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Predicting Mortality and ICU Admission in Trauma: An Emergency Nursing Comparison of NEWS, RTS, and MREMS

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Abstract
Trauma is a global health problem, which is a serious issue, claiming around 8% of all lives lost. Proper treatment is crucial, and accurate assessment is key. Coming hotfooting out of nowhere or being involved in a sudden accident are two of the most common causes. Many methods have been established for the determination of trauma and for the guidance of treatment. This study attempted to compare the performance of NEWS, MREMS, and RTS in predicting death and ICU admission among trauma patients in Indonesia. This cross-sectional design analyzed 90 trauma patients admitted to the hospital in 2024. Patients aged ≥ 16 years with complete medical records were included. The instruments used to predict mortality and ICU admission were NEWS (National Early Warning Score), *RTS* (Revised Trauma Score), *and MREMS. The analysis was conducted by comparing the predictive performance using AUCROC with the optimal threshold value by the Youden index. The Odds Ratio (OR) value was also determined. The analysis of this study was conducted using SPSS version 29. Interpretation results with $p < 0.05$ were considered significant. The results of this study analysis showed that the three scoring systems (NEWS, RTS, and MREMS) had excellent discriminatory ability to predict mortality (AUCROC ≥ 0.95, $p < 0.001$), with NEWS achieving the highest performance (AUCROC 0.979, sensitivity 0.966, specificity 0.883) compared to other instruments. In the ICU admission variable, the predictive performance results were lower, but NEWS still had a better value (AUCROC 0.816) compared to the others. This analysis concludes that the three instruments have acceptable discriminative power. NEWS is a superior instrument, as evidenced by better descriptive results for sensitivity and specificity in predicting trauma mortality and ICU admission. This finding further validates the usability of NEWS as an effective triage tool for predicting early risk of mortality and ICU admission in trauma patients.*

Keywords: emergency, early warning score, *mortality, Intensive Care Unit, admission, trauma*
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INTRODUCTION

Trauma is a health condition disrupted by rape and remains a major global health problem. Trauma causes a high global mortality rate, accounting for 4.4 million deaths annually and contributing to 8% of all deaths worldwide (Smith & Devar, 2024). Trauma patients require a clear and accurate assessment when they come to the emergency department (ED) after a traumatic event. This assessment is essentially the key to figuring out what their care needs are, and ultimately helps cut down the number of deaths and complications from their injuries (Park et al., 2019; Wohlgemut et al., 2023). Trauma cases are very prevalent in Indonesia, and one hospital in Jember, Indonesia, reported that in

2024, they had to treat 2,343 trauma cases. The heavy workload faced by doctors in the ED is also very evident.

Trauma severity assessment based on triage is highly error-prone, despite its widespread use. Several studies have demonstrated both over- and under-triage across various study populations: 22.2% over-triage and 20.3% under-triage among trauma patients with Pacific Islanders, American Indians, Hispanics, and Medicare (Hayashi et al., 2024); 26.0% overtriage and 4.9% undertriage in Thailand (Huabbangyang et al., 2023), and also occurred in a hospital in Jakarta, 7.5% overtriage and 16.1% undertriage during crowded hospital conditions (Sari & Fajarini, 2022). Errors in the trauma assessment process can delay diagnosis and appropriate treatment. This, in turn, reduces therapeutic effectiveness and increases the risk of morbidity and mortality (Jeppesen et al., 2020; Wohlgemut et al., 2023). The inaccuracy of the assessment is also related to subjective assessment, complex emergencies, patient load at that time, and the short time pressure in the emergency room (Cetin et al., 2020; Chen et al., 2021). Previous research also stated that patient sociodemographic factors, such as age, complaints, arrival time, and pain severity, are also related to errors during the triage process (Huabbangyang et al., 2023).

