RESEARCH PAPER

Predictive Value of S-TRIAGE and NEWS Score for Early Risk Stratification in Geriatric Patients Presenting to the Emergency Department

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ABSTRACT

Background: Emergency Department (ED) visits by older adults have increased substantially worldwide. Accurate early risk stratification of geriatric patients remains challenging due to atypical presentations, frailty and multiple comorbidities. The S-TRIAGE score (Screening Tool Risk Score Assessment for the Geriatric in the Emergency Department) and the National Early Warning Score (NEWS) are two candidate tools for this purpose, yet their comparative performance in a South Asian tertiary emergency setting is not established.

Objectives: To evaluate and compare the predictive accuracy of the S-TRIAGE and NEWS scores for 28-day mortality and life-saving intervention requirements among geriatric patients presenting to the ED.

Methods: A prospective cohort study was conducted at the Emergency Department of SRIHER, Chennai, from September 2025 to February 2026. Adult patients aged ≥65 years were enrolled consecutively. Patients with cardiac arrest, trauma, do-not-resuscitate orders or who left against medical advice were excluded. S-TRIAGE and NEWS scores were calculated at triage. The primary outcome was 28-day all-cause mortality. Discriminative performance was assessed using receiver operating characteristic (ROC) curve analysis; chi-square tests evaluated association with outcome.

Results: A total of 349 patients were analysed (mean age 65–75 years; 61.0% male). Twenty-eight-day mortality was 22.1% (n = 77). S-TRIAGE achieved an area under the ROC curve (AUC) of 0.73 (sensitivity 75%, specificity 70%), compared with AUC 0.66 for NEWS (sensitivity 50%, specificity 75%). Both scores were significantly associated with 28-day mortality (χ^2 = 38.85 and 61.28, respectively; $p < 0.001$). S-TRIAGE very-high-risk category (score >10) carried 85.7% mortality, while NEWS high-risk category (≥7) carried 43.8% mortality. ICU admission was required in 78.2% of patients.

Conclusion: S-TRIAGE demonstrated superior sensitivity and overall discriminative ability compared with NEWS for 28-day mortality prediction in geriatric ED patients. Its incorporation of geriatric-specific clinical parameters enhances risk stratification and may support earlier escalation of care in this vulnerable population.

Keywords: *geriatric emergency medicine; S-TRIAGE; National Early Warning Score; 28-day mortality; risk stratification; triage*

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INTRODUCTION

Emergency Department (ED) visits by older persons have increased significantly as a result of rapid global population ageing. Epidemiological data document a disproportionate increase in ED utilisation among patients aged ≥65 years, accounting for a growing share of all hospital admissions, resource consumption and adverse outcomes.1,2 Early

detection of clinical deterioration is complicated by the multiple comorbidities, polypharmacy, functional impairment and atypical illness presentations that older patients frequently exhibit.3

Elderly ED patients carry a higher risk of short-term mortality, unplanned hospitalisation, functional decline and hospital-associated disability.4,17 Reduced physiological reserve, cognitive decline and frailty all contribute to poor outcomes and limit the efficacy of conventional triage systems.18,19 Consequently, early identification of high-risk older patients has become a priority in emergency medicine.

Conventional triage systems were not designed with older patients in mind and may fail to identify those at greatest risk.5 Geriatric-specific screening tools such as the Identification of Seniors at Risk (ISAR) and the Triage Risk Screening Tool (TRST) have been developed to predict adverse outcomes in older ED patients; however, their predictive performance varies across clinical settings.16 The National Early Warning Score (NEWS) is widely validated for early identification of in-hospital deterioration but may under-estimate severity in older adults owing to age-related blunting of physiological response.10,12

The S-TRIAGE (Screening Tool Risk Score Assessment for the Geriatric in the Emergency Department) is a multidimensional tool designed specifically for elderly emergency populations, incorporating clinical, functional and physiological parameters - respiratory rate, SpO_2/FiO_2 ratio, shock index, systolic blood pressure, body temperature and mental status. It has demonstrated good predictive performance for 28-day mortality (AUC 0.826) in its derivation cohort.1

This study aimed to prospectively evaluate and compare the predictive accuracy of the S-TRIAGE and NEWS scores for 28-day mortality and the need for life-saving interventions among geriatric patients presenting to a tertiary ED in South India.

