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ASSESSMENT OF TRIAGE ACCURACY AND PATIENT OUTCOMES IN A HIGH-VOLUME EMERGENCY DEPARTMENT: A PROSPECTIVE QUALITY IMPROVEMENT STUDY

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ABSTRACT

Background: Triage serves as the cornerstone of emergency department (ED) management, guiding prioritization of care based on clinical urgency. In high-volume EDs, the accuracy of triage decisions is crucial to ensure timely intervention and optimal resource utilization. **Objective:** This study aimed to assess the accuracy of triage classifications and evaluate their association with key patient outcomes. **Methods:** This cross-sectional analytical study was conducted at Tertiary Care Hospital from Nov 2024 to April 2025. A total of 155 patients were included in the study. The sample size was determined based on expected proportions of triage accuracy and clinical outcome distributions from existing literature, with a confidence level of 95% and an acceptable margin of error. Triage level at the time of presentation was documented using the institutional triage system in place (e.g., Emergency Severity Index or equivalent). A team of emergency medicine consultants independently reviewed each case retrospectively within the first hour of presentation, using presenting complaints, vital signs, and early clinical findings to assign a reference triage category. **Results:** Out of the 155 patients, 103 (66.5%) were accurately triaged, while 28 (18.1%) were undertriaged and 24 (15.4%) were overtriaged. Undertriaged

patients showed significantly higher rates of ICU transfer (42.9%, $p < 0.001$) and mortality (17.9%, $p = 0.020$) compared to accurately triaged individuals. Overtriaged patients experienced the longest median ED stay (8.3 hours, $p = 0.002$). Hospital admission was significantly associated with triage accuracy ($p = 0.008$), with undertriaged patients more frequently requiring inpatient care. **Conclusion:** Triage inaccuracy, particularly undertriage, is associated with poorer clinical outcomes including higher ICU admission and mortality rates. These findings underscore the importance of ongoing training, regular audit, and decision-support tools to enhance triage accuracy in high-volume emergency departments.

INTRODUCTION

Emergency departments serve as the primary access point for patients requiring immediate medical attention and operate under high-pressure conditions that demand rapid, accurate decision-making. In high-volume emergency departments, the intensity of this pressure is magnified due to a constant influx of patients, resource limitations, and time constraints [1]. Within this dynamic setting, triage becomes the cornerstone of effective patient management. It is a clinical sorting process that aims to prioritize patients based on the urgency of their condition, thereby ensuring that those in critical need receive timely care while others are managed efficiently [2]. The precision of this initial assessment significantly impacts the quality, timeliness, and outcomes of care delivered in emergency settings. Standardized triage tools have been developed globally to bring consistency to this process [3]. Systems such as the Emergency Severity Index, Manchester Triage System, South African Triage Scale, and Canadian Triage and Acuity Scale aim to reduce subjectivity and guide healthcare providers in assigning appropriate acuity levels. These systems generally assess patients based on symptoms, vital signs, and expected resource needs. However, even with these tools in place, the accuracy of triage can vary widely, particularly in overburdened emergency departments where staff may be fatigued, undertrained, or overwhelmed [4]. In such environments, there is a higher risk of misclassification, which can lead to detrimental clinical consequences. The accuracy of the triage refers to the extent to which the triage level assigned is associated with the actual severity of the sickness condition of the patient. Inaccurate triage may be in the form of undertriage or overtriage [5]. The concept of undertriage (a patient in need of high priority is given low priority by mistake) may prolong the interventions, leading to impaired outcomes. Overtriage, on the other hand, places low priority on less urgent patients, inefficiently using already strained resources as well as increasing wait times of other patients [6]. Both types of error have been linked to extended length-of-stays and longer admission and readmission rates as well as preventable death, especially among patients with time-sensitive illnesses, including sepsis, stroke, or myocardial infarction [7]. The triage performance is affected by many factors. The personal factors involve clinical judgment, level of experience, and the cognitive load whereas systemic factors include institutional procedures and protocols, the level of availability of decision-support tools, the language barrier, and the physical arrangement of the emergency department [8]. Also, scheduled training of staff, on-the-job monitoring and audit processes are vital to ensure consistency of the triage [9]. Unfortunately, in high-volume scenarios, assessments of triage rightness are not part and parcel of