As dealing with a trauma patient in an emergency situation, it's not always easy to determine the extent of the injury. This is why trauma-specific assessment tools are so important (Martín-Rodríguez, Sanz-García, et al., 2021). Coming hotfooting into the emergency room, some go-to tools for assessing a patient's condition include the NEWS (National Early Warning Score), RTS (Revised Trauma Score), and MREMS (Modified Rapid Emergency Medicine Score). For predicting patient deterioration, NEWS is a physiological scoring system that can be used in conjunction with blood pressure, heart rate, breathing rate, and level of consciousness data (Bourke-Matas et al., 2024; Tsai et al., 2023). Developed by the National Early Warning Score, this system zeroes in on seven parameters: Respiration Rate, Oxygen Saturation, Air or Oxygen, Systolic Blood Pressure, Pulse Rate, Consciousness, and Temperature (Su et al., 2021). Coming from a different direction, the RTS is one of the best predictors of mortality in trauma patients, so much so that it's one of the most widely used instruments in the emergency assessment process. Research has shown the RTS has a commendable area under the receiver operating characteristic curve or AUC (Jiang et al., 2023; Moorthy et al., 2025). The MREMS, a system that evaluates six physiological markers. Age, systolic blood pressure, heart rate, respiratory rate, oxygen saturation, and the Glasgow Coma Scale have proven to be a regular fixture in the predictive evaluation of trauma cases, with valid results (Phunghassaporn et al., 2022).

Regarding predicting mortality and ICU admission for trauma patients, NEWS, RTS, and MREMS are three widely used instruments in healthcare settings, including hospitals. However, in Indonesia, the relative merits of these tools have not been well studied, and only a few studies have directly compared them. Given the need for a comprehensive analysis, a comparison of NEWS, RTS, and MREMS is badly needed in Indonesian healthcare.

METHODS

Design

This was a retrospective, cross-sectional study. We designed the research methodology following the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) statement, which enabled us to report the results of observational studies with rigor and methodological consistency. We chose this design to compare the predictive accuracy of several early warning instruments for trauma patients (NEWS, RTS, and MREMS). This study was conducted at a dr. Soebandi Hospital in Jember, Indonesia. We collected the data from the hospital from January to June 2024.

Participants

The population in this study was trauma patients admitted to the emergency department at the hospital who met the research criteria. To be eligible for this study, patients had to meet the following

Inclusion criteria: (1) age of 16 years and above, (2) Full medical reports with all required physiological parameters for the study that included age, breathing rate, systolic blood pressure (SBP), oxygen saturation (%), pulse rate, and Glasgow Coma Scales. We excluded the patients referred to other hospitals, those who died during the traumatic event or upon arrival at the hospital, and patients with incomplete triage data. Additionally, patients who died before ICU admission were also excluded because they did not complete the standard triage-to-ICU or ward pathway and frequently lacked complete physiological data required for score calculation.

We used a non-probability method to select the sample involved in this study by considering the inclusion criteria that we had set. We found that there were 250 trauma cases in the hospital. The minimum sample size that we set refers to the calculation results from MedCalc based on a Type I error of 5% (α = 0.05), a Type II error of 5% (β = 0.05), and an expected Area Under the Receiver Operating Characteristic Curve (AUCROC) of 0.725, using the following formula:

$$n = \frac{(Z_\alpha + Z_\beta)^2 \cdot [P_0(1-P_0) + P_1(1-P_1)]}{(P_1 - P_0)^2}$$

where $Z\alpha$ and $Z\beta$ are the standard normal values corresponding to the chosen Type I and Type II errors, and P_0 and P_1 represent the AUC under the null hypothesis (0.5) and the expected AUC (0.725), respectively. Substituting the values:

$$n = \frac{(1.96 + 1.645)^2 \cdot [0.5(1-0.5) + 0.725(1-0.725)]}{(0.725 - 0.5)^2} \approx 116$$

We found that 116 patients were necessary for the study when calculating the required sample size. Unfortunately, we only had data on 90 patients who met the research criteria and therefore, proceeded with this reduced sample size.

Data Collection

We had to get approval and access to the medical records of a research hospital, which we were able to do when we embarked on our study. We teamed up with the hospital's medical records team, who laid out the patient criteria for us, and they were instrumental in giving us the data. Coming to us in either electronic form or as printed patient service forms. From these, we carefully picked out the medical records that we needed and took a very close look at each one to pluck out the data. Two research associates and I worked together to extract the data, creating a spreadsheet to sort it all out according to the variables we were using. We triple-checked the data to make sure everything was valid and discarded anything that didn't fit our criteria.

