

Prognostic Accuracy of News2 and Qsofa for Predicting In-Hospital Mortality in Emergency Department Patients with Suspected Sepsis

Afzal Kunhammed¹, P A Kabeer²

¹Senior Registrar, Emergency Medicine, Department of Emergency Medicine, Meitra Hospital, Kozhikode, Kerala, India. ²HOD & Senior consultant, Department of Emergency Medicine, Al madeena Institute of Medical Science, Kottakkal, Kerala, India

Abstract

Background: Proactive risk evaluation is crucial for bettering prognoses in those with suspected sepsis entering the emergency room. Although the National Early Warning Score 2 (NEWS2) and the rapid Sequential Organ Failure Assessment (qSOFA) are extensively utilized as bedside prognostic measures, their relative performance remains unclear. The objective is to compare the prognostic accuracy of NEWS2 and qSOFA in predicting in-hospital mortality among adult emergency department patients with suspected sepsis, with subsequent review of ICU admission and the requirement for mechanical ventilation. **Material and Methods:** Between June 2022 and June 2023, the Almadeena Institute of Medical Sciences' Department of Emergency Medicine in Kerala, India, carried out this prospective observational study. A total of 400 adult patients with suspected sepsis were enrolled. NEWS2 and qSOFA scores were calculated at presentation and repeated one hour after emergency department admission. The prognostic performance of both scoring systems was assessed using receiver operating characteristic (ROC) curve analysis in order to predict 24-hour mortality, 3-day mortality, ICU admission, and the requirement for mechanical ventilation. **Results:** Non-survivors were older, predominantly male, and more frequently had lower respiratory tract infections, diabetes mellitus, and hypertension. They demonstrated poorer physiological parameters, higher oxygen requirements, and greater rates of ICU admission and mechanical ventilation. Both NEWS2 and qSOFA scores were significantly higher among non-survivors at presentation and one hour after admission. At presentation, both scores showed comparable discrimination for predicting 24-hour mortality, 3-day mortality, and the need for mechanical ventilation, whereas NEWS2 demonstrated superior discrimination for ICU admission (AUROC 0.970 vs. 0.926). At one hour, for predicting 3-day death (AUROC 0.915 vs. 0.880), mechanical ventilation (AUROC 0.931 vs. 0.884), and ICU admission (AUROC 0.972 vs. 0.931), NEWS2 outperformed qSOFA in terms of prognostic accuracy; however, both scores were similar for predicting 24-hour mortality. **Conclusion:** When an adult patient presents to the emergency room with suspected sepsis, NEWS2 and qSOFA are both helpful bedside instruments for early risk assessment. When reviewed an hour after presentation, NEWS2 showed greater predictive accuracy than qSOFA for predicting ICU admission, mechanical ventilation, and short-term death.

Keywords: Sepsis; NEWS2; qSOFA; Emergency Department; Risk Stratification; In-Hospital Mortality; Intensive Care Unit.

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INTRODUCTION

A major source of morbidity and mortality globally, sepsis is a potentially fatal disease that arises from a dysregulated host response to infection that causes organ failure. Early recognition and timely risk stratification in the Emergency Department (ED) are essential for prompt initiation of appropriate treatment, escalation of care, and improved clinical outcomes.^[1-7]

Several bedside scoring systems have been developed to facilitate early identification of patients at risk of adverse outcomes. Introduced as part of the Sepsis-3 recommendations, the fast Sequential Organ Failure Assessment (qSOFA) is a straightforward bedside assessment intended to identify patients with suspected infection who are more likely to experience poor clinical outcomes outside of the intensive care unit.^[1] Although

qSOFA has demonstrated good specificity, studies and systematic reviews have reported variable sensitivity, prompting continued evaluation of alternative early warning systems for emergency department triage and prognostication.^[3-17]

The National Early Warning Score 2 (NEWS2) has been

Address for correspondence: Dr. Afzal Kunhammed, Senior Registrar, Emergency Medicine, Department of Emergency Medicine, Meitra Hospital, Kozhikode, Kerala, India. E-mail: dr.afzalk94@gmail.com