METHODS

Study Design and Setting

This was a prospective observational cohort study conducted in the Emergency Department of Sri Ramachandra Institute of Higher Education and Research (SRIHER), a 1,500-bed tertiary teaching hospital in Porur, Chennai, India. Data were collected from September 2025 to February 2026 (six months).

Participants

Consecutive patients aged ≥65 years presenting to the ED during the study period were screened for eligibility. Patients were excluded if they had: (i) cardiac arrest at or before arrival; (ii) traumatic injury as the primary complaint; (iii) do-not-resuscitate (DNR) orders; or (iv) departure against medical advice (AMA), or missing data.

Sample Size

Sample size was calculated using the formula $n = Z^2p(1-p)/d^2$, with a confidence level of 90% ($Z = 1.645$), an expected mortality proportion of 10.3% (derived from Supatanakij et al.1), and a margin of error of 3%. This yielded $n = 278$; adjusted for 10% attrition, the required sample was 309. The final enrolment of 349 patients exceeded this target.

Data Collection and Scoring

A structured case record form was used to capture demographic details, presenting complaint, vital signs at triage, past medical history (comorbidities), ED interventions (invasive mechanical ventilation [IMV], non-invasive ventilation [NIV], vasopressor support, surgical intervention, ICU admission, haemodialysis, blood transfusion) and outcome.

The S-TRIAGE score was calculated from six parameters at triage: respiratory rate, SF ratio (SpO_2/FiO_2), shock index (heart rate / systolic blood pressure), systolic blood pressure, body temperature and mental status The NEWS score was simultaneously calculated from respiratory rate, oxygen saturation, supplemental oxygen use, temperature, systolic blood pressure, heart rate and level of consciousness. Both scores were calculated independently by trained research staff blinded to outcome.

Outcome

The primary outcome was 28-day all-cause mortality, determined by medical record review and, where necessary, telephone follow-up. Secondary outcomes included the requirement for life-saving interventions during the ED stay and ICU admission.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 26.0. Continuous variables are presented as mean ± standard deviation or median (interquartile range) as appropriate; categorical variables are presented as frequency and percentage. Associations between score categories and mortality were examined using the chi-square test (or Fisher's exact test where cell counts < 5). Discriminative performance was assessed by ROC curve analysis; areas under the curve (AUCs) with 95% confidence intervals were calculated. Sensitivity and specificity were derived at optimal cut-off points. A two-tailed p-value < 0.05 was considered statistically significant.

Ethics

The study was approved by the Institutional Ethics Committee of SRIHER (CSP/25/AUG/166/397). All data were anonymised and stored securely. Informed consent was obtained from patients or their next of kin as appropriate.

RESULTS

Demographic and Clinical Characteristics

Table 1. Gender Distribution

Gender	n	%

Male	214	61.0%
Female	135	38.7%
Total	349	100.0%

The majority of patients were male (61.0%).

Table 2. Age Distribution

Age Group	n	%
65–75 years	229	65.6%
76–85 years	97	27.8%
>85 years	23	6.6%
Total	349	100.0 %

Most patients (65.6%) were in the 65–75-year age group.

Table 3. Comorbidity Distribution

Comorbidity	n	%
Hypertension	255	73.1 %
Diabetes Mellitus	247	70.8 %
Coronary Artery Disease	97	27.8 %
Chronic Kidney Disease	54	15.5 %
Dyslipidaemia	45	12.9 %
COPD / Asthma	40	11.5 %
Hypothyroidism	32	9.2%
Cerebrovascular Accident	27	7.7%
Active Malignancy	14	4.0%
Parkinson's Disease	11	3.2%
Other	42	12.0 %
None	22	6.3%

Hypertension (73.1%) and diabetes mellitus (70.8%) were the most prevalent comorbidities.