Measurement Tools

We compared the NEWS, RTS, and the MREMS in our study when evaluating the efficacy of different early warning systems. The NEWS, being one of the most well-known early warning systems, monitors seven physiological signs: respiratory rate, oxygen saturation, supplementary oxygen use, body temperature, systolic blood pressure, heart rate, and level of consciousness, and scores anything from 0 to 20. The score is determined by a simple point-based system and is basically interpreted based on the result; the higher the score, the more severe the condition. The NEWS has shown itself to be very reliable and accurate, with a good validity and discriminative accuracy of 0.859, 95% CI: 0.856, 0.861 (Chen et al., 2021). To assess the severity of a patient's condition, the Revised Trauma Score (RTS) is also used, weighing three main factors: GCS, systolic blood pressure, and breathing rate. The RTS system is essentially a mathematical formula: each parameter is assigned a specific number of points, which are added together to yield a total score between 0 and 8. Well-known for its predictive power, the RTS has been shown to have an AUC of 0.83. The MREMS instrument is also used in this case, and has six main indicators: age, systolic blood pressure, heart rate, breathing rate, oxygen saturation, and GCS (Wu et al., 2018). The MREMS instrument is also used in this case, and has six main indicators: age, systolic blood pressure, heart rate, breathing rate, oxygen saturation, and GCS. The calculation of

this score is similar to the previous instrument, with a total score ranging from 0 to 26. A higher score corresponds to an increased risk. Additionally, the MREMS instrument has been evaluated and was found to diagnostically discriminate well (AUC 0.851) (Donoso Calero et al., 2023).

Statistical Analysis

As we delved into the research data, we ran a Kolmogorov-Smirnov test on the continuous variables age and length of stay to see if they were normally distributed. They passed the test with a p-value greater than 0.05. Our next step was to evaluate the predictive ability of our three research tools in forecasting mortality and ICU admissions. We used the AUC-ROC to determine the optimal threshold and found the Youden Index to be the best. We performed a descriptive comparison of AUC values between assessment instruments. The DeLong test for comparing ROC curve statistics was not applied in this study. To assess the association between score categories and outcomes, odds ratios (ORs) with 95% confidence intervals (CIs) were calculated. For low data counts and zero cell counts, odds ratios were calculated with the Haldane–Anscombe correction, and Fisher's exact test was used to assess statistical significance rather than chi-square statistics. Statistical analyses were conducted with IBM SPSS version 29, and $p < 0.05$ was considered statistically significant.

RESULTS

Our research results show that 90 trauma patients with complete data are presented in Table 1.

Table 1. Characteristics of Trauma Patients Admitted to the Emergency Room

Characteristics	***Mortality* f (%)**	***Non Mortality* f (%)**	**Total n(%)**	***ICU Admission* f(%)**	***Non-ICU Admission* f (%)**	**Total n (%)**
n (%)	**30 (33,7)**	**60 (66,3)**	**90 (100)**	**30 (33,7)**	**60 (66,3)**	**90 (100)**
Sex:						
Male	19 (21,1)	41 (45.6)	60 (66.7)	23 (25.6)	41 (45.6)	64 (71.2)
Female	11 (12.2)	19 (21.1)	30 (33.3)	7 (7.8)	19 (21.1)	26 (28.9)
Total n(%)			90 (100)			90 (100)
Trauma Mechanism:						
Penetrating Trauma	1 (1.1)	8 (8.9)	9 (10)	1 (1.1)	7 (7.8)	8 (8.9)
Blunt Trauma	29 (32.2)	50 (55.6)	79 (87.8)	29 (32.2)	51 (56.7)	80 (88.9)
Thermal Trauma	-	2 (2.2)	2 (2.2)	-	2 (2.2)	2 (2.2)
Total n(%)			90 (100)			90 (100)
Comorbid Disease						
Yes	17 (18.9)	15 (16.7)	32 (35.6)	16 (17.7)	14 (15.6)	30 (33.3)
Hypertension	19 (59.4)			16 (53.3)		
DM	13 (40.6)			14 (46.7)		
No	13 (14.4)	45 (50)	58 (64.4)	14 (15.6)	46 (51.1%)	60 (66.7)
Total n(%)			90 (100)			90 (100)
Age (M ± std)	**52.53 ± 12.99**	**43.32 ± 19.16**		**43.03 ± 17.22**	**40.07 ± 18.55**	
Length of stay (M ± std)	**1.67 ± 2.55**	**3.70 ± 2.29**		**6.93 ± 3.58**	**3.70 ± 2.29**	

