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NEWS SCORE AS A PREDICTOR OF ICU ADMISSION IN PATIENTS PRESENTING TO THE EMERGENCY DEPARTMENT OF A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: *The National Early Warning Score (NEWS) is a standardized risk-stratification tool used to identify acutely ill patients at risk of clinical deterioration. It helps predict outcomes such as mortality, the need for intensive care unit (ICU) admission, and other critical events in various acute and pre-hospital settings. The ED (ED) is often the first point of contact for critically ill patients, many of whom initially respond well to resuscitation and management. However, this can sometimes be misleading, resulting in patients being falsely deemed stable and admitted to regular wards, where they may deteriorate rapidly. To mitigate this risk, it is essential that critically ill patients be transferred directly to the ICU from the ED. This study explores the utility of NEWS as a predictor for ICU admission in patients presenting to the ED of a tertiary care hospital (TCH).*

Objective: *To evaluate the predictive accuracy of NEWS in identifying patients requiring ICU admission among those presenting to the ED.*

Materials and Methods: *This prospective cohort study was conducted at the ED of Combined Military Hospital (CMH), Rawalpindi. A total of 200 patients were enrolled using consecutive non-probability sampling, with inclusion criteria focusing on adults aged ≥16 years and a NEWS score ≥6 at presentation. Patients were excluded if they were trauma cases, pregnant, brought in dead, or under palliative care, among other criteria. Vital signs were recorded at presentation, and NEWS was calculated using standardized parameters. The primary outcome was ICU admission. Diagnostic accuracy at a cutoff of NEWS ≥6 was evaluated using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and ROC curve analysis. Statistical analyses were performed using IBM SPSS Version 26.0.*

Results: *Of the 160 eligible participants, the mean age was 35.6 years (SD ±12.7), with a slight female predominance (55%). NEWS ≥6 yielded a sensitivity of 67.35% and specificity of 53.15% for predicting ICU admission. The PPV was 38.82%, and the NPV was 78.67%, with an overall diagnostic accuracy of 57.5%. ROC analysis identified NEWS ≥8 as the optimal threshold, achieving the highest Youden's Index (0.231). The area under the ROC curve supported moderate predictive capability of NEWS in this setting.*

Conclusion: *NEWS is a reliable and practical tool for predicting ICU admission among patients presenting to the ED. Its implementation can facilitate early identification of critically ill patients and optimize resource allocation in tertiary care settings.*

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Keywords: *National Early Warning Score, ICU admission, emergency room, tertiary care hospital, patient triage, critical care prediction.*

INTRODUCTION

Critically ill patients frequently present to EDs (EDs), where timely identification and triage are crucial for improving outcomes [1]. Missed or delayed recognition of clinical deterioration can lead to inappropriate ward admissions instead of intensive care unit (ICU) placement, resulting in increased morbidity and mortality [2]. This is particularly problematic in resource-constrained tertiary care hospitals (TCHs), where overcrowding and limited ICU capacity exacerbate risks. In such settings, objective early warning systems are needed to supplement subjective clinical assessments, which remain prone to variability and delay [3].

To address these challenges, various triage tools have been implemented globally, among which the National Early Warning Score (NEWS) has emerged as a validated and standardized method for detecting clinical deterioration [4]. Developed by the Royal College of Physicians (RCP) in the United Kingdom, NEWS incorporates vital parameters including respiratory rate (RR), oxygen saturation (SpO_2), temperature (T^0), systolic blood pressure (SBP), heart rate (HR), level of consciousness (measured via AVPU or GCS) [5], and supplemental oxygen (FiO_2) use. Each component is assigned a weighted score, and the aggregated total—ranging from 0 to 20—guides clinical response, with higher scores indicating greater severity [6-7].

