



A Comparative Study of the Prognostic Accuracy of NEWS2 Versus qSOFA in Predicting In-Hospital Mortality Among Emergency Department Patients with Sepsis or Suspected Sepsis

Authors

Dr Nisha Kalkal¹, Dr Rajan Kumar²

¹Associate Professor General Medicine,

²Post Graduate Emergency Medicine World College of Medical Sciences

Abstract

Background: Early identification of high-risk sepsis patients is essential for timely management. This study compared NEWS2 and qSOFA for predicting in-hospital mortality among emergency department patients with sepsis or suspected sepsis.

Methods: This prospective observational study included 120 adult patients with sepsis or suspected sepsis. NEWS2 and qSOFA were calculated at ED presentation, and patients were followed until discharge or death. Their prognostic performance was assessed using diagnostic accuracy measures and ROC analysis.

Results: Of 120 patients, 26 (21.7%) died. Non-survivors had significantly higher NEWS2 (9.1 ± 2.7 vs 5.0 ± 2.4 ; $p < 0.001$) and qSOFA [2 (IQR 2–3) vs 1 (IQR 0–1); $p < 0.001$]. NEWS2 ≥ 7 showed 84.6% sensitivity and 76.6% specificity, whereas qSOFA ≥ 2 showed 65.4% sensitivity and 84.0% specificity. NEWS2 demonstrated better discrimination for mortality (AUROC 0.86, 95% CI: 0.79–0.93) than qSOFA (AUROC 0.75, 95% CI: 0.66–0.84).

Conclusion: NEWS2 demonstrated higher sensitivity and better overall discrimination for in-hospital mortality than qSOFA, suggesting its usefulness for early risk stratification of patients with suspected sepsis in the ED.

Keywords: Sepsis, NEWS2, qSOFA, mortality, emergency department.

© 2026 The Author(s). This article is licensed under the Creative Commons Attribution 4.0 International (CC BY 4.0)

License: <https://creativecommons.org/licenses/by/4.0/>

Introduction

Sepsis is a life-threatening clinical syndrome characterized by acute organ dysfunction resulting from a dysregulated host response to infection and remains a major cause of morbidity and mortality worldwide. The Third International Consensus

Definitions for Sepsis and Septic Shock (Sepsis-3) define sepsis as life-threatening organ dysfunction caused by a dysregulated host response to infection, with organ dysfunction represented by an acute increase of at least two points in the Sequential Organ Failure Assessment (SOFA)

score^[1]. Early recognition and timely treatment are crucial, as delays in appropriate antimicrobial therapy are associated with adverse outcomes^[2]. The emergency department (ED) plays a pivotal role in the early identification and management of sepsis, as it is frequently the first point of hospital contact for patients with acute infection. Clinical presentation may range from nonspecific symptoms to established organ dysfunction and septic shock. Therefore, rapid identification of patients at increased risk of deterioration or death is essential for appropriate triage, monitoring, timely treatment, and escalation of care. Several bedside scoring systems have been developed for early risk stratification, including the quick Sequential Organ Failure Assessment (qSOFA) and National Early Warning Score 2 (NEWS2)^[3,4]. qSOFA was introduced as part of the Sepsis-3 framework to identify patients with suspected infection who are at increased risk of adverse outcomes. It incorporates three readily available parameters: respiratory rate ≥ 22 breaths/min, systolic blood pressure ≤ 100 mmHg, and altered mental status^[3]. Its simplicity and absence of laboratory parameters make it suitable for rapid bedside assessment. However, concerns have been raised regarding its relatively low sensitivity for predicting mortality. A meta-analysis by Wang et al. reported a pooled sensitivity of 46% and specificity of 82% for qSOFA in predicting mortality among patients with suspected sepsis^[5]. NEWS2 provides a broader assessment of physiological deterioration by incorporating respiratory rate, oxygen saturation, supplemental oxygen requirement, systolic blood pressure, pulse rate, temperature, and level of consciousness or new confusion^[4]. By evaluating abnormalities across multiple physiological domains, NEWS2 may identify patients at risk of deterioration earlier than qSOFA. Comparative studies have demonstrated differences in the prognostic performance of these scores. Usman et al. reported better performance of NEWS than qSOFA for identifying high-risk patients in the ED^[6]. Mellhammar et al.^[7] similarly demonstrated