From the description, it was found that the majority of the gender was male in the mortality group (21.1%) and the ICU admission group (25.6%). The mechanism of trauma in patients was caused mostly by blunt trauma, both in the mortality group (32.2%) and the ICU admission group (32.2%). From the comorbidity data, the majority of trauma patients who died were those with comorbid diseases (18.9%), while in the ICU admission group, trauma patients with comorbid diseases were also dominant (17.8%). The results of the mortality analysis found that males were more dominant in both groups, and blunt trauma was the most common mechanism. Patients who died were, on average, older

(52.53 ± 12.99 years) than survivors (43.32 ± 19.16 years) and had a shorter mean length of stay (1.67 ± 2.55 vs. 3.70 ± 2.29 days). In the analysis of ICU admissions, males and blunt trauma also predominated. ICU-admitted patients had a slightly higher mean age (43.03 ± 17.22 years) than non-ICU patients (40.07 ± 18.56 years) and a longer hospital stay (6.93 ± 3.58 vs. 3.70 ± 2.29 days).

Table 2 shows a comparative analysis of NEWS, RTS, and MREMS scores between survivors and deceased patients, along with their odds ratios (OR), confidence intervals (CI), and p-values. Table 2 shows a significant difference in NEWS, RTS, and MREMS scores between deceased and non-deceased patients (p<0.001). The NEWS score results indicate that most deceased patients (82%) were in the high-risk category with an OR of 1.45 (95%CI). This condition indicates that patients with a high NEWS score have a 145-fold higher risk of death than patients with a lower category. The RTS results show that most deceased patients are categorized as immediate and urgent (87.9%) with an OR of 0.002 (95%CI), indicating that patients with an immediate and urgent RTS score have a greater risk of death than those with a delayed category score. Meanwhile, the MREMS results showed that all patients were in the moderate risk category (100%), and some of them were in the low risk category (24.1%) with an OR of 0.0014 (95% CI), which means that moderate and low MREMS scores have a lower tendency to die compared to other categories.

Table 2. Differences in NEWS, RTS, and MREMS Scores between Mortality and Non-Mortality

Variable	Mortality		Total	OR (95% CI)	p - value
	No n (%)	Yes n (%)			
NEWS					
Low, moderate risk	58 (92.1)	5 (7.9)	63 (100)	145 (26.3–798.1)	<0,001**
High risk	2 (18)	25 (82)	27 (100)		
RTS					
Immediate, urgent	4 (12.1)	29 (87.9)	33 (100)	0.002 (0–0.23)	<0,001**
Can be delayed	56 (98.2)	1 (1.8)	57 (100)		
MREMS					
Low risk	60 (75.9)	19 (24.1)	79 (100)	0.014* (very wide CI)	<0,001**
Moderate risk	0 (0)	11 (100)	11 (100)		

Note: Zero cell counts were observed in the MREMS moderate-risk category; *Odds ratio was calculated using the Haldane–Anscombe correction (+0.5 added to each cell). Fisher's exact test was applied to obtain p-values. ** Fisher's exact test was applied due to sparse data.

We further evaluated the discriminatory ability of this scoring system, presented in Table 3 and Figure 1, based on the results of the AUCROC analysis, sensitivity, specificity, and optimal cutoff points. Our analysis showed that all three scores had excellent discriminatory power (AUCROC ≥0.9). The NEWS score performed the best compared to the others (AUCROC = 0.979, sensitivity = 0.966, specificity = 0.883), indicating that NEWS is capable of identifying the risk of death in trauma patients admitted to the hospital emergency department.

