. Nurse triage decisions in the Emergency Department was 59.3% accurate. It may be helpful to develop electronic guiding support systems in order to increase triage accuracy and perform triage within the recommended time period. National studies on the rates of triage errors in emergency departments are needed.

decreased patient and employee satisfaction, and even increased mortality rates.<sup>[2,5]</sup> Therefore, triage needs to be fast and should be completed in 2 to 5 min.<sup>[6]</sup>

Triage practice in our country is a fairly new field and has its challenges. Legal arrangements for triage were announced in 2009; however, the accuracy and error rates of the triage performed are unknown.<sup>[7]</sup> The number of studies in the field of triage at the national level is quite low. These few existing studies mostly focused on the creation, practicability, and validity of triage algorithms. Moreover, another noteworthy issue that studies on nurse triage are inadequate.<sup>[8]</sup>

Therefore, it is important to conduct studies on triage practices at the national level. Studies assessing nurse triage will be useful in the process of continuous monitoring, supervision, and quality service delivery. The study aims to share data on the accuracy and duration of the nurse triage performed in an adult emergency department. Knowing the accuracy, duration of nurse triage, and other affecting factors can form the basis for developing measures for providing safer health care to patients.

## Methods

### Setting

This study was conducted in the emergency department of a university hospital, with an average admission rate of 280 patients daily. The emergency overcrowding score according to The National Emergency Department Overcrowding Scale was calculated to be Level 4 (overcrowded). Triage in the emergency department is performed by nurses with at least 1-year emergency experience and 6 h of triage training. In this hospital, there are 19 nurses working in the field of triage. The accuracy and duration of the triage performed by nurses in the hospital can be monitored through the Hospital Information Management System (HIMS) using the Structured Query Language (SQL) Script language developed previously.

### Design

We obtained data on nurse triage performed for patients in the adult emergency department of a university

hospital between June 15 and July 15, 2019, from the HIMS. SQL Script, developed by the researchers, is considered the gold standard for the accuracy and duration of triage decisions. In this system, the accuracy of triage decisions was determined according to the clinical outcome criteria using the Emergency Severity Index algorithm, for determining the triage categories of 3, 4, and 5 based on the resource requirement. If patients did not require any resources, they were considered category 5. If they required the use of one resource, they were category 4, and the use of multiple resources was category 3.

In patients with triage categories 1, 2, and 3, accuracy assessments were performed according to the clinical outcome criteria. The clinical outcome criteria include the death of the patient in emergency department, referral to another hospital, hospitalization in the intensive care unit or clinic, and the death in the first 24 h of the hospitalization. The SQL script system developed was designed such that the triage performed can be considered correct if the categories assigned to the patient by the triage nurse falls into one of the above situations, and incorrect if they do not.

The study data were obtained from the HIMS by writing a SQL Script together with the information technology unit. The duration of performing triage in the system refers to the time period between the moment that the triage nurse starts receiving the first data from the patient by clicking on the new record button and completes all the procedures by clicking the save button.

A total of 8684 patients applied to the adult emergency department during the study duration. Pediatric trauma patients (under the age of 18) were excluded from the study; hence, the study sample consisted of 7705 adult patients.

Written consent was obtained from the faculty of medicine clinical research ethics committee (March 4, 2020/225), the university hospital, and the emergency department before starting the study. The study was designed as a descriptive and cross-sectional study.

### Statistical analysis

Statistical analysis was performed using IBM corp. SPSS Version 23.0 (NY, USA). Average, frequency, standard deviation, and percentage were calculated for categorical and continuous variable data. The relationship between categorical variables was evaluated using the Chi-square test. Bonferroni's multiple comparison test was performed to test group differences after the Chi-square test. The independent sample *t*-test was used to compare parametric continuous data. The level of significance was set as 0.05.

## Results

In the study, the data of 7705 patients were evaluated. The median age of the patients was  $41.40 \pm 17.64$  years. The nurse triage accuracy rate was found as 59.3% ( $n = 4566$ ). The mean triage duration was found to be  $1.51 \pm 2.10$  min [Table 1].

