RELATIONSHIP BETWEEN EMERGENCY DEPARTMENT TRIAGE DATA AND 24- AND 48-HOUR MORTALITY IN AN ACADEMIC TEACHING HOSPITAL

Ramdinal Aviesena Zairinal[1,2]*, Salma Rizqi Amanah[1]

[1]Department of Neurology, Faculty of Medicine Universitas Indonesia
[2]Department of Neurology, Universitas Indonesia Hospital

eISSN: 2828-4070
https://doi.org/10.69951/proceedingsbookoficeonimeri.v9i-.319
Proceedings ICE on IMERI. 2025.
Received: November 11th,2025
Accepted: January 28th, 2026
Published online: February 6th, 2026

Corresponding Author
Name : Ramdinal Aviesena Zairinal
Email : ramdinal.md@ui.ac.id

Abstract

Introduction: Triage data plays an essential role in the initial assessment and prioritization of emergency patients. However, the association between triage parameters and short- term mortality remains underexplored. Evaluating 24-hour and 48-hour mortality may serve as an indicator of the effectiveness of triage and early resuscitation efforts. **Objectives:** To determine the relationship between emergency department triage parameters and short-term mortality (24-hour and 48-hour) among patients treated at an academic teaching hospital. **Methods:** A retrospective cohort study was conducted on all patients admitted to the emergency department from January to February 2024. Demographic and clinical data obtained during triage were analyzed. Bivariate and multivariate binary logistic regression analyses were performed to identify factors associated with 24-hour and 48-hour mortality. **Results:** A total of 1,976 patients were included. The 24-hour and 48-hour mortality rates were 1% and 5%, respectively. Significant predictors of 24-hour mortality were triage category (OR = 4.42; 95% CI 1.93–10.09), respiratory rate (OR = 1.09; 95% CI 1.02–1.16). Predictors of 48-hour mortality included age (OR = 1.02; 95% CI 1.008–1.036), triage category (OR = 3.23; 95% CI 2.23–4.67), respiratory rate (OR = 1.08; 95% CI 1.03–1.13), systolic blood pressure (OR = 0.98; 95% CI 0.97–0.99), and mental status (OR = 3.58; 95% CI 2.11–6.07). **Conclusion:** Several routinely collected data during initial admission to the emergency unit are independently associated with both 24-hour & 48-hour mortality. These results highlight that triage data can serve as meaningful predictors of early mortality and may support rapid risk stratification, resource allocation, and operational decision-making in the Emergency Department.

Keywords: Emergency department; Triage; 24-hour mortality; 48-hour mortality

Introduction

Emergency departments (EDs) provide a critical role in determining early survival for acutely ill patients, where delays in recognition and intervention can rapidly lead to death. Early identification of patients at high risk of mortality remains a major challenge in the ED setting. Accurate and timely risk stratification is essential to support clinical decision- making and optimize the use of limited emergency and critical care resources.[1,2]

Addressing this challenge, triage is the first structured clinical decision in the ED, designed to prioritize patients based on their acuity and anticipated resource needs to ensure that the most critically ill receive timely evaluation and intervention. Although triage is a routine part of ED care, it is not always perfect. Sometimes, patients are assigned a lower priority than warranted, a phenomenon known as undertriage. This misclassification can lead to delays in providing critical care for serious conditions such as myocardial infarction and stroke. Evidence suggests that undertriage is associated with poorer patient outcomes, including increased mortality.[3–5]

The first 24 hours following ED admission are crucial in determining early survival, as this period reflects both the severity of illness at presentation and the effectiveness of initial clinical management. Mortality within this timeframe indicates severe disease and identifies patients who may benefit most from timely ED interventions. Previous studies on early warning scoring systems in the ED have demonstrated strong predictive performance for short-term mortality, with an area under the receiver operating characteristic curve (AUC) of 0.88 (95% CI, 0.87–0.89; $P < .001$) at 24 hours and 0.86 (95% CI, 0.84–0.88; $P < .001$) at 48 hours. These tools rely on routinely collected physiological parameters at triage, such as respiratory rate, oxygen saturation, heart rate, and blood pressure, highlighting their potential role in early risk identification.[6]

In Indonesia, although several studies have examined triage systems, evidence focusing specifically on early mortality, particularly within the first 24 to 48 hours of ED admission remains limited. Research conducted at Cipto Mangunkusumo Hospital has shown that early warning scores can predict mortality in patients with neurological emergencies. Nevertheless, the effectiveness of individual triage parameters in predicting early mortality across a broader spectrum of emergency conditions has not been well established. Furthermore, delays in care continue to occur, especially in high-volume or resource-limited ED settings, indicating the need for improved early risk stratification.[7,8]

Therefore, this study aims to evaluate the association between triage parameters and early mortality outcomes in the emergency department setting. Specifically, it seeks to identify which triage-related parameters are most strongly associated with 24-hour and 48-hour mortality. By improving early risk identification, this study is expected to contribute to enhanced triage performance, more informed clinical decision-making, and more efficient utilization of emergency and critical care resources in Indonesian hospitals.