The utility of NEWS in predicting adverse outcomes such as ICU admission, cardiac arrest, and in-hospital mortality has been well-documented in high-income healthcare systems [8,9]. For instance, a study by Jusoh et al demonstrated that a NEWS threshold of ≥5 yielded high sensitivity (87.5%) and specificity (91.3%) in predicting ICU admissions and other serious events [10]. However, despite its widespread adoption, the applicability of NEWS in low- and middle-income countries (LMICs) remains under-explored. The heterogeneity of patient profiles, variability in disease burden, and infrastructural limitations in LMICs like Pakistan warrant context-specific validation of such scoring tools.

Given these gaps, it is critical to assess whether NEWS can serve as a reliable predictor of ICU admission in South Asian tertiary care settings. Therefore, the objective of this study is to evaluate the predictive value of the National Early Warning Score (NEWS) in identifying patients requiring ICU admission from the ED of a tertiary care hospital in Pakistan.

Materials and Methods

This prospective cohort study was conducted to evaluate the predictive value of the National Early Warning Score (NEWS) in determining the need for ICU admission among patients presenting to the ED of Combined Military Hospital (CMH), Rawalpindi—a tertiary care teaching hospital with an annual ED attendance exceeding 200,000 patients. The study received prior approval from the Institutional Review Board (IRB) of CMH Rawalpindi, and written informed consent was obtained from all participants.

A total of 200 patients were enrolled using consecutive non-probability sampling. The sample size was determined using data from a previous study by Jusoh et al., which reported a 15% ICU admission rate among ED patients. Using a 95% confidence interval and a 5% margin of error, a minimum sample of 160 patients was required.

Upon presentation, vital signs were recorded by the ED clinical team and used to calculate the NEWS score. A standardized data collection tool was employed to document demographic details, NEWS parameters, and patient disposition. The reference cutoff of NEWS ≥6 was selected based on prior studies demonstrating its predictive validity for serious clinical outcomes, including ICU admission, with high sensitivity and specificity. Patients were stratified by outcome (ICU vs ward admission), and their initial NEWS scores were compared to assess the score's predictive performance.

The primary outcome was ICU admission. The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of NEWS ≥6 in predicting ICU admission were calculated using the final disposition data. This structured approach ensured consistent data collection, minimized inter-observer variability, and allowed for robust analysis of the score's clinical utility in a South Asian tertiary care setting.

Eligibility Criteria

Inclusion Criteria:

Patients aged ≥16 years (as the NEWS score is validated only for adults).

All patients presenting to the ED with a NEWS score ≥6 at initial clinical assessment.

Patients who provided informed consent for study

participation.
Availability of a complete set of vital signs to calculate the NEWS score.

Exclusion Criteria:

Trauma patients, as such cases may require a trauma-specific scoring system.
Pregnant patients, due to altered physiological parameters during pregnancy.
Patients brought in dead (BID).
Patients with out-of-hospital cardiac arrest.
Patients who left against medical advice (LAMA), were transferred, or referred to another facility (i.e., not admitted within the same institution).
Patients directly referred for ICU admission prior to a formal NEWS assessment.
Patients with documented Do-Not-Resuscitate (DNR) orders or those under palliative care with defined ceilings of care.

Data Collection and Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were used to summarize baseline demographic and clinical characteristics. For continuous variables, such as age and individual NEWS components, the mean and standard deviation (SD) were reported. Categorical variables, including gender, admission disposition (ICU or ward), and categorical NEWS groupings, were expressed as frequencies and percentages. The association between the NEWS score and ICU admission was assessed using an independent-samples t-test for continuous variables and the chi-square test for categorical variables. A p-value of <0.05 was considered statistically significant.

Receiver Operating Characteristic (ROC) curve analysis was performed to assess the predictive ability of the NEWS for ICU admission. The area under the ROC curve (AUC) was calculated to quantify diagnostic accuracy, with an AUC closer to 1.0 indicating stronger predictive performance. Sensitivity, specificity, PPV, and NPV were calculated at a NEWS cutoff of ≥6. This threshold was selected based on previous literature supporting its high sensitivity and specificity for predicting clinical deterioration and ICU admission in ED settings. Diagnostic accuracy was further evaluated using 2×2 contingency tables.