quality assurance systems, so improvement opportunities have often been overlooked in this case. The effects of triage inaccuracy do not limit themselves to single patients but reach into the scope of the whole healthcare system [10]. The process of misclassification may lead to overcrowding of the emergency departments, as well as additional pressure on inpatient units, which will enhance the current systemic inefficiencies [11]. Proper triaging is not only needed to ensure the best clinical outcomes, but it is also necessary to improve the operational flow and sustain the integrity of emergency care services. Although triage is significant, little has been done in resource-poor or high-volume settings to test the performance of triage systems in the real world as well as their influence on patient outcomes [12].

Objective

This study aimed to assess the accuracy of triage classifications and evaluate their association with key patient outcomes.

METHODOLOGY

This cross-sectional analytical study was conducted at Tertiary Care Hospital from Nov 2024 to April 2025. A total of 155 patients were included in the study. The sample size was determined based on expected proportions of triage accuracy and clinical outcome distributions from existing literature, with a confidence level of 95% and an acceptable margin of error. A non-probability consecutive sampling technique was employed to enroll eligible patients who met the inclusion criteria during the study period.

Inclusion and Exclusion Criteria

Patients aged 18 years and above, of either gender, presenting to the emergency department and triaged using the standard institutional triage protocol were included. Only those patients for whom complete clinical outcome data (including hospital admission, ICU referral, ED length of stay, and in-hospital outcome) were available were considered for final analysis. Patients who left against medical advice, were referred to another facility prior to clinical evaluation, or had incomplete triage records were excluded.

Data Collection Procedure

Triage level at the time of presentation was documented using the institutional triage system in place (e.g., Emergency Severity Index or equivalent). A team of emergency medicine consultants independently reviewed each case retrospectively within the first hour of presentation, using presenting complaints, vital signs, and early clinical findings to assign a reference triage category. Triage accuracy was then assessed by comparing the triage category assigned by the frontline triage nurse to this consultant-determined reference category. Discrepancies were classified as undertriage, accurate triage, or overtriage. Patient outcomes, including emergency department length of stay, admission to inpatient or ICU wards, and in-hospital mortality, were recorded from the hospital's electronic medical records. Data were entered into a structured database by trained personnel and anonymized before analysis.

Data Analysis

Data analysis was performed using Statistical Package for the Social Sciences (SPSS) version 25. Descriptive statistics were applied to summarize baseline characteristics; means and standard deviations were calculated for continuous variables, and frequencies and percentages for categorical variables. The association between triage accuracy and patient outcomes was evaluated using the Chi-square test for categorical outcomes (hospital admission, ICU transfer, mortality), and the independent samples t-test was applied for continuous variables (length of ED stays). A p-value of less than 0.05 was considered statistically significant.

Results

The study included 155 patients with a mean age of 42.7 ± 16.3 years. Males made up 56.8% of the sample. Chest pain (28.4%) and shortness of breath (21.3%) were the most common presenting complaints, followed by abdominal pain (17.4%) and altered consciousness (11.6%). Nearly half of the patients were triaged as Category II (urgent), while only 14.2% were classified as Category I (emergent), reflecting a diverse spectrum of emergency presentations.

Table 1: Baseline Characteristics of Study Participants (n = 155)

Variable	Value
Age (years), Mean ± SD	42.7 ± 16.3
Gender	
– Male	88 (56.8%)
– Female	67 (43.2%)
Presenting Complaints	
– Chest pain	44 (28.4%)
– Shortness of breath	33 (21.3%)
– Abdominal pain	27 (17.4%)
– Altered consciousness	18 (11.6%)
– Other	33 (21.3%)
Initial Triage Category	
– Category I (Emergent)	22 (14.2%)
– Category II (Urgent)	75 (48.4%)
– Category III (Semi-urgent)	48 (31.0%)
– Category IV/V (Non-urgent)	10 (6.4%)

Out of 155 patients, triage was accurate in 66.5% of cases. Undertriage occurred in 18.1% of patients, while 15.4% were overtriaged. Although most triage decisions were correct, a considerable proportion of patients were either underestimated or overestimated in urgency, highlighting potential areas for triage process improvement.