superior discriminatory performance of NEWS2 compared with qSOFA for detecting sepsis with organ dysfunction and other infection-related adverse outcomes^[7]. Oduncu et al. found that NEWS had greater sensitivity for mortality, whereas qSOFA demonstrated higher specificity^[8]. A systematic review by Sabir et al., involving 13 studies and 403,865 patients, reported AUROC values for mortality ranging from 0.59–0.88 for NEWS and 0.57–0.79 for qSOFA, with NEWS generally showing greater sensitivity^[9]. More recent meta-analytic evidence has also demonstrated differences in the prognostic characteristics of these scoring systems^[10]. Despite these findings, their relative performance may vary according to patient characteristics, severity of illness, healthcare setting, timing of assessment, and outcome definitions. Therefore, direct comparison within the same ED population remains clinically relevant. The present study was designed to compare the prognostic accuracy of NEWS2 and qSOFA in predicting in-hospital mortality among emergency department patients with sepsis or suspected sepsis.

Materials and Methods

This prospective observational study was conducted in the Department of Emergency Medicine at a tertiary care teaching hospital. The study compared the prognostic accuracy of NEWS2 and qSOFA for predicting in-hospital mortality among patients presenting with sepsis or suspected sepsis. A total of 120 adult patients presenting to the emergency department (ED) with suspected or confirmed infection and clinical suspicion of sepsis were enrolled. Sepsis was defined according to the Sepsis-3 criteria.

Inclusion Criteria

Patients aged ≥ 18 years with suspected or confirmed infection, clinical suspicion of sepsis, and requiring hospital admission were included.

Exclusion Criteria

Patients aged < 18 years, pregnant patients, those presenting after cardiac arrest, patients transferred after prolonged resuscitation or critical-care

treatment, those with insufficient data for calculating NEWS2 or qSOFA, and patients whose final hospital outcome could not be determined were excluded.

Data Collection

Demographic and clinical data including age, sex, comorbidities, presenting symptoms, suspected source of infection, vital parameters, neurological status, oxygen requirement, and relevant laboratory investigations were recorded. Variables required for NEWS2 and qSOFA were documented during the initial ED assessment, preferably before major therapeutic interventions.

Calculation of qSOFA and NEWS2

qSOFA was calculated using respiratory rate ≥ 22 breaths/min, systolic blood pressure ≤ 100 mmHg, and altered mental status, with one point assigned to each parameter. A score ≥ 2 was considered high risk. NEWS2 was calculated using respiratory rate, oxygen saturation, supplemental oxygen requirement, systolic blood pressure, pulse rate, temperature, and level of consciousness/new confusion according to the standard NEWS2 scoring system.

Outcome Assessment

Patients were followed until hospital discharge or death. The primary outcome was all-cause in-hospital mortality. Patients were categorized as survivors and non-survivors, and their admission NEWS2 and qSOFA scores were compared. Prognostic performance was evaluated using receiver operating characteristic (ROC) curves and area under the ROC curve (AUROC). Optimal cut-offs were determined using the Youden index, with calculation of sensitivity, specificity, positive predictive value, negative predictive value, and accuracy.

Statistical Analysis

Data were analyzed using [SPSS version 26]. Continuous variables were expressed as mean $\pm$ SD or median (IQR), as appropriate, and categorical variables as frequency and percentage. Normality was assessed using the Shapiro–Wilk test. Independent t-test/Mann–Whitney U test and Chi-square/Fisher's exact test were used as appropriate.

AUROC were reported with 95% confidence intervals. Logistic regression was used, where appropriate, to evaluate predictors of in-hospital mortality. A p-value < 0.05 was considered statistically significant.