Materials and Methods

Study Design and Setting

This was a retrospective cohort study conducted in the Emergency Department (ED) of Universitas Indonesia Hospital between January and February 2024.

Study Population

All patients who underwent triage evaluation in the ED during the study period were considered eligible for inclusion (total sampling), with no restriction based on age or gender, and no exclusion were made based on comorbidities. Patients with incomplete documentation of triage variables or missing mortality outcomes were excluded in the final analysis.

Data Collection

Data were extracted from the hospital's electronic medical record system. Demographic information collected including age and gender. Clinical variables were obtained from the initial triage assessment. Numeric variables included respiratory rate, oxygen saturation, systolic blood pressure, pulse rate and body temperature. Categorical variables included triage category, airway status, peripheral perfusion, and mental status. Mental status was evaluated using Glasgow Coma Scale (GCS) and categorized as good (score 15) or impaired (score <15)

The primary outcomes were mortality within 24 and 48 hours after presentation to the ED. Mortality outcomes were obtained from hospital records and documented as binary variables (yes/no).

Statistical Analysis

Statistical analysis was performed using the Statistical Product and Service Solution (IBM SPSS), version 28. Patient characteristics were summarized using descriptive statistics. Bivariate analysis was conducted to examine the association between demographical data, clinical variables and mortality outcomes at 24 and 48 hours. Variables that demonstrated statistically significant associations in the bivariate analysis were included in multivariate logistic regression to identify independent predictors of mortality. Results

During the study period, 2526 patients presented to the emergency department. After excluding patients with incomplete data, 1976 patients were included in the final analysis.

Patient Characteristics and Outcome

Patient characteristics stratified by 24-hour and 48-hour mortality are presented in Table

1. Patients who died within 48 hours were significantly older compared to survivors (median age 45 vs. 60 years, $p < 0.001$). No significant differences in gender distribution were observed between survivors and non-survivors.

Triage category was significantly associated with mortality outcomes. Patients classified as yellow and red triage categories had higher mortality rates at both 24 and 48 hours compared to those classified as green ($p < 0.001$). Airway status was also significantly associated with mortality, particularly at 48 hours, with higher mortality observed among patients with partial or total airway obstruction ($p < 0.001$).

Several triage parameters differed significantly between survivors and non-survivors. Non- survivors exhibited higher respiratory rates, lower oxygen saturation, abnormal pulse rates, and lower systolic and diastolic blood pressure values at both 24 and 48 hours. Variables that showed significant associations with mortality in bivariate analysis were included in the multivariate logistic regression analysis, with numeric variables analyzed as continuous variables.

The proportions of survival and mortality at 24 and 48 hours are shown in Figure 1. Mortality accounted for 1% of cases within 24 hours and increased to 5% within 48 hours after Emergency Department admission.

Table 1. Patient Characteristics

Variables	24-Hour Mortality		p value	48-Hour Mortality		p value
	Survived	Died		Survived	Died	
Age	46 (0-90)	54 (18-91)	0.212	45 (0-91)	60 (15-89)	<0.001
Gender						
Female	1133 (99.0)	11 (1.0)	0.607	1093 (95.5)	51 (4.5)	0.077
Male	822 (98.8)	10 (1.2)		780 (93.8)	52 (6.3)	
Triage (n = 1972)						
Green	1099 (100)	0 (0)	<0.001	1092 (99.4)	7 (0.6)	<0.001
Yellow	707 (98.7)	9 (1.3)		658 (91.9)	58 (8.1)	
Red	145 (92.4)	12 (7.6)		119 (75.8)	38 (24.2)	
Airway status (n = 1974)						
Clear	1800 (99.1)	17 (0.9)	0.079	1733 (95.4)	84 (4.6)	<0.001
Partial obstruction	123 (97.6)	3 (2.4)		113 (89.7)	13 (10.3)	
Total obstruction	30 (96.8)	1 (3.2)		25 (80.6)	6 (19.4)	
Respiratory rate (n = 1973)	20 (10-59)	28 (22-48)	<0.001	20 (10-59)	25 (18-59)	<0.001

