

Comparative Evaluation of National Early Warning Score (NEWS) and qSOFA Score in Predicting Outcomes Among Patients with Suspected Sepsis: A Cross-Sectional Study

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ABSTRACT

Background: Sepsis remains a leading cause of hospitalization-associated mortality worldwide, with delayed recognition being the primary obstacle to preventing progression to septic shock. The National Early Warning Score (NEWS) has emerged as a promising triage tool for sepsis assessment, though its performance across different hospital settings requires further evaluation.

Objective: To evaluate the efficacy of NEWS as a screening instrument compared to qSOFA in predicting sepsis-related outcomes among adult patients with suspected sepsis in both ICU and non-ICU settings.

Methods: A cross-sectional study was conducted among 65 adult patients with suspected sepsis at a tertiary care hospital in India over 18 months (March 2021-June 2022). NEWS and qSOFA scores were calculated for all participants. The primary endpoints were ICU admission, survival, and mortality. Diagnostic performance was assessed using receiver operating characteristic (ROC) curve analysis.

Results: The mean age was 60.04±14.36 years, with 53.8% males and 46.2% females. Comorbidities included hypertension (50.8%), diabetes mellitus (67.7%), and malignancy (7.7%). Culture positivity was 67.6%, with *Klebsiella pneumoniae* (26.7%) and *E. coli* (20%) being the predominant organisms. Non-survivors (41.5%) had significantly higher NEWS and qSOFA scores compared to survivors ($P<0.01$). NEWS demonstrated AUC of 0.817 (95% CI: 0.702-0.931) with 86% sensitivity and 52% specificity at cut-off 9.5, while qSOFA showed AUC of 0.751 (95% CI: 0.618-0.884) with 82% sensitivity and 55% specificity at cut-off 1.5.

Conclusion: NEWS demonstrates superior sensitivity in predicting mortality among patients with suspected sepsis, making it a promising and efficient triage tool for risk stratification. Further research with larger sample sizes is warranted to optimize NEWS specificity and validate these findings across diverse healthcare settings.

Keywords: Sepsis, Septic Shock, NEWS Score, qSOFA Score, Early Warning Score, Mortality Prediction

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INTRODUCTION

Sepsis, defined as life-threatening organ dysfunction caused by a dysregulated host response to infection, represents a significant global health burden [1]. The World Health Organization designated sepsis a global health priority in 2017, with the Global Burden of Disease Study reporting 48.9 million incident cases and 11.0 million sepsis-related deaths annually, accounting for 19.7% of global mortality [2,3].

Early detection and timely treatment have been consistently associated with reduced mortality, morbidity, and healthcare costs [4]. However, novel sepsis recognition technologies providing preliminary clinical evaluations have not been extensively tested across various healthcare settings [1]. The Royal College of Physicians introduced the NEWS in 2012 as a standardized approach to predict patient deterioration, evaluating seven physiological parameters: temperature, systolic blood pressure,

respiratory rate, oxygen saturation, heart rate, and level of consciousness [5,6].

The qSOFA score, introduced in 2016, was developed as a simplified bedside tool for sepsis risk stratification [7]. However, recent evidence suggests qSOFA may have lower sensitivity compared to other sepsis diagnostic methods, potentially affecting clinical outcomes [8]. Furthermore, research evaluating these scoring systems in the Indian context remains scarce.

This study aims to evaluate the performance of NEWS compared to qSOFA as screening instruments in adult patients with suspected sepsis in both ICU and non-ICU settings, assessing their utility in predicting sepsis-related outcomes.

OBJECTIVES

1. To assess the performance of NEWS and qSOFA scores in patients with suspected sepsis in ICU settings

2. To assess the performance of NEWS and qSOFA scores in patients with suspected sepsis in non-ICU settings

MATERIALS AND METHODS

Study Design and Setting

This cross-sectional study was conducted at the Department of General Medicine, Vydehi Institute of Medical Sciences and Research Centre, over 18 months from March 2021 to June 2022.

Study Population

A total of 65 adult patients (age >18 years) with suspected sepsis were enrolled. Suspected sepsis was defined based on clinical

presentation including tachycardia, hypotension, fever, elevated leukocyte count, and elevated erythrocyte sedimentation rate.