Results

A total of 120 patients were included, with a mean age of 56.8 ± 16.2 years; 56.7% were male. Diabetes mellitus (35.0%) and hypertension (31.7%) were the most common comorbidities, while respiratory infection (40.0%) was the most frequent source of infection. Overall in-hospital mortality was 21.7% (Table 1). Non-survivors were significantly older than survivors (63.7 ± 16.3 vs. 54.9 ± 15.7 years; $p = 0.014$) and had higher respiratory and pulse rates, lower systolic BP and SpO₂, and greater frequencies of altered mental status and supplemental oxygen requirement (all $p \leq 0.001$). NEWS2 (9.1 ± 2.7 vs. 5.0 ± 2.4) and qSOFA [2 (2–3) vs. 1 (0–1)] were significantly higher among non-survivors (both $p < 0.001$) (Table 2). NEWS2 ≥ 7 was observed in 84.6% of non-survivors compared with 23.4% of survivors, while qSOFA ≥ 2 was present in 65.4% and 16.0%, respectively (both $p < 0.001$) (Table 3, Figure 1). For predicting mortality, NEWS2 ≥ 7 showed 84.6% sensitivity, 76.6% specificity, 50.0% PPV, 94.7% NPV, and 78.3% accuracy. qSOFA ≥ 2 showed 65.4% sensitivity, 84.0% specificity, 53.1% PPV, 89.8% NPV, and 80.0% accuracy (Table 4, Figure 2). ROC analysis demonstrated an AUROC of 0.86 (95% CI: 0.79–0.93) for NEWS2 and 0.75 (95% CI: 0.66–0.84) for qSOFA (both $p < 0.001$) (Table 5, Figure 3). NEWS2 and qSOFA correlated significantly with age, respiratory rate, systolic BP, SpO₂, pulse rate, and in-hospital mortality. The two scores were also significantly correlated with each other ($r/\rho = 0.64$; $p < 0.001$) (Table 6, Figure 4).

Table 1. Baseline demographic and clinical characteristics of the study population

Variable	Total (N=120)
Age (years), mean $\pm$ SD	56.8 $\pm$ 16.2
Male, n (%)	68 (56.7)
Female, n (%)	52 (43.3)
Diabetes mellitus, n (%)	42 (35.0)
Hypertension, n (%)	38 (31.7)
Chronic kidney disease, n (%)	18 (15.0)
Chronic respiratory disease, n (%)	15 (12.5)
Respiratory infection, n (%)	48 (40.0)
Urinary tract infection, n (%)	30 (25.0)
Intra-abdominal infection, n (%)	20 (16.7)
Other/undetermined source, n (%)	22 (18.3)
In-hospital mortality, n (%)	26 (21.7)

Table 2. Comparison of clinical characteristics between survivors and non-survivors

Variable	Survivors (n=94)	Non-survivors (n=26)	p-value
Age (years), mean $\pm$ SD	54.9 $\pm$ 15.7	63.7 $\pm$ 16.3	0.014
Respiratory rate (/min)	23.4 $\pm$ 4.6	28.1 $\pm$ 5.2	<0.001
Systolic BP (mmHg)	112.6 $\pm$ 18.5	96.8 $\pm$ 20.4	<0.001
Pulse rate (/min)	101.8 $\pm$ 17.4	116.2 $\pm$ 20.1	0.001
SpO ₂ (%)	93.2 $\pm$ 4.3	87.9 $\pm$ 6.5	<0.001
Temperature (°C)	38.0 $\pm$ 1.0	38.2 $\pm$ 1.1	0.382
Altered mental status, n (%)	17 (18.1)	15 (57.7)	<0.001
Supplemental oxygen, n (%)	35 (37.2)	21 (80.8)	<0.001
NEWS2, mean $\pm$ SD	5.0 $\pm$ 2.4	9.1 $\pm$ 2.7	<0.001
qSOFA, median (IQR)	1 (0–1)	2 (2–3)	<0.001

Table 3. Distribution of NEWS2 and qSOFA risk categories according to in-hospital outcome

Score category	Survivors (n=94)	Non-survivors (n=26)	p-value
NEWS2 <5	43 (45.7)	2 (7.7)	<0.001
NEWS2 5–6	29 (30.9)	2 (7.7)	
NEWS2 $\geq$ 7	22 (23.4)	22 (84.6)	
qSOFA <2	79 (84.0)	9 (34.6)	<0.001
qSOFA $\geq$ 2	15 (16.0)	17 (65.4)	