Table 4. Primary Diagnosis Distribution – Top Diagnoses

Diagnosis	n	%
Acute Coronary Syndrome (all types)	48	13.8 %
Sepsis / Septic Shock / MODS	38	10.9 %
Acute Ischaemic Stroke / CVA / TIA	31	8.9%
Acute Pulmonary Oedema	21	6.0%
Acute Exacerbation of COPD	16	4.6%

Community-Acquired Pneumonia	14	4.0%
Respiratory Failure	12	3.4%
Cellulitis	11	3.2%
Acute Gastroenteritis	11	3.2%
Influenza	10	2.9%
Others	125	35.8%

Acute coronary syndrome was the most common diagnosis (13.8%), followed by sepsis/septic shock (10.9%) and acute cerebrovascular events (8.9%).

Primary Outcome

Table 5. 28-Day Mortality

Outcome	n	%
Alive	272	77.9%
Deceased	77	22.1%
Total	349	100.0%

Overall 28-day mortality was 22.1%.

NEWS Score Analysis

Table 6. NEWS Score Distribution

NEWS Category	n	%
Low (1–4)	158	45.3%
Medium (5–6)	61	17.5%
High (≥7)	130	37.3%
Total	349	100.0%

Table 7. NEWS Score – Descriptive Statistics

Statistic	Value
Mean	9.99
Median	9
Standard Deviation	2.82

Table 8. Association Between NEWS Category and 28-Day Mortality

NEWS Category	Total	Alive	Deceased	% of Deaths	Mortality %
Low (1–4)	158	149	9	5.7%	11.7%
Medium (5–6)	61	52	9	5.7%	11.7%
High (≥7)	130	73	57	88.6%	43.8%
Total	349	272	77	100%	22.1%

Chi-square analysis: $\chi^2 = 61.277$, $df = 1$, $p < 0.001$. Patients with high NEWS scores (≥7) had a mortality rate of 43.8%, compared with 5.7% in low and medium categories.

S-TRIAGE Score Analysis

Table 9. S-TRIAGE Score Distribution

Risk Category	Score Range	n	%
Very Low	≤1	20	5.7%
Low	>1–≤3	45	12.9%
Moderate	>3–≤7	79	22.6%
High	>7–≤10	37	10.6%
Very High	>10	168	48.1%
Total		349	100.0%

Table 10. S-TRIAGE Score – Descriptive Statistics

Statistic	Value
Mean	9.63
Median	10
Standard Deviation	6.34

Table 11. Association Between S-TRIAGE Category and 28-Day Mortality

S-TRIAGE Category	Total	Alive	Deceased	% of Deaths	Mortality %
Very Low (≤1)	20	20	0	0%	0%
Low (>1–≤3)	45	43	2	2.6%	4.4%
Moderate (>3–≤7)	79	73	6	7.8%	7.6%
High (>7–≤10)	37	34	3	3.9%	8.1%
Very High (>10)	168	102	66	85.7%	39.3%
Total	349	272	77	100%	22.1%

Chi-square analysis: $\chi^2 = 38.850$, $df = 1$, $p < 0.001$. No mortality was observed in the very-low category; 85.7% of deaths occurred in the very-high category (>10).

Association Between S-TRIAGE and NEWS Categories

Table 12. Cross-Tabulation: S-TRIAGE Category vs NEWS Category

NEWS Category	VL	Low	Mod	High	VH	Total
Low (1–4)	20	42	67	15	14	158
Medium (5–6)	0	2	7	10	42	61
High (≥7)	0	1	5	12	112	130
Total	20	45	79	37	168	349

VL = Very Low; Mod = Moderate; VH = Very High. Very-high S-TRIAGE category showed strong concentration in high NEWS category.