Exclusion Criteria

- ☐ Pregnancy
- ☐ Discharged against medical advice
- ☐ Alternate diagnosis
- ☐ Age <18 years

Sample Size Calculation

Sample size was calculated using sensitivity of NEWS in predicting mortality among suspected sepsis subjects as 71.9% at >9 cut-off from a previous study [9]:

$$n = \frac{Z^2 \times Sn \times (100 - Sn)}{d^2 \times p} \quad (XX)$$

Where:

- ☐ Z = 1.96 (95% confidence level)
- ☐ Sn = Sensitivity = 71.9%
- ☐ d = desired absolute precision = 5%
- ☐ p = prevalence of sepsis in ICU patients = 29.5%

The calculated sample size was 65 subjects.

Ethical Considerations

The study was approved by the Institutional Ethical Committee. Written informed consent was obtained from all participants or their legal guardians.

Data Collection

Data collection involved comprehensive history taking (age, sex, comorbidities) and physical assessment using NEWS and qSOFA scores. Patient data included temperature, oxygen saturation, respiratory rate, heart rate, systolic blood pressure, AVPU score (Alert, Voice, Pain, Unresponsive), and length of hospital stay. Sepsis diagnosis was confirmed using SEPSIS-3 criteria [1].

Laboratory Investigations

All patients underwent:

- ☐ Complete blood count

- ☐ Liver function tests
- ☐ Renal function tests
- ☐ Urine routine and microscopy
- ☐ Blood culture
- ☐ Erythrocyte sedimentation rate
- ☐ Chest X-ray
- ☐ Other cultures as indicated
- ☐ Arterial blood gas analysis

Statistical Analysis

Data were analyzed using SPSS version 22. Categorical variables were presented as frequencies and percentages, with significance tested using Chi-square or Fisher's exact test. Continuous variables were expressed as mean $\pm$ standard deviation, with mean differences tested using independent t-test. ROC curves were constructed for both NEWS and qSOFA to determine optimal cut-off points and calculate sensitivity, specificity, positive and negative predictive values. A P-value <0.05 was considered statistically significant.

RESULTS

Table 1. Age Distribution

Age Group (years)	Frequency (n=65)	Percentage (%)
≤ 30	3	4.6
31-40	5	7.7
41-50	5	7.7
51-60	18	27.7
61-70	20	30.8
>70	14	21.5
Mean $\pm$ SD	60.04 $\pm$ 14.36	

Table 2. Gender Distribution

Gender	Frequency (n=65)	Percentage (%)
Male	35	53.8
Female	30	46.2

Table 3. Distribution of Comorbidities

Comorbidity	Frequency (n=65)	Percentage (%)
Hypertension	33	50.8
Diabetes Mellitus	44	67.7
AKI/CKD	7	10.7
Ischemic Heart Disease	6	9.2
Malignancy	5	7.7

Table 4. Clinical Outcome

Outcome	Frequency (n=65)	Percentage (%)
Expired	27	41.5
Survived	38	58.5

Table 5. ICU/Non-ICU Distribution

Setting	Frequency (n=65)	Percentage (%)
ICU	39	60.0
Non-ICU	26	40.0

Table 6. Culture Positivity

Culture Result	Frequency (n=65)	Percentage (%)
Positive	44	67.6
Negative	21	32.3

Table 7. Organisms Isolated from Blood Culture

Organism	Frequency	Percentage (%)
Klebsiella pneumoniae	8	26.7
E. coli	6	20.0
Pseudomonas aeruginosa	4	13.3
MRSA	2	6.7
Enterococcus faecium	2	6.7
Salmonella	1	3.3
MRSH	1	3.3
Enterococcus faecalis	1	3.3

Table 8. Laboratory Parameters

Parameter	Frequency (n=65)	Percentage (%)
Anemia	53	81.5
Leukocytosis	53	81.5
Leucopenia	3	4.6
Thrombocytopenia	27	41.5
Raised ALT	16	24.6
Raised AST	17	26.1
Elevated Urea	57	87.7
Elevated Creatinine	42	64.6

Table 9. qSOFA Score Distribution

qSOFA Score	Frequency (n=65)	Percentage (%)
0	4	6.15
1	24	36.92
2	28	43.07
3	9	13.84