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extensively assessed for early risk stratification in patients with suspected sepsis and acute illness. It has proven useful in predicting mortality, admission to the intensive care unit, and other unfavorable clinical outcomes. It takes into account routinely measured physiological parameters.^[10–16] Although both NEWS2 and qSOFA are widely used for early risk assessment, evidence comparing their prognostic performance in adult patients presenting to the Emergency Department with suspected sepsis remains inconsistent across different healthcare settings.^[9,11–14]

Furthermore, prospective data comparing these scoring systems in Indian emergency department populations remain limited. Direct comparison of NEWS2 and qSOFA in this setting is therefore clinically relevant for optimizing early risk stratification, guiding timely clinical decision-making, and facilitating appropriate escalation of care.^[15]

This study's main goal was to assess how well NEWS2 and qSOFA predicted in-hospital mortality in adult patients who arrived at the emergency room with suspected sepsis. Comparing how well both scoring systems performed in predicting ICU admission, the requirement for mechanical ventilation, 24-hour mortality, and 3-day mortality were secondary goals.

MATERIALS AND METHODS

Study Design and Setting: Over the course of a year, from June 2022 to June 2023, this prospective observational study was carried out in the Department of Emergency Medicine at the Almadeena Institute of Medical Sciences in Kottakkal, Kerala. The Institutional Ethics Committee approved the study (Approval No. EC/NEW/INST/2023/KL/0369), and prior to enrollment, all participants or their legally designated representatives provided written informed consent.

Study Population: As the operational definition for suspected sepsis in the emergency room, patients who met at least two SIRS criteria and had a suspected infection were prospectively enrolled at the time of study preparation. This operational enrolment strategy was selected to facilitate early bedside identification before definitive organ dysfunction assessment.

Inclusion Criteria

Patients were included if they:

- Were at least eighteen years old.
- Presented with a suspected illness that met two or more SIRS (Systemic Inflammatory Response Syndrome) criteria:
 - The temperature is either $<36^{\circ}\text{C}$ or $>38^{\circ}\text{C}$.
 - Heart rate greater than 90 beats per minute.
 - $\text{PaCO}_2 <32$ mmHg or respiratory rate >20 breaths per minute.
 - White blood cell counts greater than $12,000/\text{mm}^3$, less than $4,000/\text{mm}^3$, or more than 10% immature (band) forms.

Exclusion Criteria

Patients were excluded if they:

- Were younger than 18 years.
- Had an established diagnosis of sepsis before

presentation to the emergency department.

Sample Size: Using the formula for estimating diagnostic sensitivity, the sample size was determined based on the estimated sensitivity of the NEWS-2 score for in-hospital mortality prediction. Assuming a sensitivity of 74%, an anticipated in-hospital mortality of 15%, a 95% confidence level, and an absolute precision of 15% of the expected sensitivity, the minimum required sample size was estimated to be 400 patients.

Sampling Technique: In order to reach the necessary sample size of 400 participants, eligible patients who presented at times when the investigator was accessible were prospectively enrolled using a convenience sampling technique.

Study Procedure: A standardized data collection form was used to capture demographic information, clinical history, comorbidities, physical examination results, and pertinent laboratory tests after informed consent was obtained. Vital signs were recorded at presentation and repeated one hour after admission to the emergency department.

NEWS-2 and qSOFA scores were calculated using physiological parameters obtained at presentation. The respiratory rate, oxygen saturation, need for extra oxygen, systolic blood pressure, pulse rate, body temperature, and consciousness level were all included in the NEWS-2 score. The Glasgow Coma Scale score of less than 15, respiratory rate (≥ 22 breaths/minute), and systolic blood pressure (≤ 100 mmHg) were used to generate the qSOFA score.

All patients received standard treatment as determined by the treating physician. Patients were followed throughout their hospital stay until discharge or death. The primary outcome was in-hospital mortality.