There was no difference between the accuracy decision and triage times in patients with triage category 2. However, the average duration of accurate triage decisions in category 2 was longer ( $P = 0.53$ ). Additionally, the triage durations by accurate triage decisions were longer in patients with triage category 3 ( $P = 0.01$ ). In patients with triage category 4 and 5, there was a difference in terms of average time and accuracy decisions. The average duration of accurate triage decisions was shorter ( $P = 0.01$ ) [Table 2].

It was determined that the accuracy rates of nurse triage in the adult emergency department differed by shift.

**Table 1: Descriptive characteristics (n=7705)**

Patient's gender	n (%)
Male	3740 (48.5)
Female	3965 (51.5)
Shift	
Day (08:00-15:59)	3045 (39.5)
Evening (16:00-23:59)	3343 (43.4)
Night (00:00-07:59)	1317 (17.1)
Triage category	
1	18 (0.2)
2	677 (8.8)
3	3215 (41.7)
4	3159 (41.0)
5	636 (8.3)
Triage decision	
Inaccurate	3139 (40.7)
Accurate	4566 (59.3)
Triage duration (s), $\bar{x} \pm SD$ (minimum-maximum)	$1.51 \pm 2.10$ (0.25-4.95)

SD=Standard deviation

**Table 2: Accuracy duration of nurse triage decisions by triage categories (n=7705)**

Triage category	Decision	n (%)	Triage duration (sec)		t	P
			$\bar{x}$	SD		
1	Inaccurate	1 (5.6)	0.93	-	-	-
	Accurate	17 (94.6)	1.41	1.676		
2	Inaccurate	365 (53.9)	1.73	2.393	-0.62	0.53
	Accurate	312 (46.1)	2.04	9.063		
3	Inaccurate	821 (25.5)	1.54	0.686	-4.28	0.01*
	Accurate	2394 (74.5)	1.74	1.269		
4	Inaccurate	1792 (56.7)	1.39	0.817	3.81	0.01*
	Accurate	1367 (43.3)	1.29	0.479		
5	Inaccurate	160 (25.2)	1.26	0.439	2.61	0.01*
	Accurate	476 (74.8)	1.13	0.582		

\*Significant difference. SD=Standard deviation

According to the Bonferroni test, the reason for this difference is the higher patient density in the evening shift than in the day and night shifts ( $P = 0.03$ ) [Table 3].

It was determined that the accuracy rates of triage in the emergency department differed by working time of nurses in triage ( $P = 0.01$ ). According to the Bonferroni test, the difference is due to the fact that triage accuracy rates of specialist nurses (61.8%) are higher comparing to novice nurses (54.8%) ( $P = 0.01$ ). Novice nurses have lower triage accuracy rates [Table 4].

## Discussion

This study shows that the nurse triage decisions 59.3% are accurate. Moreover, it was determined that 41.7% of the patients who presented to the Emergency Department were determined as category 3 by nurses and that their accuracy rates were high [Table 1]. In triage category three patients, the average duration of correct triage decisions was longer [Table 2]. This result suggests that triage assessment times should be longer especially for category three patients and should be made in line with the literature.<sup>[6]</sup> One study found that approximately half of the patients (49.1%) that applied to the Emergency Department were determined as category 3.<sup>[9]</sup> In another multicenter study, the accuracy rates of nurse triage decisions did not differ between regions and the average accuracy rate was found to be 59.2%.<sup>[10]</sup> In another study, the accuracy rate of nurse triage was found to be 68.3%.<sup>[4]</sup> In a study by Chen *et al.*,<sup>[11]</sup> nurses' triage decisions were inaccurate at 40%. In a study where the accuracy rates of triage decisions were evaluated by case scenarios, it was stated that 40.4% of the triage decisions were inaccurate.<sup>[12]</sup>

In our study, the average duration of triage assessments was found to be  $1.51 \pm 2.10$  min, which was less and below the time period recommended in the literature [Table 1]. Furthermore, it was determined that the levels between the accuracy rates of nurse triage decisions and the duration of triage were different in categories 3, 4, and 5 [Table 2]. In one study, it was found out that the average time to the end of the patients' triage assessments was 04':04.<sup>[13]</sup> Some studies indicated that the average duration of triage is  $2.6 \pm 2.5$ ,<sup>[14]</sup> and 5.9 minutes.<sup>[15]</sup> In another study, it was found that the longest time period allocated for triage was in category three patients at  $2.8 \pm 2.5$  min.<sup>[14]</sup> The literature suggests that triage assessment should be performed between 2 and 5 min in order for the assessment to be fast and accurate.<sup>[6]</sup>