Table 3. Comparison of NEWS, RTS, and MREMS in the mortality and non mortality group

Score	AUCROC	95CI	Opt cut-off	Sensitivity	Specificity
NEWS	0.979	0.957-1.001	≥3.5	0.966	0.883
RTS	0.976	0.936-1.015	≤7.5	0.966	0.933
MREMS	0.959	0.925-0.994	≥2.5	0.966	0.833

Note: AUCs were not statistically compared using the DeLong test; differences are descriptive.

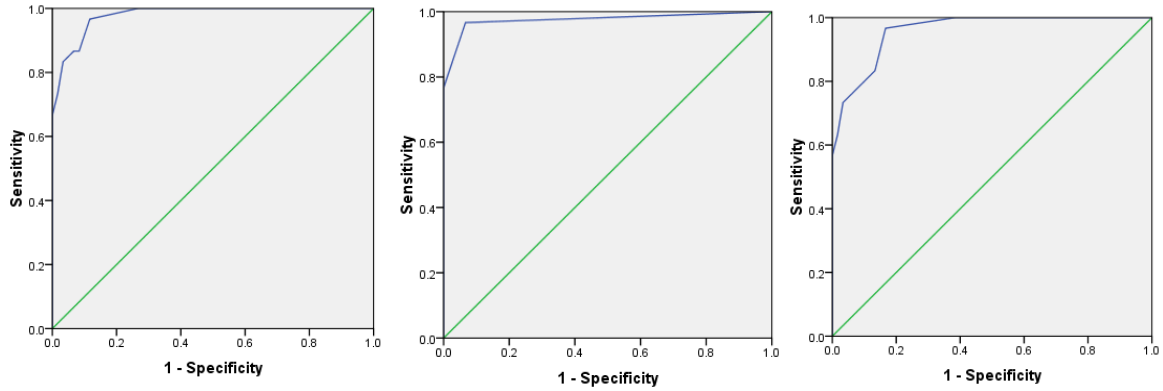

Figure 1. AUCROC NEWS, RTS, and MREMS for Identifying Mortality Risk

Table 4 presents the results of the analysis of the differences between the NEWS, RTS, and MREMS scores in the ICU and non-ICU patient groups. Our analysis results show that most trauma patients treated in the ICU have a high-risk NEWS score, namely 11 patients (84.6%). Our analysis results show a significant difference in NEWS scores between the ICU and non-ICU groups (p <0.001). The OR results also show that the OR value is 16.7 (95% CI), which means that patients with a high NEWS score are 16.7 times more likely to require ICU care compared to patients in the low or moderate category. For the RTS score, the majority of patients (80%) are in the immediate and urgent categories. Our analysis results also show a significant difference (p <0.001). The OR value is also obtained at 0.78 (95% CI), which means that patients with an immediate and urgent classification have a higher risk of being admitted to the ICU compared to the delayed category. The MREMS results showed that some patients (33.7%) were in the low-risk group and one patient (100%) was in the moderate-risk group; The analysis results showed no significant difference (p = 0.344) with a very small OR value of 0.17 (95% CI), indicating that MREMS was less predictive of ICU admission.

Table 4. Differences in NEWS, RTS, and MREMS Scores between ICU Admission and Non-ICU Admission Groups

Variable	ICU Admission		Total	OR (95% CI)	p - value
	No n (%)	Yes n (%)			
NEWS					
Low, moderate risk	58 (75.3)	19 (24.7)	77 (100)	16.7 (3.4–82.5)	<0.001**
High risk	2 (15.4)	11 (84.6)	13 (100)		
RTS					
Immediate, urgent	3 (20)	12 (80)	15 (100)	13.6 (3.1–59.4)	<0.001**
Can be delayed	48 (76.2)	15 (23.8)	63 (100)		
MREMS					
Low risk	59 (66.3)	30 (33.7)	89 (100)	0.17* (very wide CI)	0.344
Moderate risk	0 (0)	1 (100)	1 (100)		

Note: Zero cell counts were observed in the MREMS moderate-risk category; *Odds ratio was calculated using the Haldane–Anscombe correction (+0.5 added to each cell). Fisher's exact test was applied to obtain p-values; ** Fisher's exact test was applied due to sparse data.