Outcome Measures: The primary outcome was the prognostic accuracy of NEWS-2 and qSOFA scores in predicting In-hospital mortality among patients presenting with suspected sepsis. Secondary outcomes included ICU admission, need for mechanical ventilation, 24-hour mortality, and 3-day mortality.

Statistical Analysis: Information was recorded in Microsoft Excel and assessed with IBM SPSS Statistics version 20.0 (IBM Corp., Armonk, NY, USA). The Shapiro–Wilk test was utilized to assess the normality of continuous data, which were presented as mean $\pm$ standard deviation (SD) or median with interquartile range (IQR), depending on the context. Categorical variables were articulated in terms of frequencies and percentages.

The independent samples t-test or Mann–Whitney U test was employed for continuous variables, while the Chi-square test or Fisher's exact test was applied for categorical variables in the comparison of survivors and non-survivors, as appropriate.

The forecasting capability of NEWS-2 and qSOFA scores was examined utilizing receiver operating characteristic (ROC) curve analysis. The AUROC, accompanied with 95% confidence intervals, was determined for every scoring system. Sensitivity, specificity, positive predictive value, negative predictive value, and overall diagnostic accuracy were evaluated using the optimal cut-off settings. A comparison was made between the AUROCs of NEWS-2 and qSOFA. A two-sided P value below 0.05 was regarded as statistically significant. All variables featured in the primary analysis had complete data.

Ethical Considerations: The study protocol was approved by the Institutional Ethics Committee of Almadeena Institute of Medical Sciences (Approval No. EC/NEW/INST/2023/KL/0369). Prior to enrollment, written informed permission was secured from all participants or their legally appointed representatives. The confidentiality of patient data was safeguarded during the trial, and all information was anonymized before analysis. No patient identifiers were used in any publication arising from this study.

RESULTS

A total of 400 patients with suspected sepsis were included in this prospective observational study. Non-survivors were older, predominantly male, and more commonly had lower respiratory tract infections, diabetes mellitus, and hypertension than survivors. They also demonstrated significantly poorer baseline physiological parameters,

higher oxygen requirements, and a greater need for mechanical ventilation and ICU admission. Both NEWS2 and qSOFA ratings were markedly elevated in non-survivors compared to survivors at the time of presentation and one hour following admission to the emergency room.

Receiver operating characteristic (ROC) curve analysis demonstrated that both NEWS2 and qSOFA had comparable discriminative ability for predicting 24-hour mortality, 3-day mortality, and the need for mechanical ventilation at presentation. NEWS2 demonstrated higher discrimination for predicting ICU admission at presentation. One hour after emergency department admission, NEWS2 showed higher discriminative ability than qSOFA for predicting 3-day mortality, the need for mechanical ventilation, and ICU admission, whereas both scores remained comparable for predicting 24-hour mortality. Higher NEWS2 and qSOFA scores were observed among patients who experienced mortality, ICU admission, and mechanical ventilation.

Table 1: NEWS2 and qSOFA Scores among survivors and non-survivors

	NEWS2score					QSOFA score				
	Survivours		Non-survivours		p-value	Survivours		Non-survivours		p-value
	Mean	SD	Mean	SD		Mean	SD	Mean	SD	
On admissionto ED	6.65	4.13	14.83	1.88	0.0001	0.45	0.75	2.2	0.58	0.0001
One hour after admissionto ED	4.68	3.45	12.16	3	0.0001	0.4	0.72	1.92	0.69	0.0001

Table 2: Secondary Outcome distribution

		Survivors		Non-survivors	
		No.	%	No.	%
Mechanical ventilation	YES	4	1.06%	12	50%
	NO	372	98.94%	12	50%
Need for ICU admission	YES	36	9.57%	22	91.67%
	NO	340	9.57%	2	8.33%