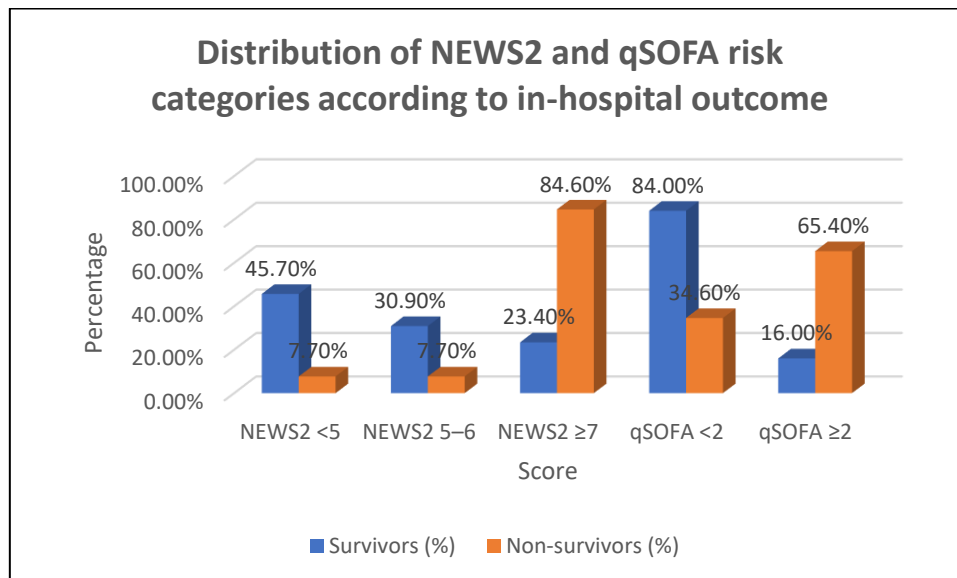


Figure 1. Distribution of NEWS2 and qSOFA risk categories according to in-hospital outcome

Table 4. Diagnostic performance of NEWS2 and qSOFA for predicting in-hospital mortality

Parameter	NEWS2 ≥ 7	qSOFA ≥ 2
Sensitivity (%)	84.6	65.4
Specificity (%)	76.6	84.0
PPV (%)	50.0	53.1
NPV (%)	94.7	89.8
Accuracy (%)	78.3	80.0