We conducted further evaluations to assess the performance of each instrument. Table 5 and Figure 2 present the results of the AUCROC analysis, optimal threshold values, sensitivity, and specificity of each instrument. The analysis revealed that all three scoring systems had lower discriminatory ability in predicting ICU admission compared to predicting in-hospital mortality.

However, among the three, NEWS had a higher AUROC value (0.816) with a sensitivity (0.666), specificity (0.833), and an optimal threshold (≥3.5). This indicates that the NEWS score performs well in identifying the risk of ICU admission in trauma patients.

Table 5. Comparison NEWS, RTS, and MREMS ICU Admission and non ICU Admission group

Score	AUCROC	95CI	Opt cut-off	Sensitivity	Specificity
NEWS	0.816	0.720-0.913	≥3.5	0.666	0.883
RTS	0.688	0.561-0.814	≤7.5	0.433	0.933
MREMS	0.781	0.672-0.889	≥2.5	0.6	0.883

Note: AUCs were not statistically compared using the DeLong test; differences are descriptive.

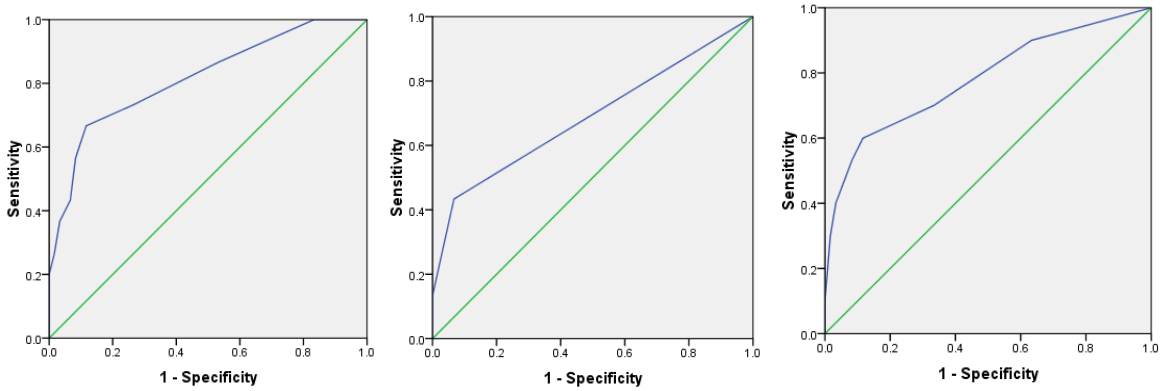

Figure 2. AUCROC NEWS, RTS, and MREMS for Identifying ICU Admission Risk

Our findings indicate that the NEWS score has a higher AUC value than the other two instruments (RTS and MREMS) in predicting mortality and ICU admission. Formal statistical analysis of the AUC using the DeLong test was not performed in this study, so differences between the three scores are interpreted descriptively. Overall, the NEWS demonstrates a good parameter of sensitivity and specificity for practical assessment in the emergency department.

DISCUSSION

Concerning triage in trauma patients, NEWS, RTS, and MREMS proved to be effective, and they're all very good at predicting mortality, with an AUCROC of 0.9 or higher. NEWS, however, was found to have the highest predictive power for mortality, with a remarkable AUCROC of 0.979, combined with sensitivity and specificity that can be described as high. This finding is in line with earlier studies that showed the high capability of NEWS and NEWS2 in forecasting short-term deteriorations, ICU admissions, and mortality in emergency room populations (Asgarzadeh et al., 2024; Covino et al., 2023; Yousefi et al., 2024).

Its ability to outperform RTS and MREMS may be due to its broader physiological coverage when assessing the performance of NEWS. NEWS incorporates extra parameters such as oxygen supplementation and body temperature, which can be indicative of the body's response to acute respiratory distress, a condition frequently seen in trauma patients (Semeraro et al., 2021; Okada et al., 2022;Ma et al., 2022). This comprehensive physiological assessment likely enhances its ability to identify patients at high risk of mortality.