Table 3: Summary of comparison of qSOFA and NEWS 2

Outcome	On Admission to ED NEWS 2 AUC (95% CI)	On Admission to ED qSOFA AUC (95% CI)	p-value	One Hour After Admission to ED NEWS 2 AUC (95% CI)	One Hour After Admission to ED qSOFA AUC (95% CI)	p-value
Mortality within 24 hours	0.943 (0.890–0.980)	0.948 (0.917–0.979)	<0.0001	0.933 (0.885–0.981)	0.941 (0.915–0.967)	<0.0001
Mortality within 3 days	0.927 (0.896–0.958)	0.910 (0.873–0.946)	<0.0001	0.915 (0.865–0.965)	0.880 (0.843–0.936)	<0.0001
Need for Mechanical Ventilation	0.943 (0.912–0.974)	0.926 (0.888–0.964)	<0.0001	0.931 (0.894–0.968)	0.884 (0.804–0.964)	<0.0001
ICU Admission	0.970 (0.952–0.988)	0.926 (0.888–0.964)	<0.0001	0.972 (0.957–0.987)	0.931 (0.894–0.968)	<0.0001

DISCUSSION

In this prospective observational analysis, both NEWS2 and qSOFA showed effective prognostic capabilities in anticipating severe clinical outcomes for adult patients entering the Emergency Department with suspected sepsis. Overall, NEWS2 shown enhanced prognostic accuracy relative to qSOFA for anticipating ICU admission, the demand for mechanical ventilation, and short-term mortality, notably when re-evaluated one hour following emergency department entry. These findings support the utility of NEWS2 as an effective bedside risk stratification

tool in the emergency department and provide the basis for comparison with previously published studies.^[3]

Demographic details of the study population: In the present study, the mean age of non-survivors was significantly higher than that of survivors (69.04 ± 13.62 years vs. 47.96 ± 18.42 years), suggesting that increasing age is associated with poorer prognosis in patients with sepsis. Elderly individuals have continually been recognized as an autonomous predictor of death due to diminished physiological capacity and the increased occurrence of related comorbid conditions. Although both males and females were affected, a slightly higher proportion of males was observed among non-survivors.

Respiratory tract infections constituted the predominant cause of sepsis in deceased patients, with 79.17% of fatalities, with urosepsis following at 12.57%. These results suggest that infections of the lower respiratory tract correlate with a poorer prognosis relative to other origins of sepsis.

Comorbidities: Among the comorbid conditions evaluated, diabetes mellitus, hypertension, and coronary artery disease were more frequently observed among non-survivors. A large proportion of patients with diabetes mellitus (75%) and hypertension (70.83%) died within three days of admission, indicating that the presence of chronic comorbid illnesses adversely affects the clinical outcome of sepsis. These findings are in agreement with previous studies demonstrating that pre-existing comorbidities significantly increase the risk of organ dysfunction, prolonged hospitalization, and mortality.^[10]

Vital parameters: Baseline physiological parameters differed significantly between survivors and non-survivors both at presentation and one hour after admission. Patients who died had significantly lower systolic blood pressure and oxygen saturation and higher respiratory rates than survivors ($P < 0.0001$). Altered mental status was also markedly more common among non-survivors, with all non-survivors presenting with confusion at admission, while the majority of survivors remained alert.

Similarly, the requirement for supplemental oxygen was significantly higher among non-survivors, with all non-survivors requiring oxygen therapy both at presentation and one hour after admission. These findings emphasize the importance of early physiological assessment in identifying patients at increased risk of adverse outcomes.

Mechanical ventilation and ICU admission: The requirement for mechanical breathing and admission to the intensive care unit (ICU) was markedly greater in non-survivors compared to survivors. Half of the non-survivors required mechanical ventilation, while more than 90% required ICU admission. These findings indicate that patients with greater physiological derangement at presentation are more likely to require organ support and experience poor clinical outcomes.