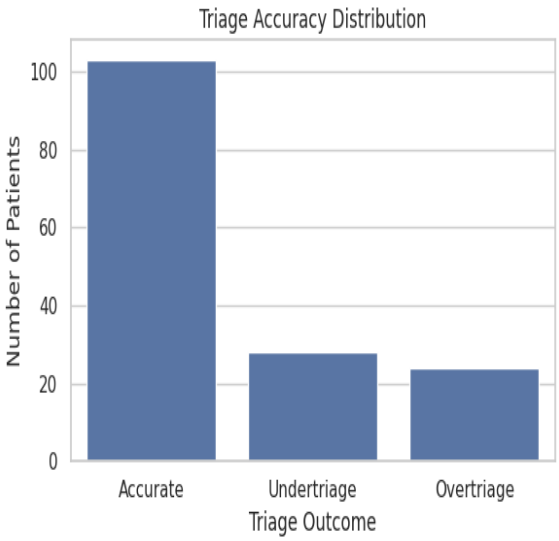
Table 2: Triage Accuracy Distribution (n = 155)

Triage Outcome	Frequency (n)	Percentage (%)
Accurate Triage	103	66.5%
Undertriage	28	18.1%
Overtriage	24	15.4%

Hospital admission was most common in accurately triaged patients (66.0%), but undertriaged cases also had a high admission rate (71.4%), indicating misjudgment in initial assessment. ICU transfers were significantly more frequent in the undertriaged group (42.9%) compared to accurately triaged cases (10.7%) with a highly significant p-value (<0.001).

Table 3: Triage Accuracy and Hospital Admission

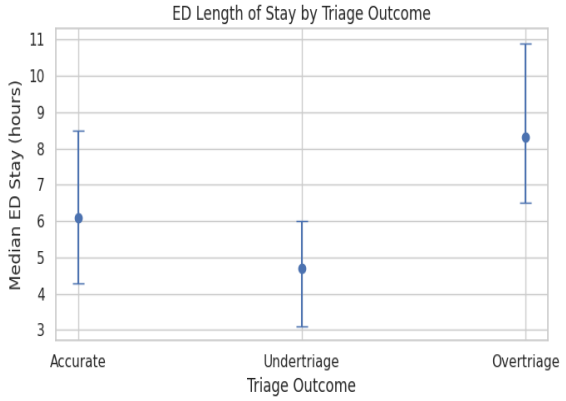
Triage Outcome	Admitted (n)	Not Admitted (n)	Total (n)	p-value
Accurate Triage	68	35	103	0.008
Undertriage	20	8	28	
Overtriage	9	15	24	
Total	97	58	155	
Triage Outcome	**ICU Transfer (n)**	**No ICU (n)**	**Total (n)**	**p-value**
Accurate Triage	11	92	103	<0.001
Undertriage	12	16	28	
Overtriage	4	20	24	
Total	27	128	155	



Patients who were overtriaged had the longest median emergency department stay (8.3 hours), while those undertriaged had the shortest (4.7 hours). Accurate triage was associated with a median stay of 6.1 hours. The significant p-value (0.002) implies that triage accuracy substantially influences patient flow and ED efficiency.

Table 4: Triage Accuracy and Emergency Department Length of Stay

Triage Outcome	Median ED Stay (hours)	IQR	p-value
Accurate Triage	6.1	4.3 – 8.5	0.002
Undertriage	4.7	3.1 – 6.0	
Overtriage	8.3	6.5 – 10.9	



Among the 11 patients who died, nearly half (5) had been undertriaged, despite representing a smaller proportion of the total sample. The mortality rate was notably higher in undertriaged cases (17.9%) compared to accurately triaged patients (4.9%), with a significant p-value (0.020), emphasizing that undertriage may contribute to adverse outcomes.