Oxygen saturation	97.04±3,13	92.05±7.11	0.004	97.13±2.97	94.26±5.75	<0.001
Pulse	96 (33-194)	116 (80-165)	<0.001	95 (36-194)	104 (33-165)	<0.001
Systolic Blood Pressure	125 (20-244)	110 (63-160)	0.006	125 (20-244)	120 (57-234)	0.001
Diastolic Blood Pressure	73 (14-140)	64 (40-103)	0.023	73 (14-140)	67 (32-123)	0.003
Extremity						
Warm	1951 (99.1)	18 (0.9)	<0.001	1870 (95.0)	99 (5.0)	<0.001
Cold	4 (57.1)	3 (42.9)		3 (42.9)	4 (57.1)	
Temperature	36.56±0.69	36.76±1.00	0.204	36.56±0.69	36.65±0.80	0.277
Mental status						
Good	1809 (99.3)	12 (0.7)	<0.001	1758 (96.5)	63 (3.5)	<0.001
Impaired	146 (94.2)	9 (5.8)		115 (74.2)	40 (25.8)	

Figure 2. Outcome Proportions for 24-Hour and 48-Hour Mortality.

Multivariate Analysis

Multivariate logistic regression analysis identified triage category and respiratory rate as independent predictors of both 24-hour and 48-hour mortality (Table 2 and 3). For 24-hour mortality, a higher triage category was associated with increased odds ratio (OR 4.422, 95% CI 1.937–10.094, p < 0.001), and increased respiratory rate (OR 1.089, 95% CI 1.020–1.166, p= 0.011). For 48-hour mortality, triage category (OR 3.233, 95% CI 2.237–4.673, p < 0.001) and respiratory rate (OR 1.084, 95% CI 1.039–1.130, p < 0.001) remained significant predictors. Additional independent predictors of 48-hour mortality included systolic blood pressure (OR 0.982, 95% CI 0.971–0.993, p = 0.002), impaired mental status (OR 3.588, 95% CI 2.119–6.073, p < 0.001), and age (OR 1.022, 95% CI 1.008–1.036, p = 0.002).

Table 2. Independent Factors for 24- Hour Mortality

		95% CI for OR		
Variables	**p value**	**OR**	**Lower**	**Upper**
Triage	<0.001	4.422	1.937	10.094
Respiratory Rate	0.011	1.090	1.020	1.166

Table 3. Independent Factors for 48- Hour Mortality

		95% CI for OR		
Variables	**p value**	**OR**	**Lower**	**Upper**
Triage	<0.001	3.233	2.237	4.673
Respiratory Rate	<0.001	1.084	1.039	1.130
Systolic Blood Pressure	0.002	0.982	0.971	0.993
Mental Status	<0.001	3.588	2.119	6.073
Age	0.002	1.022	1.008	1.036

Discussion

This retrospective cohort study assessed whether routinely collected triage data at ED arrival could predict short-term mortality in 1,976 patients. The key research found that triage category and respiratory rate remained consistent independent predictors of mortality at both time points, while other parameters; age, systolic blood pressure, and mental status became more prominent in assessing 48-hours mortality.

The strong relationship between triage category and mortality (OR 4.442 at 24 hours; OR 3.233 at 48 hours) reinforces triage as a practical first step for early risk stratification. Systematic reviews show that commonly used ED triage systems generally demonstrate good sensitivity for identifying high-acuity patients, including those at risk of early mortality, although performance varies by setting, implementation, and reference standard[.3] A study of Emergency Severity Index (ESI) version 4 demonstrated meaningful undertriage and overtriage in routine care, underlining that misclassification can occur even in mature systems.[9] These data indicate that while triage categories provide high- value prognostic information, they remain an imperfect indicator that should be supplemented by objective physiological assessments to improve predictive accuracy.

Our results are also consistent with prior work showing that adding a small number of routine variables to triage can improve mortality prediction. Massaut et al.

demonstrated that South African Triage Scale (SATS) category which includes red, yellow, orange and green combined with age and reason for admission could predict in-hospital death better.[10]This supports the broader concept that routinely captured ED variables can be translated into clinically implementable risk tools without relying on laboratory testing.