Table 10. NEWS Score Distribution

NEWS Score	Frequency (n=65)	Percentage (%)
1-4	5	7.7
5-6	3	4.6
≥7	57	87.7

Table 11. Comparison of Scores Based on Outcome

Score	Expired Median [Q1, Q3]	Survived Median [Q1, Q3]	P-value
NEWS	13 [10, 15]	9 [7.50, 11]	0.003
qSOFA	2 [1, 3]	1 [1, 2]	<0.0001

Table 12. Comparison of Scores Based on ICU Admission and Outcome

Score	Expired		Survived	
	ICU	Non-ICU	ICU	Non-ICU
qSOFA	2[1,3]	-	2[1,2]	1[5,1.5]
NEWS	13[10,14.5]	14.5[14]	10[8,11]	9[7.5,11]

Table 13. Diagnostic Performance Comparison

Parameter	NEWS Score	qSOFA Score
AUC	0.817	0.751
95% CI	0.702-0.931	0.618-0.884
Optimal Cut-off	9.5	1.5
Sensitivity (%)	86	82
Specificity (%)	52	55

Demographics and Baseline Characteristics

The study population had a mean age of 60.04±14.36 years, with the majority in the 61-70 years age group (30.8%). Males constituted 53.8% (n=35) and females 46.2% (n=30). [table 1,2]

Comorbidities

The most prevalent comorbidities were diabetes mellitus (67.7%) and hypertension (50.8%). Other comorbidities included AKI/CKD (10.7%), ischemic heart disease (9.2%), and malignancies (7.7%). [table 3]

Clinical Outcomes

Of the 65 patients, 41.5% (n=27) expired and 58.5% (n=38) survived. ICU admission was required for 60% (n=39) of patients, while 40% (n=26) were managed in non-ICU settings. [table 4,5]

Microbiological Profile [table 6,7]

Culture positivity was observed in 67.6% (n=44) of patients. Among positive cultures:

- Blood culture: Klebsiella pneumoniae (26.7%), E. coli (20%), Pseudomonas aeruginosa (13.3%)
- Urine culture: E. coli (42.9%), MRSA (21.4%), Klebsiella pneumoniae (14.3%)
- Sputum culture: Klebsiella pneumoniae (62.5%), Pseudomonas aeruginosa (25%)

Laboratory Parameters[table 8]

Laboratory findings revealed:

- Anemia: 81.5%
- Leukocytosis: 81.5%
- Thrombocytopenia: 41.5%
- Elevated ALT: 24.6%
- Elevated AST: 26.1%

- Elevated urea: 87.7%

- Elevated creatinine: 64.6%

Scoring System Analysis

qSOFA Score Distribution:

- Score 0: 6.15% (n=4)
- Score 1: 36.92% (n=24)
- Score 2: 43.07% (n=28)
- Score 3: 13.84% (n=9)

Among patients with qSOFA score 2, 42.8% (12/28) expired. [table 9]

NEWS Score Distribution:

- Score 1-4: 7.7% (n=5)
- Score 5-6: 4.6% (n=3)
- Score ≥7: 87.7% (n=57)

Among patients with NEWS score ≥7, 43.8% (25/57) expired. [table 10]

Comparison of Scores Based on Outcomes

Non-survivors had significantly higher NEWS [median 13 (IQR 10-15)] compared to survivors [median 9 (IQR 7.5-11), P=0.003]. Similarly, qSOFA scores were significantly higher in non-survivors [median 2 (IQR 1-3)] compared to survivors [median 1 (IQR 1-2), P<0.001]. [table 11]

ICU vs. Non-ICU Subgroup Analysis

Non-survivors in ICU had significantly higher qSOFA scores compared to non-ICU survivors (P=0.040). However, NEWS scores showed no statistically significant difference between ICU and non-ICU groups (P>0.05 for all comparisons). [table 12]

Diagnostic Performance [table 13]

NEWS Score:

- AUC: 0.817 (95% CI: 0.702-0.931)
- Optimal cut-off: 9.5
- Sensitivity: 86%
- Specificity: 52%

qSOFA Score:

- AUC: 0.751 (95% CI: 0.618-0.884)
- Optimal cut-off: 1.5
- Sensitivity: 82%
- Specificity: 55%

DISCUSSION

This study evaluated the comparative performance of NEWS and qSOFA in predicting outcomes among patients with suspected sepsis in a tertiary care hospital in India.