Comparison of qSOFA and NEWS-2 score on admission: Both qSOFA and NEWS-2 scores demonstrated good prognostic ability in predicting mortality within 24 hours and three days of admission. However, NEWS-2 showed better discrimination than qSOFA for predicting ICU admission, with AUROC values of 0.97 and 0.92, respectively ($P < 0.0001$). Despite both scores exhibiting comparable efficacy in forecasting the necessity for mechanical ventilation, the enhanced performance of NEWS-2 regarding ICU admission indicates that it could serve as a more dependable bedside instrument for preliminary risk assessment in individuals with suspected sepsis.^[11,13]

One hour after admission: Assessment of patients one hour after admission further improved the prognostic performance of NEWS-2. While both qSOFA and NEWS-2 performed comparably in predicting mortality within the first 24 hours, NEWS-2 demonstrated superior accuracy for

predicting three-day mortality (AUROC 0.915 vs. 0.88), need for mechanical ventilation (AUROC 0.931 vs. 0.88), and ICU admission (AUROC 0.97 vs. 0.94), with all comparisons being statistically significant ($P < 0.0001$).

These findings suggest that reassessment using NEWS2 one hour after emergency department admission may improve risk stratification compared with assessment at presentation alone.

Goulden R, Hoyle MC, Monis J, et al. reported that NEWS demonstrated equivalent or superior prognostic performance compared with SIRS and qSOFA in predicting in-hospital mortality, which is consistent with the findings of the present study. Similarly, Usman OA, Usman AA also found that NEWS was the most accurate bedside scoring system for identifying patients at risk of adverse sepsis-related outcomes.^[11]

Jang JG, Hur J, Hong KS, et al. demonstrated that the NEWS score was superior in predicting 28-day mortality among patients with COVID-19, further supporting its usefulness as an early warning tool. Several additional studies have likewise reported that NEWS provides better sensitivity for predicting ICU admission and mortality, although with slightly lower specificity than qSOFA.^[12]

Kovach CP, Fletcher GS, Rudd KE, and colleagues evaluated various prognostic scoring systems and determined that NEWS and SOFA exhibited superior prognostic precision compared to qSOFA or SIRS in forecasting hospital mortality, ICU transfer, and ICU duration, findings that closely align with the current study's results.^[13]

In the present study, increasing NEWS-2 and qSOFA scores were associated with a greater need for mechanical ventilation, ICU admission, and higher mortality within both 24 hours and three days of admission. Patients with multiple comorbidities also demonstrated higher NEWS-2 and qSOFA scores, reflecting more severe physiological derangement.

Corfield AR, Lees F, Zealley I, et al. in a national audit, similarly demonstrated that increasing NEWS values at emergency department presentation were associated with significantly higher odds of adverse clinical outcomes among patients with sepsis.¹⁶ Studies evaluating qSOFA have likewise reported that increasing scores are associated with poor prognosis, increased need for mechanical ventilation, ICU admission, and mortality, findings that are consistent with those observed in the present study.^[14-17]

Limitations: This research possesses numerous constraints. Initially, the study was performed at a solitary tertiary-care facility, perhaps constraining the applicability of the results. Second, participants were enrolled using Systemic Inflammatory Response Syndrome (SIRS)-based screening criteria rather than Sepsis-3 definitions, which may limit direct comparison with studies employing contemporary sepsis definitions. Thirdly, the application of convenience sampling might have engendered selection bias, thus constraining the representativeness and generalizability of the results. Fourth, although the prospective observational design allowed temporal assessment of outcomes, it precludes causal inference. Finally, external validation in larger, multicentre cohorts is required before these findings can be generalised to other emergency department settings.

CONCLUSION

In this prospective observational study both NEWS-2 and qSOFA are useful bedside tools for early risk stratification in patients presenting with suspected sepsis. However, NEWS-2 showed superior prognostic accuracy in predicting the need for intensive care unit admission, mechanical ventilation, and short-term mortality, particularly when reassessed one hour after emergency department admission. Increasing scores on both NEWS-2 and qSOFA were associated with poorer clinical outcomes. Further large-scale, multicentre studies are recommended to validate these findings and evaluate the utility of serial NEWS-2 assessment across diverse healthcare settings.

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Conflicts of interest

There are no conflicts of interest.

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