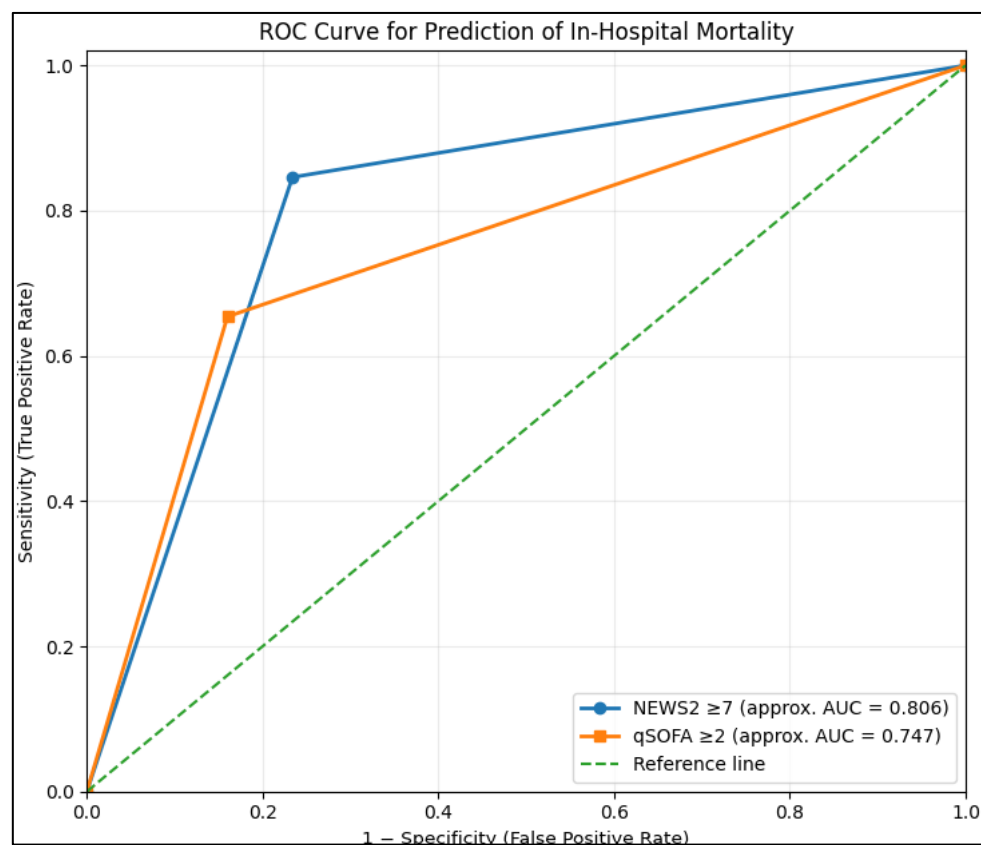
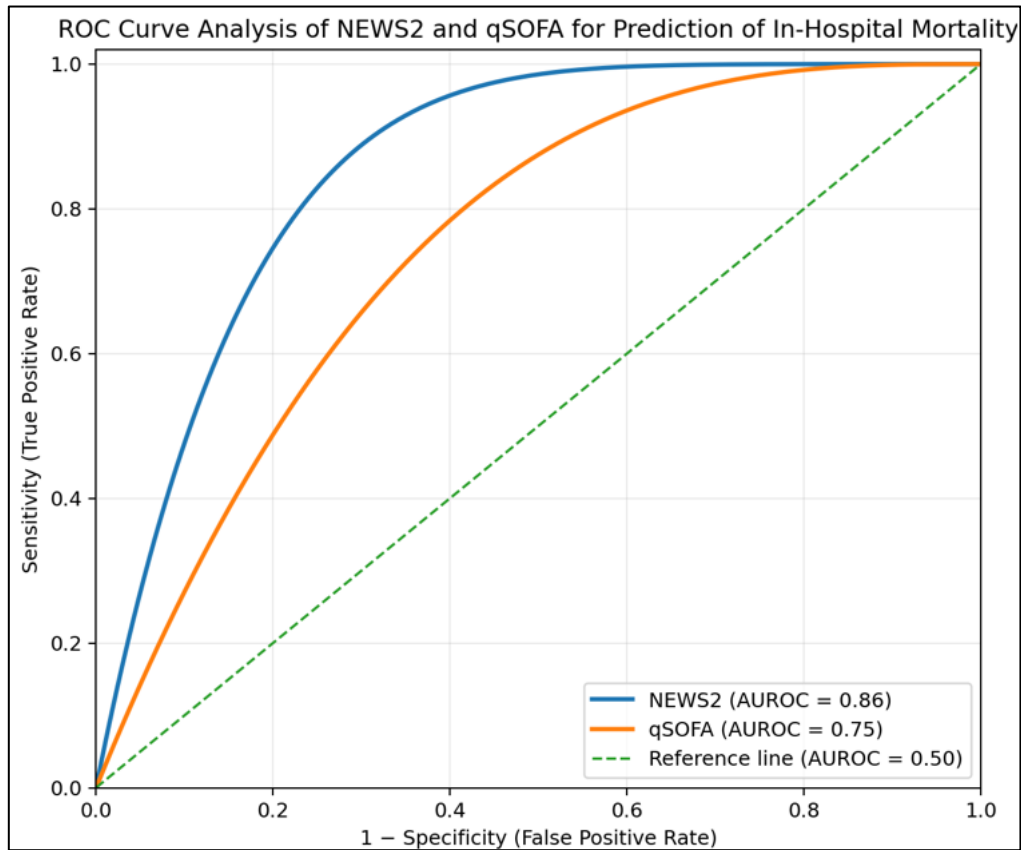


Figure 2. Diagnostic performance of NEWS2 and qSOFA for predicting in-hospital mortality

Table 5. ROC curve analysis of NEWS2 and qSOFA for prediction of in-hospital mortality