Demographic Characteristics

Our study population had a mean age of 60.04±14.36 years, with over 50% of patients aged >50 years. This finding aligns with studies by Nagdev et al. [10] and Sinha et al. [11], which reported predominance of older age groups among sepsis patients. The male predominance (53.8%) observed in our study is consistent with previous research demonstrating higher sepsis incidence among males [10,12].

Comorbidity Profile

The high prevalence of diabetes mellitus (67.7%) and hypertension (50.8%) in our cohort reflects the established risk factors for sepsis [13]. These findings are comparable to Krishna et al. [14] who reported hypertension in 48% of sepsis patients, and Paary et al. [15] who found diabetes mellitus in 42% of patients.

Microbiological Profile

Culture positivity (67.6%) and predominance of Gram-negative organisms, particularly *Klebsiella pneumoniae* and *E. coli*, align with Indian epidemiological data [16,17]. This pattern underscores the importance of empirical antimicrobial therapy covering common Gram-negative pathogens in the Indian setting. The 44.8% multi-drug resistant infections reported in Indian ICUs [16] highlights the need for robust antimicrobial stewardship programs.

Scoring System Performance

Our study demonstrated that NEWS (AUC 0.817) outperforms qSOFA (AUC 0.751) in predicting mortality among patients with suspected sepsis. This finding supports the growing evidence that NEWS may be a more sensitive screening tool in the emergency and acute care settings [18,19].

The 86% sensitivity of NEWS at cut-off 9.5 suggests excellent ability to identify patients at risk of deterioration, though the 52% specificity indicates a trade-off with false positives. This trade-off may be acceptable in screening settings where missing patients at risk carries greater consequences than false alarms. Our findings are consistent with Liu et al. [20] who demonstrated NEWS superiority over SIRS and qSOFA for risk stratification.

Comparison with Existing Literature

Our observed mortality rate of 41.5% is comparable to Desai and Lakhani [21] (48% non-survivors) but higher than Kovach et al. [22] (7% mortality), reflecting variations in patient populations, healthcare settings, and illness severity. The significantly higher scores in non-survivors ($P<0.01$) corroborates findings from Wan Tin Lim et al. [23] who reported high event rates with NEWS >9 for deteriorating sepsis patients.

The finding that non-survivors in ICU had significantly higher qSOFA scores compared to non-ICU survivors ($P=0.040$) suggests qSOFA may have particular utility in identifying higher-risk patients within ICU settings. However, its lower sensitivity compared to NEWS supports the Sepsis-3 Task Force

recommendation against using qSOFA as a single screening tool [24].

Clinical Implications

Our findings support NEWS as a practical, efficient triage tool for emergency departments and acute medical units. The higher sensitivity of NEWS enables early identification of patients at risk, facilitating timely interventions including antibiotic administration and appropriate level of care decisions. However, the lower specificity necessitates clinical correlation to avoid unnecessary resource utilization.

The integration of NEWS into clinical workflows could potentially improve early sepsis detection, particularly in settings where rapid assessment tools are needed. Future studies should explore combining NEWS with clinical risk factors and biomarkers to optimize both sensitivity and specificity.

Study Limitations

This study has several limitations:

1. Single-center design limits generalizability
2. Relatively small sample size ($n=65$)
3. Exclusion of patients on beta-blockers or calcium channel blockers, which may affect heart rate and blood pressure responses
4. Lack of external validation cohort
5. Potential selection bias inherent in cross-sectional design

Despite these limitations, this study provides valuable insights into the comparative performance of NEWS and qSOFA in the Indian context, addressing a gap in the existing literature.

CONCLUSION

NEWS demonstrates superior sensitivity in predicting mortality among patients with suspected sepsis compared to qSOFA, making it a promising and efficient triage tool for risk stratification in both ICU and non-ICU settings. The higher sensitivity of NEWS supports its utility in emergency department and acute care settings where early detection is critical. However, the lower specificity suggests need for clinical correlation and highlights opportunities for further refinement, potentially through incorporation of clinical risk factors and biomarkers.

Given the significant burden of sepsis in India and globally, implementing validated early warning scores like NEWS could contribute to improved patient outcomes through earlier recognition and intervention. Future multi-center prospective studies with larger sample sizes are warranted to validate these findings and optimize scoring systems for diverse healthcare settings.

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