Respiratory rate showed the most stable association with mortality in our cohort. The finding such as tachypnea is a common early response to hypoxemia, metabolic acidosis, shock, and sepsis, and may appear before hypotension is obvious. Respiratory rate is also a core element of established physiologic scoring approaches. For example, NEWS 2 was designed to standardize assessment of acute illness severity using six routinely collected parameters, including respiratory rate, systolic blood pressure, and mental status.[11] Systematic reviews and meta-analyses focused on ED or prehospital settings similarly conclude that early warning scores based on routine physiology parameters can meaningfully stratify early deterioration and mortality, supporting our finding that respiratory rate carries high-signal information at triage.[6]

The 48-hour mortality result showed a broader set of independent associations including age (OR 1.022, 95% CI 1.008–1.036), systolic blood pressure (OR 0.982, 95% CI 0.971–0.993), and mental status (OR 3.588, 95% CI 2.119–6.073) were significant along the triage category and respiratory rate. This likely reflects that, beyond the first day, mortality is influenced more by physiologic reserve (age), hemodynamic stability (blood pressure), and organ dysfunction (mental status). These findings align with a systematic review literature, which indicates that predictive accuracy for mortality is highest during the immediate period after assessment. As the length of stay increases, this predictive power declines. This suggests that later clinical outcomes are less likely to be detected by a single baseline assessment of vital signs.[12]

The strong association between impaired mental status and 48-hour mortality is consistent with emergency department cohort evidence, showing higher short-term mortality among patients presenting with altered mental status compared those with other common complaint. Together with systolic blood pressure and respiratory rate, these findings support that early abnormalities in neurologic, hemodynamic, and ventilatory status at presentation are linked to increased risk of early mortality. This pattern is in line with the findings of Jeong et al., who evaluated predictors of early mortality in a large trauma cohort, the study demonstrated that the GAP score, which integrates Glasgow Coma Scale, Age, and Systolic blood pressure was independently associated with early mortality.[13,14]

Study Limitation

This study was conducted at a single center. Multicenter studies are needed to confirm these findings across different emergency department settings. The small number of mortality events, particularly in the first 24 hours, reduced the precision of some estimates and resulted in wider confidence intervals. The analysis included only variables available at the time of triage and did not include additional clinical information such as laboratory tests, imaging results, or clinical progression. Including laboratory data, patient interventions, and changes in vital signs over time could improve the prediction of early mortality.

Conclusions

Several routinely collected triage data including triage category, respiratory rate, systolic blood pressure, mental status, and age, were independently associated with 24-hour and 48-hour mortality. These results highlight that triage data can serve as meaningful predictors of early mortality and may support rapid risk stratification, resource allocation, and operational decision-making in the ED.

Competing Interests

The authors declare that they have no competing interest

Acknowledgments

We'd like to thank the organizing committee of the 10th ICE on IMERI 2025, Faculty of Medicine, Universitas Indonesia, for their excellent support throughout manuscript preparation and peer review.

Generative AI Declaration

In the development of this manuscript, the authors made use of Grammarly to support Language editing and grammar correction. All outputs were carefully reviewed, revised, and refined by the authors, who take full responsibility for the accuracy, originality, and integrity of the final published version.

References

1. Yosha HD, Tadele A, Teklu S, Melese KG. A two-year review of adult emergency department mortality at Tikur Anbesa specialized tertiary hospital, Addis Ababa, Ethiopia. BMC Emerg Med. 2021 Dec 1;21(1).
2. Liu Q, Zhang Y, Sun J, Wang K, Wang Y, Wang Y, et al. Early identification of high- risk patients admitted to emergency departments using vital signs and machine learning. World J Emerg Med. 2025;16(2):113–20.
3. Zachariasse JM, Van Der Hagen V, Seiger N, Mackway-Jones K, Van Veen M, Moll HA.

Performance of triage systems in emergency care: A systematic review and meta-analysis. Vol. 9, BMJ Open. BMJ Publishing Group; 2019.