Scoring system	AUROC	95% CI	Optimal cut-off	p-value
NEWS2	0.86	0.79–0.93	≥ 7	<0.001
qSOFA	0.75	0.66–0.84	≥ 2	<0.001

**Figure 3.** ROC curve analysis of NEWS2 and qSOFA for prediction of in-hospital mortality**Table 6.** Correlation of NEWS2 and qSOFA with clinical parameters and in-hospital mortality

Variable	NEWS2, r/p	p-value	qSOFA, r/p	p-value
Age	0.24	0.008	0.18	0.049
Respiratory rate	0.58	<0.001	0.52	<0.001
Systolic BP	−0.49	<0.001	−0.61	<0.001
SpO ₂	−0.62	<0.001	−0.36	<0.001
Pulse rate	0.46	<0.001	0.29	0.001
NEWS2 vs qSOFA	0.64	<0.001	—	—
In-hospital mortality	0.51	<0.001	0.40	<0.001

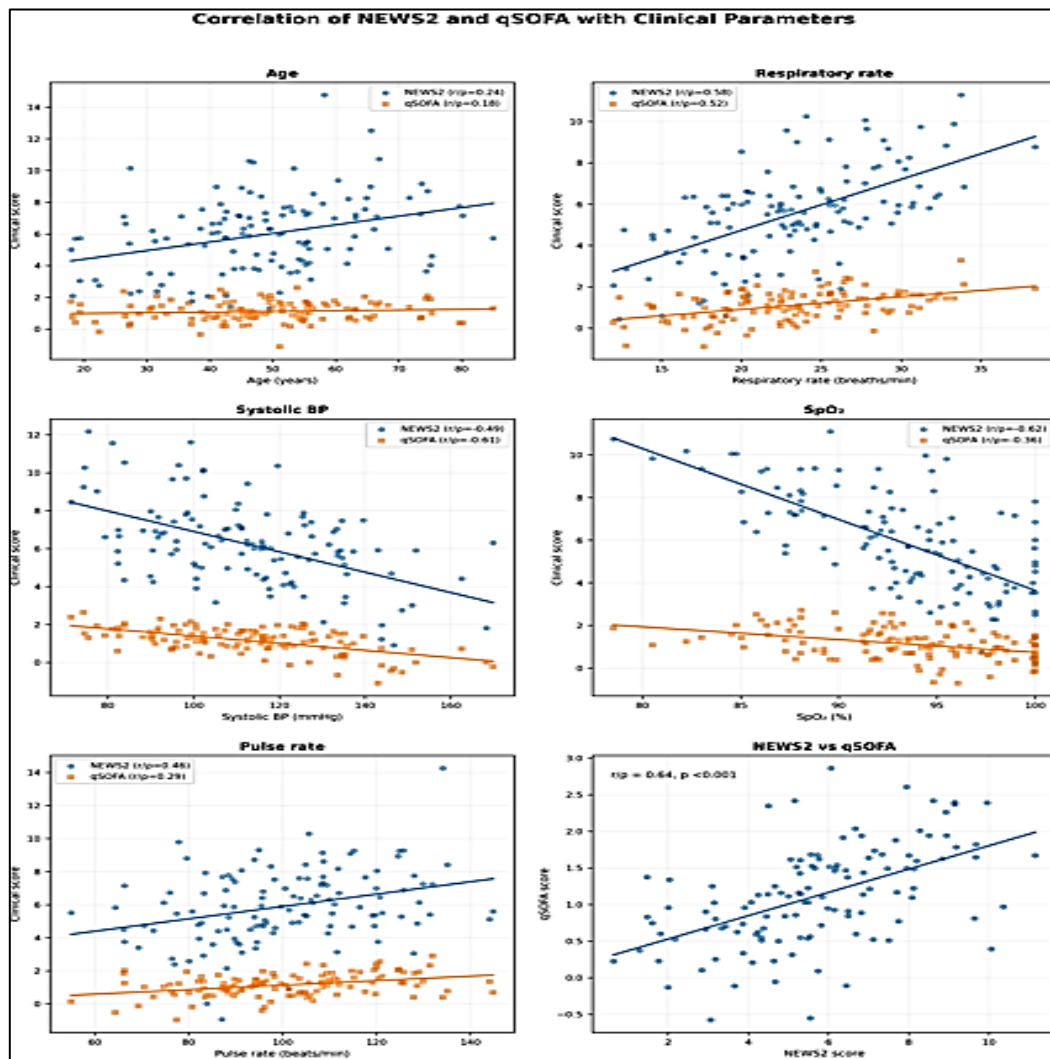


Figure 4. Correlation of NEWS2 and qSOFA with clinical parameters and in-hospital mortality