The RTS stood out as a strong indicator of mortality when evaluating the trauma patients (Abhinandan et al., 2025; Kuronen-Stewart et al., 2021). Comprising the Glasgow Coma Scale, systolic blood pressure, and respiratory rate, RTS is a trauma-specific physiological score, but because it relies so heavily on GCS and SBP, its accuracy can differ between prehospital and in-hospital settings, or between different trauma populations. Newscore may offer a practical alternative, its score that is

easily integrated into regular triage, and given its widespread use on the wards (Saberian et al., 2022; Zaboli et al., 2025).

MREMS showed good discrimination for mortality but weaker performance for ICU admission. Previous studies have reported heterogeneous results for (m)REMS, with predictive accuracy varying according to patient characteristics and clinical context (Astasio-Picado et al., 2025; Martín-Rodríguez et al., 2023; Martín-Rodríguez, Martín-Conty, et al., 2021). These differences may be related to the weighting of age and GCS, as well as the exclusion of temperature and oxygen therapy from the score, which may limit its sensitivity to early physiological deterioration in trauma (Donoso Calero et al., 2023; Setioputro et al., 2020).

Regarding mortality, the predictive accuracy of NEWS, SOFA and APACHE II scores is well-documented, outperforming their ability to predict ICU admission (Mitsunaga et al., 2019; Rio et al., 2023; Ying et al., 2022). NEWS in particular, showed a significant degree of discrimination in the case of ICU admissions, however ICU transfer decisions go beyond physiological measures. Resource availability and institutional policies also come into play (Covino et al., 2023; Doğu et al., 2020; Price et al., 2023).

When predicting mortality and ICU admission in trauma patients, NEWS proved the most effective tool in a recent study. Coming from its simplicity, objectivity, and being easily integrated into standard triage systems, NEWS has become a handy and efficient way to sort out patients at emergency departments, especially in resource-poor regions. The fact that this study was a one-centre, retrospective analysis with a relatively small sample means that we need a larger, multicentre, forward-looking study to further verify its performance.

Limitations of this study include its retrospective, single-center design and the small number of patients, which may limit generalizability. Comparisons between scoring systems were descriptive; formal statistical comparison using the DeLong test for AUC differences was not performed. ICU admission decisions may also be influenced by factors beyond physiological scores, and including only patients with complete records may introduce selection bias.

CONCLUSION

Our findings indicate that NEWS has higher predictive performance (compared to RTS and MREMS) for mortality in trauma patients. However, it exhibits lower discriminatory ability for predicting ICU admission. NEWS can be a good instrument for early risk stratification in the emergency department. Emergency nurses and other hospital healthcare providers can use the NEWS instrument during patient assessments as a basis for further evaluation to determine appropriate interventions and optimize trauma patient care.

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None.

ETHICAL STATEMENT

This research was also conducted with ethical clearance following the ethical standards of the Declaration of Helsinki, and was approved by the Research Ethics Committee of the Faculty of Nursing, University of Jember (Approval Number 351/UN25.1.14/KEPK/2024).

CONFLICTS OF INTEREST

None.

AUTHOR CONTRIBUTIONS

RAY (Principal Researcher) performed the literature review, Research Design, Funding Sources, Data Collection, Data Validation, Data Analysis, Manuscript writing, and Manuscript revision. SM (Research Fellow) participated in Literature Review, Research Design, Research Instrument Validation, Data Collection, Research Data Extraction, and Data Analysis. BS (Research Fellow) participated in Data Collection, Research Design, Data Analysis, and Manuscript Preparation. RH participated in the Literature Review, Data Analysis, and manuscript writing. MZA participated in data validation, data analysis, and manuscript preparation. All authors have read, verified, and validated the contents of this research manuscript. All authors have approved the final version of the manuscript for publication.

DATA AVAILABILITY STATEMENT

The researchers used hospital medical records that were not publicly available when conducting this study. This was due to privacy, data security, and ethical guidelines. The data may be supplied to applicants who request it for legitimate purposes, under the terms of the research code of ethics.

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