4. Sax DR, Warton EM, Mark DG, Reed ME. Emergency Department Triage Accuracy and Delays in Care for High-Risk Conditions. JAMA Netw Open. 2025 May 2;8(5).
5. Soola AH, Mehri S, Azizpour I. Evaluation of the factors affecting triage decision-making among emergency department nurses and emergency medical technicians in Iran: a study based on Benner's theory. BMC Emerg Med. 2022 Dec 1;22(1).
6. Arévalo-Buitrago P, Morales-Cané I, Olivares Luque E, Guler I, Aurora Rodríguez-Borrego M, Jesús López-Soto P, et al. Predictive power of early-warning scores used in hospital emergency departments: a systematic review and meta-analysis.
7. Zairinal R, Kurniawan M. Association between the national early warning score and the mortality among neuroemergency patients. In: Journal of Natural Science, Biology and Medicine. Wolters Kluwer Medknow Publications; 2019. p. S16–9.
8. Mailani F, Simandalahi T, Purnama Sari A. Analysis of factors influencing length of stay in the emergency department in public hospital, Padang, Indonesia. Med J Armed Forces India. 2025 Jan 1;81(1):52–7.
9. Sax DR, Warton EM, Mark DG, Vinson DR, Kene M V., Ballard DW, et al. Evaluation of the Emergency Severity Index in US Emergency Departments for the Rate of Mistriage. JAMA Netw Open. 2023 Mar 17;6(3):E233404.
10. Markussen DL, Brevik HS, Bjørneklett RO, Engan M. Validation of a modified South African triage scale in a high-resource setting: a retrospective cohort study. Scand J Trauma Resusc Emerg Med. 2023 Dec 1;31(1).
11. Indd N. National Early Warning Score (NEWS) 2 Standardising the assessment of acute-illness severity in the NHS [Internet]. 2017. Available from: www.rcplondon.ac.uk
12. Holland M, Kellett J. A systematic review of the discrimination and absolute mortality predicted by the National Early Warning Scores according to different cut-off values and prediction windows. Vol. 98, European Journal of Internal Medicine. Elsevier B.V.; 2022. p. 15–26.
13. Stanich JA, Oliveira J. e Silva L, Ginsburg AD, Mullan AF, Jeffery MM, Bellolio F. Increased short-term mortality among patients presenting with altered mental status to the emergency department: A cohort study. American Journal of Emergency Medicine. 2022 Jan 1;51:290–5.
14. Yong Jin WY, Jeong JH, Kim DH, Kim TY, Kang C, Lee SH, et al. Factors predicting the early mortality of trauma patients. Ulusal Travma ve Acil Cerrahi Dergisi. 2018;24(6):532–8.
15. Soola AH, Mehri S, Azizpour I. Evaluation of the factors affecting triage decision-

making among emergency department nurses and emergency medical technicians in Iran: a study based on Benner's theory. BMC Emerg Med. 2022 Dec 1;22(1).

16. Arévalo-Buitrago P, Morales-Cané I, Olivares Luque E, Guler I, Aurora Rodríguez-Borrego M, Jesús López-Soto P, et al. Predictive power of early-warning scores used in hospital emergency departments: a systematic review and meta-analysis.
17. Zairinal R, Kurniawan M. Association between the national early warning score and the mortality among neuroemergency patients. In: Journal of Natural Science, Biology and Medicine. Wolters Kluwer Medknow Publications; 2019. p. S16–9.
18. Mailani F, Simandalahi T, Purnama Sari A. Analysis of factors influencing length of stay in the emergency department in public hospital, Padang, Indonesia. Med J Armed Forces India. 2025 Jan 1;81(1):52–7.
19. Sax DR, Warton EM, Mark DG, Vinson DR, Kene M V., Ballard DW, et al. Evaluation of the Emergency Severity Index in US Emergency Departments for the Rate of Mistriage. JAMA Netw Open. 2023 Mar 17;6(3):E233404.
20. Markussen DL, Brevik HS, Bjørneklett RO, Engan M. Validation of a modified South African triage scale in a high-resource setting: a retrospective cohort study. Scand J Trauma Resusc Emerg Med. 2023 Dec 1;31(1).
21. Indd N. National Early Warning Score (NEWS) 2 Standardising the assessment of acute-illness severity in the NHS [Internet]. 2017. Available from: www.rcplondon.ac.uk
22. Holland M, Kellett J. A systematic review of the discrimination and absolute mortality predicted by the National Early Warning Scores according to different cut-off values and prediction windows. Vol. 98, European Journal of Internal Medicine. Elsevier B.V.; 2022. p. 15–26.
23. Stanich JA, Oliveira J. e Silva L, Ginsburg AD, Mullan AF, Jeffery MM, Bellolio F. Increased short-term mortality among patients presenting with altered mental status to the emergency department: A cohort study. American Journal of Emergency Medicine. 2022 Jan 1;51:290–5.
24. Yong Jin WY, Jeong JH, Kim DH, Kim TY, Kang C, Lee SH, et al. Factors predicting the early mortality of trauma patients. Ulusal Travma ve Acil Cerrahi Dergisi. 2018;24(6):5