Sample Size Determination

A sample size of 160 patients was calculated using the sensitivity and specificity parameters reported by Jusoh et al., assuming a 15% ICU admission rate, a 95% confidence level, and a 5% margin of error. A total of 200 patients were ultimately enrolled to account for attrition and potential exclusions.

Results

This study comprised a total of 160 participants. The age of the study population ranged from 16 to 60 years, with a calculated mean of 35.6 years and a standard deviation of 12.7 years. The interquartile range reflected a central clustering around the third decade of life, with the 25th percentile at 24 years, the median at 36 years, and the 75th percentile at 46 years. This distribution illustrates a relatively young cohort, inclusive of both adolescent and middle-aged individuals, representative of a clinically relevant population.

In terms of gender distribution, there was a modest female predominance, with 88 female participants compared to 72 males (Figure 1).

The diagnostic accuracy of the evaluated scoring system or triage protocol was assessed through standard classification metrics. Out of the 160 evaluated cases, 59 were classified as True Negatives, 33 as True Positives, 52 as False Positives, and 16 as False Negatives. This distribution indicates that although the tool demonstrated a fair ability to detect both presence and absence of the condition under investigation, a considerable proportion of cases were misclassified, with False Positives outnumbering False Negatives.

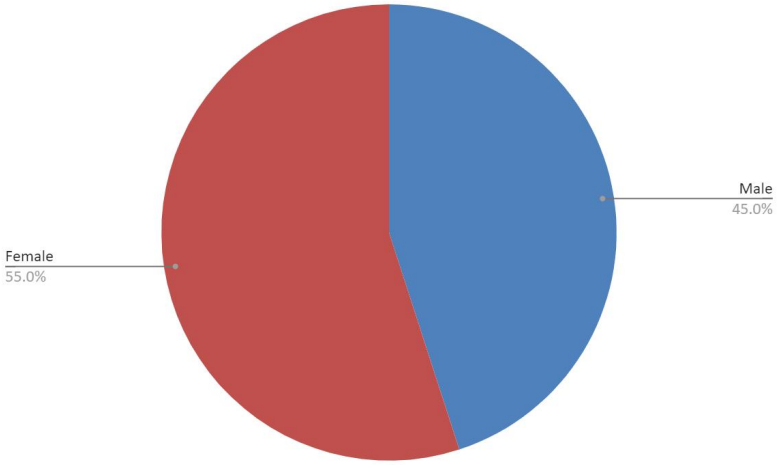

Figure 1: Gender distribution

Table 1: Determining the NEWS threshold for intensive care admission from the ED.

NEWS Cutoff	True +ve	False +ve	True -ve	False -ve	Sensitivity	Specificity	Accuracy	PPV	NPV	Youden's Index
6	33	52	59	16	0.673	0.532	0.575	0.388	0.787	0.205
7	30	50	61	19	0.612	0.55	0.569	0.375	0.762	0.162
8	29	40	71	20	0.592	0.64	0.625	0.42	0.78	0.231
9	25	33	78	24	0.51	0.703	0.644	0.431	0.765	0.213
10	19	27	84	30	0.388	0.757	0.644	0.413	0.737	0.145
11	16	20	91	33	0.327	0.82	0.669	0.444	0.734	0.146
12	11	13	98	38	0.224	0.883	0.681	0.458	0.721	0.107
13	6	7	104	43	0.122	0.937	0.688	0.462	0.707	0.059
14	0	0	111	49	0	1	0.694	0	0.694	0
15	0	0	111	49	0	1	0.694	0	0.694	0
16	0	0	111	49	0	1	0.694	0	0.694	0
17	0	0	111	49	0	1	0.694	0	0.694	0
18	0	0	111	49	0	1	0.694	0	0.694	0
19	0	0	111	49	0	1	0.694	0	0.694	0
20	0	0	111	49	0	1	0.694	0	0.694	0