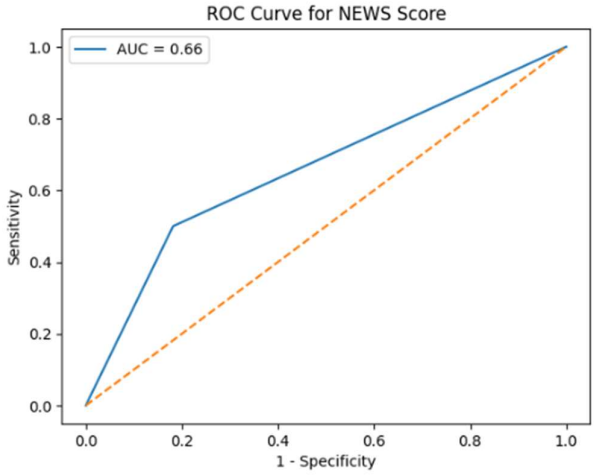
ROC Curve Analysis

Table 13. Comparison of S-TRIAGE and NEWS for Predicting 28-Day Mortality

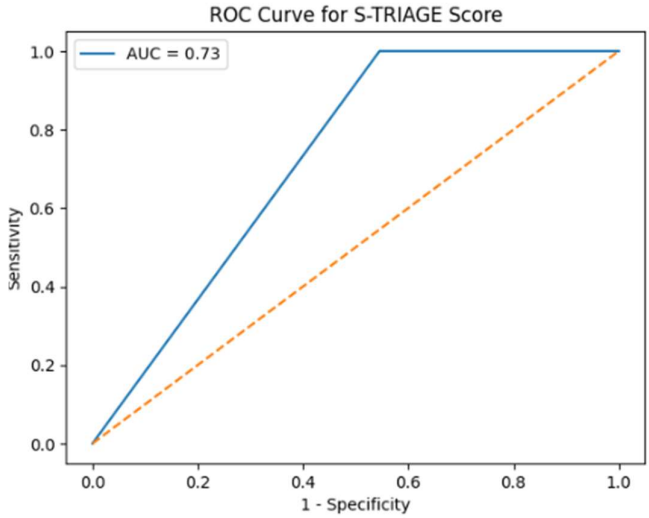
Score	AUC	Sensitivity (%)	Specificity (%)	χ^2
NEWS	0.66	50	75	61.28

S-TRIAGE	0.73	75	70	38.85

Both scores significantly predicted 28-day mortality ($p < 0.001$). S-TRIAGE demonstrated superior AUC and sensitivity.



ROC Curve – NEWS Score for 28-Day Mortality Prediction (AUC = 0.66)



ROC Curve – S-TRIAGE Score for 28-Day Mortality Prediction (AUC = 0.73)

Hospital Length of Stay and ED Interventions

Table 14. Length of Hospital Stay

LOS Category	n	%
<1 day	9	2.6%
1–3 days	92	26.4%
4–7 days	133	38.1%
8–14 days	66	18.9%
15–30 days	41	11.8%
>30 days	7	2.0%
Total	349	100.0%

Table 15. ED Intervention Requirements

Intervention	n	%
ICU Admission	273	78.2%
Surgical Intervention	91	26.1%
Vasopressor Support	75	21.5%
Non-Invasive Ventilation (NIV)	56	16.1%
Invasive Mechanical Ventilation (IMV)	51	14.6%
Haemodialysis	19	5.4%
Blood Transfusion	7	2.0%

ICU admission was required in 78.2% of patients, underscoring the high acuity of this cohort.

DISCUSSION

This prospective cohort study evaluated and compared the ability of the S-TRIAGE and NEWS scores to predict 28-day mortality in geriatric patients presenting to a tertiary ED in South India. The principal finding was that S-TRIAGE demonstrated superior overall discriminative accuracy (AUC 0.73 vs 0.66) and markedly higher sensitivity (75% vs 50%), suggesting that it captures clinically important risk information that NEWS alone misses in this population.

The demographic profile - predominantly male, aged 65–75 years, with high rates of hypertension and diabetes - is consistent with published data from Indian emergency departments and reflects the epidemiology of non-communicable disease in this region.2 The preponderance of cardiovascular, cerebrovascular and infectious diagnoses mirrors global patterns for geriatric ED attendances.4

The 28-day mortality of 22.1% is higher than the 10.3% reported in the Thai derivation cohort of S-TRIAGE1 and likely reflects differences in case-mix severity, baseline frailty and health-system access factors in this setting. It underscores the importance of locally validating scoring tools before clinical implementation.

The S-TRIAGE score demonstrated a clear stepwise gradient of mortality across risk categories - from 0% in the very-low group to 85.7% in the very-high group - consistent with the original derivation study.1 In contrast, NEWS mortality rates were comparable in the low and medium categories (5.7% each), with divergence only in the high category (43.8%). This reflects the well-documented limitation of NEWS in older adults: age-related blunting of heart rate and blood pressure responses may prevent elevation of NEWS even in the presence of significant physiological compromise.10,12 The S-TRIAGE instrument partly compensates for this by incorporating geriatric-specific indicators - notably altered mental status and shock index - that are sensitive to early deterioration in frail older patients.