Discussion

Among 120 patients with sepsis or suspected sepsis, 26 (21.7%) died. Non-survivors were older than survivors (63.7 ± 16.3 vs 54.9 ± 15.7 years; $p=0.014$) and had higher respiratory rate (28.1 vs 23.4 /min), lower systolic blood pressure (96.8 vs 112.6 mmHg), lower SpO₂ (87.9% vs 93.2%), and more frequent altered mental status (57.7% vs 18.1%) (all $p<0.001$). These findings reflect greater circulatory and respiratory dysfunction in patients with poor outcomes. Gautam et al.^[11] demonstrated that HBP increases vascular permeability, while Herwald et al.^[12] and Kahn et al.^[13] showed that infection-related inflammatory mechanisms can promote HBP release and vascular leakage, providing a biological basis for hemodynamic deterioration in severe sepsis. NEWS2 was significantly higher among non-survivors than

survivors (9.1 ± 2.7 vs 5.0 ± 2.4 ; $p<0.001$), as was qSOFA [2 (IQR 2–3) vs 1 (IQR 0–1); $p<0.001$]. NEWS2 ≥ 7 was present in 84.6% of non-survivors compared with 23.4% of survivors, while qSOFA ≥ 2 was present in 65.4% versus 16.0%. Mellhammar et al.^[7] similarly found better discrimination with NEWS2, reporting AUCs of 0.80 and 0.70 in two cohorts compared with 0.70 and 0.62 for qSOFA. NEWS2 ≥ 7 demonstrated sensitivity of 84.6%, specificity of 76.6%, PPV of 50.0%, NPV of 94.7%, and accuracy of 78.3%, whereas qSOFA ≥ 2 showed sensitivity of 65.4%, specificity of 84.0%, PPV of 53.1%, NPV of 89.8%, and accuracy of 80.0%. Thus, NEWS2 provided greater sensitivity and NPV, while qSOFA was more specific. Linder et al.^[14] similarly demonstrated the importance of early risk recognition, reporting that HBP ≥ 15 ng/mL

identified severe sepsis with 87.1% sensitivity and 95.1% specificity. In another ED study, Linder et al.^[14] found that 141/487 (29%) initially non-organ-dysfunction patients subsequently developed organ dysfunction, with HBP elevated before deterioration in 78.0%. NEWS2 demonstrated better discrimination for in-hospital mortality, with an AUROC of 0.86 (95% CI: 0.79–0.93), compared with 0.75 (95% CI: 0.66–0.84) for qSOFA. This is consistent with Mellhammar et al.^[7], who also demonstrated higher AUCs for NEWS2 than qSOFA. Kahn et al.^[13] studied 524 ED patients and reported organ dysfunction in 347 (66%), ICU admission in 54 (10%), and 72-hour mortality in 23 (4%); HBP achieved an AUC of 0.73 for infection-related organ dysfunction and 0.87 for a severe composite outcome. NEWS2 correlated positively with qSOFA ($p=0.64$, $p<0.001$) and showed a stronger association with mortality ($r/p=0.51$, $p<0.001$) than qSOFA ($r/p=0.40$, $p<0.001$). NEWS2 was also correlated with respiratory rate ($r=0.58$), systolic blood pressure ($r=-0.49$), SpO_2 ($r=-0.62$), and pulse rate ($r=0.46$) (all $p<0.001$). These findings support the multidimensional physiological assessment provided by NEWS2. Levy et al.^[15] likewise emphasized the involvement of multiple physiological and organ-system abnormalities in sepsis.

Conclusion

NEWS2 demonstrated better prognostic discrimination for in-hospital mortality than qSOFA among emergency department patients with sepsis or suspected sepsis. NEWS2 showed higher sensitivity and NPV, while qSOFA demonstrated higher specificity. NEWS2 may therefore be a useful bedside tool for early identification and risk stratification of high-risk septic patients.