One of the most important factors affecting decision making in triage is the number of patients in the emergency department.<sup>[16]</sup> In our study, the error rate in the night shift with lower patient density ( $n = 1317$ )

**Table 3: Distribution of triage accuracy by shift**

Decision	Shift			$\chi^2$	P
	Day (08:00-15:59)	Evening (16:00-23:59)	Night (00:00-07:59)		
Inaccurate, n (%)	1233 (40.5)	1407 (42.1)	499 (37.9)	7.05	0.03*
Accurate, n (%)	1812 (59.5)	1936 (57.9)	818 (62.1)		

\*Significant difference

**Table 4: Distribution of nurses' triage decisions by working hours**

Decision	Working time in triage (months)					$\chi^2$	P
	0-11 months (novice)	12-23 months (experienced)	24-35 months (proficient)	36-59 months (master)	60 months and ↑ (expert)		
Inaccurate, n (%)	359 (45.2)	192 (41.6)	741 (41.8)	1045 (40.6)	802 (38.2)	13.43	0.01*
Accurate, n (%)	435 (54.8)	270 (58.4)	1030 (58.2)	1531 (59.4)	1300 (61.8)		

\*Significant difference

was 37.9% and in the evening shift with higher patient density ( $n = 3343$ ) was 42.1% [Table 3]. In day and evening shifts with high patient density, triage accuracy rates decrease. The literature review indicates that the accuracy of nurse triage is associated with the number of nurses working in each shift, patient density,<sup>[17]</sup> and workload.<sup>[5]</sup>

In our study, it was determined that accuracy rates increased as the years of triage experience of nurses increased [Table 4]. Previous studies determined that the accuracy of triage decisions increased as the working time of nurses in the emergency department and triage increased.<sup>[11,12]</sup> In the same study, it was found that the nurses with 3–4 years of triage experience had an accuracy rate of 67.2%, while those with 0–1 years of triage experience had an accuracy rate of 58.1%.<sup>[12]</sup> In a study examining the relationship between triage performance and experience, it was found that the triage accuracy rate of nurses with less experience was found to be 45.76% and those with more experience was 53.8%.<sup>[18]</sup> Hammad *et al.*<sup>[19]</sup> state that nurses working in triage should have at least five years of experience.

These findings reveal the need for novice nurses to be not employed in daytime and evening shifts where patient density is high. It may be recommended that novice nurses work together with experienced nurses during high patient density times to build skill and competency. It also shows the need to increase the number of triage nurses in terms of sharing workload in intense shifts.

### Limitations

The limitation of this study is that it was conducted using data of nurse triage from the HIMS of a university hospital.

### Conclusions

Accurate triage is vital in emergency departments. However, patient density and time pressure make triage difficult. The findings of this study showed that nurse

triage was 59.3% accurate. The accuracy of nurse triage is affected by seniority, shift, and triage times. In order to increase the accuracy of nurse triage in the Emergency Department, it is important to increase the number of trained and experienced triage nurses, increase the number of nurses in shifts with high number of patients, and develop computer-based guiding support systems. Furthermore, there is a need for national and international studies on the accuracy/error rates of nurse triage and, triage assessment durations.

### Author contributions statement

SB, OE, and FC were responsible for the study conception and design. OE, MC, and MG accessed data. SB and FC performed the data analysis. SB, OE, and FC were responsible for the drafting of the manuscript. OE and FC supervised the study.

### Conflicts of interest

None Declared.

### Ethical approval

Ethical approval was granted by the Akdeniz University Faculty of Medicine Ethics Committee for Non-Interventional Clinical Research (04.03.2020/225).

### Consent to participate

The data were obtained from the HIMS. The Standards for Privacy of Individually Identifiable Health Information (the Health Insurance Portability and Accountability Act-HIPAA) were followed.

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