The chi-square association was numerically stronger for NEWS (χ^2 61.28) than for S-TRIAGE (χ^2 38.85), which is paradoxical given S-TRIAGE's higher AUC. This likely reflects the greater polarisation of NEWS scores (45.3% low vs 37.3% high), which maximises chi-square statistics when mortality is concentrated in the high category, while S-TRIAGE distributes patients across five categories. The AUC, as an integration of sensitivity and specificity across all cut-points, is the appropriate metric for comparative discriminative performance.

The high rate of ICU admission (78.2%) and frequent requirement for vasopressor support (21.5%), IMV (14.6%) and NIV (16.1%) corroborate the clinical severity of this cohort and highlight the operational relevance of early risk stratification: timely identification of patients likely to require intensive intervention enables appropriate resource allocation and may reduce preventable deterioration.16 Evidence supports early warning tools as a means of prompting escalation of care before physiological decompensation becomes irreversible.22

These findings align with previous studies demonstrating limited sensitivity of NEWS in elderly populations8,9 and support the emerging evidence for geriatric-specific composite scoring tools.1,7 The strong positive association between S-TRIAGE and NEWS score categories (very-high S-TRIAGE predominantly clustering in high NEWS) also suggests that the two instruments capture overlapping but non-redundant physiological information; a combined or tiered approach may warrant investigation.

LIMITATIONS

Several limitations should be acknowledged. First, this was a single-centre study at a tertiary referral hospital; the case-mix and resource availability may differ from district-level or community hospitals, limiting generalisability. Second, outcome was limited to 28-day mortality; longer-term outcomes including functional decline, quality of life and readmission were not captured. Third, both scores were calculated only at triage; serial reassessment, which might enhance predictive performance, was not undertaken. Fourth, variability in vital sign measurement by different providers may have introduced measurement bias, despite standardised data collection protocols. Fifth, the study was conducted over a six-month period; seasonal variation in case-mix (e.g., influenza peaks) may have influenced

results.

CONCLUSION

In this prospective cohort of geriatric patients presenting to a tertiary Indian ED, the S-TRIAGE score demonstrated superior sensitivity and overall discriminative performance compared with NEWS for predicting 28-day mortality. Its geriatric-specific parameters - incorporating altered mental status, shock index and oxygenation ratio - confer an advantage over a purely physiological score in a population where conventional vital-sign changes may be blunted. Prospective implementation of S-TRIAGE at triage may support earlier identification of high-risk older adults, enabling timely escalation, ICU consultation and resource allocation. Multicentre validation studies are needed to confirm these findings and to explore the potential incremental value of combining both instruments.

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APPENDIX

Table A1. S-TRIAGE Scoring System

Variable	Criterion	Points
Respiratory Rate	<11 or >22 bpm	5
SF Ratio (SpO_2/FiO_2)	≤420	5
SF Ratio (SpO_2/FiO_2)	420–450	4
Shock Index	≥1	3
Shock Index	0.6–0.99	1.5
Systolic Blood Pressure	<100 mmHg	4
Body Temperature	<36°C or >37.5°C	1
Mental Status	Altered	6

Risk interpretation: Very Low (0–1), Low (2–3), Moderate (4–7), High (8–10), Very High (>10).

Table A2. National Early Warning Score (NEWS)

Parameter	3	2	1	0	1	2	3
Respiratory Rate	≤8		9–11	12–20		21–24	≥25
Oxygen Saturation	≤91	92–93	94–95	≥96			
Supplemental O_2		Yes		No			
Temperature (°C)	≤35		35.1–36	36.1–38	38.1–39	≥39.1	
Systolic BP (mmHg)	≤90	91–100	101–110	111–219			≥220
Heart Rate	≤40		41–50	51–90	91–110	111–130	≥131
Consciousness				Alert			V/P/U

Risk interpretation: Low (1–4), Medium (5–6), High (≥7).