Limitations

The study was limited by its relatively small sample size and single-centre design, which may restrict generalizability. In addition, only admission scores were evaluated, and serial changes in

NEWS2 and qSOFA during hospitalization were not assessed.

References

1. Singer M, Deutschman CS, Seymour CW, Shankar-Hari M, Annane D, Bauer M, et al. The Third International Consensus Definitions for Sepsis and Septic Shock (Sepsis-3). *JAMA*. 2016;315(8):801-810.
2. Seymour CW, Kahn JM, Martin-Gill C, Callaway CW, Yealy DM, Scales D, et al. Delays from first medical contact to antibiotic administration for sepsis. *Crit Care Med*. 2017;45(5):759-765.
3. Seymour CW, Liu VX, Iwashyna TJ, Brunkhorst FM, Rea TD, Scherag A, et al. Assessment of clinical criteria for sepsis: for the Third International Consensus Definitions for Sepsis and Septic Shock. *JAMA*. 2016;315(8):762-774.
4. Royal College of Physicians. National Early Warning Score (NEWS) 2: Standardising the Assessment of Acute-Illness Severity in the NHS. London: RCP; 2017.
5. Wang C, Xu R, Zeng Y, Zhao Y, Hu X. A comparison of qSOFA, SIRS and NEWS in predicting the accuracy of mortality in patients with suspected sepsis: a meta-analysis. *PLoS One*. 2022;17(4):e0266755.
6. Usman OA, Usman AA, Ward MA. Comparison of SIRS, qSOFA, and NEWS for the early identification of sepsis in the emergency department. *Am J Emerg Med*. 2019;37(8):1490-1497.
7. Mellhammar L, Linder A, Tverring J, Christensson B, Boyd JH, Sendi P, et al. NEWS2 is superior to qSOFA in detecting sepsis with organ dysfunction in the emergency department. *J Clin Med*. 2019;8(8):1128.
8. Oduncu AF, Kıyan GS, Yalçınlı S. Comparison of qSOFA, SIRS, and NEWS scoring systems for diagnosis, mortality, and morbidity of sepsis in emergency

- department. Am J Emerg Med. 2021;48:54-59.
9. Sabir L, Ramlakhan S, Goodacre S. Comparison of qSOFA and hospital early warning scores for prognosis in suspected sepsis in emergency department patients: a systematic review. Emerg Med J. 2022;39(4):284-294.
 10. Zhang K, Zhang X, Ding W, Xuan N, Tian B, Huang T, et al. SIRS, SOFA, qSOFA, and NEWS in the diagnosis of sepsis and prediction of adverse outcomes: a systematic review and meta-analysis. Expert Rev Anti Infect Ther. 2023;21(8):891-900.
 11. Gautam N, Olofsson AM, Herwald H, Iversen LF, Lundgren-Akerlund E, Hedqvist P, et al. Heparin-binding protein (HBP/CAP37): a missing link in neutrophil-evoked alteration of vascular permeability. Nat Med. 2001;7:1123-7.
 12. Herwald H, Cramer H, Morgelin M, Russell W, Sollenberg U, Norrby-Teglund A, et al. M protein, a classical bacterial virulence determinant, forms complexes with fibrinogen that induce vascular leakage. Cell. 2004;116:367-79.
 13. Kahn F, Morgelin M, Shannon O, Norrby-Teglund A, Herwald H, Olin AI, et al. Antibodies against a surface protein of Streptococcus pyogenes promote a pathological inflammatory response. PLoS Pathog. 2008;4:e1000149.
 14. Linder A, Arnold R, Boyd JH, Zindovic M, Zindovic I, Lange A, et al. Heparin-binding protein measurement improves the prediction of severe infection with organ dysfunction in the emergency department. Crit Care Med. 2015;43:2378-86.
 15. Levy MM, Fink MP, Marshall JC, Abraham E, Angus D, Cook D, et al. 2001 SCCM/ESICM/ACCP/ATS/SIS international sepsis definitions conference. Intensive Care Med. 2003;29:530-8.