The diagnostic test demonstrated a sensitivity of 67.35%, indicating a moderate ability to detect true positive cases. Specificity was lower at 53.15%, reflecting a limited capacity to correctly rule out individuals without the condition. The positive predictive value (PPV) was 38.82%, meaning a substantial proportion of positive results were false positives. In contrast, the negative predictive value (NPV) was 78.67%, suggesting relatively higher reliability in ruling out disease in negative cases. The overall diagnostic accuracy stood at 57.50%, highlighting modest performance in correctly classifying both positive and negative cases. Optimal NEWS threshold was found to be 8.0 with a Maximum Youden's Index of 0.231

Discussion

The predictive efficacy of the National Early Warning Score 2 (NEWS-2) for ICU admissions has been extensively evaluated across various populations and healthcare settings. In our study, a NEWS threshold of ≥6 yielded a sensitivity of 67.3%, specificity of 53.2%, and an area under the receiver operating characteristic (AUROC) curve of 0.575. These metrics suggest moderate discriminative ability, particularly when juxtaposed with findings from other international studies.

Compared to the sensitivity and specificity values reported in Western cohorts—often exceeding 80% in studies by Royal College of Physicians—our results fall short, particularly with regard to specificity. The lower predictive validity observed in our study raises concerns about the uncritical application of Western-

derived clinical scoring systems in South Asian populations without prior contextual validation [11].

Interestingly, our findings align more closely with data from South Asian contexts. A study from Bangladesh evaluating NEWS2 in COVID-19 patients reported an AUROC of 0.96; however, at a threshold of 7, the sensitivity dropped to 29.4%, albeit with a specificity of 99.3% [12]. This suggests that while higher thresholds may enhance specificity, they could compromise sensitivity, potentially delaying critical interventions. Similar patterns were observed from studies in Egypt [13] and Philippines [14].

The discrepancies between our results and those from Western studies may be attributed to several factors. Firstly, the demographic profile of our cohort, with a mean age of 35.6 years, is younger than those in many Western studies, where older populations with multiple comorbidities are prevalent [15]. Younger patients may exhibit more resilient physiological responses, potentially affecting the sensitivity of early warning scores. Secondly, variations in healthcare infrastructure, patient presentation patterns, and disease prevalence in South Asia may influence the performance of standardized scoring systems like NEWS.

Furthermore, our study's exclusion criteria, notably the omission of patients with NEWS scores below 6 and those transferred to the ICU within 12 hours post-ward admission, may have impacted the sensitivity and overall predictive accuracy of the score. These exclusions could have led to an underestimation of the true incidence of clinical deterioration, thereby affecting the evaluation of NEWS's performance.

In light of these observations, while NEWS remains a valuable tool for early detection of patient deterioration, its application in South Asian settings may require contextual adjustments. Tailoring the threshold values and integrating additional clinical parameters pertinent to the local population could enhance its predictive utility. Further multicentric studies encompassing diverse patient demographics are warranted to refine the applicability of NEWS in varying healthcare contexts.

Study strengths and Limitations:

The study's prospective nature ensures that data collection occurred in real-time, reducing recall bias and providing more accurate information. The sample size is sufficient to ensure robust statistical analysis, contributing to reliability of the outcomes. The primary objective of the study is very clear, addressing an important clinical question that could have significant implications for ED triage protocols.

As this study excluded patients with an initial NEWS of less than 6, the findings cannot be generalized to all ED patients. Additionally, a small proportion of patients with a lower NEWS who might still have required ICU admission may have been overlooked. Furthermore, patients who were initially admitted to the ward from ED, but later transferred to the ICU within 12 hours of admission were not considered. Including this data could have further enriched the study's findings.

Conclusion:

NEWS is a reliable and practical tool for predicting ICU admission among patients presenting to the ED. Its implementation can facilitate early identification of critically ill patients and optimize resource allocation in tertiary care settings.

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