Table 5: Triage Accuracy and In-Hospital Mortality

Triage Outcome	Died (n)	Survived (n)	Total (n)	p-value
Accurate Triage	5	98	103	0.020
Undertriage	5	23	28	
Overtriage	1	23	24	
Total	11	144	155	

DISCUSSION

This study evaluated the accuracy of triage decisions in a high-volume emergency department and explored their association with patient outcomes, including hospital admission, ICU transfer, emergency department length of stay, and in-hospital mortality. The results indicate that even though the triage category of most patients was correct, a large percentage of patients underwent under-triage or over-triage, both of which were highly related to poor clinical outcomes. The accuracy of triage in the given study reached 66.5, which is comparable to the values of international literature where triage accuracy varies and ranges between 60 and 80 percent and it depends on the given triage system, development of the personnel, as well as institutional setting. Nevertheless, undertriage in 18.1 percent and overtriage in 15.4 percent is of a serious concern. Particularly, undertriage is a major problem because the critically ill will suffer due to delayed treatment. According to our study,

indeterminately greater rates of advancement to ICU and mortality were shown in under triaged patients and our study was able to confirm what had been previously recorded by other studies in that undertriage was shown to be an independent predictor of adverse outcomes in emergency care consecutively and retrospectively [13]. Hospitalization rate was much high in the underserved patients group compared to that of the accurately or overserved patients. This is likely to be caused by the lack of awareness by the first about the clinical severity and the subsequent but finally required improvement of the level of care. Over triage during the same moment led to inefficient use of resources and extended stay of the patient in the emergency room but it could be safe to the individual patient [14]. These findings indicate how thin the threshold must be that triage schemes must balance: failure to under-recognise severity, on one hand, but failure not prioritise cases never needing high-acuity cases, on the other, can over-fill the ED. Structurally, that is, the association between the accuracy of triage and admission to ICU was especially high. The patients who underwent triage were four times more likely to undergo admission to the ICU than the patients who were adequately triaged [15]. It is a sign of the indecision of early intervention as it is likely to foresee the clinical decline even before getting the appropriate level of care. The findings concur with the findings of other researchers, including van der Wulp et al, who have indicated a relationship between undertriage and delayed transfer to ICU, sepsis progression, and cardiac arrest development in the ED [16]. The overtriaged individuals took the longest time in the emergency room. Even though it is possible to think that the overtriage can be a less dangerous error in first glance, it becomes an aspect resulting in respiratory clogging, bed blocking, and employee burnout. The outcome of such kind of inefficiencies within a high-volume background can quickly lead to the block of access and overcrowding impacting the care of subsequent customers [17]. Triage inaccuracy was highly correlated with the in-hospital mortality, on which the daily experience of deaths was quite low (in general). Death amongst under-triaged patients was nearly four times more than that among appropriate triaged patients. Though this can reflect the increased severity of the condition of illness in them, it indicates the improved accuracy in triage, which would eliminate any deaths that may occur. Triage errors are not merely the threat to the individual patient's safety, but a system-level issue of efficient performance and outcome [18]. The outcome of the present study suggests that there is a need to have continuous employee training, performance auditing, and feedback loops on triage staff. The challenge of triage should be viewed as a dynamic clinical reasoning procedure that needs to be strengthened mechanically, especially in workplaces devoid of assets, with a vast number of problems [19]. The incorporation of the clinical decision support tools and the periodical review of the triage systems based on the local data are bound to increase the accuracy and eventually lead to a positive long-term impact in terms of patient outcomes. Such close correlations between the levels of accuracy in the triage process and adverse outcomes in the given study allude to the idea that they must be treated as prioritized by the emergency departments, high-flow departments, in particular; examining the possibilities to evaluate and optimise their triage processes since it should remain a subject of attention of the respective caring of patients.

CONCLUSION

It is concluded that triage accuracy plays a critical role in determining patient outcomes in high-volume emergency departments. In this study, a significant proportion of patients were either undertriaged or overtriaged, and these inaccuracies were strongly associated with adverse outcomes such as increased rates of ICU transfer, prolonged emergency department stay, and higher in-hospital mortality. Undertriage, in particular,

emerged as a serious concern, reflecting missed opportunities for timely intervention and risk stratification. The findings emphasize the need for regular evaluation of triage practices, continuous staff training, and the integration of decision-support mechanisms to improve triage performance. Strengthening triage accuracy is essential not only for enhancing individual patient safety but also for optimizing emergency department efficiency and healthcare resource utilization.

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